Lab Seminar SS 2010
Foundations of Artificial Intelligence

July 23, 2010

10:00–10:30 PD Dr. Jan-Georg Smaus
Classes of Terminating Logic Programs

The procedural interpretation of logic programs and queries is parametric to the selection rule, i.e. the rule that determines which atom is selected in each resolution step. Termination of logic programs and queries depends critically on the selection rule. In this survey, we present a unified view and comparison of seven notions of universal termination considered in the literature, and the corresponding classes of programs. For each class, we focus on a sufficient, and in most cases even necessary, declarative characterisation for determining that a program is in that class. By unifying different formalisms and making appropriate assumptions, we are able to establish a formal hierarchy between the different classes and their respective declarative characterisations.

10:30–10:50 Jens Witkowski
A Brief Introduction to Proper Scoring Rules

A principal can use proper scoring rules to elicit an agent's truthful belief about the probability of a publicly-observed future event. Any positive-affine transformation of such a proper scoring rule is also truthful (and hence a proper scoring rule). These positive-affine transformations can be used to incorporate costs an agent could have to learn or report her belief. In this talk, I briefly introduce proper scoring rules and the aforementioned concepts.

11:20–11:40 Robert Mattmüller
Location-based Abstraction Refinement for Timed Controller Synthesis

We present a general approach to combine symbolic state space representations for the discrete and continuous parts in the synthesis of winning strategies for timed reachability games. The combination is based on abstraction refinement where discrete symbolic techniques are used to produce a sequence of abstract timed game automata. After each refinement step, the resulting abstraction is

used for computing an under- and an over-approximation of the timed winning states. The key idea is to identify large relevant and irrelevant parts of the precise weakest winning strategy already on coarse, and therefore simple, abstractions. If neither the existence nor nonexistence of a winning strategy can be established in the approximations, we use them to guide the refinement process. Based on a prototype that combines binary decision diagrams (Bryant 1986, Burch et al. 1992) and difference bound matrices (Bengtsson 2002), we experimentally evaluate the technique on standard benchmarks from timed controller synthesis. The results clearly demonstrate the potential of the new approach concerning running time and memory consumption compared to the classical on-the-fly algorithm implemented in Uppaal-Tiga (Cassez et al. 2005, Behrmann et al. 2007).

11:40–12:00 Dr. Sebastian Kupferschmid
Searching for Good Patterns

Directed model checking accelerates the detection of reachable error states with the help of heuristic search. In heuristic search the traversal of the state space is guided with a heuristic, a function that estimates a state's distance to a nearest error state. In this work we are dealing with pattern database (PDB) heuristics. Roughly speaking, a PDB heuristic is a lookup table that contains the reachable states of an abstract/simplified system, annotated with abstract error distances. The informedness of a PDB heuristic crucially depends on the selected pattern.

In this talk we are introducing a new approach to the pattern selection problem. Our first results are very encouraging. The PDB heuristics allow to find shortest possible error traces in previously hardly to solve case studies. As a byproduct, we were also able to prove some benchmarks correct that are completely beyond the scope of other heuristic search methods.

12:00–12:20 Dapeng Zhang
Playing Tetris Using Learning by Imitation

Tetris is a board game, which is stochastic and open-end. Playing Tetris can be modeled as a sequential decision problem, which fostered the development of several AI players. In this paper, an AI player was built by employing learning by imitation. The training process improves the similarities between the AI player and the imitated human player. The experiments showed that our AI player can defeat another AI player which can remove on average more than 2000 lines in a single game. The framework supports incremental learning because our AI can find stronger players and imitate them.

13:50–14:30 Dr. Malte Helmert
Strengthening Landmark Heuristics via Hitting Sets

The landmark cut heuristic is perhaps the strongest known polytime admissible approximation of the optimal delete relaxation heuristic h+. Equipped with this

heuristic, a best-first search was able to optimally solve 40% more benchmark problems than the winners of the sequential optimization track of IPC 2008. We show that this heuristic can be understood as a simple relaxation of a hitting set problem, and that stronger heuristics can be obtained by considering stronger relaxations. Based on these findings, we propose a simple polytime method for obtaining heuristics stronger than landmark cut, and evaluate them over benchmark problems. We also show that hitting sets can be used to characterize h+ and thus provide a fresh and novel insight for better comprehension of the delete relaxation.

14:30–15:00 Gabriele Röger
Preparing, Conducting, and Post Processing Courses and Lectures

This talk was motivated by my university didactics training and gives a short overview how a lecturer could prepare, conduct, and post-process a course and its lectures properly. The emphasis of the talk is put in on the preparation of course but I will also present a small selection of exemplary teaching methods that can be useful to achieve the educational objectives.

15:30–15:50 Moritz Göbelbecker
CogX planning revisited

This talk will discuss the planning architecture for year 2 of the CogX project. While plans can be quickly found by classical planning, there are sub-problems (like observation planning) where continual planning usually does not perform very well. On the other hand, using a POMDP framework for the whole task is usually intractable. Our approach is to use a "switching planner" to identify parts of the problem where a decision theoretic approach is justified and embed these parts as a sub-task for a POMDP planner into a continual plan. Additionally, we discuss ways to use a common knowledge representation for continual and decision theoretic planning.

15:50–16:10 Thomas Keller
Object-based Planning

In our work "Semantic Attachments for Domain-Independent Planning Systems" (Dornhege et al., 2009) we presented an approach to add external modules to a planning domain, which are called by the planner during the planning process. From a planner user's (as opposed to a planner developer) point of view, this work has two weaknesses: Firstly, writing modules based on predicates and fluents that are only represented by strings is cumbersome work, leading to a low usability. Secondly, modules are imaginable that contain methods a planner user needs frequently, as e.g. the distance between two points in a multidimensional space. In this talk, I'd like to discuss an object-based planning approach, including an input language and a planning system that enables high

usability and easy reusability, and additionally serves as a framework to include subsolvers into the planning process.

16:10–16:30 Michael Brenner
Plans for Multiple Agents and Multiple Goals

N/A

17:00–17:20 Dr. Alexander Kleiner
Moving Target Search on Height Maps

In this talk I present a novel approach for moving target search that considers a 2.5d environment represented by a height map. Such a representation is particularly suitable for large-scale outdoor scenarios capturing some aspects of 3d visibility and can include target heights. In our approach we construct a graph representation of the environment by sampling strategic locations and computing their detection sets, an extended notion of visibility. From the graph we compute strategies using previous work on graph-searching. These strategies are used to coordinate the robot team and to generate paths for all robots using an appropriate classification of the terrain. In experiments we investigate the performance of our approach and provide examples including a sample maps with multiple loops and elevation plateaus. Furthermore, I present results from an large-scale experiment conducted with ten participants in the wild (Gascola area around Pittsburgh).

17:20–17:40 Dali Sun
Behavior research moral dilemmas in case of an emergency by means of UnrealEngine

In emergency situations, many decisions and actions are required are morally and legally relevant. Thus, that is possible that the selfish goal is in conflict with altruistic motives and legal standards. Or it may be several possibilities for action, each of them is legally or morally, but they can not be taken simultaneously and obey one would result in transgressing another (moral dilemma). On the legal level people do not agree on how to judge the certain behaviors in emergency situations. Often the proposed solutions by the courts are significant differences in international comparison. Therefor the behavior research in case of an emergency is very attractive and meaningful to Psychologist.

The psychologist design several experiments with certain emergency scenarios for this research. The psychologist hope that the emergency scenarios can be better simulated, so that the experimenter may feel more real in the experiments. In recent years the computer 3D-Game technology becomes more realistic and user-friendly. The technology are now not only being used to create computer games, but also being used for serious applications: visualization,

training, medical, and robotic simulation. We use a 3D-Game technology UnrealEngine 2 to help the psychologist to create more realistic and user-friendly experiments.

17:40–18:00 Dr. Vittorio Amos Ziparo

Everyone is a Taxi

In this talk, we present some ongoing work on the design and development of a car sharing application for smartphones equipped with GPS devices and internet connection. The goal of the system is to enable users which need to travel to different locations, to group in order to share cars. Our approach is innovative in at least two ways: 1) it enables users to group in real-time and 2) is uses auctions as a coordination mechanism. The long term perspective is to reduce global traffic volume (i.e. global pollution) and, most importantly, overcharging taxi drivers!