

# Matej Jusup

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## EDUCATION

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- **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  
AVAILABILITY FOR THE INTERNSHIP: Flexible for 3-6 months between May and December 2024  
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

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- **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*
- *Technology Analyst Program* New York & London  
*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

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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, arXiv:2306.17052
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
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

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- **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

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- **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

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**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

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**English:** Professional working proficiency

**Croatian:** Native proficiency

**German:** Basic

## INTERESTS AND AWARDS

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**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

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**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