International Oberseminar
2012

14.5.2012 – 16.5.2012

Schedule

Time	Speaker	Title
Monday, 14th May		
09:00-09:10	Bernhard Nebel	Welcome
Session I. Chair: Bernhard Nebel		
09:10-09:35	Luca Iocchi	Automated generation and learning of finite-state controllers
09:35-10:00	Moritz Göbelbecker	Explaining Execution Failures in Continual Planning
10:00-10:25	Eirini Kaldeli	Continual planning with sensing in dynamic service environments
10:25-10:55	Coffee break	
Session II. Chair: Luca Iocchi		
10:55-11:20	Patrick Eyerich	Preferring Properly: Increasing Coverage while Maintaining Quality in Anytime Temporal Planning
11:20-11:45	Ilche Georgievski	An Overview of Hierarchical Task Network Planning
11:45-12:10	Florian Pommerening	Optimal Planning for Delete-free Tasks with Incremental LM-cut
12:10-14:00	Lunch break	
Session III. Chair: Marco Aiello		
14:00-14:25	Domenico Bloisi	Camera based target recognition for maritime awareness
14:25-14:50	Johannes Löhr	A Planning Based Framework for Controlling Hybrid Systems
14:50-15:15	Andreas Hertle Christian Dornhege	Tidyup Robot: Controlling Autonomous Robots using Symbolic Planning
15:15-15:45	Coffee break	
15:45-18:00	Postersession I	
Tuesday, 15th May		
Session IV. Chair: Esra Erdem		
09:00-09:25	Yusra Alkhazraji	Partial order reduction for automated planning
09:25-09:50	Martin Wehrle	About Partial Order Reduction in Planning and Computer Aided Verification
09:50-10:15	Julien Hué	An Automatic Decomposition Method for Qualitative Spatial and Temporal Reasoning
10:15-10:45	Coffee break	
10:45-12:10	Postersession II	
12:10-14:00	Lunch break	
14:00-21.30	Excursion to Trier	

Time	Speaker	Title
Wednesday, 16th May		
	Session V. Chair: Stefan Wölfl	
09:00-09:25	Christian Becker-Asano	Computational modeling of emotions
09:25-09:50	Andrea Pagani Tuan Anh Nguyen	Optimizing offices for the smart grid
09:50-10:15	Viktoriya Degeler	Cost-Efficient Context-Aware Rule Maintenance
10:15-10:45	Coffee break	
	Session VI. Chair: Malte Helmert	
10:45-11:10	Erdi Aker	Housekeeping with Multiple Autonomous Robots: Revisited
11:10-11:35	Dali Sun	Adaptive Task Allocation and Path Planning for Industrial Robot Teams
11:35-12:00	Vittorio Amos Ziparo	MADMASS: the massively distributed multi-agent system simulator
12:10-14:00	Lunch break	

Schedule Postersessions

Speaker	Title
Postersession I	
Johannes Aldinger	UCT Initialization Techniques for the Canadian Traveler's Problem
Tuan Anh Nguyen	Realize a practical embedded hardware solution for management of home electric power consumption
Taigo Bonanni	Person-tracking and gesture-driven interaction for a mobile robot
Zeynep Dogmus	ReAct: An Intelligent User Interface for Representing and Reasoning about Action Domains
Nguyen Duc Thien	A survey of heterogeneous multi-robot cooperation: Micro Unmanned Aerial Vehicle (MAV) and Unmanned Ground Vehicles (UGV)
Andrea Pagani	The Smart Grid's Last Mile as a Complex Network
Andrea Pennisi	Context-aware crowd analysis and people counting for infomobility
Matthias Westphal Stefan Wölfl	Relational languages for qualitative spatio-temporal planning
Postersession II	
Pavel Bulanov	Process Variability Framework: Declarative and Imperative
Ando Emerencia	Generating personalized advice for schizophrenia patients
Doga Gizem Kisa	Using Answer Set Programming for Multi-Agent Path Planning
Suha Orhun Mutluergil	Phylogeny Reconstruction based on Genome Rearrangement Problems
Fabio Previtali	Multi-Clustered Particle Filter for Distributed Data Fusion
Gabi Röger Malte Helmert	Non-optimal Multi-Agent Pathfinding is Solved (Since 1984)
Alexander Schimpf	Using Program Refinement Techniques in Computer-Supported Verfication for Model Checking
Erfan Shojaei	A survey of SLAM methods for mobile robots

Full Presentations

Monday, 09:10–09:35

Luca Iocchi

Automated generation and learning of finite-state controllers

In this talk I will describe a method to generate and learn agent controllers, represented as state machines, to act in non-deterministic environments. Such controllers are generated using planning techniques from an incomplete description of the domain and then used by a Hierarchical Reinforcement Learning method to adapt the agent's behavior to the actual conditions of the environment thus improving performance from experience. The proposed method, by suitably combining planning and learning, has two important advantages: with respect to a pure learning approach, it is able to deal with non-modeled features of the domain and can increase performance over time from experience; with respect to a pure learning approach, it uses a much smaller search space, thus increasing learning rate. The proposed method has been applied to a mobile robot acting in a dynamic, non-stationary environment. Experiments with a realistic simulator have been performed in order to assess the performance of the proposed method.

Monday, 09:35–10:00

Moritz Göbelbecker

Explaining Execution Failures in Continual Planning

Continual planning is an effective approach to decision making in uncertain dynamic worlds. It involves creating plans based on assumptions about the real world and replanning if those plans fail. We discuss methods for making these assumptions explicit and providing explanations why a continual planning task may have failed or produced unexpected outcomes.

Monday, 10:00–10:25

Eirini Kaldeli

Continual planning with sensing in dynamic service environments

Service domains constitute an application field where automated planning can significantly contribute towards achieving customisable and adaptable compositions. Within the last years, several approaches have addressed the problem of Web Service composition as a planning task from different perspectives. Most of these approaches however disregard the issues raised by the high degree of dynamicity and unpredictability that charachterize service domains: the state of the environment continiously changes by the actions of exogenous agents, existing services may become unavailable and new ones may arrive, and service invocations may respond with a failure, timeout or behave differently than expected. Moreover, to deal with incomplete knowledge, sensing has to be performed, and the range of possible observation outcomes may be too large to include in advance in a conditional plan. This combination of unknowns, changes, and contingencies may interfere at any stage with the plan under execution and lead to inconsistencies. To address these issues we propose using a planner based on dynamic Constraint Satisfaction techniques, and resort to continual planning via approrriately altering the Constraint Satisfaction Problem depending on the feedback acquired at runtime. At the same time a high degree of parallelism is maintained, with the interactions between the planning and the service components being asynchronous, non-blocking and event-driven. The approach is evaluated against a number of scenarios in the setting of a smart home and a domain of services publically available on the Web.

Monday, 10:55–11:20

Patrick Eyerich

Preferring Properly: Increasing Coverage while Maintaining Quality in Anytime Temporal Planning

Temporal Fast Downward (TFD) is a successful temporal planning system that is capable of dealing with numerical values. Rather than decoupling action selection from scheduling, it searches directly in the space of time-stamped states, an approach that has shown to produce plans of high quality at the price of coverage. To increase coverage, TFD incorporates deferred evaluation and preferred operators, two search techniques that usually decrease the number of heuristic calculations by a large amount. However, the current definition of preferred operators offers only limited guidance in problems where heuristic estimates are weak or where subgoals require the execution of mutex operators. In this paper, we present novel methods of how to refine this definition and show how to combine the diverse strengths of different sets of preferred operators using a restarting procedure incorporated into a multi-queue best-first search. These techniques improve TFD's coverage drastically and preserve the average solution quality, leading to a system that solves more problems than each of the competitors of the temporal satisficing track of IPC 2011 and clearly outperforms all of them in terms of IPC score.

Monday, 11:20–11:45

Ilche Georgievski

An Overview of Hierarchical Task Network Planning

Over many years, the Hierarchical Task Network (HTN) planning has become a widely used approach to automated planning. The literature reflects a variety of HTN planners that employ different concepts relating to the search strategy, plan structure, task interactions and domain representation. Our aim is, firstly, to place these contributions in the context of how HTN planners structure actions within a plan and, subsequently, to discuss a number of characteristics and features that these planners incorporate. We begin by presenting two ways of performing HTN planning: in particular, planners that structure partially ordered plans and employ a least-commitment strategy, and planners that structure totally ordered plans and employ an ordered task decomposition strategy. We continue by discussing the easiness of domain authoring, expressiveness, efficiency, complexity and applications in the scope of the state-of-the-art HTN planners. Finally, we draw short conclusions and propose possible research directions.

Monday, 11:45–12:10

Florian Pommerening

Optimal Planning for Delete-free Tasks with Incremental LM-cut

Optimal plans of delete-free planning tasks are interesting both in domains that have no delete effects and as the relaxation heuristic h+ in general planning. Many heuristics for optimal and satisficing planning approximate the h+ heuristic, which is well-informed and admissible but intractable to compute. In this work, branch-and-bound and IDA* search are used in a search space tailored to delete-free planning together with an incrementally computed version of the LM-cut heuristic. The resulting algorithm for optimal delete-free planning exceeds the performance of A* with the LM-cut heuristic in the state-of-the-art planner Fast Downward.

Monday, 14:00–14:25

Domenico Bloisi

Camera based target recognition for maritime awareness

The control of vessel traffic in highly congested areas has become a critical requirement for safety and security. It is often correlated to environment protection issues, due to possible casualties and environmental disasters caused by tankers and vessels carrying dangerous goods. Moreover, the protection of the sea coasts is a requirement which has been given raising emphasis in recent years, due to the increasing threats coming from smugglers, refugees, intruders, and other non-conventional maritime forces (e.g., pirates). In this talk a framework for a camera based vessel recognition system is proposed. The framework is designed to enhance the functionalities of current Vessel Traffic Services (VTS) systems by adding a visual dimension to VTS data and the classification of non-cooperative targets. Furthermore, the framework can be suitable for the vessel traffic monitoring in populated areas where radar-based systems cannot be used due to electromagnetic radiation emissions. A quantitative evaluation of the detection performance on a publicly available dataset that validates the approach is provided.

Monday, 14:25–14:50

Johannes Löhr

A Planning Based Framework for Controlling Hybrid Systems

The control of dynamic systems, which aims to minimize the deviation of state variables from reference values in a continuous state space, is a central domain of cybernetics and control theory. The objective of action planning is to find feasible state trajectories in a discrete state space from an initial state to a state satisfying the goal conditions, which in principle addresses the same issue on a more abstract level. We combine these approaches to switch between dynamic system characteristics on the fly, and to generate control input sequences that affect both discrete and continuous state variables. We present an approach (called Domain Predictive Control) which is applicable to hybrid systems with linear dynamics and discretizable inputs. We intent to use Domain Predictive Control for autonomy purposes in order to enable dynamic systems to react on a changing environment or system failures by continuous replanning.

Monday, 14:50–15:15

Andreas Hertle and Christian Dornhege

Tidyup Robot: Controlling Autonomous Robots using Symbolic Planning

As the complexity of tasks for autonomous robots increases, traditional mission control approaches – like finite state automata – struggle to keep up. Symbolic planning offers a possible solution: a planner can reason about a wide variety of situations efficiently due to the abstraction of symbolic logic. However, tasks that require precise geometric information are difficult to represent in symbolic logic. Semantic attachments bridge this gap: during the planning process the resolution of geometric constraints is deferred to specialized geometric planners. We present Tidyup Robot project, where an autonomous robot has the task to tidy a living room table by picking up objects on the table and bringing them to a designated locations. We show how the Temporal Fast Downward planner is integrated with existing path and manipulation planners in order to produce executable plans for the robot.

Tuesday, 09:00–09:25

Yusra Alkhazraji

Partial order reduction for automated planning

Partial order reduction is a prominent technique used to reduce the search space in the area of computer-aided verification. It has been successfully applied to prune redundant parts of the search space while (or before) performing the search by model checking algorithms. In model checking, there are several effective approaches that have been used to achieve this reduction. However, these approaches are highly similar and the differences among their reduction power are not obvious. Furthermore, similar approaches have been proposed to be used for reducing the search space of automated planning without properly relating them to the original approaches used in model checking. Most of those approaches do neither preserve completeness nor optimality. In this thesis, we present a general theoretical framework of partial order reduction for automated planning. Furthermore, we establish and discuss the relationship among several original partial order reduction methods from the area of model checking and adapt two of them from the literature to automated planning. For one of these two methods we show that it performs reduction and preserves completeness and optimality of any search algorithm.

Tuesday, 09:25–09:50

Martin Wehrle

About Partial Order Reduction in Planning and Computer Aided Verification

Partial order reduction is a state space pruning approach that has been originally introduced in computer aided verification. Recently, various partial order reduction techniques have also been proposed for planning. Despite very similar underlying ideas, the relevant literature from computer aided verification has hardly been analyzed in the planning area so far, and it is unclear how these techniques are formally related. We provide an analysis of existing partial order reduction techniques and their relationships. We show that recently proposed approaches in planning are instances of general partial order reduction approaches from computer aided verification. Our analysis reveals a hierarchy of dominance relationships and shows that there is still room for improvement for partial order reduction techniques in planning. Overall, we provide a first step towards a better understanding and a unifying theory of partial order reduction techniques from different areas.

Tuesday, 09:50–10:15

Julien Hué

An Automatic Decomposition Method for Qualitative Spatial and Temporal Reasoning

Qualitative spatial and temporal reasoning is a research field that studies relational, constraint-based formalisms for representing, and reasoning about, uncertain spatial and temporal information. The standard approach for checking consistency is based on an exhaustive representation of possible configurations between three entities, the so-called composition tables. These tables, however, encode semantic background knowledge in a redundant way, which becomes apparent, when the logical rules represented in the composition tables need to be grounded, for example, in SAT encodings of qualitative reasoning problems. In this paper, we present a new framework that allows for decomposing these rule sets into simpler parts, while preserving logical equivalence. By utilizing Answer Set Programming, we can automa-

tically generate decompositions that are guaranteed to be minimal. The method is explained in detail by discussing minimal decompositions for RCC5 and RCC8. We discuss the impact of our decomposition method on Boolean SAT encodings of QSTR problems, and present an implementation of a reasoning system built on decompositions that compares favorably with state-of-the-art solvers.

Wednesday, 09:00–09:25

Christian Becker-Asano

Computational modeling of emotions

"With the advance of virtual reality and social robotics computer scientists became increasingly interested in modeling inherently human, interpersonal states and processes. The quest of constructing machines that behave appropriately in direct human interaction affords to integrate social competence, which in turn includes a robot's ability to deal with such soft concepts as "emotions."

After a short motivation I give an overview of a selection of the many theories that emotion psychology has to offer. In particular, one possible distinction of three classes of emotions is being motivated, namely that of primary, secondary, and social emotions. These classes serve as basis for the the introduction of "WASABI", a computational model of emotions, in which only the first two classes can be represented so far. Thus, in the end it is discussed, how dynamic epistemic logic might be used as basis for the additional integration of social emotions such as "embarrassment", "shame", or "guilt."

The ideas concerning the connection between dynamic epistemic logic and social emotions are joint work with Bernhard Nebel, Benedikt Löwe, Andreas Witzel, and Yanjing Wang.

Wednesday, 09:25–09:50

Andrea Pagani and Tuan Anh Nguyen

Optimizing Offices for the smart grid

The Smart Grid promises to not only provide for a more reliable distribution infrastructure, but also give the end users better pricing and information. It is thus interesting for them to be ready to take advantage of features such as dynamic energy pricing and real-time choice of operators. In this work, we propose a system to monitor and control an office environment and to couple it with the Smart Grid. The idea is to schedule the operation of devices according to policies defined by the users, in order to minimize the cost of operation while leaving unaffected user comfort and productivity. The implementation of the system and its testing in a living lab environment show interesting economic saving of an average of about 35% and in some cases even overall energy savings in the order of 10% for a building equipped with renewable generation plants, and savings of 20% and 10%, respectively, for a building without local renewable installations.

Wednesday, 09:50–10:15

Viktoriya Degeler

Cost-Efficient Context-Aware Rule Maintenance

Energy and other costs reduction is important in smart homes automation area. It is cumbersome and error-prone to create proper rules for saving costs manually, thus an automatic approach is desirable that continuously checks for the possibility to save costs. We propose an approach that unifies handling of user defined rules, and searches for a possibility to move

each device to a more cost-efficient state when this does not violate any rules. With every event in the environment, our approach partially rechecks only those parts of the system that are affected by the change, thus saving computational resources.

Wednesday, 10:45–11:10

Erdi Aker

Housekeeping with Multiple Autonomous Robots: Revisited

We consider a housekeeping domain with multiple cleaning robots that involves durative actions and temporal constraints on the completion of tasks, and allows collaborations of robots. We represent this domain in Answer Set Programming (ASP), and use the answer set solver iClingo to compute plans.

Wednesday, 11:10–11:35

Dali Sun

Adaptive Task Allocation and Path Planning for Industrial Robot Teams

Although a remarkably high degree of automation has been reached in production and intralogistics nowadays, human labor is still used for transportation using handcarts and forklifts. High labor cost and risk of injury are the undesirable consequences. Alternative approaches in automated warehouses are fixed installed conveyors installed either overhead or floorbased. The drawback of such solutions is the lack of flexibility. We propose a approach of decentralized teams of autonomous robots performing intra-logistics tasks using distributed algorithms. The task is to transport material between stations keeping the communication network structure intact and most importantly, to facilitate a fair distribution of robots among loading stations. In particular we use an adapted version of distributed heterogeneous hash tables (DHHT) for distributing the tasks and localized communication. Besides the task assignment problem, another challenge in this domain is to efficiently coordinate the simultaneous navigation of large robot teams in confined and cluttered environments. We present adaptive road map optimization (ARMO) for large robot teams that is capable of adapting the road map whenever the environment or the station demand has changed. The proposed approach has been evaluated with robot teams both in simulation and in a real-world scenarios. The preliminary results show that our method is capable to efficiently solve the intra-logistics tasks.

Wednesday, 11:35–12:00

Vittorio Amos Ziparo

MADMASS: the massively distributed multi-agent system simulator

In this talk, I will present the MAssively Distributed Multi Agent System Simulator (MADMASS). MADMASS is an open-source Rails Engine for Torquebox that simplifies the development of (HTML5) apps for the Cloud.

MADMASS adopts AI design patterns and methodologies, as MADMASS applications are Multi-Agent Systems, i.e. communities of agents that cooperate in the Cloud to provide services to their users. During the talk, I will introduce the key concepts of MADMASS and show how it is being used to develop an online multi-player real-time strategy game (The Harvestar) and a geo-social benchmark (GeoGraph).

MADMASS applications are designed to scale and must be able to deal with rapid and unpredictable fluctuations in the workload that can yield to high levels of contention on data. Current technologies fall short in such scenarios, especially if the domain requires transactional

operations and strong consistency. To this end, I will show how MADMASS integrates with the Cloud-TM platform to deliver optimal performance in any situation.
MADMASS is developed by the Italian start-up Algorithmica (www.algorithmica.it) in the frame of the EU project Cloud-TM (www.cloudtm.eu). The Cloud-TM partners are Inesc-ID, Red Hat, Algorithmica and CINI.

Posters

Postersession I

Johannes Aldinger

UCT Initialization Techniques for the Canadian Traveler's Problem

UCT relies heavily on the heuristic initialization during early rollouts. We present some sophisticated Dijkstra variations to estimate the path cost and show that storing the initial values in a table saves time that can be used to perform more rollouts.

Postersession I

Tuan Anh Nguyen

Realize a practical embedded hardware solution for management of home electric power consumption

A practical touch-screen embedded hardware to control Plugwise system for management of home electric power consumption.

Postersession I

Taigo Bonanni

Person-tracking and gesture-driven interaction for a mobile robot

In order to make robotic systems accessible to a wider audience, there is the need to address novel paradigms for a simpler interaction between humans and robots, discarding wearable and graspable user interfaces, which in fact make those platforms usable only for system experts, due to the effort required to the user for an effective interaction. A new human-robot interaction paradigm is presented, focused mostly on simplifying the effort required to the human, presenting a vision-based social robot, whose behaviours are controlled by gestures and actions performed by users, through computer-vision techniques applied on data aquired by the kinect sensor. Finally, a in-development approach for the construction of semantic map, which heavily exploites the kinect sensor, is presented.

Postersession I

Zeynep Dogmus

ReAct: An Intelligent User Interface for Representing and Reasoning about Action Domains

We present a software system, called ReAct, that guides the user to represent actions and change in the action language C+, and then solve planning problems using CCalc.

Postersession I

Nguyen Duc Thien

A survey of heterogeneous multi-robot cooperation: Micro Unmanned Aerial Vehicle (MAV) and Unmanned Ground Vehicles (UGV)

No abstract.

Postersession I

Andrea Pagani

The Smart Grid's Last Mile as a Complex Network

The poster describes an approach to Smart Grid analysis and design using Complex Network Analysis techniques. Design principles for the next generation Power Grids are proposed in the poster with the potential benefits provided.

Postersession I

Andrea Pennisi

Context-aware crowd analysis and people counting for infomobility

Mobility in large touristic cities, where the needs of citizens and tourists are so different, is a relevant problem. Thus the infomobility is becoming increasingly important, since active technologies are more invasive, a complete passive sensor system is needed. This work presents a development and experimentation of techniques for automatic estimation of the number of people present in a bus stop area and proposes an integrating approach for 3D data analysis, coming from a stereo camera.

Postersession I

Matthias Westphal and Stefan Wölfl

Relational languages for qualitative spatio-temporal planning

In this work we discuss ways to represent spatial planning problems in relational, qualitative constraint languages. We discuss embeddings of such formalisms and present some preliminary computational complexity results for these languages.

Postersession II

Pavel Bulanov

Process Variability Framework: Declarative and Imperative

To lower both implementation time and cost, many Business Process Management tools use process templates to implement highly recurring processes. However, in order for such templates to be used, a process has to adhere substantially to the template. Therefore, current practice for processes which deviate more than marginally is to either manually implement them at high costs, or for the business to inflexibly comply to the template. In this demo we present a tool which demonstrates a variability based solution to process template definition.

Postersession II

Ando Emerencia

Generating personalized advice for schizophrenia patients

The results of routine patient assessments in psychiatric healthcare in the Northern Netherlands are primarily used to support clinicians. We developed Wegweis, a web based advice platform, to make this data accessible and understandable for patients.

Postersession II

Doga Gizem Kisa

Using Answer Set Programming for Multi-Agent Path Planning

We propose to use expressive knowledge representation and efficient solvers of language Answer Set Programming to solve Multi-Agent Path Planning problems.

Postersession II

Suha Orhun Mutluergil

Phylogeny Reconstruction based on Genome Rearrangement Problems

We have developed several algorithms based on the genome rearrangement problem and the median genome problem, and applied them to understand the evolutionary relationships between some species.

Postersession II

Fabio Previtali

Multi-Clustered Particle Filter for Distributed Data Fusion

Distributed Particle filter-based algorithms have been proved to be effective to model non-linear and dynamic processes in Multi Agent Systems. In complex scenario, where mobile agents are involved, it is crucial to disseminate good belief among agents, to avoid degradation on the global estimation. In this paper, we propose a cluster-based data association to boost the performance of a Distributed Particle Filter (DPF). A two-tiered architecture is proposed: a local layer, associated to a single-agent PF is used to track multiple objects in the local frame; and a global layer, where the distributed estimation is performed. The results obtained using multiple environments and multiple agents/targets configurations demonstrate the effectiveness of this novel approach, like the low average error and the low false detection rate.

Postersession II

Gabi Röger and Malte Helmert

Non-optimal Multi-Agent Pathfinding is Solved (Since 1984)

Optimal solutions for multi-agent pathfinding problems are often too expensive to compute. For this reason, suboptimal approaches have been widely studied in the literature. Specifically, in recent years a number of efficient suboptimal algorithms that are complete for certain subclasses have been proposed at highly-rated robotics and AI conferences. However, it turns out that the problem of non-optimal multi-agent pathfinding has already been completely solved in another research community in the 1980s. With this poster, we would like to bring this earlier related work to the attention of more robotics and AI researchers.

Postersession II

Alexander Schimpf

Using Program Refinement Techniques in Computer-Supported Verfication for Model Checking

When implementing algorithms using a theorem prover like Isabelle/HOL, the desired properties abstractness and efficiency are in conflict. In order to provide a solution for this problem, program refinement techniques can be used. I'm going to present program refinement techniques in the context of Model Checking and how they can be used in practice.

Postersession II

Erfan Shojaei

A survey of SLAM methods for mobile robots

No abstract.