

Tuesday
2 August 2005

**Babies and Bayes Nets: Causal Inference in
Computers and Children**

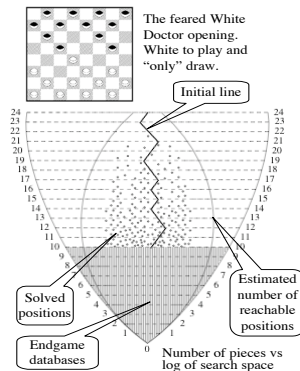
Alison Gopnik

Research suggests that by the age of five, children have extensive causal knowledge, in the form of intuitive theories. The critical question is how young children are able to learn causal structure from evidence. Recently, researchers in computer science and statistics working in the causal bayes net or causal graphical model framework have developed representations and learning algorithms to infer causal structure from evidence. Here we explore evidence suggesting that 3 and 4 year old children make unconscious causal inferences consistent with causal Bayes net learning algorithms. Specifically, we look at children's ability to learn from evidence in the form of conditional probabilities, interventions and combinations of the two. Our experiments suggest that preschool children make assumptions that allow them to correctly infer causal structure from patterns of dependency, to integrate new evidence and prior knowledge appropriately, and to overturn prior knowledge when appropriate. Perhaps most dramatically children could use what we call "the conditional intervention principle", using complex information about the effects of interventions to discriminate causal chains, common causes and conjunctions. Children also could use probabilities appropriately to infer causal strength, spontaneously generated informative causal interventions, and discriminated confounded and unconfounded interventions appropriately. These results both suggest that children's learning involves powerful, normative, computational mechanisms of the sort described by computer scientists, and also suggest new computational problems for computer scientists to solve.

Solving Checkers

J. Schaeffer, Y. Björnsson, N. Burch, A. Kishimoto, M. Müller, R. Lake, P. Lu, S. Sutphen
 Department of Computing Science, University of Alberta, Edmonton, Canada

- Checkers has 5×10^{20} positions
 - Computations begin in 1989!
- Search algorithm:
 - Endgame databases; all positions with 10 or fewer pieces (3.9×10^{13})
 - Backend; 2 searches done per position
 - Heuristic (search guidance)
 - Proof (attempt to prove value)
 - Front-end; maintains proof tree and decides where to search
 - Iterates on heuristic value threshold
- White Doctor opening is a draw
 - Analysis runs hundreds of ply deep
 - 174 openings, but only need result of 50 to determine the value of the initial position (no moves made)

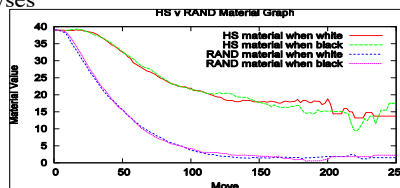


10:30 - 11:00

Game-Tree Search with Combinatorially Large Belief States

Austin Parker, Dana Nau, and V.S. Subrahmanian

- Game-tree search in imperfect-information games
- Combining game-tree search and statistical sampling for kriegspiel chess
 - ♦ Three statistical sampling algorithms
 - » All Observation Sampling (AOSP), Last Observation Sampling (LOS), and a Hybrid (HS).
 - ♦ Rough mathematical analyses
- Experimental tests
 - ♦ Performance vs random play
 - » HS is most successful (right)
 - ♦ Performance vs each other
- Conclusions and future work



Adversarial Reasoning, 2005

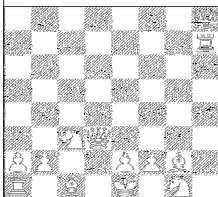


11:00 - 11:30

Efficient belief-state AND-OR search, with application to Kriegspiel

Stuart Russell and Jason Wolfe
 University of California, Berkeley

Given White's history of moves and observations, White to move and force checkmate within 5 ply



(Black's pieces are hidden from White)

- Kriegspiel, a partially observable chess variant: pieces and moves of adversary hidden; referee provides percepts
- Problem: identify guaranteed wins
- Approach: search of AND-OR tree whose nodes correspond to belief states
- New family of "incremental" algorithms for finding guaranteed wins; recognize uncertainty as new possible search dimension in addition to depth and breadth
- On newly constructed database of 500 5-ply Kriegspiel checkmate problems, $\approx 100x$ speedup over existing algorithms

11:30 - 12:00

Why Minimax Works: An Alternative Explanation

Mitja Luštrek, Ivan Bratko and Matjaž Gams
 Jožef Stefan Institute and University of Ljubljana, Slovenia

- Conventional wisdom: the deeper a game-playing program searches, the better it plays.
- Theoretical analyses: in many cases the deeper a program searches, the worse it plays – pathology.
- The usual explanation: if game trees have certain properties, such as dependence of nearby positions, the pathology disappears.

An alternative, simpler explanation:

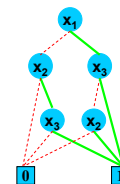
- Positions must have real-number values, not only losses and wins (like most other researchers assumed).
- Position values tend to be further apart at lower levels of the game tree.
- This makes error less probable when searching to a greater depth.
- The error is reduced sufficiently to eliminate the pathology.
- No special properties are needed to make minimax work.

12:00 - 12:30

DPLL with a Trace: From SAT to Knowledge Compilation

Jinbo Huang, Adnan Darwiche
University of California, Los Angeles, California, USA

- Use DPLL to compile knowledge into various languages
 - DPLL naturally leads to FBDD (see figure on right)
 - Impose static ordering: OBDD
 - Allow decomposition: d-DNNF
 - **Beyond DPLL?**
- Use language results to understand power, complexity, and limitations of DPLL-based algorithms
 - Example: several model counters produce traces in d-DNNF
 - Therefore, they are (1) as powerful as a d-DNNF compiler, and (2) hopeless on inputs having no tractable d-DNNF representation

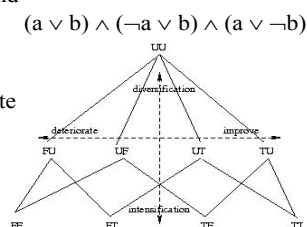


10:30 - 11:00

Three Truth Value for the SAT and MAX-SAT Problems

Frédéric Lardeux, Frédéric Saubion and Jin-Ka Hao
University of Angers, France

- New resolution framework for SAT and MAX-SAT
- Introduction of a third truth value *undefined*
- Hybridization of exact and approximate methods
- New logical interpretation rules: pessimistic approach
- Experimental comparisons with Tabu Search and Walksat on SAT2003 instances to show the interest of this framework
- Future work: extend other well-known algorithms within this framework



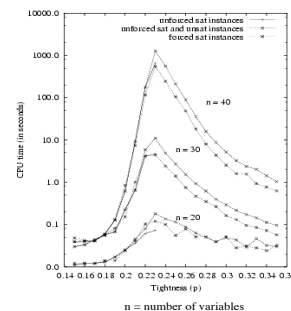
The 3-valued framework.

11:00 - 11:30

A Simple Model to Generate Hard Satisfiable Instances

Ke Xu¹, Frédéric Boussemart², Fred Hemery², Christophe Lecoutre²
¹Beihang Univ., Beijing, China – ²Univ. d'Artois, Lens, France

- About the theoretical and practical interests of two models, called RB and RD, of random constraint networks
- Asymptotic phase transitions are guaranteed while applying certain limited conditions
- A formal analysis shows that forced satisfiable instances have hardness similar to unforced satisfiable ones
- An intensive experimentation, using complete and incomplete search methods, confirm such predictions



11:30 - 12:00

Phase Transitions of Dominating Clique Problem and Their Implications to Heuristics in Satisfiability Search

Joseph Culberson, Yong Gao, Calin Anton
University of Alberta, Edmonton, Alberta, Canada T6G 2E8

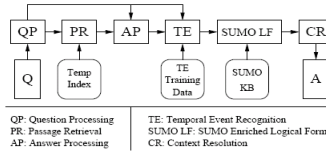
- A study of phase transitions of the dominating clique problem and their implications to satisfiability search
- An exact threshold of the phase transition of the dominating clique problem on random graphs
- A backtracking algorithm for the dominating clique problem and empirical results on the typical-case hardness
- A CNF-tailored implementation of our search algorithm which outperforms state-of-the-art SAT solvers on the CNF encoding of the dominating clique problem
- Strong evidence showing that our solver outperforms other solvers on other problems with similar structures, such as the sub-graph isomorphism problem

12:00 - 12:30

Temporal Context Representation and Reasoning

Dan Moldovan, Christine Clark, and Sanda Harabagiu
Language Computer Corporation, Richardson, Texas, USA

- Details a temporally informed QA system that outperforms its uninformed counterpart by 22 %
- Detects temporal relations between events in natural language text
- Translates the detected temporal events into a SUMO enriched first order logic representation
- Filters candidate answers using temporal context resolution via COGEX, a theorem prover adapted for textual inference



10:30 - 11:00

TimeML-Compliant Text Analysis for Temporal Reasoning

Branimir Boguraev, Rie Kubota Ando
IBM T.J. Watson Research Center, Yorktown Heights, New York, USA

Reasoning with time needs more than just a list of temporal expressions. TimeML—an emerging standard for temporal annotation as a language capturing properties and relationships among time-denoting expressions and events in text—is a good starting point for bridging the gap between temporal analysis of documents and reasoning with the information derived from them. Hard as TimeML-compliant analysis is, the small size of the only currently available annotated corpus makes it even harder. We address this problem with a hybrid TimeML annotator, which uses cascaded finite-state grammars (for temporal expression analysis, shallow syntactic parsing, and feature generation) together with a machine learning component capable of effectively using large amounts of unannotated data.

11:00 - 11:30

IJCAI, 2005

Slide 1

Viewing Referring Expression Generation as Search
Bernd Bohnet and Robert Dale

- Referring Expression Generation is a widely explored problem in Natural Language Generation.
- The problem: given a symbol corresponding to an intended referent, how do we work out the semantic content of a referring expression that uniquely identifies the entity in question?
- Over the last 15 years, a wide variety of algorithms have been proposed to solve various versions of the problem.
- But the different approaches taken make it very difficult to compare and contrast the algorithms provided in any meaningful way.
- Our approach: to represent existing referring expression generation algorithms in terms of problem-solving by search, making it (a) easier to see the similarities and differences, (b) easier to see where component parts of solutions can be reused, and (c) easier to see potential solution configurations that were previously overlooked.

11:30 - 12:00

Automatic Evaluation of Text Coherence Models and Representations

Mirella Lapata
University of Edinburgh

Regina Barzilay
Massachusetts Institute of Technology

Goal: Make machine generated texts more readable. Start by automatically evaluating their coherence. Useful for applications, e.g., summarization.

☐ **What to model?**

- ✓ Focus on local coherence, sentence transitions.

☐ **How to represent texts?**

- ✓ Focus on shallow text properties.
- ✓ Focus on syntactic aspects of text coherence (entity-based).
- ✓ Focus on semantic aspects of text coherence (similarity-based).
- ✓ Combine both aspects.

☐ **How to model?**

- ✓ Generative probabilistic model.
- ✓ Latent Semantic Analysis (LSA).
- ✓ Linear Regression.

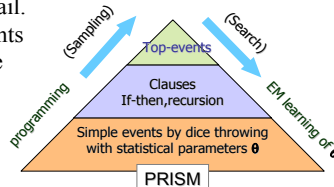
Results: models are complementary, correlate significantly with humans.

12:00 - 12:30

Generative Modeling with Failure in PRISM

Taisuke Sato, Yoshitaka (Tokyo Institute of Technology, Japan)
Neng-Fa Zhou (CUNY Brooklyn College, USA)

- PRISM is a logic-based probabilistic language for modeling complex events governed by rules and probabilities.
- Simple events are combined by programming constructs to build up complex observable events (generative modeling).
- Generative modeling covers BNs, HMMs, PCFGs etc.
- When models are more complex, we wish to use complex constraints that may fail.
- Introduction of failure constraints considerably expands definable distributions.
- New semantics and a learning algorithm for such failure models are presented.

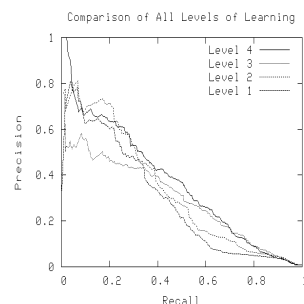


10:30 - 11:00

View Learning for Statistical Relational Learning: With an Application to Mammography

Jesse Davis, Elizabeth Burnside, Inês Dutra, David Page,
Raghu Ramakrishnan, Vitor Santos Costa and Jude Shavlik
University of Wisconsin - Madison, USA

- Statistical relational learning (SRL) learns probabilistic models from multi-relational data
- Current SRL approaches constrained to use existing database (DB) schema
- New approach provides SRL the capability to learn new *views* of DB
- We define a 4-level hierarchy of learning: 1) parameters, 2) structure, 3) aggregates, 4) views
- Empirical results on categorizing mammogram abnormalities as “benign” or “malignant”



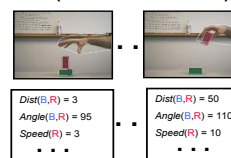
11:00 - 11:30

A Simple-Transition Model for Relational Sequences

Alan Fern
School of Electrical Engineering and Computer Science
Oregon State University

- We study inference of relational state sequences from relational observations
- Introduce the simple-transition model (STM) where inference reduces to the single-state minimization (SSM) problem
- Give relational STM representation based on weighted first-order horn rules where SSM corresponds to weighted MAX-SAT
- Learn relational STMs by: 1) use Claudien to mine “nearby sound” horn rule, 2) use Perceptron-updates to learn rule weights
- Experimental results in video interpretation show good performance compared to several competitors

Input: relational observation sequence (derived from video)



Output: relational state sequence

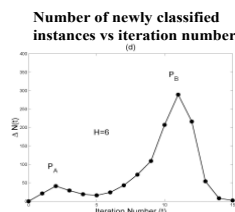


11:30 - 12:00

Inferring Useful Heuristics from the Dynamics of Iterative Relational Classifiers

Aram Galstyan and Paul R. Cohen
USC Information Sciences Institute, Marina del Rey, California, USA

- Single-parameter binary iterative classifier
- Utilizes different time scales of True and False label propagation
- “Two-tiered” dynamics in the number of newly classified instances
- The parameter value is set in a self consistent way making the classifier effectively parameter free
- Experimental results for synthetic and real world data
- Analytical results for random-graph-like relational datasets



Two-tiered dynamics: P_A and P_B correspond to propagation of true and false class labels, respectively

12:00 - 12:30

Updating Action Domain Descriptions

Thomas Eiter, Esra Erdem, Michael Fink, and Ján Senko
 Vienna University of Technology, Vienna, Austria

- How can an intelligent agent update her knowledge base about an action domain, subject to some conditions (possibly obtained from earlier observations), in particular, when some new knowledge about that domain is added?
- Described the problem above precisely in a formal framework for reasoning about actions and change.
- Analyzed the computational complexity of the problem.
- Introduced methods to compute a solution and an approximate solution.

10:30 - 11:00

Semantics for a useful fragment of the situation calculus

Gerhard Lakemeyer
 RWTH Aachen

Hector J. Levesque
 University of Toronto

In a recent paper, we presented a new logic called ES for reasoning about the knowledge, action, and perception of an agent. Although formulated using modal operators, we argued that the language was in fact a dialect of the situation calculus but with the situation terms suppressed. This allowed us to develop a clean and workable semantics for the language without piggybacking on the generic Tarski semantics for first-order logic. In this paper, we reconsider the relation between ES and the situation calculus and show how to map sentences of ES into the situation calculus. We argue that the fragment of the situation calculus represented by ES is rich enough to handle the basic action theories defined by Reiter as well as Golog. Finally, we show that in the full second-order version of ES, almost all of the situation calculus can be accommodated.

11:00 - 11:30

Planning with Loops

Hector Levesque
 University of Toronto, Toronto, Canada

- Classical planning, but with incomplete knowledge and sensing actions
- New method for generating plans that may contain loops
- Avoids having to synthesize and prove properties of plans online
- Works on small problems where other methods are not applicable
- But no guarantee of correctness
- In some simple cases, the method can be proven to be correct offline

Example plan

```
increment acc1;
loop
  case test= acc1 input
    equal: exit
    diff: increment acc1;
          increment acc2;
          increment acc2;
          next
  endc
end1;
increment acc2
```

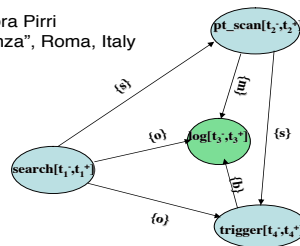
Goal: $acc2 = 2 * input - 1$

11:30 - 12:00

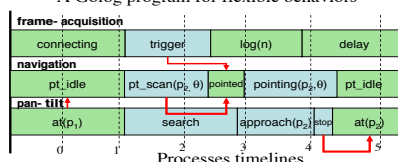
Representing Flexible Temporal Behaviors in the Situation Calculus

Alberto Finzi and Fiora Pirri
 Università di Roma "La Sapienza", Roma, Italy

- Flexible behaviors in the Situation Calculus (SC) based on a model of time and concurrent situations.
- A new hybrid framework combining temporal constraint reasoning and reasoning about actions.
- The expressive power of SC meets the advanced planning policies of Constraint Based Interval Planning.
- A new Golog interpreter, suitable to flexible plans over multiple timelines, for scripting.



proc($prog_c, plan T_1 : Nil \parallel \dots \parallel plan T_k : Nil$)
 A Golog program for flexible behaviors



12:00 - 12:30


10:30 - 11:00

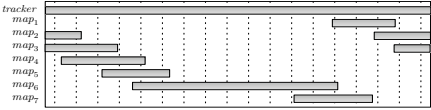
Combining Structural Descriptions and Image-based Representations for Image, Object and Scene Recognition

Nicolas Do Huu, Williams Paquier, Raja Chatila
LAAS-CNRS, Toulouse, France

- An architecture that learns and recognizes images, objects and scenes
- Layered network of neural maps and distributed computations
- Extracts and learns visual and 3D patterns using stability detection and temporal coherence properties
- Builds hierarchical and distributed models of visual data with structured view-based representations
- Future work : stereovision, automatic map connectivity adaptation, association of actions with visual representations

Input image






Maps activation diagram

11:00 - 11:30

2D Shape Classification and Retrieval

Graham McNeill, Sethu Vijayakumar
University of Edinburgh, UK

- Generic, correspondence-based technique for shape matching.
- Efficient matching algorithm uses hierarchical approach with likelihood cut-off.
- Intuitive definition of mean shape enables model-based classification.
- Tests on benchmark data demonstrate accurate classification and retrieval.



11:30 - 12:00

Inferring Image Templates from Classification Decisions

Arnab Dhua, Florin Cutzu
Computer Science Department, Indiana University
Bloomington, IN, USA


Assuming human image classification decisions are based on estimating the degree of match between a small number of stored internal templates and certain regions of the input images, we present an algorithm which infers observers classification templates from their classification decisions on a set of test images. The problem is formulated as learning prototypes from labeled data under an adjustable, prototype-specific elliptical metric. The matrix of the elliptical metric indicates the pixels that the template responds to. The model was applied to human psychophysical data collected in a simple image classification experiment.

12:00 - 12:30

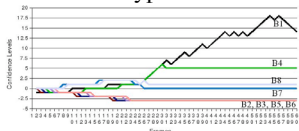
Compound Effects of Top-down and Bottom-up Influences on Visual Attention During Action Recognition

Bassam Khadhoury and Yiannis Demiris
Imperial College London, UK

- We present an attention mechanism that combines the saliency of top-down elements, based on multiple hypotheses about the demonstrated action, with the saliency of bottom-up components.
- The bottom-up part of the attention mechanism is used to initialise the top-down, hence resulting in a selection of the behaviours that rightly require the limited computational resources.
- Resource scheduling algorithms are then used to select only one of the remaining hypothesized behaviours at each frame, for processing.

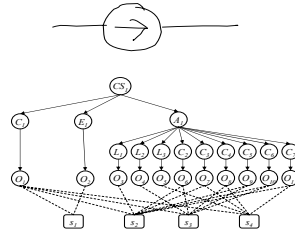


Example of demonstrated action (above) , picking a soda can (B1); confidences of different hypotheses below



**Dynamically Constructed Bayes Nets
for Multi-Domain Sketch Understanding**Christine Alvarado, Randall Davis
MIT CSAIL, Cambridge, Massachusetts, USA

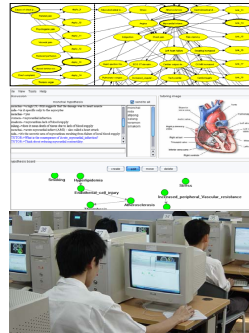
- Framework for dynamically constructing Bayesian networks in response to sketched input
- Applied to 2D sketch recognition task
- Domain-flexible, extendible, hierarchical recognition engine
- Bayes net framework integrates stroke and domain information to correctly recognize messy input
- Results on two domains: family trees and circuit diagrams
- Significantly reduces error over bottom-up only recognition approach



10:30 - 11:00

**Clinical-Reasoning Skill Acquisition
through Intelligent Group Tutoring**Siriwan Suebnukarn, Peter Haddawy
Asian Institute of Technology, Pathumthani, Thailand

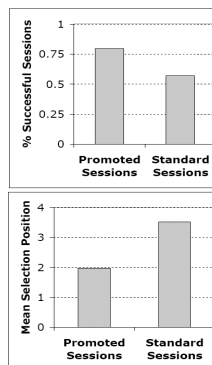
- We present COMET, the first general domain-independent framework for group intelligent medical tutoring.
- COMET uses Bayesian networks to model individual and collaborative problem solving for medical problem-based learning.
- Generic domain-independent tutoring algorithms use the models to generate tutoring hints.
- ROC curve analysis indicates that the models are highly accurate in predicting student actions.
- Student clinical reasoning gains from COMET are significantly higher than those obtained from human tutoring sessions.



11:00 - 11:30

A Live-user Evaluation of Collaborative Web SearchBarry Smyth, Evelyn Balfe, Oisín Boydell, Keith Bradley, Peter Briggs,
Maurice Coyle, Jill Freyne
University College Dublin, Dublin, Ireland

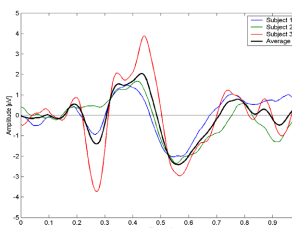
- Communities of like-minded users tend to search in similar ways, reusing similar queries and selecting similar results.
- These search patterns can be reused to help disambiguate vague queries by promoting community selections during future searches.
- Collaborative Web Search (CWS) provides a platform for the reuse of community search patterns.
- CWS allows results from generic search engines (eg. Google) to be tailored for the needs of communities of searchers.
- End-user trials show marked performance advantages relative to leading search engines.



11:30 - 12:00

**You Are Wrong! – Automatic Detection of
Interaction Errors from Brain Waves**Pierre W. Ferrez, José del R. Millán
IDIAP Research Institute, Rue du Simplon 4, 1920 Martigny, Switzerland

- Brain-Computer Interfaces (BCI) are prone to errors in the recognition of subject's intent
- Reported presence of Error-Related Potentials (ErrP) in the EEG right after the subject makes an error
- Key question for interaction: Are ErrP also elicited when errors are made by the interface and not by the subject?
- New kind of ErrP (Interaction ErrP), Figure 1
- Satisfactory online detection, Table 1
- Significant improvements of the BCI performance



Subject	Error %	Correct %
#1	87.2±11.3	82.8±7.2
#2	74.4±12.4	75.3±10.0
#3	78.1±14.8	89.2±4.9
Average	79.9±6.6	82.4±7.0

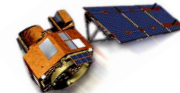
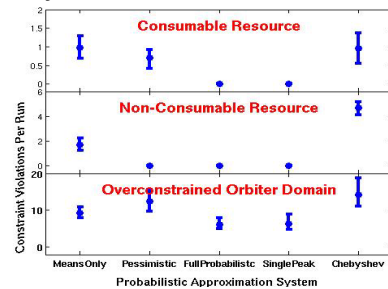
12:00 - 12:30

10:30 - 11:00

Probabilistic Reasoning for Plan Robustness

Steve Schaffer, Bradley Clement, Steve Chien
Jet Propulsion Laboratory, Pasadena CA, USA

- Consider continuous-valued action duration and resource usages described by parametric probability distributions.
- Guide local search planning by propagating distributions and detecting likely conflicts.
- Compare approximations that trade probabilistic precision for computational feasibility.
- Evaluation in abstract and imaging satellite domains show that approximation can be very effective.



11:00 - 11:30

Planning with Continuous Resources in Stochastic Domains

Mausam, Emmanuel Benazera, Ronen Brafman,
Nicolas Meuleau and Eric Hansen

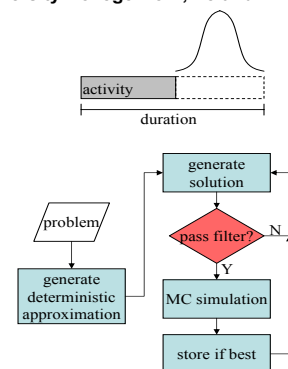
- Problem:** Planning under uncertainty with:
 - A concrete starting state,
 - Limited continuous resources (including time),
 - Uncertain action effects (including resource consumptions),
 - Several possible one-time-rewards (or goals), only a subset of which are achievable within resource constraints.
- Approach:**
 - Given a technique for performing dynamic programming backups for hybrid MDPs with continuous and discrete state variables,
 - A variant of the AO* algorithm that searches in the hybrid state space where states with similar discrete components are aggregated.
- Application:** Creating activity plans for planetary exploration rovers.

11:30 - 12:00

Proactive Algorithms for Scheduling with Probabilistic Durations

J. Christopher Beck and Nic Wilson
University of Toronto, Canada and University College Cork, Ireland

- Goal: find the schedule with smallest makespan, that is achievable with probability α
- Constraint programming or tabu search with Monte Carlo (MC) simulation
- Reduce MC simulation by filtering potential solutions with a deterministic approximation
- Empirical results demonstrate strong correlation between deterministic and probabilistic makespan, providing an explanation for algorithm performance
- Future work: principled methods for deterministic approximation



12:00 - 12:30

Conditional Planning in the Discrete Belief Space

Jussi Rintanen
Albert-Ludwigs-Universität Freiburg, Germany

- We present a framework for conditional planning with partial observability and analyze its basic properties.
- We show that the basic dynamic programming step in the framework is NP-complete.
- We argue that the problem of making branching choices is easier in the backward than in the forward direction.
- An implementation of these ideas and some experiments are presented to support the claim.

**Report on the 12th International Conference on
Artificial Intelligence in Education (AIED-05)
Amsterdam, July 18-22, 2005**

Gord McCalla and Chee-Kit Looi, AIED-05 Program Co-Chairs
mccalla@cs.usask.ca, cklooi@nie.edu.sg

- AIED: an interdisciplinary, applied area of artificial intelligence since 1970; biennial AIED conferences since the mid 1980's
- AIED-05 conference theme: *supporting learning through intelligent and socially informed technology*
- AIED-05 main sessions: learner modeling, motivation, pedagogical agents, tutorial dialogue, collaborative learning, domain knowledge representation, ontology, data mining, educational games, authoring tools, evaluation, innovative pedagogy, applications
- AIED-05 statistics: 289 submissions, 89 accepted papers (31%), 72 posters, 4 invited talks, 2 panels, 12 workshops, 5 tutorials, 11 interactive events, 28 papers in Young Researchers' Track
- Conference organizers: Bert Bredeweg, Joost Breuker, Helen Pain
- For more: <http://hcs.science.uva.nl/AIED2005/>

10:30 - 10:50

**Generating Better-Than-Human Texts
(10th European Workshop on Natural Language Generation)**

Ehud Reiter, University of Aberdeen, Scotland, UK

- SumTime generates weather forecast texts that are better than forecast texts written by human forecasters
 - As judged by forecast readers
- Partially because of better model of reader diversity (idiolect)
 - Readers have varying linguistic and lexical preferences
 - Writers are not always sensitive to this, and sometimes assume that readers are like themselves
 - They write texts that they themselves would like to read
 - SumTime "wins" because it has a limited understanding of variations in language usage and preferences
- Implications
 - Application: NLG is not just cheaper, it can also be better
 - Scientific: Importance of understanding diversity (idiolect)

10:50 - 11:10

**International Conference on Uncertainty in AI
Faheim Bacchus**

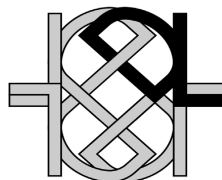
11:10 - 11:30

Trends in Description Logic

Carsten Lutz
TU Dresden, Germany

This talk summarizes recent trends and developments in the field of Description Logic.

In particular, it gives an overview of the issues discussed at the 2005 Workshop on Description Logic.



11:30 - 11:50

11:50 - 12:10

Symposium on Abstraction, Reformulation and Approximation
SARA

Berthe Y. Choueiry
Constraint Systems Laboratory, University of Nebraska-Lincoln

- **Meetings** started in 1988, evolved into SARA in 1994.
- **The goal** is to overcome the barrier of computational complexity and improve interactions with users. Thus, it is fundamental for problem solving and of concern to AI, Computer Science, and Engineering.
- **The research** addresses issues of *modeling* a problem from the real world into an encoding; and *reformulating* a problem encoding into another encoding ‘more amenable’ to problem solving.
- **A contribution** typically describes an abstraction mechanism and its automation in a given context, and evaluates the abstraction process by assessing its costs and effects in terms of a set of qualitative and quantitative evaluators and logical properties.
- **Refer** to the proceedings of SARA and the special issues of Phil. Trans. Royal Society Vol. 358 (2003) and AIJ Vol. 162 (2005).

12:10 - 12:30

Workshop on Automated Reasoning
ARW 2005

Jacques D Fleuriot
University of Edinburgh

- Informal forum for Automated Reasoning community
- Topics covering breadth and diversity of AR
 - Applications to e-Science
 - Theorem proving (automatic and interactive)
 - Reasoning systems and mechanisms

Examples:

- Formal methods
- Logic-based representation
- Symmetry and Reasoning
- Reasoning for and about agents

- Invited talks
- Alan Frisch, Mike Gordon, Marta Kwiatkowska, Luc Moreau
- Panel Sessions

Invited Speaker: Andrew Blake
Chair: David Hogg

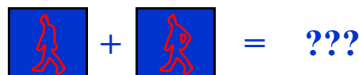
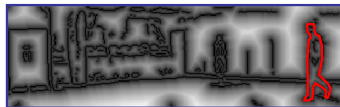
tuesday **2** august
14:00 - 15:00 Pentland Room

Visual Tracking of Objects in Motion

Andrew Blake, Microsoft Research Cambridge, UK



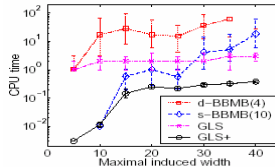
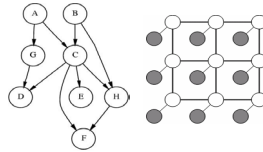
- Deterministic contour models
- Kalman snake -- active contour
- Particle filter tracking
- Appearance modelling
- Predictive localization



Stochastic Local Search for MPE Solving

Frank Hutter, Holger Hoos, and Thomas Stützle
University of British Columbia, Vancouver, Canada &
Darmstadt University of Technology, Darmstadt, Germany

- Problem: find most likely instantiation of all variables in a graphical model given partial evidence
- Approach: Stochastic Local Search (SLS) over complete instantiations
- SLS was previously shown to be outperformed on this problem (by branch-and-bound algorithms)
- Our improved SLS is best for random instances, still has problems with structure
- SLS doesn't care about induced width
- Future work: exploit structure in SLS and apply algorithm to stereo vision problems

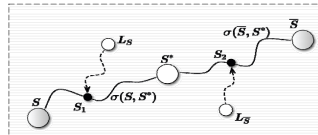


15:30 - 16:00

The COMPSET Algorithm for Subset Selection

Yaniv Hamo and Shaul Markovitch
CS Dept., Technion, Haifa, Israel

- A general algorithm applicable to all subset selection problems
- Guides known local-search algorithms using insights specific to subset selection



15:30 - 16:00

The Complexity of Quantified Constraint Satisfaction Problems under Structural Restrictions

Georg Gottlob¹, Gianluigi Greco², and Francesco Scarcello²

¹Technische Universität Wien, Vienna, Austria,

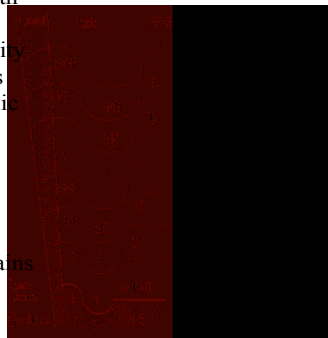
²University of Calabria, Rende, Italy

Bad News:

- Even tree-structured QCSPs with prefix $\forall\exists$ are intractable.
- For fixed domains, the tractability of bounded-treewidth QCSPs is optimal: even QCSPs with acyclic hypergraphs and bounded treewidth incidence graphs are intractable

Good News:

- k -guarded QCSPs are tractable, without any restriction on domains or quantified alternations.



16:00 - 16:30

QCSP-Solve:

A Solver for Quantified Constraint Satisfaction Problems

Ian Gent, Peter Nightingale (University of St. Andrews, UK)

Kostas Stergiou (University of the Aegean, Greece)

- A specialized solver for Quantified CSPs (QCSPs)
 - A QCSP is the extension of CSP that allows universally quantified variables
- QCSP-Solve incorporates a variety of look-ahead and look-back techniques:
 - FC and MAC,
 - Pure Value Rule (the analogue of the pure literal rule in QBF),
 - Conflict-based Backjumping,
 - Conflict-directed Pruning,
 - Symmetry breaking through Neighborhood Interchangeability
- Experiments with a novel unflawed random generation model show that QCSP-Solve is orders of magnitude more efficient than previous approaches

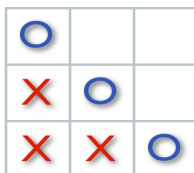
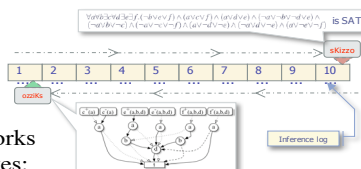
16:30 - 17:00

Extracting Certificates from Quantified Boolean Formulas

Marco Benedetti

ITC-Irst (Institute for Scientific and Technological Research), Trento, Italy

- We show how to represent, verify and extract **SAT-certificates** for QBFs (theory, experimental results, implementation and future works are discussed). Such certificates:



- Provide solver-independent evidence of satisfiability;
- Certify the answers of QBF solvers;
- Can be used to extract winning strategies from every QBF-encoded 2-player game;
- Have important practical applications to model checking, automated planning and synthesis.

A Model for Generating Random Quantified Boolean Formulas

Hubie Chen

17:00 - 17:30

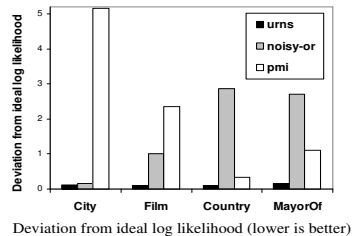
A Probabilistic Model of Redundancy in Information Extraction

Doug Downey, Oren Etzioni, and Stephen Soderland
University of Washington, Seattle, WA, USA

When extracting information from massive corpora such as the Web, the same extraction is often found repeatedly in different documents – how does this redundancy impact the probability that the extracted information is correct?

We present a combinatorial balls-and-urns model (“URNs”) that explicitly models the impact of sample size, redundancy, and corroboration from multiple distinct extraction rules on the probability of correctness.

Experiments show URNs produces substantially more accurate probabilities than techniques used in previous work on unsupervised information extraction.



15:30 - 16:00

Shallow Semantics for Relation Extraction

Sanda Harabagiu, Cosmin Adrian Bejan, Paul Morarescu
The University of Texas at Dallas, Richardson, Texas, USA

- New method for extracting meaningful relations from unstructured natural language sources;
- The method is based on information made available by shallow semantic parsers;
- To investigate the role of semantic information for relation extraction we used two shallow semantic parsers, one trained on PropBank and one on FrameNet;
- Semantic information provided by the parsers was used:
 - to enhance the features of dependency kernels;
 - to generate a new representation, called semantic dependency structure.
- The semantic dependency structure enabled the extraction of relevant relations with better performance than previous state of the art kernel methods.

16:00 - 16:30

Semantic Annotation of Unstructured and Ungrammatical Text

Matthew Michelson and Craig A. Knoblock
University of Southern California, Information Sciences Institute,
Marina Del Rey, CA, USA

- Annotate unstructured, ungrammatical text
 - For example posts on Ebay, BiddingForTravel.com, or Craig's List
- Exploit “reference sets” – data sources of known entities and attributes
- Exploit record linkage techniques to align text to a “reference set”
- Extract attributes from the text using matched record from “reference set”
- Outperforms lexical and structural extraction methods
 - e.g. Amilcare, Simple Tagger

Hotel Posts from BiddingForTravel.com

\$25 winning bid at holiday inn sel. univ. ctr.
Westin 3* Con. Cent. 37\$+5 12-8-01
3* Arden - \$33 Doubletree 2/13-2/15
4* 6/4 - 6/6 Manchester Hyatt or near would be perfect!

Annotation using Reference Sets

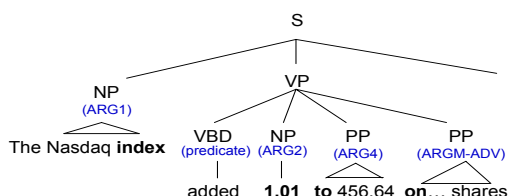
Hotel Name	Area	Star	Price	Date
holiday inn sel.	univ. ctr.		\$25	
Westin Con. Cent.		3*	37\$+5	12-8-01
Doubletree	Arden	3*	\$33	2/13-2/15
Manchester Hyatt		4*		6/4 6/6

16:30 - 17:00

Semantic Argument Classification Exploiting Argument Interdependence

Zheng Ping Jiang¹, Jia Li², Hwee Tou Ng^{1,2}
¹Singapore-MIT Alliance, Singapore
²National University of Singapore, Singapore

- Proposes the use of additional features of neighboring semantic arguments in determining the class of the current semantic argument
- Achieves relative error reduction of 18% over baseline system

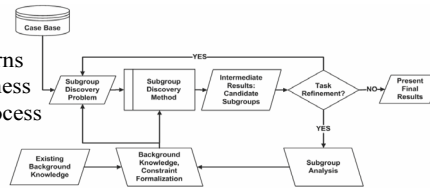


17:00 - 17:30

Exploiting Background Knowledge for Knowledge-Intensive Subgroup Discovery

Martin Atzmueller¹, Frank Puppe¹, Hans-Peter Buscher²
¹University of Würzburg, ²DRK-Clinics Berlin-Köpenick, Germany

- Apply background knowledge to:
 - restrict search space
→ increase efficiency
 - focus on relevant patterns
→ increase interestingness
- Knowledge-Intensive Process for subgroup discovery
 - Exploration
 - Descriptive Induction
- Knowledge acquisition: reduce costs, make knowledge formalization easier by reusing known knowledge-concepts
- Use: Constraint Knowledge, Ontological K., Abstraction K., Pattern K.
- Experimental evaluation in the medical domain (case study) showed impact of the presented approach



15:30 - 16:00

Training without data: knowledge insertion into RBF neural networks

Ken McGarry and Stefan Wermter
School of Computing and Technology
University of Sunderland, UK

A major problem when developing neural networks for machine diagnostics situations is that no data or very little data is available for training on fault conditions. However, the domain expert often has a good idea of what to expect in terms of input and output parameter values. If the expert can express these relationships in the form of rules, this would provide a resource too valuable to ignore.

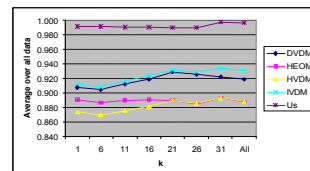
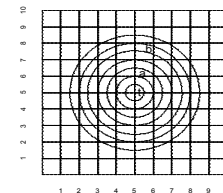
This paper investigates the development of a novel knowledge insertion algorithm that explores the benefits of prestructuring RBF neural networks by using prior fuzzy domain knowledge and previous training experiences. Pre-structuring is accomplished by using fuzzy rules gained from a domain expert and using them to modify existing Radial Basis Function (RBF) networks.

16:00 - 16:30

A flexible and robust similarity measure based on contextual probability

Hui Wang, Werner Dubitzky
University of Ulster, Northern Ireland, UK

- New formalism for defining similarity by system of neighborhoods
- Derived from contextual probability -- an uncertainty reasoning formalism
- For relational data the similarity has linear computational complexity
- Experimental comparisons with 4 popular distance measures demonstrate clear superiority on classification
- Probabilistic characterization of classification by the similarity
- Future work: introduce weighting into the similarity



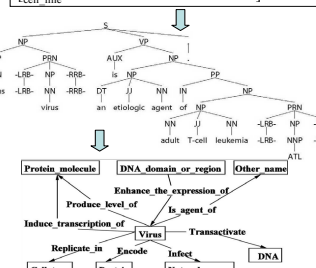
16:30 - 17:00

Unsupervised Learning of Semantic Relations between Concepts of a Molecular Biology Ontology

M. Ciaramita¹, A. Gangemi¹, E. Ratsch^{2,3}, J. Sarić² and I. Rojas²
¹Institute for Cognitive Science and Technology (CNR), Italy; ²EML-Research GmbH, Germany; ³University of Würzburg, Germany

- Unsupervised learning of ontological relations from biological text.
- Purpose: text data mining and manual ontology building support
- GENIA ontology and its annotated corpus were used
- Relations represented as dependency paths between named entities
- Automatic selection of relevant relations
- In-depth analysis of the results from biological and ontological perspectives.

[virus, Human T-cell leukemia virus type I]
([virus HTLV-I]) is the etiologic agent of the
[other_name adult T-cell leukemia], an
aggressive and often fatal malignancy of
[cell_line activated human CD4 T cells].



17:00 - 17:30

Exploiting Informative Priors for Bayesian Classification and Regression Trees

Nicos Angelopoulos & James Cussens
 Dept of Computer Science, University of York, UK

- The Bayesian argument: it helps to incorporate prior knowledge into learning.
- But how to do this in practice?
- We use stochastic logic programs: each C&RT tree is encoded as a first-order term.
- We approximate a posterior over all possible C&RT trees using MCMC.
- Adding prior knowledge improves this approximation and improves predictive accuracy.

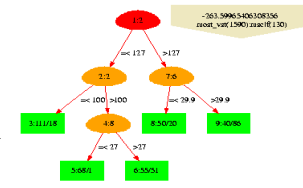


Figure 1: Most-visited C&RT tree.

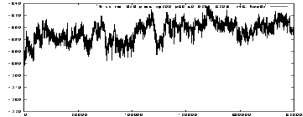


Figure 2: Log-likelihood trajectory.

15:30 - 16:00

Generalization Error of Linear Neural Networks in an Empirical Bayes Approach

Shinichi Nakajima, Sumio Watanabe
 Tokyo Institute of Technology, Japan, Nikon Corporation, Japan

Previous works showed that

- Almost all learning machines used in artificial intelligence, for example, neural nets, Bayesian nets, mixtures, hidden Markov models, etc., are not statistically regular but singular and unidentifiable.
- In unidentifiable models, Bayes estimation has advantage of generalization to maximum likelihood (ML) estimation, but it is intractable.
- James-Stein (JS) estimator, a classic in statistics, is superefficient.

In this paper, we

- Clarify generalization error of a tractable approximation of Bayes estimation, called subspace Bayes (SB) approach, in linear neural nets. (SB approach is an extension of empirical Bayes (EB) approach.)
- Prove equivalence between SB approach and JS type estimation.
- Discuss equivalence also to variational Bayes (VB) approach, which has shown good generalization in many applications.

16:00 - 16:30

Generalization Bounds for Weighted Binary Classification with Applications to Statistical Verification

Vu Ha and Tariq Samad
 Honeywell Labs, Minneapolis, Minnesota, USA

- New statistical verification approach based on Vapnik-Chervonenkis inequalities that allows explicit tradeoff between safety & performance
- Additional ideas from control, statistics (Neyman-Pearson hypothesis testing), machine learning (cost-sensitive classification), and V&V
- Several real-world applications
- Contribute to better understanding of VC bounds for generalizations of weighted binary classifiers
- Open up several exciting research directions related to data-dependent bounds and VC-NP classification
- Example of used inequalities, due to Shawe-Taylor *et al.* (1993):

$$n\epsilon > 4d \Rightarrow P_n(l_n(h) = 0, l(h) > \epsilon) \leq 2 \exp\left(2\sqrt{2d} - \epsilon n + d \ln \epsilon + 2d \ln \frac{en}{d}\right)$$

Sponsored by DARPA & AFRL, Contract No. F33615-01-C-1848

Honeywell

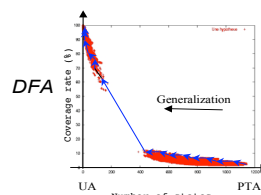
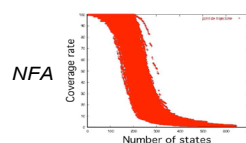
16:30 - 17:00

Phase Transitions within Grammatical Inference

Nicolas Pernot, Antoine Cornuéjols, Michèle Sebag
 L.R.I., Paris-Sud University, Orsay, France

- Induction is based on the measure of the coverage rate of the hypotheses
- We study this rate in samplings of finite state automata
- Findings:
 - Near phase transition for NFA
 - A gap for DFA
 - Bad generalization performances
- Necessity of well-informed heuristics

- Ideas for new heuristics for GI
- Theoretical analysis



17:00 - 17:30

15:30 - 16:00

Tractable Reasoning with Incomplete First-Order Knowledge in Dynamic Systems with Context-Dependent Actions

Yongmei Liu and Hector J. Levesque
University of Toronto, Canada

- A basic reasoning problem in dynamic systems is the projection problem: determine if a formula holds after a sequence of actions is performed.
- This paper proposes a tractable solution to the projection problem in the presence of incomplete first-order knowledge and context-dependent actions.
- Our solution is based on a type of progression, that is, we progress the initial knowledge base wrt the action sequence and answer the query against the resulting knowledge base.
- Our solution is always logically sound and is also logically complete when the query is in a certain normal form and the agent has complete knowledge (perhaps by sensing) about the context of any context-dependent actions.

16:00 - 16:30

Goal Change

Steven Shapiro
University of Leipzig

Yves Lespérance
York University

Hector J. Levesque
University of Toronto

Although there has been much discussion of belief change, goal change has not received much attention. In this paper, we propose a method for goal change in the framework of Reiter's theory of action in the situation calculus, and investigate its properties. We extend the framework developed in [Shapiro et al. 98] and [Shapiro and Lespérance 2001], where goals and goal expansion were modelled, but goal contraction was not.

16:30 - 17:00

From knowledge-based programs to graded belief-based programs, Part II: off-line reasoning

Noël Laverny and Jérôme Lang
IRIT – Univ. Paul Sabatier and CNRS (Toulouse, France)

- **Graded version of KD45** with a semantics based on **ranking functions** Example: the formula

$$P_1(B_2^r \vee B_2^{\neg r}) \wedge P_\infty(B_1^r \vee B_1^{\neg r})$$
- **Second-order uncertainty:**
 - belief state = ranking function
 - complex belief state = ranking function over belief states

means that executing the plan will lead:

 - with full certainty, to a belief state where the truth value of r is believed at least to degree 1
 - possibly (to degree 1) to a belief state where the truth value of r is believed at least to degree 2
- **Off-line progression** of a belief state by a plan (and its computation)

17:00 - 17:30

Iterated Belief Change: A Transition System Approach

Aaron Hunter, James P. Delgrande
Simon Fraser University, Burnaby, Canada

- We address belief change brought about by actions
 - Belief update is defined using transition systems
 - Belief revision is defined using distance functions on states
- Iterated belief change
 - We consider sequences of alternating updates and revisions
 - Non-elementary interactions between update and revision can occur
 - Rationality postulates describing the interaction are given
- Belief evolution
 - We introduce a new belief change operator, belief evolution
 - Action histories are mapped to plausible belief histories
 - The result satisfies the interaction postulates
 - Also satisfies the Darwiche-Pearl postulates for iterated revision
- Future work
 - Address fallible action histories and unreliable observations

Stationary Deterministic Policies for Constrained MDPs with Multiple Rewards, Costs, and Discount Factors

Dmitri Dolgov, Edmund Durfee
University of Michigan, Ann Arbor, MI, USA

Problem:

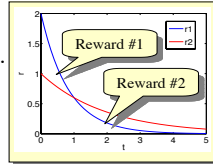
- Optimal policies for constrained MDPs with multiple discount factors are neither deterministic nor stationary.
- Optimal non-stationary policies are huge and finding them is very hard (exact complexity is not known).

Approach:

- Limit search to stationary deterministic policies.
- This problem is NP-hard.

Results:

- A practical solution approach, based on a reduction to a mixed integer linear program.
- Empirical analysis of algorithm's performance shows an anytime profile. For many restricted domains with one discount and multiple costs, deterministic policies perform close to optimal (in the general case, quality analysis is difficult for lack of optimal algorithms).



15:30 - 16:00

Bounded Policy Iteration for Decentralized POMDPs

Daniel S. Bernstein, University of Massachusetts Amherst
Eric A. Hansen, Mississippi State University
Shlomo Zilberstein, University of Massachusetts Amherst

We present a bounded policy iteration algorithm for infinite-horizon decentralized POMDPs. Policies are represented as joint stochastic finite-state controllers, which consist of a local controller for each agent. We also let a joint controller include a correlation device that allows the agents to correlate their behavior without exchanging information during execution, and show that this leads to improved performance. The algorithm uses a fixed amount of memory, and each iteration is guaranteed to produce a controller with value at least as high as the previous one for all possible initial state distributions. For the case of a single agent, the algorithm reduces to Poupart and Boutilier's bounded policy iteration for POMDPs.

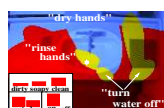
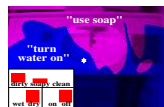
16:00 - 16:30

Solving POMDPs with Continuous or Large Discrete Observation Spaces

Jesse Hoey
University of Toronto

Pascal Poupart
University of Waterloo

- Large observation spaces cause problems for POMDP solution algorithms
- Only observations that would change the policy need be distinguished
- Induces partition of observation space based on the decision problem, which can be found while computing a policy
- Demonstrated on assisted living task simulated rewards:
our method: 13.7 ± 1.4
naive method: 4.7 ± 0.3



policy and belief state

observation space partition

16:30 - 17:00

Algebraic Markov Decision Processes

Patrice Perny, Olivier Spanjaard, Paul Weng
LIP6, Pierre & Marie Curie University, Paris, France

Main topic: Algebraic approach for a unified treatment of MDPs

- factorizes many existing models (quantitative or qualitative)
- gives a theoretical ground to new models (with complete or partial preferences, probabilistic or possibilistic uncertainty)
- provides a general algorithmic solution

Formal framework:

- a semiring structure on rewards
- a semiring structure on plausibilities
- generalized expected utility (GEU) as decision model

Solution method:

- algebraic Bellman equations
- Jacobi algorithm (for generalized path problems)

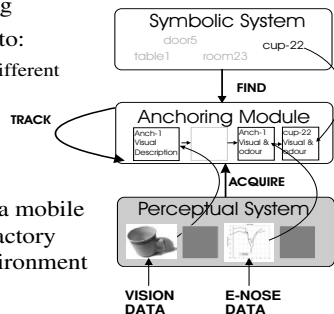
Future works: Infinite horizon, rank dependent decision models

17:00 - 17:30

Maintaining Coherent Perceptual Information Using Anchoring

Amy Loutfi, Silvia Coradeschi and Alessandro Saffiotti
Center for Applied Autonomous Systems, Örebro University, Sweden

- We show how a modified anchoring framework could be used as a tool to:
 - Manage perceptual information from different sensing modalities
 - Maintain object persistency.
 - Track an object over time.
- Present experiments conducted on a mobile robot that uses both spatial and olfactory sensors and monitors an office environment over extended periods of time.

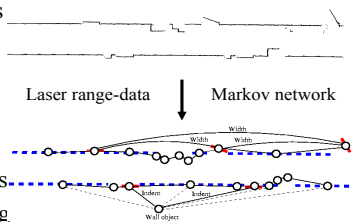


15:30 - 16:00

Relational Object Maps for Mobile Robot Mapping

Benson Limketkai, Lin Liao, Dieter Fox
University of Washington, Seattle, Washington, USA

- **Goal:** Generate object-descriptions of environments
- **RO-Maps:** General framework to reason about
 - hierarchy of objects
 - spatial relationships between objects
- Extend relational Markov networks
- MCMC inference handles changing structure of underlying network
- Achieve high accuracy in labelling objects in previously unknown hallways



Environm.	Lengths	Lengths + Neighbors	All
1	62.6%	88.5%	90.7%
2	58.7%	63.0%	93.5%
3	59.0%	79.2%	89.7%
4	51.8%	96.5%	97.7%
5	60.0%	68.5%	77.9%

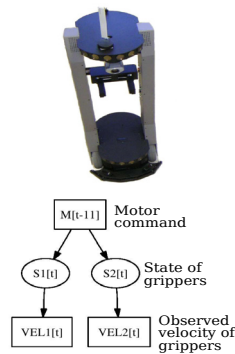
Accuracy

16:00 - 16:30

Learning Forward Models for Robots

Anthony Dearden, Yiannis Demiris
Imperial College, London, UK

- Forward Models predict the consequences of a motor command
- Can be used by a robot to perform imitation
- Learning forward models allows robot to adapt to its environment
- Can be represented as Bayes nets, to model the causal relationship between motor commands and the effect on the environment
- Experiment performed for robot to learn Bayes net structure and parameters by motor 'babbling'



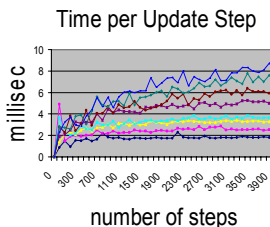
16:30 - 17:00

Learning Partially Observable Deterministic Action Models

Eyal Amir
University of Illinois at Urbana-Champaign, Illinois, USA

- A method for online learning of logical action models, given a sequence of actions and partial observations
- Based on logical filtering
- Our algorithm is *exact and efficient*, if only successful actions are given
- Our algorithm is *inexact or super-polynomial*, if it learns preconditions (i.e., if failed actions are also given)
- The exact version of our algorithms (sometimes inefficient) is theoretically and experimentally faster than exact methods for HMMs, RL, DBN learning
- Future work: first-order learning

Below: The time taken by our exact algorithm to update the reprn of possible action models with different domain sizes.



17:00 - 17:30

Wednesday
3 August 2005

Understanding Molecular Regulatory Mechanisms

Nir Friedman
Hebrew University, Jerusalem, Israel

- Revolution in molecular biology:
 - High-throughput assays that provide different observations about the inner working of cells
 - Massive amounts of data
 - New opportunities and challenges for computational methods
- I will discuss a series of works that use probabilistic graphical models to elucidate molecular mechanisms from such data
- Emphasis on
 - Promise of machine learning tools for biological discovery
 - Biological research is a challenging application area
 - Some insight on how to make an impact
 - Interesting open questions

Limited Discrepancy Beam Search

David Furcy, University of Wisconsin Oshkosh
Sven Koenig, University of Southern California

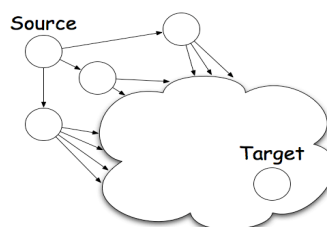
- The memory consumption of beam search, though lower than that of best-first search, can still quickly exceed the available memory.
- We developed BULB (Beam search Using Limited discrepancy Backtracking), a complete memory-bounded search method that augments beam search with backtracking and generalizes limited discrepancy search to beam widths larger than one.
- BULB finds shorter paths than beam search because it is able to use larger beam widths without running out of memory.
- BULB is able to solve more problem instances of large search problems than beam search and does so with a reasonable runtime.
- BULB outperformed beam search and variants of WA* in our experiments. It solved all of our test problems for the 80-Puzzle and resulted in a state-of-the-art Rubik's Cube solver.
- BULB can easily be transformed into an admissible anytime algorithm.

10:30 - 11:00

Decentralized Search in Networks Using Homophily and Degree Disparity

Özgür Şimşek and David Jensen
University of Massachusetts Amherst, USA

- How to find a target node in a network in which each node knows only its immediate neighbors?
- We formulate this as a decision making task under uncertainty
 - Minimize expected path length
 - Use both homophily (tendency of attributes of connected nodes to be correlated) and differences in node out-degree



- Our formulation leads to a simple yet effective algorithm: forward message to neighbor most likely to link to target
- Applications in small-world and scale-free networks for multi-agent systems, peer-to-peer networks, and web search

11:00 - 11:30

AND/OR Branch-and-Bound for Graphical Models

Radu Marinescu and Rina Dechter
University of California, Irvine CA 92697, USA

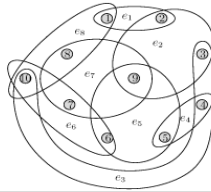
- Evaluation of a new framework for optimization in graphical models, based on AND/OR search spaces
- The size of the AND/OR search space can be far smaller than that of a traditional OR representation
- Introduce a new generation of AND/OR Branch-and-Bound algorithms for solving Constraint Optimization Problems
- Guiding heuristics based on bounded inference (mini-buckets) and/or directional soft arc-consistency
- Empirical evaluation includes solving Weighted CSPs and finding the MPE in belief networks
- The new AND/OR approach improves considerably over the classic OR space, on various benchmarks including both random models and real-life instances

11:30 - 12:00

A Unified Theory of Structural Tractability for Constraint Satisfaction and Spread Cut Decomposition

David Cohen, RHUL, University of London, England
 Peter Jeavons, Computing Lab, Oxford University, England
 Marc Gyssens, Limbergs Universitair Centrum, Belgium

- *Structural Decompositions* are studied in Databases (Conjunctive Query Evaluation) and in Constraint Satisfaction
- Many decompositions are known: Hypercutset, Hinge, Hypertrees, etc.,
- We describe a general theory, giving necessary and sufficient conditions for decompositions to be tractable
- We embed the best known decompositions in our framework and also invent a new decomposition (the *spread cut*) exponentially better than the best existing method (hypertrees).



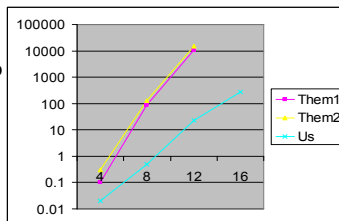
This simple structure (hypergraph) has hypertree width three but spread cut width only two.

10:30 - 11:00

Breaking Variable Symmetries in All Different Problems

Jean-François Puget
 ILOG, France

- A linear number of binary constraints is sufficient for breaking all variable symmetries when there is an all different constraint
- These constraints are automatically computed using computational group theory
- These constraints can be combined with value symmetry breaking techniques
- Experimental comparisons with all other approaches demonstrates clear superiority

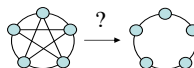
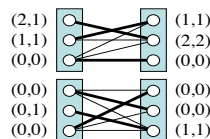


11:00 - 11:30

Structural Symmetry Breaking

Meinolf Sellmann and Pascal Van Hentenryck
 Brown University, Providence, RI, U.S.A.

- Scope: Symmetry breaking by dominance detection in constraint programming
- Contribution: Theoretical complexity analysis of dominance detection for different types of CSPs
 - CSPs with partially symmetric unit-value variables and partially symmetric values – **tractable!**
 - CSPs with partially symmetric set-variables and partially symmetric values – **intractable!**
- Future Work: Other types of symmetry where groups of entities are not pairwise symmetric.



11:30 - 12:00

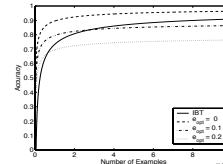
10:30 - 11:00

Learning and Inference over Constrained Output

Vasin Punyakanok, Dan Roth, Wen-tau Yih, Dav Zimak
University of Illinois at Urbana-Champaign, Urbana, Illinois, USA

- We study learning in the presence of constraints over output variables of which values are output by local classifiers.
- We compare two strategies
 1. Learning independent classifiers (L+I): constraints are used only in evaluation time.
 2. Inference based training (IBT): constraints are incorporated into training. (similar to a discriminative version of CRFs).
- Note: L+I has computational advantages
- Conclusions:
 - L+I is better when the local classifiers are good.
 - IBT is superior when local classifications are difficult to learn, provided that there are sufficiently many examples.

Generalization bound for IBT and L+I with various difficulties of local classifiers.



A Two-Stage Method for Active Learning of Statistical Grammars

Markus Becker, Miles Osborne
School of Informatics, University of Edinburgh

Active learning reduces the amount of manually annotated sentences necessary when training state-of-the-art statistical parsers. One popular method, uncertainty sampling, selects sentences for which the parser exhibits low certainty. However, this method does not quantify confidence about the current statistical model itself. In particular, we should be less confident about selection decisions based on low frequency events. We present a novel two-stage method which first targets sentences which cannot be reliably selected using uncertainty sampling, and then applies standard uncertainty sampling to the remaining sentences. An evaluation shows that this method performs better than pure uncertainty sampling, and better than an ensemble method based on bagged ensemble members only.

11:00 - 11:30

Redundancy-free Island Parsing of Word Graphs

Bernd Kiefer, DFKI Saarbrücken, Germany

- Island-Parsing: a bidirectional parsing strategy relevant for
 - Robust processing
 - Resource-limited processing
- Traditionally applied in speech processing
- Existing efficient algorithm has been only formulated for string input
- Extension of the existing algorithm to word graph input
- Simple implementation-oriented reformulation of well-proven algorithm
- Integration of seed selection into the parser's search process
 - Increases flexibility and
 - Facilitates implementation w.r.t. search strategies
- Correctness of extended algorithm is shown
- Future work: Empirical evaluation in real speech system

11:30 - 12:00

Theory of Alignment Generators and Its Applications to Statistical Machine Translation

Raghavendra Udupa, Hemanta Maji
IBM India Research Lab, New Delhi

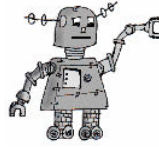
- A formal theory of alignment generators
- A common algorithmic framework for two fundamental NP-hard search problems in SMT:
 - **Decoding** and **Viterbi Alignment**
 - Polynomial time approximate search algorithms
- Based on a nice characterization of exponentially large subspaces.
 - Each subspace can be produced from a generator alignment by employing local operations (**SHRINK**, **MERGE**, **GROW**).
 - Each subspace admits fast polynomial time optimal search algorithms for both Decoding and Viterbi Alignment.
- Substantial improvements in speed (> 100% for long sentences), BLEU scores (16%), log scores (20%) over the greedy decoder and local search.

12:00 - 12:30

Reinforcement Learning in POMDPs Without Resets

Eyal Even-Dar¹, Sham Kakade² and Yishay Mansour¹
Tel Aviv university¹, University of Pennsylvania².

- Realistic reinforcement learning setting in which an agent starts in an unknown environment (the POMDP) and must follow one continuous and uninterrupted chain of experience with no access to “resets” or “offline” simulation
- An implementation of an approximate reset strategy, which we show always exists in every POMDP.



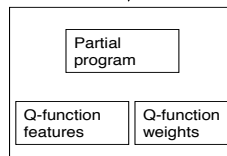
10:30 - 11:00

Concurrent Hierarchical Reinforcement Learning

Bhaskara Marthi, Stuart Russell, David Latham
UC Berkeley

Carlos Guestrin
CMU

- Concurrent Alisp: A language for hierarchical reinforcement learning in domains with concurrent activities
 - Allows specification of prior knowledge using ‘partial programs’
 - Partial programs can have multiple threads
 - During learning, find best completion of this partial program
 - At runtime, threads coordinate to efficiently find best joint choices
- Have applied our algorithms to Stratagus video game



11:00 - 11:30

Learning against opponents with bounded memory

Rob Powers and Yoav Shoham
Stanford University, Stanford, California, USA

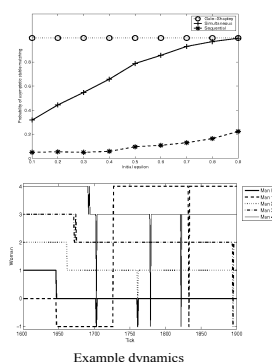
- Most previous work on learning in multi-agent systems has focused on stationary opponents, ignoring the complexities that arise when the opponent may be adapting to the agent’s past play.
- We consider a rich class of adaptive opponents that condition their play on a bounded history of past moves and describe a new algorithm for 2-player repeated games that provably achieves an ϵ -best response average payoff against any member of this class, while simultaneously guaranteeing a minimum worst-case payoff against any opponent and performing well in self-play.
- This algorithm is shown to achieve strong empirical results against existing algorithms across a wide range of environments.
- We conclude with a discussion of several directions for future research in expanding these results to more general settings.

11:30 - 12:00

Two-Sided Bandits and the Dating Market

Sanmay Das and Emir Kamenica
MIT and Harvard University, Cambridge, Massachusetts, USA

- New class of problems used for modeling two-sided matching markets with learning
- Focus on different matching mechanisms and the stability of outcomes
- Simulation results that show the probability of asymptotic stability of matchings with ϵ -greedy learning algorithm
- Definition of regret for learning algorithms and examples of system dynamics when outcomes are unstable



12:00 - 12:30

10:30 - 11:00

Pushing the EL Envelope

Franz Baader, Sebastian Brandt, Carsten Lutz
Theoretical Computer Science, TU Dresden, D-01062 Dresden, Germany

Recently, it has been shown that the small description logic (DL) EL, which allows for conjunction and existential restrictions, has better algorithmic properties than its counterpart FL_0 , which allows for conjunction and value restrictions. Whereas the subsumption problem in FL_0 becomes already intractable in the presence of acyclic TBoxes, it remains tractable in EL even with general concept inclusion axioms (GCIs). On the one hand, we extend the positive result for EL by identifying a set of expressive means that can be added to EL without sacrificing tractability. On the other hand, we show that basically all other additions of typical DL constructors to EL with GCIs make subsumption intractable, and in most cases even EXPTIME-complete. In addition, we show that subsumption in FL_0 with GCIs is EXPTIME-complete.

11:00 - 11:30

On the Interaction Between Inverse Features and Path-functional Dependencies in Description Logics

David Toman, Grant Weddell
University of Waterloo, Waterloo, Ontario, Canada

Many applications of *description logics* (DLs) require an ability to capture keys and functional dependencies in an associated *terminology*. In combination with inverse roles and number restrictions, logical implication then becomes undecidable for boolean complete DLs.

CONTRIBUTIONS

- We show how adding inverse features to a DL with keys and functional dependencies incorporated as *path-functional dependencies* (PFDs) also leads to undecidability.
- We then show how logical implication in the DL remains EXPTIME-complete in two cases:
 1. PFDs in a terminology satisfy a syntactic prefix condition; and
 2. The terminology uses inversions for particular features at most once by virtue of a coherency condition.

11:30 - 12:00

Ordering Heuristics for Description Logic Reasoning

Dmitry Tsarkov and Ian Horrocks
University of Manchester, UK

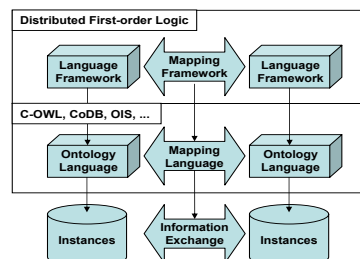
- New tableaux reasoner architecture for DLs such as *SHOIQ*
 - description Logics underlying OWL
 - algorithms implemented in FaCT, Racer, Pellet, ...
- More flexible completion rule application using “to-do lists”
 - allows for more optimisations
 - provides better performance
- Range of new heuristics for ordering rule applications
 - ordering based on syntactic characteristics of ontology
 - empirical evaluation using real and artificial test data
 - up to 10x speedup with “good” heuristics
 - future work: automate choice of heuristic

12:00 - 12:30

A Formal Investigation of Mapping Language for Terminological Knowledge

Luciano Serafini¹, Heiner Stuckenschmidt², Holger Wache²
¹ITC-IRST, Trento, Italy & ²Vrije Universiteit Amsterdam, The Netherlands

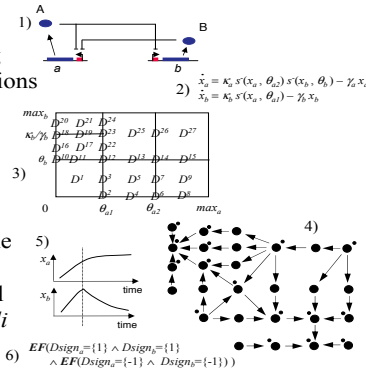
- we show how the DFOL formalism can be used to model relations between heterogeneous domains
- we encode existing mapping approaches in a common framework, making them more comparable
- we make hidden assumptions explicit in terms of distributed first order logic axioms
- we provide first results on the relative expressiveness of the approaches and identify shared fragments



Analysis and Verification of Qualitative Models of Genetic Regulatory Networks: A Model-Checking Approach

G. Batt, D. Ropers, H. de Jong, J. Geiselmann, R. Mateescu, M. Page, D. Schneider
INRIA Rhône-Alpes and Université Joseph Fourier, Grenoble, France

- Context: qualitative simulation of genetic regulatory networks, using piecewise-linear differential equations
- Bottleneck: analysis of simulation results for large networks
- Approach: combine qualitative simulation with model-checking techniques
- Implementation: new version of the tool Genetic Network Analyzer
- Application: analysis of nutritional stress response in bacterium *E. coli*

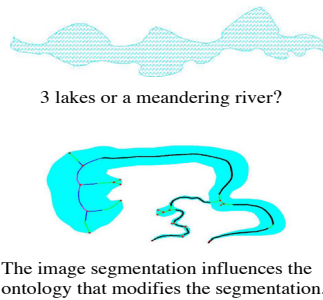


10:30 - 11:00

Supervaluation Semantics for an Inland Water Feature Ontology

Paulo Santos, Brandon Bennett⁽¹⁾ and Georgios Sakellariou⁽²⁾
(1) School of Computing, University of Leeds, UK
(2) Imperial College, London, UK

This paper describes an ontology for inland water features built using *formal concept analysis* and *supervaluation semantics*. The first is used to generate a complete lattice of the water domain, whereas *supervaluation semantics* is used to model the variability of the concepts. We also present an algorithm for individuation and classification of water features from snapshots of river networks.



11:00 - 11:30

Cohesion, coupling and the meta-theory of actions*

Andreas Herzig and Ivan Varzinczak
IRIT – Université Paul Sabatier, Toulouse, France

- What should a good action theory look like?
- Link between Software Engineering and Knowledge Representation
- Modularity of an action theory:
Maximal cohesion and minimal coupling
- Advantages:
 - more efficient consistency checking
 - elaboration tolerance
- Step towards formal criteria for theory evaluation

* Work partially supported by CAPES – Brazil – Grant 1389-01-7.

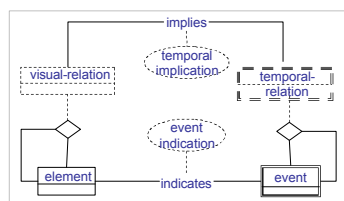
11:30 - 12:00

Cognitive Modelling of Event Ordering Reasoning in Imagistic Domains

Laura S. Mastella, Mara Abel, Luis C. Lamb, Luiz F. De Ros
Federal University of Rio Grande do Sul, Porto Alegre, Brazil

- Cognitive model** for event ordering reasoning within domains whose elements have been modified by past events.
- Temporal relations** between events derived from *visual-spatial relations* among domain elements.

- Problem-solving method:** models the expert's reasoning when deriving the events' sequence;
- Event Ontology:** presents constructs for representing temporal aspects.



- Validation in a petroleum reservoir evaluation application: current visual characteristics of the rock define its genesis sequence.

12:00 - 12:30

10:30 - 11:00

Encoding formulas with partially constrained weights in a possibilistic-like many-sorted propositional logic

Salem Benferhat¹, Henri Prade²

1. CRIL-CNRS, Université d'Artois, Lens, France
2. IRIT, Université Paul Sabatier, Toulouse, France

- Handles classical logic formulas with constrained symbolic weights
- The symbolic weights are partially ordered by the constraints
- The available knowledge, and the constraints on symbolic weights, are encoded by means of two distinct propositional knowledge bases.
- The inference process is characterized in terms of forgetting variables
- It provides an extension of possibilistic logic

11:00 - 11:30

Asymptotic Conditional Probability in Modal Logic: A Probabilistic Reconstruction of Nonmonotonic Logic

Riccardo Rosati
DIS, Univ. Roma "La Sapienza"

Georg Gottlob
Inst. Informationssysteme, TU Wien

Problem studied:

asymptotic conditional validity of modal formulas $\lim(g \mid f)$ = the probability that a modal formula g is valid in the Kripke structures in which f is valid, when the size of structures grows to infinity

Results:

1. we characterize the formulas g that are almost surely valid (i.e., with probability 1) in case f is a flat, **S5**-consistent formula:
 $\lim(g \mid f) = 1$ iff f entails g in the nonmonotonic modal logic **S5_G**
2. computational account of the asymptotic conditional validity problem in Kripke structures:

Deciding whether $(g \mid f) = 1$ is Π^P_2 -complete

- ⇒ probabilistic semantics to the nonmonotonic logic **S5_G**
⇒ a new bridge between nonmonotonic and probabilistic reasoning!

11:30 - 12:00

Lifted First-Order Probabilistic Inference

Rodrigo de Salvo Braz, Eyal Amir, Dan Roth
University of Illinois at Urbana-Champaign, USA

- Algorithm for doing inference with first-order probabilistic rules (or undirected potentials) with *well-defined semantics*. Example input:
"if friends(X,Y) and smoker(Y) then smoker(X)" 0.6
- *Novelty*: inference directly on the first-order level (as in theorem proving), instead of propositionalizing (grounding random variables per each individual in domain).
- Useful (shown empirically) for domains with large numbers of objects about which we have the same knowledge (e.g., populations).
- Foundation for theorem proving-like probabilistic inference algorithms.
- Future work: computational complexity, bounded approximation (allowing similar objects to be lumped together), functional symbols, queries with open logical variables (e.g., find X such that killer(X) is most likely).

12:00 - 12:30


BLOG: Probabilistic Models with Unknown Objects


Brian Milch, Bhaskara Marthi, Stuart Russell,
David Sontag, Daniel L. Ong, and Andrey Kolobov
University of California, Berkeley, CA, USA

- BLOG: combining probability theory with the semantic foundations of full first-order logic
- Well-formed BLOG model defines unique distribution over first-order model structures ("possible worlds"), allowing:
 - varying sets of objects
 - varying maps from symbols to objects
- Models developed for:
 - citation matching
 - data association
- Complete inference algorithms exist for large fragment of language
- Experiments provide proof of concept

A, B, C, D  World 1

A, C  World 2

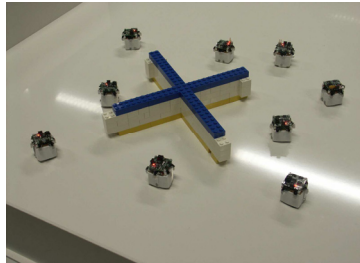
A, C  World 3

B  World 4

Collective AI: context awareness via communication

S.Kornienko, O.Kornienko, P.Levi
 Institute of Parallel and Distributed Systems, University of Stuttgart, Germany

- Collective Artificial Intelligence
- Emergent properties of micro-robotic swarm
- Situation context & communication
- Communication in swarm: embodiment concept
- Content and Context diffusion
- Growing of Collective AI due to context awareness
- Design of hardware and software supporting context awareness
- Real Experiments with artificial swarm

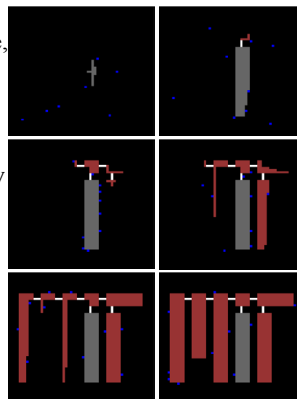
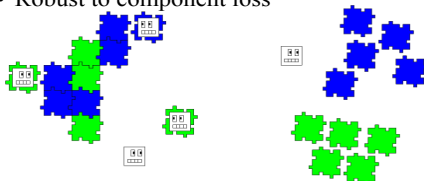


10:30 - 11:00

Building Patterned Structures with Robot Swarms

Justin Werfel, Yaneer Bar-Yam, Radhika Nagpal
 MIT/NECSI/Harvard, Cambridge, Massachusetts, USA

- System for automated construction
- Mobile and structural components: simple, autonomous robots with fixed behaviors; building blocks which communicate
- Fully prespecified or adaptive structures, satisfying high- or low-level constraints
- Relies on simple procedures for feasibility of implementation
- Robust to component loss



11:00 - 11:30

Efficient Distributed "Hormone" Graph Gradients

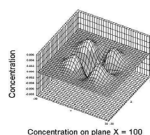
Esben Hallundbæk Østergaard
 The Maersk Mc-Kinney Møller Institute, University of Southern Denmark

Chemical/hormone gradients are known to play a major role during growth and life in multi-cellular organisms.

In physically manifested multi-agent systems, approximations of such gradients are widely used.

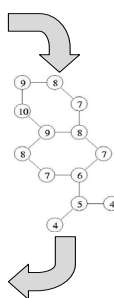
An efficient implementation is presented, featuring;

- A graph-based description of the problem domain
- Detailed algorithm Pseudo-code
- Performance documentation
- Demonstration via Java applet



```

agentProg: --
While (true) {
  for (n=0; n<4; n++) {
    sendMessage(n,i);
  }
  if (m=receivedMessage0) {
    if (i>m.i) i:=m.i;
  }
}
endProg
  
```



11:30 - 12:00

wednesday **3** august
10:30 - 12:30 Ochil Room

ECCAI Dissertation Award
Chair: Shlomo Zilberstein

Symmetry Breaking Ordering Constraints

Zeynep KIZILTAN
DEIS
University of Bologna, Italy

- Row and column symmetry is a common type of symmetry in constraint programming.
 - Such symmetries grow super exponentially.
 - Can be very problematic in a systematic search.
 - Can be difficult to deal with.
- We propose some ordering constraints which can effectively break such symmetries.
- We design and implement linear time algorithms to propagate the ordering constraints.
- We demonstrate the effectiveness of these **symmetry breaking ordering constraints** on a wide range of problems.
- This dissertation describes some of the first work for dealing with row and column symmetries effectively and efficiently.

10:30 - 11:10

Answer Set Programming: Advances in Theory and Implementation Workshop

Vladimir Lifschitz

11:10 - 11:30

Report:

10th Conference on Artificial Intelligence in Medicine

Jim Hunter
University of Aberdeen, UK

Silvia Miksch
Vienna University of Technology, Austria

Submission

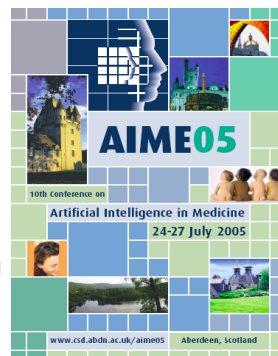
all-time high number of submissions
(128% more than for AIME 03)

Current Trends in

Clinical Guidelines & Protocols
Computer Vision & Imaging
Ontology & Terminology
Machine Learning, Knowledge
Discovery & Data Mining
Temporal Representation & Reasoning

Invited Talks

Paul Lukowicz
Frank van Harmelen

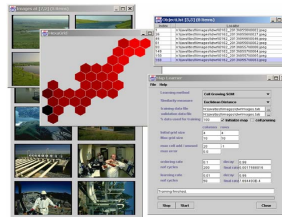


11:30 - 11:50

Adaptive Multimedia Retrieval

Marcin Detyniecki¹, Joemon Jose² and Andreas Nürnberger³
¹University of Paris, ²University of Glasgow, ³University of Magdeburg

- Interaction with today's large amount of multimedia data is extremely hard.
- An idea is to bridge the semantic gap using "adaptivity".
- What is "adaptivity" in multimedia retrieval context?
 - Personalization & Feedback.
 - Intelligent Interfaces & Visualization.
 - New types of Query & Interaction.
- Where are people putting nowadays this "adaptivity"? → state of the art.
- How can more "adaptivity" help? → challenges



Outcomes of the 3rd International Workshop on Adaptive Multimedia Retrieval



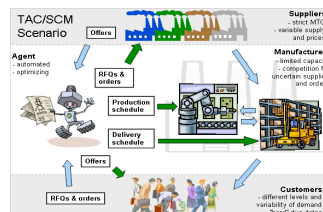
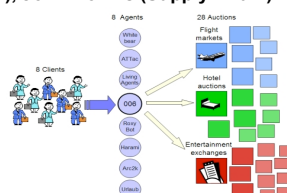
11:50 - 12:10

Trading Agent Competition



Michael P. Wellman (Chair, Assoc. Trading Agent Research)
Sverker Janson (Chair, TADA Workshop)
GameMasters: Ioannis Vetsikas (Travel), John Collins (Supply Chain)

- Open-invitation international research tournaments, featuring market games
- Annual since 2000
- Associated workshop on Trading Agent Design and Analysis (TADA)



- Two game scenarios, domains:
 - **Travel Shopping**
 - **Supply Chain Management**
- 2005 Tournament:
 - **43 Entries from 18 countries**
 - **Come watch the finals, today at Technology Exchange!**

12:10 - 12:30

The Quest for Efficient (and Exact) Probabilistic Inference

Adnan Darwiche

Computer Science Department, UCLA, USA

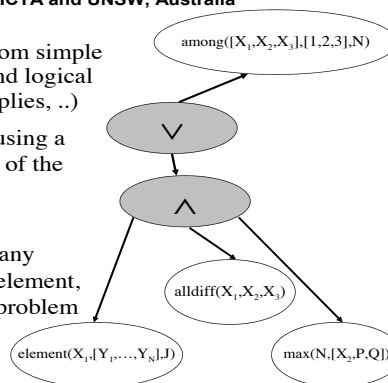
The area of exact probabilistic inference has seen major developments over the last few years, allowing one to efficiently perform exact inference on models never considered possible before. Some of these developments have indeed run contrary to strongly entrenched assumptions about the practical limits of exact inference (and some of its theoretical underpinnings). In this talk, I will provide a panoramic view of exact probabilistic inference, highlighting key historical developments that have contributed to earlier assumptions, and discussing what has been happening in the last few years to significantly expand the scalability of exact inference. I will also emphasize the fundamental interplay that has been emerging between modern techniques for probabilistic inference and those for logical reasoning (model counting and knowledge compilation), and provide concrete illustrations from various application areas on the significant scalability of current techniques.

15:30 - 16:00

Propagating Logical Combinations of Constraints

Fahiem Bacchus, University of Toronto, Canada
Toby Walsh, NICTA and UNSW, Australia

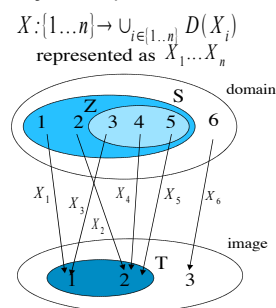
- Build complex constraints from simple primitives ($=$, $<$, alldiff, ..) and logical connectives (and, or, not, implies, ..)
- Propagate such expressions using a simple and natural extension of the propagators for the primitive constraints.
- Can be used to implement many standard global constraints (element, max, lex, ...) or specialized problem specific constraints.



The Range and Roots Constraints: Specifying Counting and Occurrence Problems

Christian Bessiere (LIRMM-CNRS), Emmanuel Hebrard (NICTA and UNSW),
Brahim Hnich (UCC), Zeynep Kiziltan (DEIS), Toby Walsh (NICTA and UNSW)

- Many combinatorial problems involve (counting) the occurrence of particular values
 - do not use the same value twice (alldifferent), minimize values used ...
- We give simple declarative language for specifying such constraints
 - Two new global constraints (RANGE and ROOTS)
 - Standard primitives ($=$, subset, ..)
- Propagation algorithms for RANGE and ROOTS mean this language is executable



Roots($[X_1...X_n]$, S, T) Range($[X_1...X_n]$, Z, T)

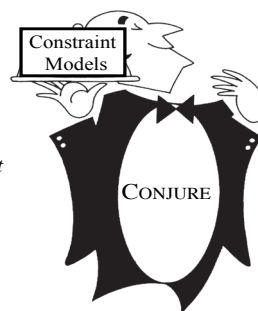
16:00 - 16:30

The Rules of Constraint Modelling

Alan M. Frisch, Christopher Jefferson, Bernadette Martinez-Hernandez,
Department of Computer Science, University of York, UK

Ian Miguel
School of Computer Science, University of St Andrews, UK

- Many combinatorial problems solved successfully using constraint programming.
- To apply constraint programming to a domain, problem must be *modelled* as a constraint satisfaction/optimisation problem.
- Typically many alternative constraint models exist, selecting an *effective* model is difficult.
- We capture modelling decisions in *refinement rules*: describe how a problem specification can be refined into alternative models.
- Rules embedded in CONJURE, an automated refinement system.
- CONJURE can generate a variety of models for practical problems from their specifications



16:30 - 17:00

Bin-Completion Algorithms for Multicontainer Packing and Covering Problems

Alex S. Fukunaga and Richard E. Korf
University of California, Los Angeles, California, USA.

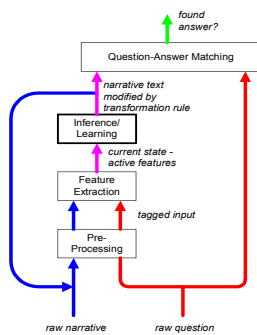
- Multicontainer packing and covering problems model multiagent problems (e.g., task allocation), as well as practical operations research problems (e.g., cargo loading/transport).
 - Packing: assign items to bins that have limited capacity (e.g., bin packing, multiple knapsack).
 - Covering: assign items to bins that have a quota (e.g., bin covering, min-cost covering).
- Bin-Completion: a general framework for solving multicontainer packing and covering problems.
 - Bin-completion used in new, state of the art algorithms for (1) multiple knapsack, (2) bin covering, and (3) min-cost covering.
 - Orders of magnitude faster than previous state of the art algorithms for hard problem instances.

17:00 - 17:30

Learning Strategies for Open-Domain Natural Language Question Answering

Eugene Grois, David C. Wilkins
University of Illinois at Urbana-Champaign, Urbana, Illinois, USA

- New model uses machine learning to improve performance of QA systems.
- Learns strategies governing application of transformation rules through inductive generalization and reinforcement learning.
- Experimental comparisons with three state-of-the-art systems on Remedia corpus.
- Demonstrate improvement upon “matching and extraction”-only techniques.

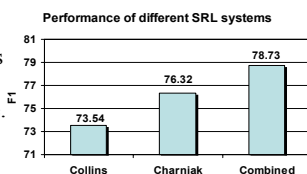


15:30 - 16:00

The Necessity of Syntactic Parsing for Semantic Role Labeling

Vasin Punyakanok, Dan Roth, Wen-tau Yih
University of Illinois at Urbana-Champaign, Urbana, Illinois, USA

- Semantic Role Labeling (SRL) is an important NLP task that discovers the verb-argument structure of a sentence.
- Although full syntactic parsing is known to be crucial to SRL, there has not been a detailed study to explain where and why it helps.
- We showed experimentally the main contribution of full parsing is in the pruning stage, which dictates the candidate argument boundaries.
- Motivated by this observation, we suggest an effective joint inference approach that combines SRL systems based on different syntactic parsers, to significantly improve performance. Joint inference is done with Integer Linear Programming [Punyakanok et. al'04].



16:00 - 16:30

Extraction of Hierarchies Based on Inclusion of Co-occurring Words with Frequency Information

Eiko Yamamoto, Kyoko Kanzaki, Hitoshi Isahara
National Institute of Information and Communications Technology, Kyoto, JAPAN

- We try to **automatically extract hierarchies** most suited to the information that a user handles.
- We apply **Complementally Similarity Measure (CSM) for gray-scale images** to natural language processing.
- CSM is developed for recognizing degraded machine-printed text and can **measure inclusion between two vectors**.
- As the initial task, we attempt to **extract hierarchies of abstract nouns co-occurring with adjectives in Japanese**.
- We compare the result with hierarchies extracted using the **CSM for binary images** which is not able to consider the frequency information.
- We verify the results by measuring their degree of agreement with the **EDR electronic dictionary**.

16:30 - 17:00

Learning to Understand Web Site Update Requests

William W. Cohen, Einat Minkov and Anthony Tomasic

- We present an intelligent system that can process natural language requests, posted via email, to update the factual content of individual tuples in a database-backed website.
- Message understanding is decomposed into a sequence of entity recognition and a scheme of text classification tasks.
- We demonstrate the effectiveness of this approach per each individual task, as well as end-to-end, using a corpus of requests generated in human-subject experiments.
- The system is proved to be robust in handling request types not seen in training and different user-specific language styles.

On the events page, delete row "Decemember 23 Assembly for Automotive Engineers Conference Room A21"

Add the following contact to the Staff list: Arthur Scott ascot@andra.com Rm 7992 281 1914

Please delete Kevin Smith's phone number - thank, Martha

Change Mike Roberts to Michael Roberts.

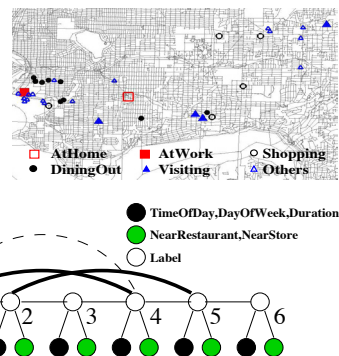
17:00 - 17:30

15:30 - 16:00

Location-Based Activity Recognition using Relational Markov Networks

Lin Liao, Dieter Fox, Henry Kautz
University of Washington, Seattle, Washington, USA

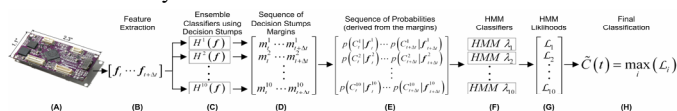
- General framework for sensor-based activity recognition using RMNs
- Extension of RMNs to incorporate global features using *aggregations*
- Efficient MCMC algorithms for inference and learning
- Positive experimental results on real data from multiple people
- Improves accuracy by extracting priors from other people's data.



A Hybrid Discriminative/Generative Approach for Modeling Human Activities

Jonathan Lester¹, Tanzeem Choudhury², Nicky Kern³, Gaetano Borriello^{1,2}, and Blake Hannaford¹
¹University of Washington, Seattle, Washington, USA
²Intel Research Seattle, Seattle, Washington, USA
³Darmstadt University of Technology, Darmstadt, Germany

- Technique for continuous recognition of human activities (i.e. walking, running, riding an elevator, driving a car, etc) from sensor data (audio, acceleration, pressure, etc.)
- Overall accuracy is ~92% for ten different activities



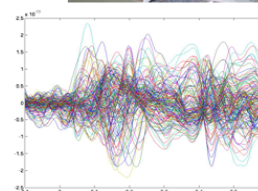
Flow diagram of the classification system (A) sequence of raw data (B) extracted features (C) features are input to an ensemble of classifiers (D) each classifier outputs a decision and a confidence margin at 4Hz (E) margins are converted to posterior probabilities P^i (F) HMM classifiers trained on P^i (G) compute HMM likelihoods every 15s (H) Pick the class with the highest likelihood

16:00 - 16:30

A Multi-Objective Multi-Modal Optimization Approach for Mining Stable Spatio-Temporal Patterns

M. Sebag*, N. Tarrisson*, S. Baillet**, J. Lefevre**, O. Teytaud*
 *TAO Inria / CNRS / Université Paris-Sud, ** Lena, CNRS, Hop. Salpêtrière

- Looking for stable spatio-temporal patterns
- Multi-objective problem (size, correlation)
- Multi-modal (any where, at any time)
- 400+ Mo
- A few minutes on one single machine

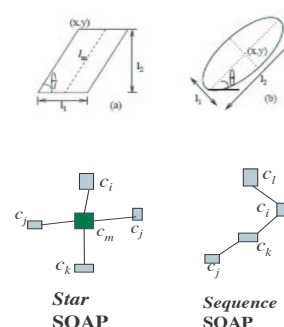


16:30 - 17:00

Mining Spatial Object Associations for Scientific Data

Hui Yang, Srinivasan Parthasarathy, Sameep Mehta
Data Mining Research Laboratory*
Ohio State University, Columbus, Ohio, USA

- Model features as geometric objects
- Define shape-based distance measurements
- Discover different Spatial Object Association Patterns (SOAPs) across multiple datasets
- Demonstrate the importance of different SOAPs on datasets from the bioinformatic domain



17:00 - 17:30

A Tableaux Decision Procedure for SHOIQ

Ian Horrocks and Ulrike Sattler
 University of Manchester, UK

- We present the first *goal-directed* decision procedure for *SHOIQ*
 - the Description Logic underlying OWL-DL
 - the extension of *SHIQ* with *nominals*
- This procedure
 - is tableau-based, like those for *SHIQ* used in FaCT and Racer
 - is sound, complete, and terminating
 - shows good “pay-as-you-go” behaviour:
 - on “harmless” inputs, it behaves like the *SHIQ* algorithm
 - uses novel “guessing” technique when nominals, number restrictions, and inverse roles interact in a complex way
 - is currently being implemented in FaCT

15:30 - 16:00

Aspects of Distributed and Modular Ontology Reasoning

Luciano Serafini
 ITC-IRST
 Trento, Italy

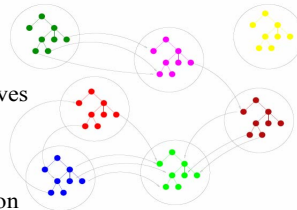
Alex Borgida
 Rutgers University
 Piscataway, NJ, USA

Andrei Tamin
 University of Trento
 Trento, Italy

We investigate a Distributed Description Logics (DDL) formalism for reasoning with multiple local ontologies connected by directional semantic mappings.

We propose:

- a changed semantics which supports “inconsistency localization” and preserves directionality of “knowledge import”;
- a fixed-point characterization of DDL inference;
- a distributed tableaux algorithm based on a coordination between local tableau decision procedures.



We indicate the applicability of the results to several proposals of KR&R that support modularity, scalability and distributed reasoning.

16:00 - 16:30

Computational ontologies of parthood, componenthood, and containment

Thomas Bittner^{1,2,3} and Maureen Donnelly^{1,3}
 Department of Philosophy¹, Department of Geography²
 University at Buffalo, NY, USA
 New York State Center of Excellence in Bioinformatics and Life Sciences³

- Parthood, componenthood, and containment relations are commonly assumed in biomedical ontologies and terminology systems, but are not usually clearly distinguished from another.
- This paper contributes towards a unified theory of parthood, componenthood, and containment relations. Our goal in this is to clarify distinctions between these relations as well as principles governing their interrelations.
- We first develop a theory of these relations in first order predicate logic and then discuss how description logics can be used to capture some important aspects of the first order theory.

16:30 - 17:00

Reasoning with Inconsistent Ontologies

Zhisheng Huang, Frank van Harmelen, and Annette ten Teije
 Department of Computer Science, Vrije Universiteit Amsterdam,
 The Netherlands

- A general framework for reasoning with inconsistent ontologies.
- A set of formal definitions to capture reasoning with inconsistent ontologies.
- Selection functions based on concept-relevance
- Linear extension strategy and its algorithm
- Implementation of the framework based on syntactic concept-relevance.
- Experiments and evaluation with the implementation:



Example	Queries	IA	CA	RA	CIA	IA (%)	ICR (%)
Bird	50	50	0	0	0	100	100
Brain	42	36	4	2	0	85.7	100
MarriedWoman	50	48	0	2	0	96	100
MadCow	254	236	16	0	2	92.9	99

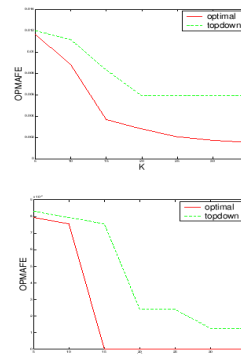
IA = Intended Answers, CA = Cautious Answers, RA = Reckless Answers,
 CIA = Counter-Intuitive Answers, ICR(%)=IA+CA+RA(%)

17:00 - 17:30

Scale-Based Monotonicity Analysis in Qualitative Modelling with Flat Segments

Martin Brooks(1), Yuhong Yan (1), Daniel Lemire (2)
1-National Research Council of Canada
2- Université du Québec in Montréal

- Scale-based monotonicity - monotonicity can be defined relative to a scale.
- Important for qualitative models.
- We solve the following problem: given a number of segments K , find K segments having the smallest monotonic approximation error.
- A novel definition of scale-based flatness.
- We compare our results with top-down piecewise linear approximation and quantify our gains (faster and more accurate, cf. right diagrams).
- Future work: we will continue to work on the multidimensional case.

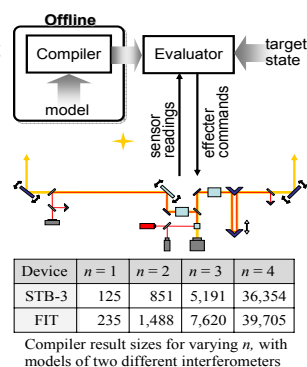


15:30 - 16:00

Model Compilation for Real-Time Planning and Diagnosis with Feedback

Anthony Barrett
Jet Propulsion Laboratory, Pasadena, California, USA

- New approach to solving the device diagnosis and reconfiguration planning problem that provides hard real-time performance guarantees.
- Computes most likely mode given n sets of sensor measurements and optimal $n-1$ step reconfiguration plans given current and target modes.
- Based on knowledge compilation that naturally includes feedback analysis.
- Compiler can take exponential time, but evaluator is linear in result size.
- Future work: Add time, dynamics, and continuous process reasoning



16:00 - 16:30

A Motion Closed World Assumption

Fusun Yaman, Dana Nau, V.S. Subrahmanian
University of Maryland, College Park, Maryland, USA

Motivation

- Our previous work introduced *go-theories* to reason about moving objects when exact speed and arrival/departure times are uncertain.
- It does not allow us to infer that an object is not inside a given region, even though common sense implies this.

Declarative Semantic

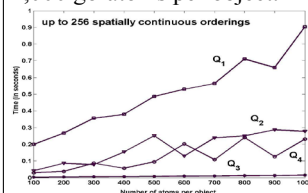
- We define a class of models of go-theories called *coherent* models where objects don't wander around arbitrarily.
- Checking coherence is NP-complete.
- A *motion closed world assumption* (MCWA) based on coherent models.

Algorithms

- We provide sound and complete algorithms to check if a ground *in* literal can be inferred using the MCWA.

Experiments

- Takes less than 1 second for 1,000 go-atoms per object.

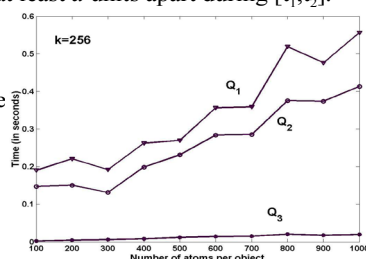


16:30 - 17:00

Going Far, Logically

Fusun Yaman, Dana Nau, V.S. Subrahmanian
University of Maryland, College Park, Maryland, USA

- Our previous work introduced a *logic of motion* to reason about moving objects when there is spatio-temporal uncertainty.
- We extend this logic to include a $far(o_1, o_2, d, t_1, t_2)$ predicate which ensures that o_1 and o_2 are always at least d units apart during $[t_1, t_2]$. It is critical for air-traffic control.
- We define a formal semantics for *far* predicate.
- We develop a sound and complete algorithm to compute far queries.
- In our experiments we were able to answer *far* queries in less than 0.6 seconds for up to 1,000 go-atoms per object.

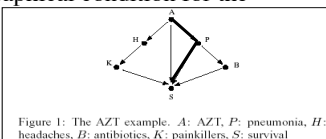


17:00 - 17:30

Identifiability of Path-Specific Effects

Chen Avin, Ilya Shpitser, Judea Pearl
 University of California, Los Angeles, USA

- We extend previous work on “direct” and “indirect” effects and study the identifiability of effects along specific paths.
- We present a simple, necessary, graphical condition for the identifiability of path-specific effects from experimental data.
- The condition becomes sufficient for Markovian models.
- We treat effects as probabilities of statements in a certain counterfactual logic and show how to convert them into subgraphs of the original causal model.
- We then introduce counterfactual formulas whose probabilities are not identifiable, and the graphical conditions associated with them.
- We conclude by proving that any path effect which includes these “problematic” subgraphs is not identifiable.

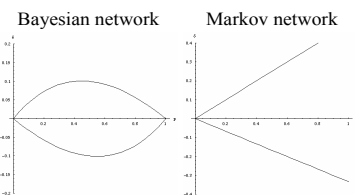


15:30 - 16:00

Sensitivity Analysis in Markov Networks

Hei Chan and Adnan Darwiche
 University of California, Los Angeles

- Tackles following problems:
 1. Effective debugging of Markov network parameters in a potential for ensuring query constraints, e.g. $\Pr(z|e) \geq k$
 2. Quantifying of Markov network parameter changes in terms of relative change
 3. Bounding the amount of query changes due to differences in Markov network parameters in a potential
- Extends approaches for similar problems solved for Bayesian networks
- Compares results with similar problems in Bayesian networks
 - E.g., the amount of permissible absolute parameter change that ensures query robustness



16:00 - 16:30

Probabilistic Reasoning with Hierarchically Structured variables

Rita Sharma, David Poole
 University of British Columbia, Vancouver, Canada

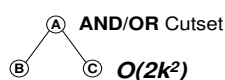
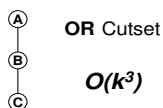
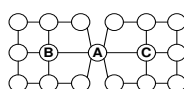
- Many domains have discrete variables in which subsets of the values of the variable can be represented hierarchically in a tree.
- We represent the distribution for such variables by specifying, for each class, the probability distribution over its immediate subclasses.
- We represent the conditional probability distribution of any variable conditioned on hierarchical variable using inheritance.
- Given a query and evidence, we construct a flat BN by collapsing the hierarchies to include only the values necessary to answer the query.
- The size of the variable in the flat BN is independent of the size of the hierarchies; it depends on how many of the classes in the hierarchies are associated with the evidence.
- The proposed approach is applicable even when the hierarchy is very large or even infinite, for example, spatial hierarchies or the hierarchies of large ontologies.

16:30 - 17:00

AND/OR Cutset Conditioning

Robert Mateescu and Rina Dechter
 University of California, Irvine, USA

- AND/OR Cutset Conditioning combines:
 - AND/OR search spaces for graphical models
 - w-cutset scheme
- AND/OR Cutset is at least as good as OR cutset, but often provides exponential improvements
- The AND/OR cutset inspires an advanced caching scheme for AND/OR search
- Experimental evaluation shows the power of new hybrid schemes of conditioning plus inference
- AND/OR Cutset is scalable to memory intensive problems, where inference algorithms are infeasible.



17:00 - 17:30

15:30 - 16:00

LRTA*(k)

A Real Time Heuristic Search Algorithm

Carlos Hernández and Pedro Meseguer
Institut d'Investigació en Intel·ligència Artificial, CSIC. Bellaterra, Spain.

- LRTA*(k) is a new LRTA*-based algorithm that performs bounded propagation of heuristic changes up to k states per move.
- Bounded propagation maintains heuristic admissibility, so LRTA*(k) inherits the good theoretical properties of LRTA*.
- Experimentally, LRTA*(k) shows a substantial performance improvement in first solution, convergence and solution stability with respect to other state-of-the-art algorithms.
- Parameter k : the higher k , the better results at the cost of longer planning steps. Results show that small k values cause moderate planning times but large benefits.

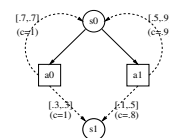
Robust Planning with (L)RTDP

Olivier Buffet & Douglas Aberdeen
National ICT Australia — The Australian National University

- Problem : what to do with Markov Decision Problems when transition matrices are uncertain ?
- Answer : robust planning, i.e. consider a game where an opponent chooses the worst possible model.
- In this paper, we make RTDP robust in a view to handle Stochastic Shortest Path problems.
- The proof of convergence of the resulting algorithm is sketched.
- Some experiments illustrate the behavior of the algorithm.

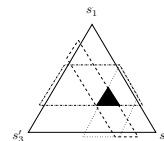
J being the cost to the goal, we get a game of the form (\mathcal{M} =models, \mathcal{A} =actions) :

$$\max_{\pi_M \in \Pi_M} \min_{\pi_A \in \Pi_A} J_{\pi_M, \pi_A}(s_0)$$



An uncertain SSP : transition probabilities are known to lie in intervals.

Interval constraints on probabilities define a set of possible models (the black triangle).

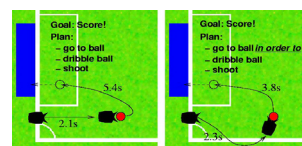


16:00 - 16:30

Optimized Execution of Action Chains Using Learned Performance Models of Abstract Actions

Freek Stulp and Michael Beetz
Technische Universität München, Munich, Germany

- A new computational model for on-line optimization of action chains.
- Based on subgoal refinement: choosing a specific intermediate state between two actions, from the set of states constrained by the pre-post-conditions of these actions.
- Uses learned prediction models to optimize expected performance.
- Significant improvement of execution time in navigation tasks.
- Bigger picture: Allows planning with general abstract actions without performance loss.



Greedy execution Total time: 7.5s
With subgoal refinement Total time: 6.1s

16:30 - 17:00

Real-Time Path Planning for Humanoid Robot Navigation

Jens-Steffen Gutmann, Masaki Fukuchi, Masahiro Fujita
Intelligent Systems Research Laboratory, Sony Corporation, Tokyo, Japan

- Finding collision-free paths in real-time in an environment with different floor heights, stairs, and obstacles.
- Multi-cylinder robot model allows to search a 3D discretized configuration space using basic action primitives.
- Classification of 2.5D sensor data into *floor*, *stairs*, *border*, *obstacle*, and *unknown* with height attribute.
- A* search with constant-time collision checking allows real-time performance.
- Experiments on Sony's humanoid robot QRIO on a 4x1 meter stage.



17:00 - 17:30

Propositional Abduction is Almost Always Hard

Gustav Nordh, University of Linköping, Sweden
Bruno Zanuttini, University of Caen, France

- Complete picture of the complexity of propositional abduction
- Very general framework with KBs = conjunctions of constraints
- P, NP-complete or Σ_2^P -complete depending on constraint language
- All classes identified and efficiently recognizable
- Only one (maximal) language in P: $\{=, \neq\}$; efficient algorithm given
- Hard languages studied with Post's lattice
- Helps designers of KBs to deal with expressivity/tractability tradeoff
- Reveals great hardness of abduction for conjunctive manifestations
- Completely closes the problem for that framework

15:30 - 16:00

Parameterized Compilability

Hubie Chen

16:00 - 16:30

Scalability Study of Peer-to-Peer Consequence Finding

P. Adjiman and P. Chatalic and F. Goasdoué and M.-C. Rousset and L. Simon
PCRI: CNRS & Université Paris-Sud (LRI) – INRIA (Futurs)

- **Setting:** peer-to-peer networks of propositional theories
- **Problem:** computing proper prime implicates of the system without centralized control
- **Contributions:**
 - a **sound, complete** (under realistic condition) and **anytime** algorithm
 - a significant **experimental study** involving more than 1000 peers
- **Applications:** Semantic Web applications which deal with distributed resources at a large scale
- **Future work:** dealing with inconsistencies, extending the data model to RDF(S)



16:30 - 17:00

The Inferential Complexity of Bayesian and Credal Networks

Cassio P. de Campos and Fabio G. Cozman
University of São Paulo, São Paulo, Brazil

- Paper presents complexity classes for several decision problems in Bayesian networks (BN) and credal networks (CN).
- Inferences (belief updating, MPE, MAP, etc) for various networks (polytrees, bounded induced-width, multiply-connected) are analyzed.

Problem	<i>Polytree</i>	<i>Bounded induced-width</i>	<i>Multiply-connected</i>
BN-Pr	Polynomial	Polynomial	PP-Complete
BN-MPE	Polynomial	Polynomial	NP-Complete
BN-MPEe	Polynomial	Polynomial	PP-Complete
BN-MAP	NP-Complete	NP-Complete	NP ^{PP} -Complete
BN-MmAP	Σ_2^P -Complete	Σ_2^P -Complete	NP ^{PP} -Hard
CN-Pr	NP-Complete	NP-Complete	NP ^{PP} -Complete
CN-MPE	Polynomial	Polynomial	NP-Complete
CN-MPEe	Σ_2^P -Complete	Σ_2^P -Complete	Σ_2^P -Hard and PP-Hard
CN-MAP	Σ_2^P -Complete	Σ_2^P -Complete	NP ^{PP} -Hard

17:00 - 17:30

Thursday
4 August 2005

Probabilistic Models of Human Sensorimotor Control

Daniel M. Wolpert

Institute of Neurology, University College London

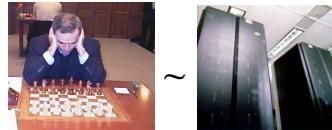
While machines can match grandmasters at chess, no robot can move a chess piece with the dexterity of a 6 year old

We focus on reverse-engineering human sensorimotor control in terms of

- Bayesian learning
- Sensory predictions
- Loss functions
- Optimal control

Taken together our studies provide strong evidence for probabilistic mechanisms underlying human sensorimotor control

What to move where



Moving



On Solution Correspondence in Answer-Set Programming

Thomas Eiter, Hans Tompits, Stefan Woltran
Vienna University of Technology, Austria

- Answer-set programming (ASP) is a fruitful approach for declarative problem solving (with efficient solvers available).
- To turn ASP into a popular programming paradigm, we need:
 - tools providing debugging or verification features;
 - methods for simplification and optimization;
 - a deeper understanding on program equivalence.
- Nonmonotonicity of ASP admits several different notions of equivalence.
- Main Contributions:
 - general framework for equivalence under projected answer sets;
 - model-theoretic characterizations and complexity results;
 - constructive method for obtaining counterexamples to equivalence.

10:30 - 11:00

A Uniform Integration of Higher-Order Reasoning and External Evaluations in Answer Set Programming

T. Eiter, G. Ianni, R. Schindlauer, H. Tompits
Institute for Information Systems, Technical University of Vienna

- Extension of Answer Set Programming with Higher Order Capabilities and External Atoms;
- Higher order is very useful for coping with metareasoning proper of Semantic Web applications;
- External atoms subsume most of the recently introduced ASP extensions
- Combining the two features is not straightforward: we settled many theoretical properties and devised operational semantics
- Prototype available at

```
triple(X, Y, Z)
:- #RDF[U](X, Y, Z), uri(U).
```

External atom – a kind of generalized quantification: inputs and outputs relations

```
C(X) :- triple(C, rdf:type, X).
```

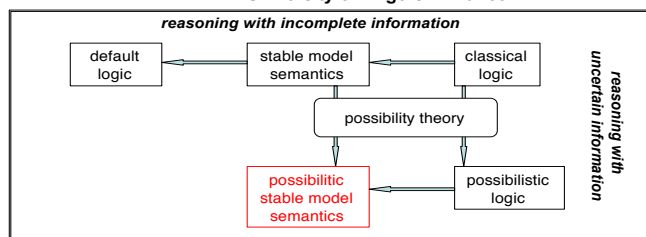
Higher order atom – predicates names can be variables. Same as HiLog, but in a Answer Set Semantics environment

<http://www.kr.tuwien.ac.at/roman/semweb1p>

11:00 - 11:30

Possibilistic Stable Models

Pascal Nicolas, Laurent Garcia, Igor Stéphan
LERIA -- University of Angers -- France



- Extension of Answer Set Programming based on possibility theory: a unique framework to reason with incomplete and uncertain information
 - ↻ semantical part based on a possibility distribution
 - ↻ syntactical part based on a fix-point operator
- Usefull for handling inconsistent normal logic programs.
- Implementation by extension of Lparse and Smodels.

11:30 - 12:00

Declarative and Computational Properties of Logic Programs with Aggregates

Francesco Calimeri, Wolfgang Faber, Nicola Leone, and Simona Perri
Department of Mathematics, University of Calabria, Rende, Italy

- Thorough analysis of Answer Set Programming with aggregates
- Focus on programs without disjunction and with monotone and/or antimonotone aggregates: LPam
- Define unfounded sets for LPams
- Answer sets of LPams are precisely unfounded-free models
- Define well-founded operator and model for LPams
- Well-founded model for LPams is in the intersection of all answer sets
- Well-founded model for LPams is polynomially computable
- Complexity: Cautious Reasoning for LPams stays in co-NP
- Complexity: Cautious Reasoning with nonmonotone aggregates, however, goes up one level in the polynomial hierarchy
- Application and future work: Well-founded operator for pruning in answer set computation, implementation

12:00 - 12:30

10:30 - 11:00

The Backbone of the Travelling Salesperson

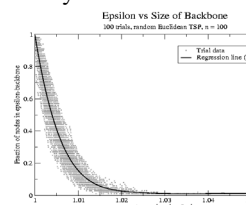
Philip Kilby¹, John Slaney^{1&3} and Toby Walsh^{2&3}

1: Australian National University, Canberra 2: UNSW, Sydney Australia 3: NICTA, Canberra and Sydney

- Approximating TSP backbones (edges in all optimal tours)
- Prove no sound approximation exists (unless P = NP)
- See what we can do anyway...
- In practice, a good heuristic can guess much of the backbone
- Backbone guided heuristics can help *find* an optimal solution, but aren't so good during proof of optimality

		n=100	n=250	n=500
Approx ratio		1.0000	1.0002	1.0008
Correct	10%	99%	69%	29%
	Median	100%	100%	76%
	90%	100%	100%	100%
False Pos	10%	0%	0%	0%
	Median	0%	0%	0%
	90%	1%	0.4%	0.6%

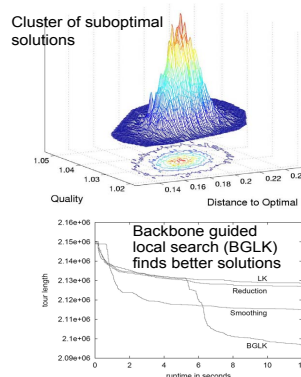
Estimation of backbone using the Lin-Kernighan heuristic. 100 trials of random Euclidean TSP problems at each size.



A Novel Local Search Algorithm for the Traveling Salesman Problem that Exploits Backbones

Weixiong Zhang (zhang@cse.wustl.edu) and Moshe Looks
Washington University in St. Louis, St. Louis, Missouri 63130, USA

- An approximation method that exploit solution structures such as backbones of combinatorial problems
- Optimal and suboptimal solutions tend to form a cluster – sharing common structures
- Common structures can be represented as backbones
- Backbones can be utilized to force a local search into regions of high quality solutions
- Superior performance when applied to local search for the TSP

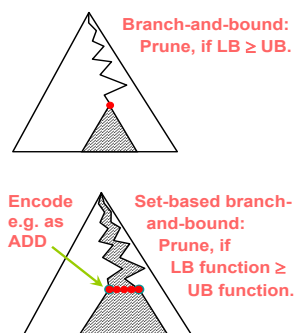


11:00 - 11:30

Bounded Search and Symbolic Inference for Constraint Optimization

Martin F. Sackinbacher and Brian C. Williams
MIT CSAIL, Cambridge, USA

- Idea: Generalize branch-and-bound search to sets of assignments (sets of bounds) instead of single assignments
- Sets can be compactly encoded using symbolic representations (e.g. ADDs)
- Paper further extends the approach to include also structural decompositions
- This unifies two previous algorithms CTE (Dechter, Kask, and Larrosa 01) and BTD (Jégou and Terrioux 03)
- We observe trade-off between making sets larger (moving towards CTE) or smaller (moving towards BTD)

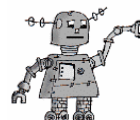


11:30 - 12:00

A Scalable Method for Multiagent Constraint Optimization

Adrian Petcu and Boi Faltings
Artificial Intelligence Laboratory, EPFL, Switzerland

- New, complete method for distributed constraint optimization
- Utility propagation based on dynamic programming
- Uses a pseudo tree arrangement of the problem graph
- Requires a **linear number of messages**
- Largest message is exponential in induced width
- Backtracking algorithms are exponential in tree depth (always at least as large as the width)
- Works well on large but loose problems (sensor networks and meeting scheduling experiments)
- Can be easily applied also to satisfaction problems
- Future work: low width pseudo trees
- <http://liawwww.epfl.ch/Publications/Archive/Petcu2005.pdf>



12:00 - 12:30

Analogy Generation with HowNet

Tony Veale, Dept. of Computer Science, University College Dublin, Ireland.

- We **consider** two alternative approaches to analogy / metaphor within the bilingual Chinese / English lexical ontology *HowNet*.
- **First**, a classical taxonomic abstraction approach, but using a *derived* functional taxonomy from HowNet's semantic definitions:

resume-agent	E.g.,
repair-agent	
repairman 修理工 watchmaker 钟表	
doctor-agent	
surgeon 医生 herbalist 药农	
amend-agent	
reviser 修订者	

- **Second**, a structure-mapping approach using *templates* derived from HowNet definitions. E.g.,

{?: {HaveKnowledge|有知:
agent={~}, content={?}}

is shared by the entries *apostle|使徒* and *person who knows inside story|个中人*.

- **Comparative Evaluation:**

Over 23,507 unique HowNet definitions:

	Taxonomy	Templates	Combo
Coverage	.27	.90	.90
Recall	.26	.61	.72
Precision	.59	.21	.24
Richness	1.0	2.48	2.24

10:30 - 11:00

Word Sense Disambiguation with Distribution Estimation

Yee Seng Chan and Hwee Tou Ng
Department of Computer Science, National University of Singapore

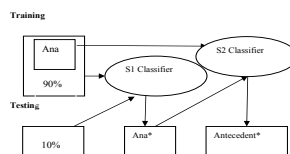
- A word sense disambiguation (WSD) system trained on one domain and applied to a different domain will show a decrease in performance
- Major reason: Different sense distributions between different domains
- Presents novel application of two distribution estimation algorithms (confusion matrix and EM-based) to provide estimates of the sense distribution of the new domain data set
- Training examples automatically gathered from parallel corpora
- Sense distributions estimated achieve a relative improvement of 56% when incorporated into our WSD system

11:00 - 11:30

A Machine Learning Approach to Identification and Resolution of One-Anaphora

Hwee Tou Ng*, Yu Zhou*, Robert Dale** and Mary Gardiner**
*Department of Computer Science, National University of Singapore, Singapore
**Centre for Language Technology, Macquarie University, Sydney, Australia

- Step 1: Learns to distinguish different uses of *one* (numeric, partitive, anaphoric, generic, idiomatic, unclassifiable)
- Step 2: Learns to determine the antecedents of anaphoric *one*
- Achieves encouraging results
- To our knowledge, the first learning-based system for the identification and resolution of *one*-anaphora



11:30 - 12:00

Measuring Semantic Similarity by Latent Relational Analysis

Peter D. Turney
National Research Council Canada, Ottawa, Ontario, Canada

- Method for measuring *similarity* in *semantic relations* between two pairs of words
- Two pairs with high relational similarity are *analogous*
- **Human-level performance** on SAT word analogy questions: 56% correct

Stem:	quart:volume	Relational similarity
Choices: (a)	day:night	0.373725
(b)	mile:distance	0.677258
(c)	decade:century	0.388504
(d)	friction:heat	0.427860
(e)	part:whole	0.370172

- **Unsupervised learning** from large corpus: 5×10^{10} English words
- Uses Singular Value Decomposition, cosine similarity measure, automatically generated thesaurus
- Applied to classification of semantic relations in noun-modifier pairs
- Relation in "laser printer": "laser" is an *instrument* used by "printer"

12:00 - 12:30

10:30 - 11:00

Leaf-Value Tables for Pruning Non-Zero-Sum Games

Nathan R. Sturtevant
University of Alberta, Edmonton, Alberta, Canada

- **Background:** Existing pruning algorithms for game tree search make pruning decisions based on simple, linear comparisons
 - $\alpha\beta$ -pruning prunes if $\alpha \leq \beta$
 - Multi-player pruning algorithms prune if $\sum \text{bounds} \geq \text{maxsum}$
- In zero-sum or constant-sum games, this works well
- In non-zero-sum games, pruning opportunities are missed
- **New Idea:** Enumerate possible game outcomes in a *leaf-value table*
 - Instead of linear comparisons, the *leaf-value table* can make an exact determination of when pruning is possible
- **Result:** In the card game Spades, trees are 1-2 orders of magnitude smaller than with previous methods, depending on the evaluation function being used

11:00 - 11:30

A Logical Model of Nash Bargaining Solution

Dongmo Zhang
University of Western Sydney, Australia

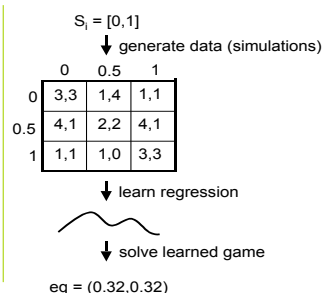
- Bargaining solutions: quantitative and qualitative analysis
- Logical representation of bargaining situations
- Entrenchment measurement on bargaining items
- Pure deals and mixed deals
- Logic-based axiomatization of Nash's Bargain Solution
- Bargaining power: an example
- Logic-based solution to automated negotiation
- Conclusion and future work

11:30 - 12:00

Learning Payoff Functions in Infinite Games

Yevgeniy Vorobeychik, Michael P. Wellman, Satinder Singh
University of Michigan, Ann Arbor, Michigan, USA

- Method for approximating empirical games with infinite strategy sets
- Use supervised learning methods to approximate players' utility functions
- Introduced a measure of accuracy of learned game based on the definition of approximate (epsilon) equilibria
- Experiments with a known game and an unknown empirical game demonstrate effectiveness of resulting equilibrium approximation



12:00 - 12:30

The Role of Clustering on the Emergence of Efficient Social Conventions

Josep M. Pujol¹, Jordi Delgado¹, Ramon Sangüesa¹ and Andreas Flache²
¹Polytechnic University of Catalonia (Catalonia, Spain)
²University of Groningen (The Netherlands)

- Global conventions can arise from local coordination processes without a central authority. However, when one convention *pareto-dominates* the other, will the agents end up coordinated on the socially efficient convention? The discussion in the social sciences gives no clear answer to why and under which conditions an efficient convention may prevail.
- We show by means of experimental simulations that agents' social network properties, especially network clustering, have a strong effect on the convention finally established: Agents embedded in a high-clustered network can coordinate on the efficient convention. In addition, the efficient convention is stable against invasion of sub-optimal conventions under a much larger range of conditions than the inefficient one.
- An analytical approximation of the simulation model is also presented.

A Feature Selection Method Based on the Shapley Value

Gideon Dror, The Academic College of Tel-Aviv Yaffo , Israel
Shay Cohen, Eytan Ruppin, Tel-Aviv University, Israel

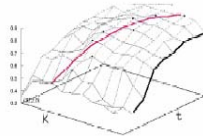
- Viewing feature selection as a coalitional game enables us to apply the Shapley Value, a well known Game theory concept, for the task of feature selection.
- Shapley Values are able to take into account intricate dependencies among features and their importance for the task at hand (classification).
- Feature sets are built iteratively using an approximation for Shapley Values that are recomputed on each iteration.
- Applying our methods to artificial datasets shows very effective selection of informative feature subsets.
- Using real life datasets, our methods successfully compete with an array of feature selection methods.

10:30 - 11:00

InterActive Feature Selection

Hema Raghavan (UMass), Omid Madani (Yahoo!) and Rosie Jones (Yahoo!)

- Access to a feature importance oracle can improve learner performance significantly over uncertainty sampling for document classification.
- Even naïve users can provide feedback on features with about 60% accuracy of the oracle.
- The relative manual cost of labeling features is about 1/5th that of labeling documents.
- A method which solicits document and term feedback simultaneously results in significant improvements over traditional active learning.



F1 score plotted against number of features (k) and examples (t). As the number of training examples increases, the number of features needed for best performance also increases.

11:00 - 11:30

ROCCER: an Algorithm for Rule Learning Based on ROC Analysis

Ronaldo C. Prati, University of São Paulo, Brazil
Peter Flach, University of Bristol, United Kingdom

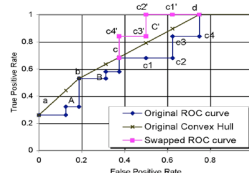
- A rule learning algorithm based on ROC analysis
- Works by selecting rules from a larger rule set
- Experimental comparison with other rule learning algorithms demonstrates comparable performance (measured in terms of the area under the ROC curve – AUC).
- Produce smaller rule sets than other rule learning algorithms
- Individual rules that composes the rule set generally have higher quality indexes than other algorithms

11:30 - 12:00

Repairing Concavities in ROC Curves

Peter A. Flach, University of Bristol, UK (Peter.Flach@bristol.ac.uk)
Shaomin Wu, University of Reading, UK (Shaomin.Wu@reading.ac.uk)

- Concavities in ROC curves indicate locally worse-than-random ranking achieved by classifier
- These can be repaired by locally randomising or **inverting** ranking
- Method: (1) select biggest concavity on training set; (2) repair it if this improves AUC on 1 or 2 validation sets
- Experiments on 23 two-class UCI data sets with naïve Bayes and decision trees showed clear improvements in AUC (12 wins and 1 loss at 0.1 confidence level for naïve Bayes with 2 validation sets, >1% increase in avg AUC)



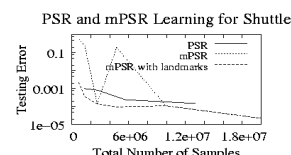
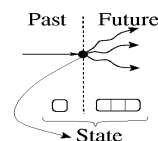
12:00 - 12:30

10:30 - 11:00

Combining Memory and Landmarks with Predictive State Representations

Michael R. James, Britton Wolfe, and Satinder Singh
University of Michigan, Ann Arbor, MI, USA

- New class of model using a state representation based on a memory of the past combined with predictions about the future
- Based only on observable quantities
- Can be more compact than models whose state representation uses only predictions about the future
- Landmarks are special memories that are used to restore the state of imperfect models
- Present an algorithm for learning of these models, and experimental results



11:00 - 11:30

Using Predictive Representations to Improve Generalization in Reinforcement Learning

Eddie J. Rafols, Mark B. Ring, Richard S. Sutton, Brian Tanner
University of Alberta, Edmonton, Alberta, Canada

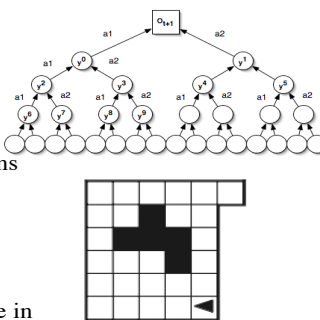
- Are predictions of the future a good way to represent the present?
- What happens when an agent **represents** the world simply in terms of the **predictions** it makes about its own future experiences?
- "Predictive" representations are becoming popular, but ...
- Are **predictive** representations **good** representations?
i.e., Will they generalize well?
- We've tested the **predictive representations hypothesis**—that predictive representations **will** generalize particularly well.
- In our talk, we present results from the first explicit test of this fundamental question.

11:30 - 12:00

Temporal-Difference Networks with History

Brian Tanner and Richard S. Sutton
Reinforcement Learning and Artificial Intelligence Laboratory
University of Alberta, Edmonton, Alberta, Canada

- Extension of TD Networks
- Predictive Knowledge Representation
- Online algorithm for learning models:
 - Grounded in observations and actions
 - Agent-centric (subjective)
 - Verifiable
- Demonstrate common-sense knowledge in highly aliased, sensory deprived environments

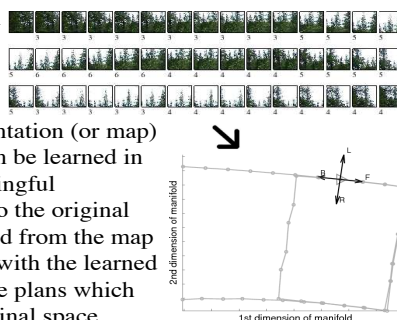


12:00 - 12:30

Learning Subjective Representations for Planning

Dana Wilkinson¹, Michael Bowling², Ali Ghodsi¹
¹University of Waterloo, Waterloo ON, Canada
²University of Alberta, Edmonton, AB, Canada

- Given an alternating stream of actions and observations (additional domain-specific knowledge not required)
- A low-dimensional representation (or map) of the observation space can be learned in which the actions are meaningful
- Operations corresponding to the original actions can then be extracted from the map
- Searching the learned map with the learned operators can yield effective plans which can then be used in the original space



Iterated Belief Revision, Revised

Yi Jin and Michael Thielscher
Dresden University of Technology, Dresden, Germany

- The standard AGM+DP postulates for Iterated Belief Revision are insufficient
- Solution: A postulate of Independence
- An elegant representation theorem
- A constructive revision operator that shows consistency with AGM and DP


$$\begin{aligned}\{\} * bird &= \{bird\} \\ \{bird\} * red &= \{bird, red\} \\ \{bird, red\} * \neg bird &= \{red, \neg bird\}\end{aligned}$$

10:30 - 11:00

Solving Logic Program Conflict through Strong and Weak Forgettings

Yan Zhang, Norman Y. Foo, Kewen Wang
Univ. of Western Sydney, Univ. of New South Wales, Griffith Univ., Australia

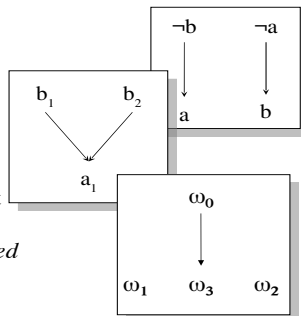
- Motivation: a more general formulation is needed for solving complex conflicts in logic programs
- Defining strong and weak forgettings in logic programs
- Logic program contexts: a general framework for conflict solving based on strong and weak forgettings
- Semantic characterizations
- The proposed framework can represent previous logic program update approaches
- Computational complexity analysis
- Conclusions: integrating dynamic preferences, handling task-dependent conflict solving problems

11:00 - 11:30

Revision of Partially Ordered Information: Axiomatization, Semantics and Iteration

Salem Benferhat, Sylvain Lagrue, Odile Papini
CRIL-CNRS, Université d'Artois, Lens, France
LSIS-CNRS, Université du Sud Toulon-Var, Toulon, France

- Belief revision of *partially ordered information* is investigated.
- An alternative *set of natural postulates* and an alternative definition of *faithful assignment* are proposed for revising partially ordered information.
- A *representation theorem* for iterated revision operators satisfying this new set of postulates is provided.
- Additional postulates dedicated to *iterated belief revision* are investigated.



11:30 - 12:00

Quota and Gmin Merging Operators

Patricia Everaere, Sébastien Konieczny, Pierre Marquis
CRIL-CNRS, Université d'Artois, Lens, France

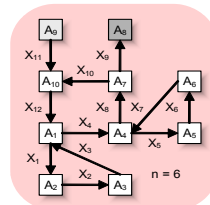
- The paper is about **propositional bases merging**
 - ➡ **Merging**: define the beliefs/goals of a group of agents from their individual beliefs/goals
- Two **new families of merging operators** are presented
 - ➡ **Quota** operators: a possible world is a model of the merging if it satisfies “sufficiently many” bases
 - ➡ **Gmin** operators: based on a leximin aggregation function
- Those merging operators are evaluated w.r.t. **four criteria**
 - ➡ Rationality
 - ➡ Computational complexity
 - ➡ Strategy-proofness
 - ➡ Discriminating power
- The evaluation shows both quota and Gmin operators as **interesting trade-offs** w.r.t. the four criteria

12:00 - 12:30

An MCMC Approach to Solving Hybrid Factored MDPs

Branislav Kveton, Intelligent Systems Program, University of Pittsburgh
Milos Hauskrecht, Department of Computer Science, University of Pittsburgh

- **Hybrid approximate linear programming (HALP)** has recently emerged as a promising framework for solving large factored MDPs with **discrete** and **continuous state and action variables**
- **Constraint satisfaction in HALP** is a challenging computational problem
- **MCMC approach** to constraint satisfaction
 - Capable of operating in the domains of **discrete** and **continuous** variables
 - Constraints are generated **intelligently** based on the **structure** of factored MDPs
 - **Space complexity** is **linear** in the number of state and action variables
- **Evaluation** on a set of **large** irrigation-network control problems



10:30 - 11:00

Continuous Time Particle Filtering

Brenda Ng, Avi Pfeffer, Harvard University, Cambridge, Massachusetts, USA
Richard Dearden, University of Birmingham, Birmingham, UK

- Extends discrete-time particle filter for monitoring continuous-time dynamic hybrid systems (consisting of discrete and continuous state variables).
- Discrete process governed by Markov jump process, observed at irregular intermittent intervals.
- Trajectories sampled from Markov jump process, then used to estimate the continuous variables using the dynamics that correspond to the discrete state in the trajectory.
- Incorporates online learning of Markov jump process model.
- Suitable for systems that evolve at multiple time granularities and for resource-bounded computation.
- More stable in performance than the discrete-time particle filter, even when discrete-time algorithm updates at a much higher rate.
- Empirical results shown on a continuous-time Mars rover model.

11:00 - 11:30

Self Adaptive Particle Filter

Alvaro Soto
Pontificia Universidad Catolica de Chile

- The efficiency and accuracy of the particle filter (PF) strongly depend on the number of particles and the propagation function used to re-allocated the samples at each iteration
- In the regular implementation of the filter both features are specified beforehand and kept fixed
- Here, using results from the theory of importance sampling, I propose a self adaptive version of the PF that at each iteration:
 1. Estimates a suitable number of particles
 2. Adaptively decides the benefits of including information from the likelihood function in the propagation function used to re-allocate the samples
- Experimental results shows the advantages of the new method when applied to synthetic data and tracking of objects in real video sequences.

11:30 - 12:00

Maximum A Posteriori Path Estimation with Input Trace Perturbation: Algorithms and Application to Credible Rating of Human Routines

Daniel H. Wilson, Carnegie Mellon University
Matthai Philipose, Intel Research Seattle

- Credible and Inexpensive Rating of Routine Human Activity
 - **1) Train** an HMM to recognize the activity
 - **2) Collect** a **trace** using the iGlove
 - **3) Rate** the trace by the likelihood of MAP path
 - **4) Repair** the trace using the K-Edit Viterbi algorithm
- Trace repair via the **K-Edit Viterbi algorithm**
 - Minimum number of changes to maximize model likelihood
 - Polynomial running time
- Further Improvements
 - K-Edit Viterbi for Hidden Semi-Markov Models (HSMMs)
 - Incorporating high-level temporal logic constraints



12:00 - 12:30

Invited Speaker: Bart Selman

Chair: Hector Levesque

thursday **4** august

14:00 - 15:00 Pentland Room

The Next Generation of Automated Reasoning Methods

Bart Selman

Dept. of Computer Science Cornell University

Just a few years ago general inference beyond hundred variable problems appeared to be out of practical reach. Current reasoning engines can handle problems with over a million variables and several millions of constraints. I will discuss what led to such a dramatic scale-up, and how progress in reasoning technology has opened up a range of new applications in AI and computer science in general. I will also describe current research directions centered around the integration of probabilistic and logical inference, the characterization of combinatorial search spaces using methods from statistical physics, the discovery of hidden problem structure using sampling techniques and other ideas from machine learning, and the development of inference methods for multi-agent systems.

Dual Lookups in Pattern Databases.

Ariel Felner, Uzi Zahavi, Jonathan Schaeffer, Robert Holte
Ben Gurion and Bar Ilan Universities, Israel ; University of Alberta, Canada

- A pattern database (PDB) is a heuristic stored as a lookup table
- We introduce an additional PDB lookup, called the dual PDB lookup which is always admissible but can return inconsistent values.
- We also present an extension of the well-known pathmax method so that inconsistencies in heuristic values are propagated in both directions in the search tree.
- Experiments show that the addition of dual lookups and bidirectional pathmax propagation can reduce the number of nodes generated by IDA* by over one order of magnitude in the TopSpin puzzle and Rubik's Cube, and by about a factor of two for the sliding tile puzzles.
- State of the art results are provided for all three domains.
- For example the number of nodes needed to solve the Fifteen Puzzle is now 18,601- twice faster than the previous benchmark of 36,710
- Similar results are provided for the other domains.

15:30 - 16:00

A New Approach to Multiobjective A* Search

Lawrence Mandow, José Luis Pérez de la Cruz
Dpto. Lenguajes y Ciencias de la Computación -Universidad de Málaga (Spain)

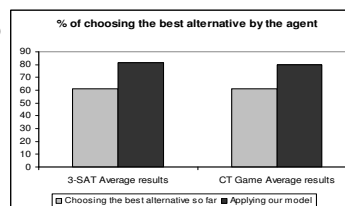
- The multiobjective search problem is an extension of the shortest path problem where arc costs become vectors.
- A previous algorithm (MOA*) extends A* to the multiobjective case preserving *node* selection and expansion as basic operations.
- The paper proposes a new algorithm that extends A* to the multiobjective case preserving *path* selection and expansion as basic operations.
- The new algorithm is provable admissible and shows important properties, analogous to those of A*, that are not shared by MOA*.
- Preliminary experimental tests confirm that the new algorithm can save substantial amounts of memory.

16:00 - 16:30

Choosing between heuristics and strategies: an enhanced model for decision-making

Shavit Talman, Rotem Toister, Sarit Kraus
Department of Computer Science, Bar-Ilan University, Ramat-Gan, Israel

- A generalized model for choosing between alternatives in general domains, where each alternative has an initial value and the agent needs to decide whether to accumulate additional information on the alternatives or to choose the best one so far.
- Addresses the problem of choosing between 2 alternatives, and then generalizes the procedure for choosing between $k > 2$ alternatives.
- Experimental design involves two domains: the 3-SAT problem and a computer game (the CT game).
- The model improves agent's performance in the domains investigated.



16:30 - 17:00

The Altricial-Precocial Spectrum for Robots

Aaron Sloman, Jackie Chappell
Computer Science & Biosciences, The University of Birmingham, UK

- Natural intelligence includes both precocial species born with genetically determined competence and altricial species born relatively helpless, yet able to achieve greater cognitive sophistication as adults.
- We examine tradeoffs between these design options and explore their relevance to design options for different sorts of robots.
- Some conditions favour precocial designs while others favour altricial designs, or some mixture of precocial and altricial skills.
- Rapid environmental variation (e.g. caused by climate change, or migration, or changes in competitors) favours altricial species.
- We conjecture that apparently incompetent altricial individuals actually have sophisticated cognitive bootstrapping mechanisms in hybrid virtual machine architectures that grow themselves.
- Similar mechanisms may be required for some intelligent robots of the future.
- See <http://www.cs.bham.ac.uk/research/cogaff/altricial-precocial.pdf>

17:00 - 17:30

Reducing Checks and Revisions in Coarse-grained MAC Algorithms

D. Mehta, M.R.C. van Dongen
Cork Constraint Computation Centre, Ireland

- Arc consistency algorithms are used to reduce the search space of constraint satisfaction problems. These algorithms repeatedly revise the domains which requires support checks.
- We introduce the notion of a *support condition* which guarantees the existence of a support and helps in reducing support checks without storing support values.
- We also introduce the notion of a *revision condition* which guarantees that all values have some support. It avoids a candidate revision.
- For hard random problems, support conditions reduce the checks required by MAC-3 (MAC-2001) up to 90% (72%). Revision conditions avoid at least 50% of the total revisions.
- Combining the two results in reducing 50% of the solution time.

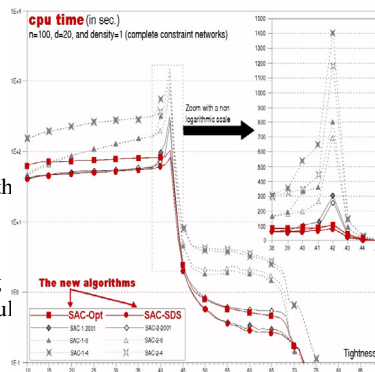
15:30 - 16:00

Optimal and Suboptimal Singleton Arc Consistency Algorithms

Christian Bessière
LIRMM (CNRS/U. Montpellier), France

Romuald Debruyne
Ecole des Mines de Nantes, France

- Characterization of the time complexity of Singleton Arc Consistency (SAC)
- An optimal algorithm for Singleton Arc Consistency
- A suboptimal SAC algorithm with better performance than any existing SAC algorithm
- An essential step before studying whether maintaining this powerful local consistency during search can pay off



16:00 - 16:30

A Greedy Approach to Establish Singleton Arc Consistency

Christophe Lecoutre and Stéphane Cardon
CRIL-CNRS FRE 2499, Université d'Artois, Lens, France

- New approach to establish Singleton Arc Consistency (SAC) on constraint networks
- Involves performing several runs of a greedy search where at each step, arc consistency is maintained
- Interest of this approach :
 - exploiting incrementality of arc consistency
 - possibility of learning relevant information from conflicts
 - potentially finding solutions during inference
 - competitive space and time complexities
- Experiments show quite good performances on networks containing easy large parts as can be expected in real-world applications

16:30 - 17:00

Existential arc consistency: Getting closer to full arc consistency in weighted CSP

Simon de Givry, Matthias Zytnicki (INRA, Toulouse, France)
Federico Heras, Javier Larrosa (UPC, Barcelona, Spain)

- **Weighted CSPs**: CSPs with an additive objective function
- **EDAC***: New form of Arc-consistency for weighted CSPs
 - Stronger than previous ones:
 - AC* (AAAI-02)
 - FDAC* (IJCAI-03).
 - Can be enforced in time $O(ed^2 \max\{nd, u\})$
 - e : n. of binary constraints
 - d : size of largest domain
 - n : n. of variables
 - u : upper bound of opt.
- Maintaining EDAC* during search (MEDAC*) is an efficient algorithm
- Good results in:
 - Max-SAT
 - Max-CSP
 - Warehouse Location
- Future work: Can we make EDAC* even stronger? Can we extend it to non-binary problems? Can we improve the enforcing algorithm (lazy version)?

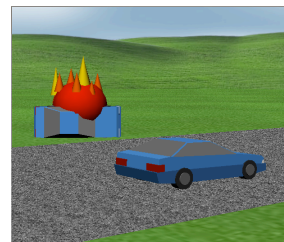
17:00 - 17:30

15:30 - 16:00

Automatic Text-to-Scene Conversion in the Traffic Accident Domain

Richard Johansson, Anders Berglund, Magnus Danielsson, Pierre Nugues
Department of Computer Science, Lund University, Sweden

- Carsim is a system that automatically converts road accident descriptions into animated 3D graphics.
- We believe that this is the first text-to-scene conversion system that has been tested using real texts.
- Information extraction is used to interpret the text, and constraint propagation and planning to generate the animation.
- We provide the first quantitative evaluation of a text-to-scene conversion system.



16:00 - 16:30

A Probabilistic Framework for Recognizing Intention in Information Graphics

Stephanie Elzer,¹ Sandra Carberry,² Ingrid Zukerman,³
Daniel Chester,² Nancy Green,⁴ Seniz Demir²

¹Dept. of Computer Science, Millersville University, Millersville, PA 17551

²Dept. of Computer Science, University of Delaware, Newark, DE 19716

³School of CS & Software Engrg, Monash Univ, Clayton, Victoria 3800 Australia

⁴Dept. of Math. Sciences, Univ. of North Carolina at Greensboro, NC 27402

Abstract

This paper extends language understanding and plan inference to information graphics. We identify the kinds of communicative signals that appear in information graphics, describe how we utilize them in a Bayesian network that hypothesizes the graphic's intended message, and discuss the performance of our implemented system. This work is part of a larger project aimed at making information graphics accessible to individuals with sight impairments.

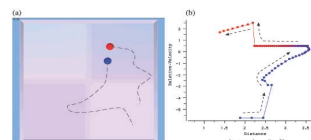
16:30 - 17:00

Maps for Verbs: The Relation Between Interaction Dynamics and Verb Use

Paul Cohen¹, Clayton Morrison¹, Erin Cannon²

¹ USC Information Sciences Institute, ² Dept. of Psychology, University of Massachusetts

- Are the meanings of some verbs related to the dynamics of scenes?
- If so, different dynamics should be associated with different verb frequencies
- Preschool children were shown movies of two colored balls interacting. The interactions had different dynamics
- Although the children had very small vocabularies, particular verbs were associated with particular dynamics



E: Okay, last one. Can you tell me a good story about this one?
S: Even gooder than all of the other ones?
E: Make it the best story!
S: It's going ummm gooder and it's playing but the red is letting the blue push him. And the red is letting the blue one push
E: How come he's letting the blue push?
S: Because he wanted to.
E: Why does he want to?
S: Because he likes to play like that.

Multi-agent Coordination using Local Search

Boi Faltings and Quang-Huy Nguyen
 Swiss Federal Institute of Technology in Lausanne (EPFL), Switzerland

- Agent coordination = multiagent constraint optimization problem
- Incentive-compatibility – making it in each agent's best interest to cooperate with the mechanism – has been impossible for large problems that can only be solved by local search.
- Leaving out a random agent from each local optimization allows for budget-balanced VCG scheme.
- Randomization makes manipulation by self-interested, bounded-rational agents impossible *with high probability*.
- Escaping from local minima: randomized search scheme has strong performance in experiments.

15:30 - 16:00

Distributive and Collective Readings in Group Protocols

Silvia Rossi¹, Sanjeev Kumar² and Philip R. Cohen²
¹ITC-irst, Povo Trento – Italy and Istituto di Cibernetica, CNR Napoli – Italy
²Oregon Health and Science University, Beaverton OR – USA

- Group Communication may have an impact in many distributed and collaborative applications
- A Semantics of Communicative Acts directed towards groups based on Cohen & Levesque's attempt-based semantics
- Logical Framework for conversations among any partners while simultaneously making exchanged message visible to a large number of destinations, normally unknown to the conversing parties
- Distributive and Collective Readings in group protocols as a way to achieve different types of commitments among group members.

16:00 - 16:30

Efficiency and envy-freeness in fair division of indivisible goods: logical representation and complexity

Sylvain Bouveret and Jérôme Lang
 IRIT, Université Paul Sabatier, Toulouse, France

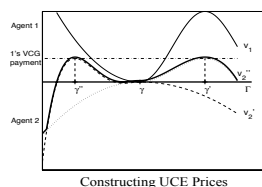
- A framework for representing a fair division problem of indivisible goods within propositional logic.
- Logical characterizations of Pareto-efficiency and envy-freeness.
- (Unexpected) connection to nonmonotonic reasoning.
- Main complexity result: the existence of a Pareto-efficient and envy-free division is \sum_2^P -complete
- Relaxing Pareto-efficiency or constraining the preferences can reduce complexity.

16:30 - 17:00

More on the Power of Demand Queries in Combinatorial Auctions: Learning Atomic Languages and Handling Incentives

Sébastien Lahaie, Florin Constantin, David C. Parkes
 Harvard University, Cambridge, Massachusetts, USA

- Presents a means of performing efficient preference elicitation in combinatorial auctions using demand queries
- Based on methods that use computational learning theory ideas for preference elicitation
- Shows how to make truthful bidding a Nash equilibrium in a nontrivial way
- Shows how to perform learning and preference elicitation for a broad class of languages including OR
- Characterizes the communication requirements of computing VCG prices, relating them to Universal CE prices
- Future work: extend to OR*



17:00 - 17:30

Learning with Labeled Sessions

Rong Jin*, Huan Liu[†] and Feng Kang*

*Dept. of Computer Science and Engineering, Michigan State University

[†]Department of Computer Science and Engineering, Arizona State University

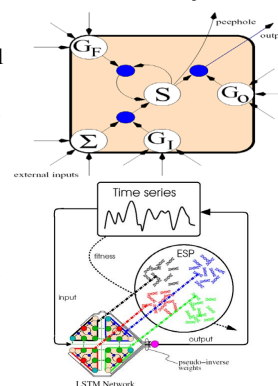
- We describe a *new* type of learning: **session-based learning** in which
 - Each labeled session (or object) consists of multiple unlabeled instances
 - A session is labeled as class ‘*a*’ if the majority of its instances are classified as ‘*a*’
- Session-based learning is challenging because of
 - **Label ambiguity problem**: Given a labeled session, it is ambiguous as to which subset of its instances should belong to the class of the session
- We propose a novel method, named “**SBoost**”, for session-based learning based on the AdaBoost algorithm.
- Empirical studies with benchmark and real-world data show that SBoost provides an effective solution to session-based learning.

15:30 - 16:00

Evolino: Hybrid Neuroevolution / Optimal Linear Maps for Sequence Learning

Jürgen Schmidhuber, Daan Wierstra, Faustino Gomez
IDSIA, Manno-Lugano, Switzerland; TU Munich, Germany

- Framework combining evolution of Recurrent Neural Networks with optimal linear mappings to outputs
- Avoids local minima of gradient descent
- Network architecture: “gated” Long Short-Term Memory - good bias for temporal sequence processing
- Able to learn tasks unsolvable by previous RNN (*Science*, 2004): context-sensitive languages, superimposed sines. Excellent on Mackey-Glass benchmark. Ongoing experiments on speech processing.



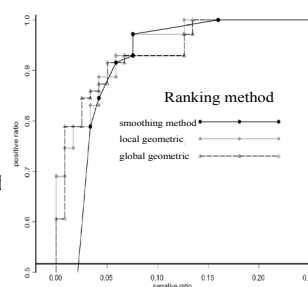
16:00 - 16:30

Ranking Cases with Decision Trees: A Geometric Method that Preserves Intelligibility

Isabelle Alvarez^(1,2) & Stephan Bernard⁽²⁾

LIP6⁽¹⁾, University of Paris VI, Paris, and Cemagref⁽²⁾, Aubière, France

- New method for ranking cases with decision trees when the data are numeric
- Based on the distance to the decision boundary: geometric score ranks cases globally or locally (inside each leaf)
- The tree is unchanged
- Projection of each case onto the leaves with a different class label: Closest leaf gives the distance
- Experiments and theory show efficiency when errors are close to the decision boundary
- Future work: distance density estimator

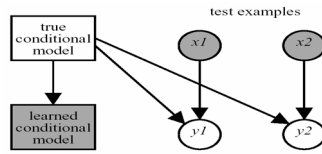


16:30 - 17:00

Learning Coordination Classifiers

Yuhong Guo, Russell Greiner, Dale Schuurmans
University of Alberta, Edmonton, Canada

- A novel classification approach
- Idea: perform relational classification on i.i.d. data
- Statistically justified in the standard i.i.d. setting:
- Interpretation
 - A new ensemble classifier
 - A natural generalization of similarity-based learning techniques
- Experimental results show significant improvements over standard i.i.d. learning; competitive to boosting



15:30 - 16:00

A Novel Approach to Model Generation for Heterogeneous Data Classification

Rong Jin* and Huan Liu†

*Dept. of Computer Science and Engineering, Michigan State University

†Department of Computer Science and Engineering, Arizona State University

- **Heterogeneous data classification (HDC)** refers to classifying the input data of a single class whose distribution is of multiple modes.
- A conventional ensemble approach to HDC is to
 - Divide the heterogeneous data into homogeneous partitions; and
 - Create a model for each partition and combine them.
- Problems with existing clustering algorithms for data partitioning are:
 - Single cluster membership → the data fragmentation problem
 - Unbalanced cluster sizes → the overfitting problem
- We propose the **HISS** (Homogeneous data In Similar Size) Algorithm that specifically addresses the above two problems.
- Empirical studies over benchmark and real-world datasets demonstrate that HISS is effective for heterogeneous data classification.

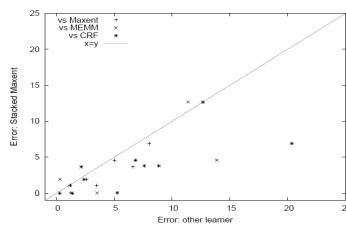
16:00 - 16:30

Stacked Sequential Learning

William W. Cohen & Vitor R. Carvalho

Carnegie Mellon University, Pittsburgh, Pennsylvania, USA

- Our new sequential learning scheme is an easily implemented meta-learning method that can be applied to any other learning method
- Experimentally, sequential stacking improves performance substantially over previous methods on “sequential partitioning problems”, like video segmentation and document analysis.
- Sequentially stacked MaxEnt outperforms CRFs on 8 of 10 benchmark problems.



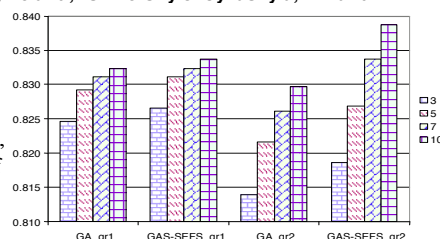
Points below line indicate that stacked MaxEnt outperforms a previous method (MEMMs, CRFs, or unstacked MaxEnt)

16:30 - 17:00

Sequential Genetic Search for Ensemble Feature Selection

Alexey Tsymbal¹, Mykola Pechenizkiy², Pádraig Cunningham¹
¹Trinity College Dublin, Ireland; ²University of Jyväskylä, Finland

- New strategy for genetic ensemble feature selection, GAS-SEFS, is introduced
- In contrast with previously considered algorithm (GA), it is sequential; a series of genetic processes for each base classifier
- More time-consuming, but with better accuracy
- Each base classifier has a considerable level of overfitting with GAS-SEFS, but the ensemble accuracy grows
- Experimental comparisons demonstrate clear superiority on 21 UCI datasets, especially for datasets with many features (gr1 vs gr2)



17:00 - 17:30

15:30 - 16:00

Discovering Classes of Strongly Equivalent Logic Programs

Fangzhen Lin, Hong Kong University of Science and Technology
Yin Chen, Sun Yat-sen University, China

- Answer Set Programming solves a problem by computing answer sets of a set of rules. It has shown promise in many applications.
- Strong equivalence is an interesting notion in ASP: if two sets of rules are strongly equivalent, then one can be replaced by the other no matter what the other rules are – good for program simplification
- This paper formulates the problem of discovering classes of strongly equivalent sets of rules as the problem of discovering theorems in first-order logic.
- Discovered theorems capture the classes of rules that are strongly equivalent to the empty set, strongly equivalent to a set of one rule, and strongly equivalent to a set of two rules.
- The general methodology used in this paper follows the one used by Lin [KR 04] for discovering state invariants in planning.

16:00 - 16:30

Strong Equivalence for Logic Programs with Preferences

Wolfgang Faber, University of Calabria, Italy
Kathrin Konczak, University of Potsdam, Germany

- Novel notion of *strong order equivalence* for logic programs with preferences
- Considered preference semantics: ordered programs (preferences among rules of a logic program)
- Characterizations for strong order equivalence for three different preference semantics
- Necessary and sufficient conditions for ordered programs being strongly order equivalent
- Analysis of the relationships among the preference semantics under strong order equivalence
- Applicability of program simplifications for ordered programs
- Future work: Study weakened notions of equivalence for logic programs with preferences

16:30 - 17:00

Equivalence in Abductive Logic

Katsumi Inoue
NII, Tokyo, Japan

Chiaki Sakama
Wakayama University, Japan

Notion of equivalence in abduction is useful for:

- comparison of abductive power of agents,
- understanding the abductive semantics with respect to contexts,
- simplification and optimization in abductive LP (ALP),
- debugging and verification in ALP,
- standardization in ALP.

Two notions of abductive equivalence:

- **explainable equivalence**: explainability is compared.
- **explanatory equivalence**: explanation contents are compared.

Characterizing abductive equivalence:

- explainable equivalence in **FOL** ⇔ *extensional equivalence* in default logic
- explanatory equivalence in **ALP** ⇔ *strong equivalence* in LPNMR

The work provides complexity results and is applied to *inductive equivalence*.

17:00 - 17:30

Measuring Conflict and Agreement between Two Prioritized Belief Bases

Guilin Qi, Weiru Liu, David A. Bell
Queen's University Belfast, Belfast, UK

- Weighted prime implicants (WPI) of a prioritized belief base are defined
- Based on WPIs, a quantity of conflict and two quantities of agreement are defined
- A degree of conflict and two degrees of agreement are defined based on the quantity of conflict and quantities of agreement
- Our quantity of conflict generalizes the well-known Dalal distance which is the hamming distance between interpretations
- Impact of measures of conflict and agreement: 1) choice of combination operators 2) ordering sources
- Future work: Computational issue will be discussed and more applications will be explored

Affine Algebraic Decision Diagrams (AADDs) and their Application to Structured Probabilistic Inference

Scott Sanner, Univ. of Toronto, CANADA
David McAllester, TTI at Chicago, USA

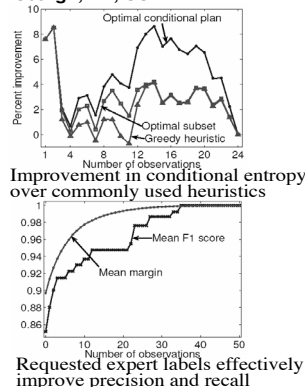
- Proposes an affine extension to ADDs (AADD) capable of compactly representing context-specific, additive, and multiplicative structure.
- Proves that AADD has worst-case time and space performance within multiplicative constant of ADDs, but can be exponentially better.
- Empirically compares Table, ADD, AADD representations for probabilistic inference in Bayes nets and MDPs.
- Empirical results: AADD never performs worse than Table or ADD and often yields exponential performance improvement over both.
- Theory and results suggest the AADD is likely to yield time and space improvements for a variety of probabilistic inference algorithms currently using Tables or ADDs in presence of additive/mult. structure.

15:30 - 16:00

Optimal Nonmyopic Value of Information in Graphical Models Efficient Algorithms and Theoretical Limits

Andreas Krause, Carlos Guestrin
Carnegie Mellon University, Pittsburgh, PA, USA

- We present efficient **optimal** algorithms for optimizing value of information in chain graphical models, capable of:
 - selecting **subsets** and **conditional plans**
 - **smoothing** and **filtering**
- Even for **polytree** graphical models, where inference is efficient, we prove that value of information is **intractable**:
 - Optimization problems are **NP^{PP} hard**
 - Computing conditional entropies is **#P hard**
- Our results indicate that our algorithms
 - improve on the performance of commonly used heuristics in real world problems
 - improve **classification accuracy** for expert guided structured classification tasks



16:00 - 16:30

A Decision-Theoretic Approach to Task Assistance for Persons with Dementia

Jennifer Boger, Pascal Poupart, Jesse Hoey, Craig Boutilier, Geoff Fernie, and Alex Mihailidis
University of Toronto, Toronto, Ontario, Canada

- Decision theoretic models developed for guidance of people with dementia during handwashing
- MDP model (25 million states) solved exactly: policy considered effective when evaluated by human caregivers
- POMDP model (50 million states) solved approximately: policy an improvement over MDP when evaluated in simulation
- Clinical trials underway to test and optimise system

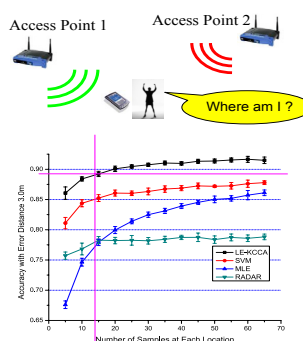


16:30 - 17:00

Accurate and Low-cost Location Estimation Using Kernels

Jeffrey Junfeng Pan, James T. Kwok, Qiang Yang, Yiqiang Chen
Hong Kong University of Science and Technology, Hong Kong, China

- A novel method for indoor-location estimation based on signals received from a wireless client
- Obtain an accurate mapping between signal strength and location spaces with Kernel Canonical Correlation Analysis (KCCA)
- Use Gaussian and Matérn kernels to well adapt the character of signal and location spaces respectively
- Experiments show the advantage of our method in both accuracy and reducing human calibration effort



17:00 - 17:30

Friday
5 August 2005

Designing Robots
From Artificial Limbs to Powerful, Autonomous Humanoids

Stephen C. Jacobsen
Sarcos Research Corporation, Salt Lake City, Utah, USA

Sarcos has developed robotic systems for applications including: entertainment systems, medical devices, remote manipulators, and intelligent micro production systems.

New thrusts aimed at producing powerful, autonomous humanoids suitable for integration with advanced, intelligent learning controllers

Power systems: integrated high performance, fuel based systems suitable for energetic autonomy.

Sensor/actuator networks: for determining system and environmental states and system management via distributed and central control.

Configuration: achieving desired kinematics, structures, coverings, and external sensors.

Collaborative efforts with groups involved in developing intelligent controllers to produce high performance humanoids with adaptive learning systems for information autonomy.

H
u
m
a
n
o
i
d



E
x
o
s
k
e
l
e
t
o
n



**Complete MCS-Based Search:
Application to Resource Constrained Project Scheduling**

Philippe Laborie
ILOG

- **Approach:**
 - A pure Constraint Programming approach based on a complete search for cumulative scheduling
 - Relies on the selection and resolution of Minimal Critical Sets
- **Results:**
 - RCPSP: closes more than 15% of open KSD instances of the PSPLIB (97 instances closed) and improves more than 30% of best known lower bounds (197 instances improved)
 - Open-shop problems: closes all the hard open-shop instances of Gueret&Prins in less than 5s CPU time
 - Other results reported on open-shop and cumulative job-shop.
- **Detailed results:** <http://scheduler.ilog.fr>

10:30 - 11:00

**Identifying Conflicts in Overconstrained
Temporal Problems**

Mark H. Liffiton, Michael D. Moffitt, Martha E. Pollack, and Karem A. Sakallah
University of Michigan, Ann Arbor, Michigan, USA

- Introducing Musilitis: A novel approach for finding minimal conflicts in infeasible temporal constraint systems
- Based on a strong connection between maximal satisfiability and minimal unsatisfiability
- Applicable to any type of constraint; motivated and demonstrated for an expressive form of temporal constraint satisfaction problem
- Experimental results on a range of benchmarks show good anytime performance of extracting multiple conflicts
- Future work includes applying Musilitis in a mixed-initiative constraint processing system

11:00 - 11:30

Counting Solutions of CSPs: A Structural Approach

Gilles Pesant
ILOG France (also Ecole Polytechnique de Montreal, Canada)

- Counting the number of solutions of a CSP is a hard problem
- Finding a solution to a CSP is also hard, but we learned to identify tractable substructures (global constraints) to make it easier
- **Idea:** Work from these substructures and exploit information that is internal to the consistency algorithms in order to get polytime exact or approximate solution counts for these constraints
- *Some of the main global constraints are investigated*
- Applications
 - *Design robust search heuristics centered on the constraints*
 - Approximate the total number of solutions of a CSP

11:30 - 12:00

10:30 - 11:00

Beyond TFIDF Weighting for Text Categorization in the Vector Space Model

Pascal Soucy, Coveo Technologies, Québec, Canada
Guy W. Mineau, Laval University, Québec, Canada

- New supervised weighting method for Text Categorization using the Vector Space Model (KNN, SVM) to replace TFIDF
- Based on confidence intervals
- Implicit feature selection mechanism
- Experimental comparisons show promising results

11:00 - 11:30

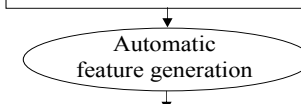


Feature Generation for Text Categorization Using World Knowledge

Evgeniy Gabrilovich and Shaul Markovitch
CS Department, Technion, Haifa, Israel

- Enhancing machine learning algorithms for text categorization with generated features based on world knowledge.
- Contextual feature generation addresses the two main problems in natural language processing – synonymy and polysemy.
- The use of knowledge-based features leverages information that cannot be deduced from the documents alone.

“Rumsfeld appeared with Gen. Richard Myers, chairman of the Joint Chiefs of Staff.”



- Society/Issues/Government Operations
- Society/Issues/Warfare and Conflict/Specific Conflicts/Iraq
- Society/History/U.S. Presidents/George W. Bush
- Society/Politics/Conservatism

11:30 - 12:00

A Probabilistic Learning Method for XML Annotation of Documents

Boris Chidlovskii, Jerome Fuselier
Xerox Research Centre Europe, Grenoble, France

The problem of semantic annotation of documents according to a target XML schema as **generalized probabilistic context-free parsing** of a sequence of observations:

1. We train a **probabilistic classifier** on the document content; it estimates terminal probabilities for each observation x_i .
2. We train a **probabilistic context-free grammar** G with the parse training set.
3. We determine **the most probable tree annotation** (y, d) by maximizing the joint probability of
 - a) a terminal sequence y for the observation sequence x and
 - b) the most probable parse d for the selected terminal sequence y :
$$(y, d)_{\max} = \arg\max p(d|y, G) \times p(y|x).$$

Sequential-Simultaneous Information Elicitation in Multi-Agent Systems:

Gal Bahar and Moshe Tennenholtz
Technion—Israel Institute of Technology, Haifa, Israel

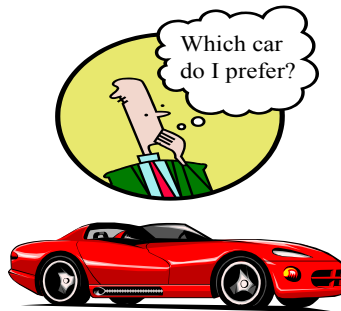
- Introduce a general setting for information elicitation in multi-agent systems, where agents may be approached both sequentially and simultaneously in order to compute a function that depends on their private secrets.
- Consider oblivious mechanisms for sequential-simultaneous information elicitation.
- Show that these mechanisms, which are easy to represent and implement are sufficient for very general settings, such as for the classical uniform model, and for the computation of the majority function and other threshold functions.
- Provide efficient algorithms for the verification of the existence of the desired elicitation mechanisms, and for synthesizing such mechanisms.

10:30 - 11:00

Regret-based Utility Elicitation in Constraint-based Decision Problems

Craig Boutilier, Relu Patrascu, University of Toronto
Pascal Poupart, University of Waterloo
Dale Schuurmans, University of Alberta

- Problem: preference elicitation in combinatorial domains
- Assumption: preferences parameterized by graphical utility model
- Approach:
 - Optimize minimax regret
 - New elicitation strategies: sequence of binary (bound) queries on utility parameters
- Experiments: car rental and real estate domains

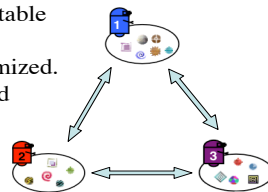


11:00 - 11:30

On Maximal Classes of Utility Functions for Efficient one-to-one Negotiation

Yann Chevaleyre, Ulle Endriss, Nicolas Maudet
University of Paris-Dauphine, France
Imperial College, London, UK

- Given a finite set of agents A , some indivisible resources R , each agent can make deals with any other agent to exchange a single resource at a time. Negotiation ends when no more profitable deal can be found.
- Our goal: to have the sum of utilities maximized.
- Know result: linear utilities \Rightarrow goal reached
- Sufficient condition: modular utilities \Rightarrow goal reached
- Necessary condition: such a condition does not exist !
- Maximality: no bigger class than modular functions can guarantee the goal to be reached

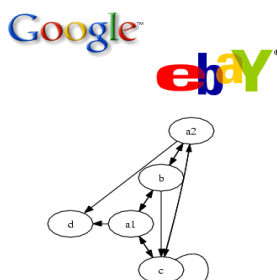


11:30 - 12:00

On the Axiomatic Foundations of Ranking Systems

Alon Altman and Moshe Tennenholtz

- Special setting of Ranking Systems where agents and alternatives coincide.
 - Applicable to:
 - eBay's feedback mechanism
 - Google's PageRank.
- Axiomatic approach applied.
- Two Simple axioms lead to strong impossibility result.
- Approval voting ranking system axiomatized.



12:00 - 12:30

10:30 - 11:00

Semi-Supervised Regression with Co-Training

Zhi-Hua Zhou, Ming Li
Nanjing University, Nanjing, China

- Semi-supervised learning exploits unlabeled examples in addition to labeled ones
- Previous research mainly focuses on semi-supervised classification. This is the first work on semi-supervised regression
- COREG: a co-training style algorithm, using two k NN regressors, does not require *sufficient and redundant views*
- Key idea: regarding the labeling of the unlabeled example which makes the regressor most consistent with the labeled example set as with the most confidence
- Theoretical analysis and experimental comparison are presented
- Future work: the key idea can be used with other regressors

Table 3: Improvement on average mean squared error

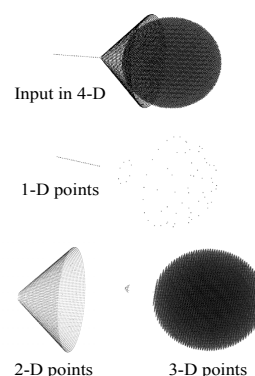
Data set	SELF	ARTRE	COREG
2d Mexican Hat	9.2%	12.8%	19.6%
3d Mexican Hat	3.9%	3.7%	5.7%
Friedman #1	-1.8%	-4.0%	0.5%
Friedman #2	-1.3%	-4.3%	2.1%
Friedman #3	-0.9%	-3.6%	0.0%
Gabor	4.0%	3.8%	9.0%
Multi	-1.9%	-4.4%	1.4%
Plane	-3.8%	-3.5%	-1.6%
Polynomial	15.1%	17.4%	22.0%
SimC	13.0%	16.4%	26.0%

11:00 - 11:30

Unsupervised Dimensionality Estimation and Manifold Learning in high-dimensional Spaces by Tensor Voting

Philippos Mordohai and Gérard Medioni
University of Southern California, USA

- Dimensionality estimation and manifold learning as perceptual organization using tensor voting
- Local information propagation provides estimates of dimensionality and manifold orientation at point level
- No global computations
- Noise robustness
- Efficient for 10^5 points in 10^3 dimensions
- Can process: non-manifolds, data with intersections or varying dimensionality



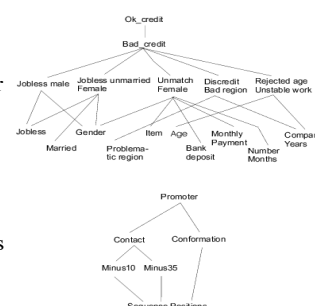
11:30 - 12:00

Partial and Vague Knowledge for Similarity Measures

Timo Steffens

Institute of Cognitive Science, Osnabrück, Germany

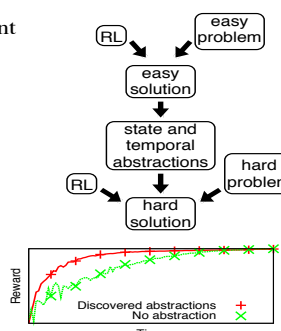
- Incorporating domain knowledge into similarity measures as virtual attributes
- Virtual attributes are not represented in the cases but can be inferred from other case attributes
- Analysis of the effect of partial and vague knowledge on classification accuracy
- In an artificial domain, partial knowledge is shown to add up, whereas vague knowledge is advantageous only up to a certain degree of vagueness
- In two UCI benchmark domains, using virtual attributes outperforms other learning methods reported in the literature



State Abstraction Discovery from Irrelevant State Variables

Nicholas K. Jong, Peter Stone
The University of Texas at Austin, USA

- **Automatic abstraction** for reinforcement learning, with no prior knowledge
- An empirical basis for state abstraction: **policy irrelevance**
- Discovers domain structure in one task for **transfer** to similar tasks
- Two **statistical methods** that trade off computational and sample complexity
- Encapsulates unsafe state abstractions inside **safe temporal abstractions**

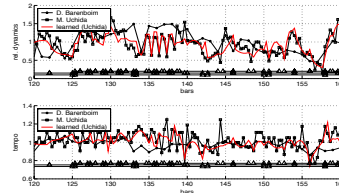


12:00 - 12:30

Learning to Play Like the Great Pianists

Asmir Tobudic and Gerhard Widmer
Austrian Research Institute for AI, Vienna
Department of Computational Perception, Johannes Kepler University, Linz

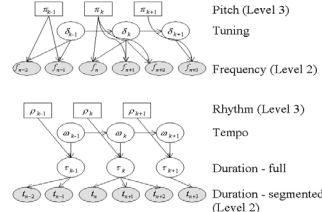
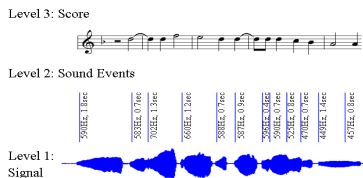
- An application of relational instance-based learning to the complex task of expressive music performance is presented
- Learning 'expressive profiles' of famous pianists using only performance information from audio CD recordings and the printed score
- Two applications of the work:
 (1) Recognizing pianists from their style of playing
 (2) Automatic style replication



10:30 - 11:00

Signal-to-Score Music Transcription using Graphical Models

Emir Kapanci and Avi Pfeffer
Harvard University, Cambridge, MA



- Transform signal into sound events (Level 1 to 2) by onset detection.
- Onset detection noisy: Possibly more than one sound event per score event
- Graphical model from Level 3 to 2
- Goal: Find the MAP configuration for Level 3, given the sound events

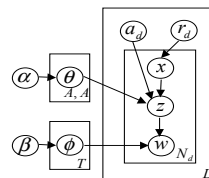
- Approximate Inference:
 1. Search over regroupings of Level 2 data (model structure)
 → Reversible Jump MCMC
 2. Search over discrete pitch and rhythms (model parameters)
 → Gibbs Sampling

11:00 - 11:30

Topic and Role Discovery in Social Networks

Andrew McCallum, Andres Corrada-Emmanuel, Xuerui Wang
University of Massachusetts, Amherst, Massachusetts, USA

- Traditional SNA models the existence of links from one entity to another, but not the language content or topics on those links
- Author-Recipient-Topic (ART) model learns topic distributions based on direction-sensitive messages sent between entities, steering the topic discovery according to the relationships between entities.
- Experimental results on both Enron email corpus and an academic email archive demonstrates that ART better predicts entities roles.
- Role-Author-Recipient-Topic (RART) explicitly capture the multiple roles of entities.
- Future work: new models explicitly captures roles and group simultaneously.



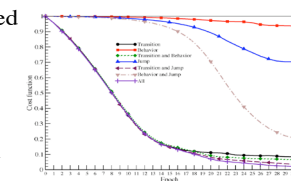
$$\begin{aligned} \theta &\sim \text{Dirichlet}(\alpha) \\ \phi &\sim \text{Dirichlet}(\beta) \\ x &\sim \text{uniform}(r_d) \\ z &\sim \text{multinomial}(\theta_{a,x}) \\ w &\sim \text{multinomial}(\phi_{r,z}) \end{aligned}$$

11:30 - 12:00

Learning Web Page Scores by Error Back-Propagation

Michelangelo Diligenti, Marco Gori, Marco Maggini
Dipartimento di Ingegneria dell'Informazione - Università di Siena - Italy

- New algorithm to learn a score distribution over the nodes of a labeled graph (directed or undirected)
- The score computation is based on a Random Walk model like in the PageRank
- The model computes scores based on both the topology and node labels
- Supervised learning is performed by optimizing a cost function with respect to the model parameters
- The learning algorithm is based on error back-propagation



Learning curves for RW models having different numbers of Free parameters

12:00 - 12:30

A Model-Theoretic Counterpart of Loop Formulas

Joohyung Lee

The University of Texas at Austin, Austin, Texas, USA

- Reformulates the definition of a loop by Lin and Zhao [2002] so that loop formulas becomes a generalization of Clark's completion.
- Presents a model-theoretic account of loop formulas:

$$\frac{\text{completion}}{\text{supported sets}} = \frac{\text{loop formulas}}{\text{externally supported sets}}$$
- Presents several translations from logic programs (under the answer set semantics) to propositional theories based on this idea.
- Shows that loop formulas are related to unfounded sets.
- In view of our theorem, the computational methods used in DLV and in SAT-based answer set solvers, such as ASSAT and CMODELS, are related to each other.

10:30 - 11:00

Minimal and Absent Information in Contexts

Floris Roelofsen
Luciano Serafini

ILLC, Amsterdam, The Netherlands
IRST, Trento, Italy

Multi-context systems (MCS) can be used to represent contextual information flow. We show that the semantics of an MCS is completely determined by the information that is obtained when simulating the MCS in such a way that a *minimal* amount of information is deduced at each step of the simulation.

In MCS, the acquisition of new information is based on the *presence* of other information only. We give a generalized account to model situations in which information can be obtained as a result of the *absence* of other information as well.

Keywords: contexts, non-monotonic reasoning, logic programming.

11:00 - 11:30

Reasoning under Inconsistency: the Forgotten Connective

Sébastien Konieczny*, Jérôme Lang*, Pierre Marquis*
*CRIL-CNRS, Université d'Artois, Lens, France
†IRIT-CNRS, Université Paul Sabatier, Toulouse, France

- A **new framework for reasoning under inconsistency** is presented
- Formulae within a set (belief base) are viewed as connected through a specific (non truth-functional) connective, called **comma**
 $\Rightarrow B = \{p_1, \dots, p_n\}$ and $B' = \{p_1 \wedge \dots \wedge p_n\}$ are treated differently
- **Several semantics** for the comma connective are pointed out, giving rise to several inference relations
- The framework is analyzed w.r.t.:
 \Rightarrow **Logical properties** of the inference relations
 \Rightarrow **Computational complexity** of the inference relations
- The framework is **general enough** to encompass several approaches for reasoning under inconsistency

11:30 - 12:00

Reconstructing an Agent's Epistemic State from Observations

Richard Booth, Macquarie University, Sydney, Australia
Alexander Nittka, University of Leipzig, Germany

- A problem in Belief Revision (BR): infer what an agent believed/will believe based on observation of how agent has responded to previous revision inputs over time
- Answer using "reverse engineering" approach: assuming a particular BR framework, find a model of the agent within this framework which "best explains" the observation
- We use BR framework which allows to model iterated, non-prioritised revision (agent's epistemic state = [(sequence of inputs received) + (core beliefs)])
- Give methods to reconstruct the agent's epistemic state (partly with help of methods from default inference)
- Prove our methods give, in some sense, most *cautious* explanation

12:00 - 12:30

The Altricial-Precocial Spectrum for Robots

Aaron Sloman, Jackie Chappell

Computer Science & Biosciences, The University of Birmingham, UK

- Natural intelligence includes both precocial species born with genetically determined competence and altricial species born relatively helpless, yet able to achieve greater cognitive sophistication as adults.
- We examine tradeoffs between these design options and explore their relevance to design options for different sorts of robots.
- Some conditions favour precocial designs while others favour altricial designs, or some mixture of precocial and altricial skills.
- Rapid environmental variation (e.g. caused by climate change, or migration, or changes in competitors) favours altricial species.
- We conjecture that apparently incompetent altricial individuals actually have sophisticated cognitive bootstrapping mechanisms in hybrid virtual machine architectures that grow themselves.
- Similar mechanisms may be required for some intelligent robots of the future.
- See <http://www.cs.bham.ac.uk/research/cogaff/altricial-precocial.pdf>

10:30 - 11:00

Attribution of Knowledge to Artificial Agents and their Principals: Philosophical and Legal Perspectives

Samir Chopra, Brooklyn College of CUNY
Laurence White, European Commission

- We consider the problem of knowledge attribution to artificial agents and their principals.
- When can we say that an artificial agent X knows p and that its principal can be attributed the knowledge of p ?
- We offer a pragmatic analysis of knowledge attribution - based on access to a proposition, and on the exercise of capacities.
- We apply this analysis to the legal theory of artificial agents and their principals.

11:00 - 11:30

PsychSim:

Modeling Theory of Mind with Decision-Theoretic Agents

David V. Pynadath and Stacy C. Marsella
Information Sciences Institute, University of Southern California
Marina del Rey, CA USA

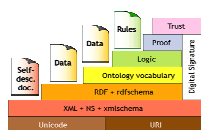
- **PsychSim**: multiagent-based social simulation
 - Use agents to simulate the behavior of an individual or group
 - Operationalize psychological theories of social influence
- **Key Idea**: Beliefs about others inform our social interactions
 - Social simulation needs computational model of "Theory of Mind"
- Express Theory of Mind in a decision-theoretic framework
 - Use recursive POMDP models to represent beliefs about others
 - Use quantitative models of probability and preferences to capture psychological theories of how people influence each other
- Approach demonstrated using the domain of school violence
 - Model alternate psychological theories on adolescent violence

11:30 - 12:00

Building the Semantic Web Tower from RDF Straw

Peter F. Patel-Schneider
Bell Labs Research, Murray Hill, New Jersey, USA

- RDF has been designated as the syntactic and semantic basis of the Semantic Web
- Extending this basis to a first-order logic introduces logical paradoxes, because using RDF as a syntactic basis requires that formula be encoded as facts
- The paradoxes do not involve particular details of the extension, but instead illustrate a fundamental flaw in building the Semantic Web solely on RDF



Semantic
Web
Tower

A Paradoxical Formula

$$\exists X (x=D) \ \& \ D$$

D is $\exists y \text{diag}(y,x) \wedge \neg \text{True}(y)$
 diag is a complex formula that (informally) requires that y be a formula that applies x to itself

12:00 - 12:30

What's New in Statistical Machine Translation

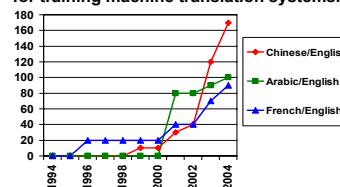
Kevin Knight
Information Sciences Institute
University of Southern California

- Things have changed a lot in automatic language translation lately!
- This talk will cover basic methods:
 - bilingual data acquisition/cleaning
 - probabilistic models of translation
 - models of language fluency
 - decoding algorithms
- It will also cover recent advances:
 - phrase-based models
 - discriminative training
 - models of syntax
 - automatic evaluation metrics

美国关岛国际机场及其办公室均接获一名自称沙特阿拉伯人拉登发出的电子邮件，威胁在9月11日对公众场所发动恐怖袭击。关岛机场在接到邮件后，立即进入高度警戒状态。关岛机场海关人员和其办公室均收到了一封来自自称是沙特阿拉伯人拉登的电子邮件，威胁在9月11日对公众场所发动恐怖袭击。关岛机场在接到邮件后，立即进入高度警戒状态。

The airport in Guam is maintaining a high state of alert after its customs airport and its offices both received an e-mail from someone calling himself the Saudi Arabian Osama bin Laden and threatening a biological/chemical attack against public places such as the airport.

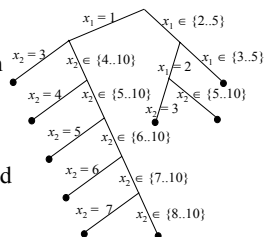
Millions of words of bilingual data available for training machine translation systems.



Value Ordering for Finding All Solutions

Barbara M. Smith
Cork Constraint Computation Centre, University College Cork, Ireland
Paula Sturdy
University of Huddersfield, U.K.

- It is well known that value order makes no difference when finding all solutions to a constraint satisfaction problem, if the search algorithm backtracks chronologically and forms k -way branches
- But if the search makes binary choices *and* propagates the removal of the value just tried before another value is selected, the value ordering *can* affect search effort
- A good value ordering can give a significant reduction in search effort

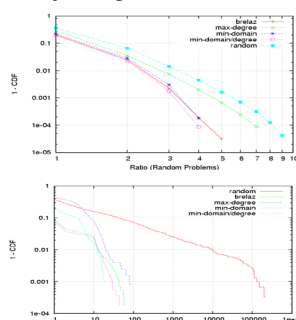


15:30 - 16:00

Optimal Refutations for Constraint Satisfaction Problems

Tudor Hulubei, Barry O'Sullivan
Cork Constraint Computation Centre, University College Cork, Ireland

- A novel approach to empirically studying problem hardness is presented.
- We compute the ratio between actual and optimal refutations of insoluble (sub)problems.
- Standard variable ordering heuristics behave very differently on random problems and real-world problems.
- Small-to-medium sized random CSPs are of limited value when developing new variable ordering heuristics.



16:00 - 16:30

Resolution in Max-SAT and its relation to local consistency in weighted CSPs

Javier Larrosa, Federico Heras
Universitat Politècnica de Catalunya, Barcelona, Spain

- New formalism for Max-SAT
 - Solving algorithms become more *logical* and less *algorithmic*.
- We extend Davis-Putnam-Loveland to Max-SAT.
- We extend Resolution to Max-SAT
 - Resolution is *sound* in Max-SAT
 - Open question: when resolution is *complete*?
- Adding Neighborhood Resolution to DPL makes it much more efficient.
- Neighborhood Resolution in Max-SAT is similar to Local Consistency in weighted CSPs.

Max-SAT	Weighted CSPs
Unary clauses	Node consistency
Binary clauses	Arc consistency

16:30 - 17:00

Decision Diagrams for the Computation of Semiring Valuations

Nic Wilson
Cork Constraint Computation Centre (4C), UCC, Ireland. n.wilson@4c.ucc.ie

- The paper describes a new approach to computation in a semiring-based system: *Semiring-Labelled Decision Diagrams (SLDDs)*
- Semiring-based systems include CSPs, systems of soft constraints and Bayesian networks.
- SLDDs can be generated like a search/decision tree: but some nodes are merged, leading to a more compact representation.
- Computations are performed by a form of dynamic programming, which can be enhanced by constraint propagation.
- SLDDs can be used e.g., to solve a semiring-based CSP, to represent compactly all optimal solutions of a weighted CSP, to count solutions of a CSP, and for inference in a Bayesian network.

17:00 - 17:30

Stepwise Nearest Neighbor Discriminant Analysis

Xipeng Qiu and Lide Wu
Department of Computer Science and Engineering
Fudan University, Shanghai, China

- The traditional LDA suffers from SSS problem and non-Gaussian data.
- NNDA finds the discriminant directions by

$$\hat{W} = \arg \max_W tr(W^T (\hat{S}_b - \hat{S}_w) W).$$

- \hat{S}_b and \hat{S}_w are the nonparametric between-class and within-class scatter matrix
- Then a stepwise dimensional reduction for approximation.

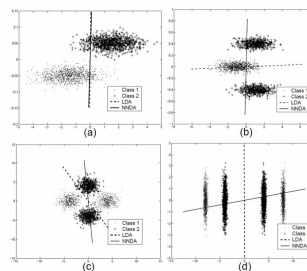


Figure 2: First projected directions of NNDA (solid) and LDA (dashed) projections, for four artificial datasets.

15:30 - 16:00

Cho-k-NN: A Method for Combining Interacting Pieces of Evidence in Case-Based Learning

Eyke Hüllermeier
Otto-von-Guericke-Universität, Magdeburg, Germany

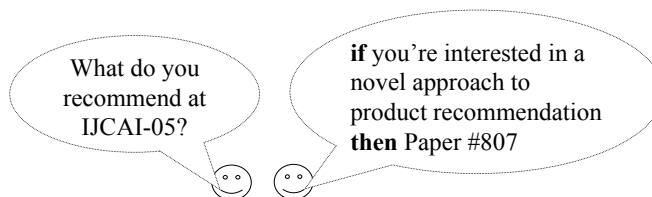
- The paper elaborates on the proper combination (aggregation) of different pieces of evidence in case-based learning.
- It is argued that cases must not be considered as independent information sources, as most approaches typically do.
- Focusing on the problem of prediction, a new inference principle is proposed that combines potentially interacting pieces of evidence by means of the so-called (discrete) Choquet-integral.
- The method takes interdependencies between cases into account and can be seen as a generalization of weighted NN estimation.

16:00 - 16:30

Automating the Discovery of Recommendation Knowledge

(Paper #807)

David McSherry and Christopher Stretch
University of Ulster, Northern Ireland



- A *rule-based* approach to retrieval of recommended products

+

- An algorithm for discovery of *recommendation rules* that are:
 - provably reliable
 - non-conflicting
 - maximally general

16:30 - 17:00

Sophia: A novel approach for Textual Case-based Reasoning

David Patterson, Niall Rooney, Mykola Galushka
NIKEL, University of Ulster, UK,
Vladimir Dobrynin, St Petersburg state University

- A novel methodology for textual case-based reasoning where cases represent unstructured documents
- Automatically discovers case and similarity knowledge in the form of clusters of semantically related cases
- Process is language independent, is scaleable and domain knowledge independent
- We present an experimental analysis of the competency of the system in terms of its effectiveness in retrieval of similar cases

17:00 - 17:30

Automatic Semantic Role Labeling for Chinese Verbs

Nianwen Xue and Martha Palmer
University of Pennsylvania, Philadelphia, PA, USA

- The Chinese Proposition Bank and its semantic representation
- Maxent-based semantic role labeling
 - with hand-crafted parses
 - with a character-based automatic parser
 - inducing verb classes and use them as features
- Conclusion
 - Challenges are from different places for Chinese and English

15:30 - 16:00

Meaning development versus predefined meanings in language evolution models

Paul Vogt
University of Edinburgh (UK) & Tilburg University (NL)

- Comparing the effect of meaning development as opposed to predefining meanings in a model of language evolution
- Model is based on a new model for studying the emergence and evolution of compositional (grammatical) structures in language and combines the *language game model* (Steels) with the *iterated learning model* (Brighton, Kirby & Smith).
- Model is implemented in a simulation of the Talking Heads experiment (Steels et al.)
- Experiments show that, although there are quantitative differences between the model that employs ontogenetic development of meanings and the one that has predefined meanings, there are little (if no) qualitative differences.
- Quantitative differences are due to statistical nature of environment.

16:00 - 16:30

Robust Ontology Acquisition from Machine-Readable Dictionaries

Eric Nichols*, Francis Bond*, Daniel Flickinger*
*Nara Institute of Science and Technology, Japan
*Nippon Telegraph and Telephone Corporation, Japan
*Stanford University, United States

- New method of ontology construction using semantic parses of Japanese dictionary definition sentences
- Combines deep and shallow parsing using Robust Minimal Recursion Semantics for higher coverage
- Currently extracting over **30,000** relations confirmed by comparison with hand-crafted ontology
- Outperforms [Tokunaga et al., 2001] and our previous work using only deep parsing [Bond et al., 2004]

Method	Nouns	Verbal Nouns	Verbs
[Bond et al., 2004]	12354	3534	N/A
Shallow	18808	3095	3884
Deep	19110	2669	3235
Deepest	22264	3376	4133

Number of relations extracted

Method	Nouns	Verbal Nouns	Verbs
[Bond et al., 2004]	57.01%	64.52%	N/A
Shallow	53.65%	46.67%	43.60%
Deep	63.31%	44.74%	43.28%
Deepest	57.68%	42.18%	40.58%

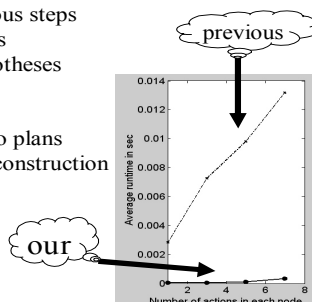
Percent of relations verified

16:30 - 17:00

Fast and Complete Symbolic Plan Recognition

Dorit Avrahami-Zilberbrand and Gal A. Kaminka
Computer Science Department, Bar Ilan University, Israel

- Reactive plan recognition
 - Interruptible plans, non-instantaneous steps
 - Complex multi-feature observations
- Several types of queries, multiple hypotheses
 - Current state of the agent
 - History of selected states
- Efficient mapping from observations to plans
 - Novel application of decision tree construction
- Lazy-commitment algorithms
 - Avoid enumerating hypotheses
 - Incremental bookkeeping only
- Analytical and empirical evaluation



Highly efficient recognition algorithms

15:30 - 16:00

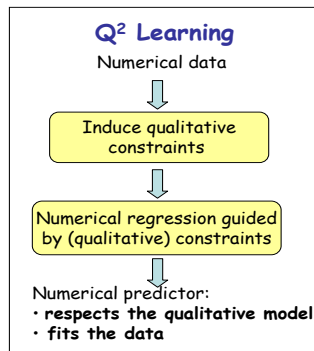
Combining Learning Constraints and Numerical Regression

Dorian Šuc^{1,2}, Ivan Bratko²

¹National ICT Australia (NICTA), Sydney, Australia

²Faculty of Comp. and Inf. Sc., University of Ljubljana, Slovenia

- Q² learning combines numerical and qualitative learning to induce **understandable** models, but can also improve **numerical accuracy**
- We propose a Q² learning scheme that can use an arbitrary numerical learner
- Study explanation and accuracy benefits, bias-variance decomposition
- Q² as a hierarchical learning scheme:
 - a hypothesis induced at a higher level guides the learner at a lower level
 - consistency of models at different levels of abstraction



16:00 - 16:30

Stereotype Extraction with Default Clustering

Julien Velcin, Jean-Gabriel Ganascia

LIP6 - University of Paris 6, FRANCE

- A theoretical framework based on default reasoning to deal with very sparse and categorical data.
- Uses the concept of stereotype instead of that of prototype.
- Clustering as an optimization problem.
- Choice of the Tabu-Search paradigm to solve this problem.
- Experimental comparison with 3 well-known clusterers (k-modes, EM, Cobweb).
- Applications in view : extraction of stereotypes for Press Content Analysis ; text clustering.
- Future work : extensive analysis with different newspapers at key dates ; development of efficient algorithms for categorical data in the sparse context.



16:30 - 17:00

Propositional Argumentation and Causal Reasoning

Alexander Bochman

Holon Academic Institute of Technology (HAIT), Israel

A number of propositional argumentation systems is obtained by gradually extending the underlying language and associated monotonic logics. An assumption-based argumentation framework of Bondarenko et al. constitutes a special case of this construction. In addition, a stronger argumentation system in a full classical language will be shown to be equivalent to a system of causal reasoning. The implications of this correspondence for the respective nonmonotonic theories of argumentation and causal reasoning are discussed.

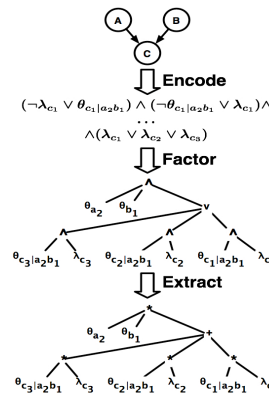
15:30 - 16:00

Compiling Bayesian Networks with Local Structure

Mark Chavira, Adnan Darwiche

University of California, Los Angeles, USA

- Compile Bayesian network offline into arithmetic circuit (AC). Online inference is then AC evaluation and differentiation.
- Compiling involves encoding the network into CNF, factoring the CNF, and extracting the AC. The encoding step captures both global and local structure.
- Paper focuses on techniques for capturing local structure during the encoding step.
- Orders of magnitude improvement in offline compile time.
- Orders of magnitude reduction in AC size (and online time) due to local structure.

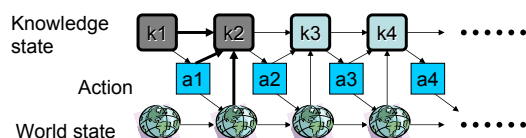


16:00 - 16:30

First-Order Logical Filtering

Afsaneh Shirazi, Eyal Amir

University of Illinois at Urbana-Champaign, Illinois, USA



- We show theoretically that updating FOL belief states into FOL belief states is enough for any future FOL queries
- Present *polynomial-time algorithms* for updating knowledge states represented in first-order logic (FOL), after precompilation
- *Algorithms are exact* when actions map states 1:1 or when actions' success or failure are known
- *Representation in FOL remains compact* for important classes of actions such as STRIPS actions

16:30 - 17:00

Inverse Resolution as Belief Change

Maurice Pagnucco and David Rajaratnam

The University of New South Wales, Sydney, Australia

- Belief change models the way in which a reasoner maintains its beliefs as it acquires new information.
- A similar situation occurs in symbolic machine learning where successive examples are presented to the learning system and a theory subsequently derived.
- In this paper, we look to reconcile the machine learning technique *inverse resolution* with the AGM belief change framework.
- This is achieved by looking at restrictions on an alternative version of the the standard AGM epistemic entrenchment ordering.
- Future work: development of rationality postulates and links to nonmonotonic logics.

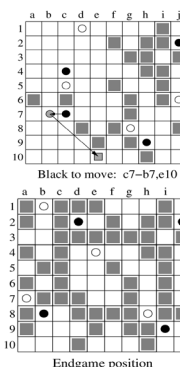
17:00 - 17:30

15:30 - 16:00

Generalized Amazons is PSPACE-complete

Timothy Furtak, Masashi Kiyomi, Takeaki Uno, Michael Buro
Department of Computing Science, University of Alberta
National Institute of Informatics, Japan

- Amazons is a two-person perfect information game played on a 10x10 board
- **Simple rules** create **vast complexity**
 - Both players have four amazons that move like chess Queens and block squares in Queen direction
 - The player running out of moves loses
 - The branching factor is **LARGE**
- It was known that determining the winner of simple Amazons endgames – in which all amazons are separated – is **NP-equivalent**
- Here, we provide two proofs of the **PSPACE-completeness** of generalized Amazons – which is played on an n by n board – by reducing HEX and GEOGRAPHY



The computational complexity of dominance and consistency in CP-nets

Judy Goldsmith
Dept. Comp. Sci.
Univ. Kentucky, USA

Jerome Lang
IRIT, Toulouse,
France

Mirosław Truszczyński
Dept. Comp. Sci.
Univ. Kentucky, USA

Nic Wilson
4C, UCC,
Ireland

- A *CP-net* compactly expresses conditional preferences over a set of variables V
- Under the assumption of *ceteris paribus*, it determines a preference ordering on the set of *outcomes*, i.e., complete assignments of values to variables in V
- This paper studies the following two problems:
 - *Dominance*: is one given outcome preferred to another
 - *Consistency*: is the preference on outcomes cycle-free
- *Dominance* and *Consistency* are PSPACE-complete for general CP-nets
- Reductions are from STRIPS planning problems
- They establish a strong connection between the two areas

16:00 - 16:30

Data Complexity of Reasoning in Very Expressive Description Logics

Ullrich Hustadt
Univ. of Liverpool

Boris Motik
FZI

Ulrike Sattler
Univ. of Manchester

- **Data complexity**: complexity of reasoning under assumption that data is much bigger than schema
 - typical assumption in relational databases
 - important for applications with large ABoxes (such as Semantic Web)
- We show that **SHIQ is data complete for NP**
 - intractable, but better than combined complexity (ExpTime)
 - follows from the reduction of SHIQ to disjunctive datalog
- Source of complexity: disjunction
- We identify **Horn-SHIQ**
 - a fragment of SHIQ not requiring disjunctive reasoning
 - exhibits **polynomial data complexity** → appealing for practice
 - expressive enough to capture many UML constructs
- We compare these results to the similar ones for datalog

16:30 - 17:00

Integrating Planning and Temporal Reasoning for Domains with Durations and Time Windows

Alfonso Gerevini* Alessandro Saetti* Ivan Serina*

*DEA, University of Brescia, Brescia, Italy

*CIS Dept., University of Strathclyde, Glasgow, UK

We address the problem of fast planning in temporal domains with deterministic exogenous events, proposing

- a new representation of temporal plans integrating disjunctive constraint-based temporal reasoning into a graph-based approach to planning;
- a polynomial method for solving the disjunctive temporal reasoning problems that arise in our context;
- some new local search techniques to guide the planning process using our representation.

A large experimental analysis demonstrates the effectiveness of our planning methods, and the good performance of the integrated temporal reasoning techniques.

15:30 - 16:00

Abstraction-based action ordering in planning

Maria Fox, Derek Long and Julie Porteous

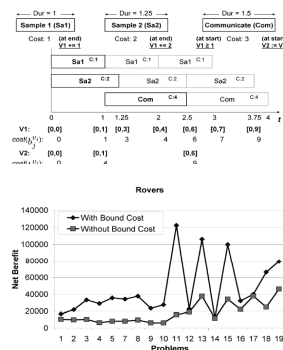
University of Strathclyde, Glasgow, UK

- The phenomenon of symmetry in planning problems has been explored in other work, but often problems exhibit near-symmetry, rather than true symmetry.
- In this case, existing techniques are unable to derive useful information and cannot improve behaviour.
- We explore a general concept of *almost symmetry* which is a symmetry in an abstraction of the original problem.
- Almost symmetry cannot be exploited in a pruning strategy without compromising completeness, but an interesting alternative is to exploit it proactively in guiding search.
- We develop this idea in the context of a forward heuristic search planning strategy, considering the impact of guiding choices using almost symmetric branches of the space.
- Preliminary results demonstrate benefits from this approach.

16:00 - 16:30

Over-subscription Planning with Numeric GoalsJ. Benton
Arizona State University
Tempe, Arizona, USAMinh B. Do
Palo Alto Research Center
Palo Alto, California, USASubbarao Kambhampati
Arizona State University
Tempe, Arizona, USA

- **Objective:** Generalize over-subscription planning to support Metric-Temporal scenarios
- **Technical Challenge:** Numeric goals allow different degrees of satisfaction
- **Our Approach:** Generalizing reachability heuristics to efficiently estimate the costs of achieving a numeric goal at different levels
- **Validation:** Implemented the planner *Sapa^{Mps}* and demonstrated the effectiveness of our cost-estimation approach.



16:30 - 17:00

Automated Composition of Web Services by Planning at the Knowledge LevelMarco Pistore, Annapaola Marconi, Piergiorgio Bertoli, Paolo Traverso
University of Trento and ITC-IRST, Trento, Italy

- An end-to-end approach for the automated composition of web services:
 - from BPEL4WS specifications of existing web services...
 - ... and from a formally specified composition goal...
 - ... automatically generate an executable BPEL4WS process which satisfies the composition requirement.
- Knowledge level techniques are exploited in the representation of the BPEL4WS specifications to avoid state explosion due to the (usually large and possibly infinite) ranges of data values exchanged among web services.
- The generation of the knowledge level model of the domain from the BPEL4WS specification and the translation of the generated knowledge level plan into executable BPEL4WS are fully automated.
- For more information: <http://www.astroproject.org/>

17:00 - 17:30