YEAR PROJECTS AND BACHELOR THESES AT KTIML

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MAIN FIELDS OF YEAR PROJECTS AND BACHELOR THESES

Implementation/experimental and theoretical work, typically associated with
any of the following topics

- Artificial Intelligence
  - Machine Learning
  - Robotics
  - Planning
  - Games
- Theoretical Informatics
  - Logic - SAT
  - Optimization
  - Algorithms
  - Charts

Topics are often listed after the student has agreed → don't be afraid to write to someone if you are interested in the topics they are working on

MACHINE LEARNING

Iveta Mrázová, Marta Vomlelová, Martin Pilát, Roman Neruda

Typically, the application of machine learning methods to some suitable problem

- Data mining, social network analysis (IM)
- Artificial neural networks, deep learning (IM, MP, RN)
- Probabilistic models, machine learning in general (MV)
- Nature-inspired algorithms (IM, MP, RN)

Examples of work from previous years

- Layered neural networks and visualization of their structure (IM)
- Social networks: trend and sentiment analysis (IM)
- Raman Microspectroscopy Data Processing (MP)
- Machine learning tools for Diagnosis of Heart Arrhythmia (MV)
- Exploring the vulnerabilities of real-life AI systems against adversarial attacks (RN)

PLANNING

Roman Barták, Jiří Švancara

- inding plans (sequences of actions) to achieve the goal
- Hierarchical planning (planning by decomposition into subtasks)
- Using formal grammars and automata in planning
- Multi-agent planning
- Applications - Automatic storage, intelligent intersection, aircraft taxiing, recognition plans/intents

Examples of work from previous years

- Path planning for multi-robotic warehouses (RB)
- Container terminal planning (RB)
- Autonomous Crossroads (RB)
- Reduction-based Solvers for Multi-agent Pathfinding: Comparing Different Models (JŠ)
- Effectiveness of centralised junction planning (JŠ)

ROBOTICS

David Obdržalek

Possibility to work directly with HW

- Building, driving robots

Simulated environment, applications

- Use of robots, e.g. coordinated path finding (Roman Barták)

Examples of work from previous years

Graph-based SLAM on Normal Distributions Transform Occupancy Map (DO)

- Household automatic control system (DO)
- Control system for mobile robot (DO)
- Formula F1:10 (DO)
- Stabilization of flying drone in dynamic environment (RB)
- inding coordinated paths for a group of robots (RB)
- Implementing and monitoring plans for AR.Drone (RB)

GAMES

Jan Hric, Vladan Majerech, Martin Pilát

Combinatorial games, puzzles, board games, ...

RP is typically the implementation of a game, BP is then the implementation of an artificial
Intelligence

Examples of work from previous years

- MCTS for Metro (JH)
- Settlers of Catan (JH)
- Controlling the tree search game (JH)
- Arimaa challenge - comparison study of MCTS versus alpha-beta methods (VM)
- Rubik's Cube (VM)

OPTIMIZATION

Jiří Fink, Marika Ivanová, Roman Barták

Energy (JF)

- Power generation and consumption planning

Communication networks (MI)

Logistics (JF, RB)

- Transport planning, optimization of timetables, optimization of winter maintenance

Examples of work from previous years

- Algorithms for positioning wireless communication systems (JF)
- Optimization of a circulating multi-car elevator system (JF)
- Optimization of delivery problems (JF)
- Planning for Transportation Problems (RB)
- Path planning for multi-robotic warehouses (RB)

SAT

Ondřej Čepek, Petr Kučera

- Knowledge representation
- □ormula compression and conversion
- SAT solvers
- Problem modelling

Mostly theoretical work with only minor implementation - typically for algorithm verification/experiments

THEORETICAL COMPUTER SCIENCE

Jakub Bulín, Petr Gregor

Discrete Optimization

Problem Complexity

Algorithms

Isormophism of graphs

Problems on hypercubes

Marta Vomlelová

Automata and grammars

Examples of work from previous years

- Parity vertex colorings (PG)
- Hamiltonian circles in hypercubes with vertices removed (PG)
- Minimum 0-Extensions of Graph Metrics (JB - diploma)

Contact: https://www.ktiml.mff.cuni.cz/KTIML-21.html