

PERSONAL INFORMATION

Emir Demirović

M.Sc. of Theoretical Computer Science

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EDUCATION

Vienna PhD School of Informatics

Doctoral thesis: Combinatorial Optimization (SAT-based techniques for the general high school timetabling)
TU Wien, Vienna, Austria

Database and Artificial Intelligence Group

Expected date of graduation: early February 2017

Academy of Music

University of Sarajevo

Department of Musical Composition

Degree upon completion: B.Sc. of Musical Composition

Currently on hold due to PhD

Previous education

M.Sc. in Theoretical Computer Science, University of Sarajevo (thesis: Machine Reassignment, see projects)

B.Sc. in Engineering - Computer Science, University of Sarajevo (thesis: Numerical Algorithms for Fluid Simulation)

FIELDS OF EXPERTISE

Primary

- Combinatorial optimization.
 - focus on scheduling and high school timetabling.
- Metaheuristic algorithms.
 - e.g. local search, large neighborhood search, and others.
- Modeling into different programming paradigms and solution techniques.
 - satisfiability (SAT), integer programming (IP), constraint programming (CP).
- General computer programming and implementation (mostly C/C++).

Secondary

- Multi-objective optimization.
- Advanced algorithms and data structures.
- Parallel Programming.
- Mathematics.
 - complexity theory, discrete, and numerical mathematics.
- Scientific computation related to physical fluid-like simulations.
- Database programming (MySQL, Oracle).
- Image processing.
- Programming PLCs via ladder diagrams.

BRIEF DESCRIPTION OF SELECTED PAPERS

Emir Demirović and Nysret Musliu (Journal). “**MaxSAT Based Large Neighborhood Search for High School Timetabling**”, accepted for publication in the journal of Computers and Operations Research.

We integrated maxSAT solving within a large neighborhood framework. Experimental results show that the approach outperforms the state-of-the-art for high school timetabling, as well as a pure maxSAT approach given limited amounts of time (e.g. 20 minutes).

Emir Demirović and Nysret Musliu (Journal), “**Bitvector Approach for High School Timetabling**”, accepted for publication in the journal Annals of Operations Research.

We present a bitvector modeling for the high school timetabling. The bitvector model is a compact way of representing high school timetabling, making it very useful for local search algorithms. In addition, it can be used with SMT solvers.

Emir Demirović and Nysret Musliu (Journal). “**Modeling High School Timetabling as Partial Weighted maxSAT**”, to be submitted to the journal of Artificial Intelligence (JAIR).

We present a detailed modeling of the general high school timetabling as SAT. Extensive experiments are performed regarding solvers, cardinality constraint encodings, and comparing with integer programming. The results demonstrate, among other things, that our maxSAT approach is state-of-the-art, outperforming integer programming. In addition, a SAT-SMT approach is studied.

Emir Demirović, Nicolas Schwind, Tenda Okimoto, Katsumi Inoue, „**Recoverable Team Formation and Algorithms: Building Teams Resilient to Change**“, submitted to the 16th international conference on Autonomous Agents and Multiagent Systems (AAMAS 2017).

We present a generalization of the team formation problem, to take into account the dynamic nature of the environment, e.g. after a team has been formed, agents may unexpectedly become unavailable due to failure or illness. We provide a formal definition of the problem, prove Σ_p^3 -hardness, and implement an algorithm. The problem is Σ_p^3 generalization of the set covering problem and resembles a $\forall\exists\forall QBF$.

INTERNATIONAL COMPETITIONS AND RESEARCH VISITS

Research visits to Tokyo, Japan

Internship, National Institute of Informatics, Inoue lab, February-June 2016

Invited for a two-week stay at the Institute of Advanced Industrial Science and Technology, October 2016

MSc Thesis: Roadef/EURO Challenge 2012: Machine Reassignment

Worked as a member of a research group, lead by Prof. Gavranović, which participated in the Challenge 2012 organized by ROADEF, EURO, and sponsored by the Google. The task was to develop optimization algorithms for the newly posed Machine Reassignment problem. The team **won first prize**. The competition was open for one year.

Elektrijada - international competition for electrical engineering students of southeastern Europe

2010 – **third** place for object oriented programming (competition of 12+ universities and 60+ selected students)

2009 – **seventh** place for object oriented programming (competition of 15+ universities and 70+ selected students)

Courses and Summer Schools

“SAT/SMT Summer School”, 2014. Been awarded for outstanding performance in the practical sessions.

"Robotics and Mathematics", Ohrid, Macedonia, August 12-18, 2012. Organized by DAAD.

"Gabor Frames and Wavelets in Local Analysis", Novi Sad, Serbia, September 15-20, 2011. Organized by DAAD.

OTHER PAPERS

Emir Demirović, Nicolas Schwind, „**Approximating Representative Solutions Efficiently in Multi-Objective Constraint Optimization**“, submitted to the 14th International Conference on Integration of Artificial Intelligence and Operations Research Techniques in Constraint Programming (CPAIOR 2017)

Emir Demirović, Nysret Musliu, Felix Winter. “**Modeling and Solving Staff Scheduling with Partial Weighted maxSAT**”, accepted for the 11th conference on the Practice and Theory of Automated Timetabling (PATAT 2016).

Emir Demirović, Théo Le Calvar, Nysret Musliu, Katsumi Inoue. “**An Exact Algorithm for Unicost Set Covering**”, accepted for the Doctoral Program for the conference on Principles and Practice of Constraint Programming (CP).

Emir Demirović, Nysret Musliu. “**Solving High School Timetabling with Satisfiability Modulo Theories**”, In Proceedings of the 10th International Conference on the Practice and Theory of Automated Timetabling (PATAT 2014).

Emir Demirovic and Nysret Musliu. “**Modeling High School Timetabling as Partial Weighted maxSAT**”, LaSh 2014: The 4th Workshop on Logic and Search (a SAT / ICLP workshop at FLoC 2014).

Haris Gavranović, Mirsad Buljubašić, and Emir Demirović. “**Variable Neighborhood Search for Google Machine Reassignment Problem**”, Electronic Notes in Discrete Mathematics 39 (2012), pages 209-216.

Emir Demirović and Haris Gavranović (Poster), “**An Efficient Method for Solving UNSAT 3-SAT and Similar Instances via Static Decomposition**”, Theory and Applications of Satisfiability Testing (SAT 2012), pages 489-490.

Mirsad Buljubašić, Haris Gavranović, Emir Demirović (Presentation), “**Adaptive Local Search for Google Machine Reassignment problem**”, European Conference on Operational Research EURO 2012.

OTHER PROJECTS

BSc Thesis: Numerical Algorithms for Simulation and Visualization of Fluids

The goal was study and implement algorithms for fluid simulations. The result was an application which runs a fluid simulation and visualizes its output. The simulation was of a highly viscous fluid which I programmed in C++ using DirectX libraries. The simulation utilized a particle system to demonstrate the interaction of fluid molecules. The behavior of fluid molecules was demonstrated with a Lagrangian point of view technique. Here is a link to a video of my simulation running: <http://bit.ly/ezhBj9>.

Participated in a two month project at the Faculty of Electrical Engineering where I programmed a microcontroller PIC16F877 in ASM and C.

Numerous projects I have completed at Faculty of Electrical Engineering related to database programming and software development.