

Matej Jusup

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EDUCATION

- ETH Zurich** Zurich, Switzerland
PhD in Artificial Intelligence Sep 2020 – Present
THESIS TITLE: Safe Multi-Agent Reinforcement Learning with Applications in Transportation
SUPERVISORS: Prof. Francesco Corman and Prof. Andreas Krause
EXPECTED GRADUATION: Mid 2025 (06/25)
- University of Zagreb** Zagreb, Croatia
MSc in Mathematical Statistics; graduated with honors Oct 2013 – Feb 2017
MASTER THESIS: Network Optimization in Railway Transport Planning
SUPERVISORS: Prof. Marko Vrdoljak and Prof. Andreas Dress
- University of Bielefeld** Bielefeld, Germany
Erasmus student exchange Sep 2015 – Jul 2016
- University of Zagreb** Zagreb, Croatia
BSc in Mathematics Oct 2010 – Jul 2013
RELEVANT COURSES:
Probabilistic artificial intelligence | Advanced probability | Mathematical statistics | Stochastic processes | Time-series analysis
Linear algebra | Linear optimization | Markov chains | Numerical analysis | Operations research | Data structures and algorithms

WORK EXPERIENCE

- Google** Zurich, Switzerland
Student Researcher in the Gemini team - under Eric Malmi's mentorship within Aliaksei Severyn's team. Apr 2024 - Present
Planning with Large Language Models:
I am focusing on planning capabilities of LLMs within the Gemini team.
Board Games and Large Language Models:
I aim to advance the extent to which LLMs can understand, plan, and reason about board games as a part of DeepMind's board games effort.
- Cantab Predictive Intelligence (startup)** Zagreb, Croatia
AI Researcher - team leader Mar 2019 - Jul 2020
Behavioral Credit Scoring:
Built a PySpark gradient-boosting model to predict consumer default risk probability, achieving market-leading Gini metric results of up to 75%.
AI-Driven Marketing Campaign:
Devised a data-driven campaign for promoting a heart disease drug to doctors on behalf of a top pharmaceutical company, which led to a 10% sales increase during A/B testing.
Statistical analysis was conducted using Statsmodels, SciPy, and Python plotting packages.
Personalized Newsletter and E-Commerce Recommender Systems:
Constructed a hybrid recommender system combining content-based and collaborative filtering, which achieved a 1.5% click-through rate during the proof-of-concept phase.
Utilized Databricks, Python, PyTorch, and AWS in the technology stack.
Delivery Delay Estimation:
Developed a customer support system for a shopping mall during the COVID-19 pandemic, which predicted delivery delays using a time-series ARIMA model supplemented with supervised learning techniques.
The technology stack comprised Pandas, NumPy, and Sklearn.
- Morgan Stanley** Budapest, Hungary
AI Researcher Oct 2017 - Mar 2019
Systemic Risk Model Execution Efficiency:
Created a parallel version of a hill climber heuristic that made the optimization problem practically tractable. The heuristic's runtime was limited to 3 minutes and, on average, generated solutions within 5% of the optimum, with the reported worst-case being 15% for tractable test-set instances. Employed a technology stack encompassed Python, CPLEX, and OR-Tools.
Treasury Department Cash Traceability:
Constructed an uncollateralized debt tracking system by amalgamating diverse daily feeds to generate comprehensive firm-wide reports within seconds. Employed Q/kdb+, Python, PyQ kernel, and SQL for the development.
E-Trading Execution Limits Calibration:
Fine-tuned an in-house model to prevent real-time executions during high-risk scenarios, employing a statistical analysis of e-trading clients. Utilized Pandas for the calibration process.
Software Developer Budapest, Hungary
Implemented and unit-tested features for the Java-based margin calculator microservice. Dec 2016 - Oct 2017

Participated in a 15-week annual grad program among 50 globally selected interview-passing students.

Aug 2016 - Dec 2016

- **University of Zagreb, Department of Mathematics**

Zagreb, Croatia

Junior Teaching Assistant for Euclidean Spaces course

Oct 2013 - Mar 2014

Selected to deliver problem-solving lectures by achieving the highest course score among 70 students.

PUBLICATIONS

1. M. Jusup, B. Pasztor, T. Janik, K. Zhang, F. Corman, A. Krause, I. Bogunovic (2023), Safe model-based multi-agent mean-field reinforcement learning, The 23rd International Conference on Autonomous Agents and Multi-Agent Systems (AAMAS 2024)
2. V. Tkachuk, S.A. Bakhtiari, J. Kirschner, M. Jusup, I. Bogunovic, C. Szepesvari (2023), Efficient planning in combinatorial action spaces with applications to cooperative multi-agent reinforcement learning, Artificial Intelligence and Statistics 2023 (AISTATS 2023)
3. M. Jusup, J. Kirschner, T. Birchler, S. Curi, I. Bogunovic, A. Krause, F. Corman (2022), Real-time railway (re-) scheduling without human-expert knowledge, 22nd Swiss Transport Research Conference (STRC 2022)
4. M. Jusup, A. Trivella, F. Corman (2021), A review of real-time railway and metro rescheduling models using learning algorithms, In 30th International Joint Conference on Artificial Intelligence (IJCAI-21)

TALKS AT CONFERENCES AND WORKSHOPS

- **Workshop on Stochastic Modelling and Monte-Carlo Tree Search (invited)** TU Munich, Germany
Neural-MCTS applications in train routing Sep 2022
- **STRC 2022 – 22st Swiss Transport Research Conference** Monte Verità, Switzerland
Real-time railway (re-)scheduling without human-expert knowledge May 2022
- **STRC 2021 – 21st Swiss Transport Research Conference** Monte Verità, Switzerland
A Review of real-time railway and metro rescheduling models using learning algorithms Sep 2021
- **IJCAI 2021 – RL for Intelligent Transportation Systems Workshop** Montreal, Canada
A Review of real-time railway and metro rescheduling models using learning algorithms Aug 2021
- **DevArena – software development conference (invited)** Zagreb, Croatia
Machine Learning - From Idea to Production Oct 2019

PERSONAL PROJECTS

- **Collaboration with Norbert Fogarasi – On Partial Sorting in Restricted Rounds (2017)**
Improved a naive C++ implementation of the algorithm by reducing $\mathcal{O}(n^2 n!)$ to $\mathcal{O}(n^2)$ space complexity

PROGRAMMING SKILLS

Advanced: Python

Work experience: PyTorch | PySpark | Q/kdb+ | C++

Minor experience: TensorFlow | SQL | Java | JavaScript | C | R | Matlab

VCS & Other: Git | GitHub | Databricks | AWS | MS Azure

LANGUAGES

English: Professional working proficiency

Croatian: Native proficiency

German: Basic

INTERESTS AND AWARDS

Chess: Won silver medal at individual Croatian junior (under 20 years) championship in 2011.

The official ELO rating of 2250 places me among the top 3% of globally registered chess players.

On www.chess.com within 3 thousand best players among over 100 million registered users (99.999% percentile).

ACADEMIC REFEREES

Prof. Andreas Krause at ETH | *google scholar* | krausea@ethz.ch | +41446326496 (assistant)

Asst. Prof. Ilija Bogunovic at UCL | *google scholar* | i.bogunovic@ucl.ac.uk

Prof. Francesco Corman at ETH | *google scholar* | francesco.corman@ivt.baug.ethz.ch | +41446333350