

## PERSONAL INFORMATION

Family name, First name: Eftimov Tome

URL for website: <http://cs.ijs.si/eftimov>

Google Scholar: 1546 citations, h-index 19

Publications: over 125 publications; 44 (11 as first author) journal papers, 75 conference papers, one Springer book, 2 chapters in books and other publications



## EDUCATION

He received his Ph.D. in Information and Communication Technologies in 2018 at the International Postgraduate School Jožef Stefan. In 2019 - 2020, he was a postdoctoral research fellow at the Department of Biomedical Data Science at Stanford University, USA, and a research fellow at the University of California, San Francisco, USA.

## CURRENT POSITIONS

He is a senior researcher at the Computer Systems Department, Jožef Stefan Institute, Slovenia, and an assistant professor at the Faculty of Computer and Information Sciences, University of Ljubljana, Slovenia.

## AWARDS

In 2018, he was selected as the best young scientist in North Macedonia (under 30 years). In 2019, he was a co-author of a paper that won the best poster award at the AI for Social Good workshop at ICLR 2019. In 2020 he was leading a team that was first ranked at the Open Optimisation Competition at GECCO 2020 and PPSN2020, organized by Sorbonne University and the Facebook AI research group, in Paris, France. In 2021, he was co-author of a paper that won the best paper award at the EvoApps 2021 conference.

## SUPERVISION OF GRADUATE STUDENTS

He co-supervised two Ph.D. and three master students who successfully defended their Ph.D. and master thesis. Currently, he is supervising one Ph.D. and two master students, and co-supervising one Ph.D. student.

## TEACHING ACTIVITIES

From 2011-2012, he was a teaching assistant (probability and statistics, linear algebra, calculus, discrete math) at the Faculty of Electrical Engineering and Information Technologies, Ss. Cyril and Methodius University - Skopje. Since 2020, he is a teaching assistant at the Faculty of Computer and Information Sciences, University of Ljubljana, Slovenia. Currently, he is teaching (an assistant professor) a course on Artificial Intelligence in master studies at the University of Ljubljana, School of Economics and Business.

## ORGANISATION OF SCIENTIFIC EVENTS

One of the main organizers of the following workshops: Program Chair at the 10th International Conference on Bioinspired Optimization Methods and Their Applications (BIOMA 2022), Special Session on Automated Algorithm Design for Evolutionary Computation (IEEE WCCI 2022, IEEE CEC 2023), Workshop on Representation Learning meets Meta-heuristics (IEEE CEC 2021), Workshop on Good Benchmarking Practices for Evolutionary Computation at the Genetic and Evolutionary Computation Conference (GECCO 2020, 2021, and 2022, IEEE CEC 2021), as well as at the 16th International Conference on Parallel Problem solving from Nature (PPSN 2020), Special session on Benchmarking of Evolutionary Algorithms for Discrete Optimization (BEADO 2020) at the IEEE WCCI 2020, Understanding Evolutionary Optimization Behavior (UEOB 2019) at the IEEE CEC 2019.

## IMPACT

In recent years he has co-presented several tutorials on comparative statistical analysis at renowned international conferences and co-organized several special sessions that took place at international conferences (GECCO, PPSN, SSCI, IEEE CEC). He also co-authored a Springer book entitled "Deep Statistical Comparison for Meta-heuristic Stochastic Optimization Algorithms".

## CURRENT ACTIVITIES

His research interests include statistical data analysis, metaheuristics, natural language processing, representation learning, and explainable machine learning. He organizes several workshops and tutorials related to AI at high-ranked international conferences. He leads an ARRS ERC StG complementary scheme (2022-2024). He was also a Scientific Coordinator of a European Food Safety Authority (EFSA)-funded project (2021-2022) related to AI information extraction from textual data and task leader of several H2020 projects. In recent years, he has also focused on educating young researchers, which is reflected in a greater number of publications in co-authorship with doctoral students, and the acquisition of national and EU projects.

## PERSONAL INFORMATION

Family name, First name: Korošec Peter

URL for web site: <https://cs.ijs.si/korosec>

Google scholar: 1633 citations with h-index 19

Publications: over 190 publications; 54 (22 as first author) journal papers, 78 conference papers, 1 book, 2 chapters in books and other publications



## EDUCATION

He received his Ph.D. in 2006 with a doctoral dissertation entitled “Stigmergy as an Approach to Metaheuristic Optimization” under supervision of Prof. Dr. Bogdan Filipič and Dr. Jurij Šilc.

## CURRENT POSITIONS

He is a senior researcher at the Computer Systems Department, Jožef Stefan Institute, Slovenia.

## AWARDS

In 2007 he received the Trimo Research Award for his Doctoral Dissertation at the 6th Trimo Research Award. In 2008 he received the Jožef Stefan Golden Emblem Prize for the most outstanding contributions made to science in the Doctoral Dissertation in the field of natural sciences in Slovenia (a maximum 1 award from this field is given per year). In 2020 he was part of a team that was first ranked at the Open Optimisation Competition at GECCO 2020 and PPSN2020, organized by Sorbonne University and the Facebook AI research group, in Paris, France.

## SUPERVISION OF GRADUATE STUDENTS

He supervised two Ph.D. students that successfully defended their Ph.D. thesis, one master student, and several undergraduate students.

## TEACHING ACTIVITIES

From 2007-2018 he was a part-time lecturer at the University of Primorska, where he taught several courses including the course on “Metaheuristic Optimization Algorithms”.

## ORGANISATION OF SCIENTIFIC EVENTS

In recent years he was a co-chair of several international scientific events (BIOMA 2018, OLA 2018, UEOb 2020).

## IMPACT

In recent years he has co-presented several tutorials on comparative statistical analysis in renowned international conferences (GECCO, PPSN, SSCI, CEC) and co-organized several special sessions that took place at international conferences (GECCO, CEC). He also co-authored a Springer book entitled “Deep Statistical Comparison for Meta-heuristic Stochastic Optimization Algorithms”.

## CURRENT ACTIVITIES

His research field comprises the development of modern metaheuristic optimization algorithms for use in combinatorial and numerical optimization and parallel / distributed computing on modern computer systems. Recently, he has been particularly focused on researching the understanding of the behavior of optimization algorithms. He published the results of his work in renowned national and international magazines and presented them at conferences in Slovenia and abroad.

In recent years, he has also focused on educating young researchers, which is reflected in a greater number of publications in co-authorship with doctoral students, and the acquisition of national and EU projects. The most notable achievement is the acquisition of the H2020 project "Synergy for Smart Multi-Objective Optimisation", SYNERGY ([synergy-twinning.eu](http://synergy-twinning.eu)), which he also successfully coordinated, and national ARRS project “Auto-OPT: Automated selection and configuration of single-objective continuous optimization algorithms”, which is in its first year of implementation.

# Description of the research group

The research group is a part of the Computer Systems Department at Jožef Stefan Institute, Ljubljana, Slovenia.

The Jožef Stefan Institute (JSI) is the largest and leading Slovenian research organization. The staff of around 960 specializes in a broad spectrum of basic and applied research in physics, chemistry, biochemistry and materials, electronics and information science, nuclear technology, energy utilization, and environmental science. The JSI in-house research has been reinforced by building strong links to universities, other research institutions, and industry.

The Computer Systems Department (CSD) specializes in metaheuristic optimization, statistical data analysis, machine learning, and natural language processing. It performs research in advanced computing structures and efficient algorithms for massive data processing and systems for effective human-computer interaction. The department focuses on meta-learning, trustworthy AI, self-adaptive systems, modeling, and optimizing complex, dynamic, and non-deterministic systems. Research results have applications for mobility, transport, energy, production, bioinformatics, and health. CSD has been involved in various European projects in Horizon Europe, PRIMA, EFSA, etc. programs, and in many national projects such as an ARRS ERC StG complementary scheme “RESPONSE: Representation Learning of Landscape Spaces for Explainable Performance of Stochastic Optimization Algorithms”, an ARRS project “AutoOpt: Automated selection and configuration of single-objective continuous optimization algorithms”. We are also part of two bilateral projects, one with Sorbonne University, Paris, France (“AutoDesign4EC: Automated Configuration, Selection, and Design of Iterative Optimization Heuristics”) and the other with the Leibniz Universität Hannover (“Fair Benchmarking for Dynamic Algorithm Configuration”). The CSD work is also actively connected to Slovenian Strategic research and innovation partnerships activities.

The CSD research group consists of Asst. Prof. Dr. Tome Eftimov (TE), Prof. Dr. Peter Korošec (PK), Prof. Dr. Barbara Koroušič Seljak (BKS), postdoctoral researcher Dr. Urban Škvorc (UŠ), postdoctoral researcher Dr. Gordana Ispirova (GI), Ph.D. student Gjorgjina Cenikj (GC), and a master student Ana Nikolikj (AN). TE is an expert in statistical data analysis and machine learning. PK is an expert in continuous optimization and machine learning. BKS is a well-established researcher in machine learning, statistics, and the semantic web. UŠ, GI, GC, and AN have competencies in benchmarking, explainable machine learning, and optimization.

# Description of the work to be carried out by the student

Project title: Learning for Continuous Single-Objective Optimization

Supervised by: Tome Eftimov and Peter Korošec

In recent years, optimization has become an important tool in many different research fields, where computer simulations are used to evaluate solutions to a problem. Unfortunately, there does not exist a single optimization algorithm that would be the best at solving all possible problems: This is known as the “no free lunch” theorem. Selecting the best optimization algorithm for a given optimization problem instance is therefore a challenging task, also known as algorithm selection. There exist a great number of optimization algorithms from which a user can choose. To optimize a single problem instance by simply running a large number of optimization algorithms in order to find the best algorithm is a tedious, time-consuming task. The majority of optimization algorithms are parameterized and require tuning (i.e., algorithm configuration), in order to perform the best for a specific problem instance. So, in addition to choosing an optimization algorithm, one often needs to also determine the best values of its hyper-parameters for the problem instance at hand. Finally, the computer simulation of real-world problems is often a time-consuming task. Therefore, to identify the best optimization algorithm for a given problem instance one needs to go through many optimization algorithms, which can have many hyper-parameters, and tune them by using time-consuming computer simulations.

The goal of the proposed project is to provide the user with a novel methodology that will select the best optimization algorithm with the best hyper-parameter values for a single-objective continuous optimization problem, given its description, quickly and with little effort. The project will merge algorithm selection and configuration into one meta-learning task. Currently, both tasks are treated separately and pose great challenges on their own. The selection of an optimization algorithm and configuration of its hyper-parameter values will be made by using predictive machine learning (ML) models learned from a constantly evolving database of optimization algorithm runs. We are motivated by the recent success of approaches to automated selection and hyper-parameter estimation of machine learning algorithms, such as Auto-WEKA, Auto-SKLearn, MLBox, TPOT, H2O AutoML, Auto-Keras, TransmogriAI, and others. We believe that the development of such a methodology for optimization algorithms would be a highly relevant contribution to the optimization community and will open up new directions for further research.

## Other relevant information

Additional funding: Despite the SPECIES scholarship the Jožef Stefan Institute will support the candidate with accommodation funding for their stay in Ljubljana, Slovenia.

Accommodation arrangements: The accommodation will be arranged and paid for by the Jožef Stefan Institute.

Location information: The Jožef Stefan Institute (<https://ijs.si/ijsw>) is the leading Slovenian scientific research institute, covering a broad spectrum of basic and applied research. It has facilities in two locations. The main facilities and the headquarters are on Jamova cesta 39, Ljubljana, and the other location is the Institute's Reactor Center Podgorica located in Dol near Ljubljana. The candidate will work at the leading facilities in Ljubljana (Jamova cesta 39, Ljubljana, Slovenia), 1.8km from the city center (20 min walking). Ljubljana is the capital and largest city of Slovenia. It is the country's cultural, educational, economic, political, and administrative center. It is one of the smallest European capitals, but also one of the greenest and most livable. It has a vibrant and diverse cultural scene, with many festivals, museums, galleries, theaters, and other attractions. Some of the landmarks of Ljubljana include the Dragon Bridge, the Triple Bridge, the Ljubljana Castle, the Central Market, and the Tivoli Park. Ljubljana is also a great base for exploring the rest of Slovenia, as it is located at the intersection of major European transportation routes.