David Kozák

Curriculum Vitae

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dkozak94
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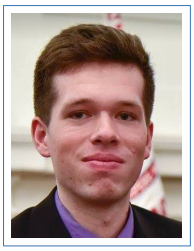

Research Activities

Research Paper **Improving Points-to Analysis with Compiler Optimizations**, *Co-author*.
- — Submitted to ECOOP 2023 (CORE A)
- — Currently pending a review
- — Using compiler optimizations before analysis to improve precision and reduce analysis time
- — Designing a mechanism to integrate static analysis results back into the compilation pipeline
- — Using *saturation* to significantly speed up (more than **3x** on some benchmarks) the analysis at the cost of slightly reducing the precision.

Research Paper **Comparing Rapid Type Analysis with Points-To Analysis in GraalVM Native Image**, *Lead author*.
- — Soon to be submitted to IEEE Access (WOS Q2)
- — Proposed how to use *Rapid Type Analysis* in Native Image and provided various extensions
  - — Parallel analysis
  - — Incremental analysis
  - — Support for heap-snapshotting
  - — Incremental analysis using *method summaries*
- — Performed an extensive experimental evaluation
- — Reduced the analysis time by up to **64%**

Research Prototype **Rapid Type Analysis for GraalVM Native Image**, *Lead author*.
- — Alternative static analysis method for GraalVM Native Image
- — **Fully integrated** into the production compiler

Research Collaborations

GraalVM Team, *Oracle Labs*, Oracle.
- — Initiated a collaboration between Oracle and FIT BUT
- — Oracle is now a **bronze partner** of FIT thanks to the initiative
- — A gift was sent from Oracle to support the research

Static Analysis of Microservices, *Baylor University*, Waco, Texas.
- — Initiated a collaboration with Tomas Cerny from Baylor University
- — Leading a group of students during their capstone project

Work Experience

Sep 2020 – now **Research Assistant**, *GraalVM, Oracle Labs*, Oracle, Brno.
- — Developing new static analysis methods for ahead-of-time compilers
- — Call graph construction, points-to analysis, compiler optimizations
- — Used *Rapid Type Analysis* to reduce the build time by up to **35%**

Mar 2019 – Aug 2020 **Software Engineer**, *Knowledge Technology Research Group* , FIT BUT, Brno.
- — Worked on a search engine for *semantically enhanced* documents
- — Designed a *distributed system* with multiple types of components
- — Designed a *special query language*, a *compiler* and specialized *searching algorithms*
- — Backend components in Kotlin using Spring
- — Web frontend in TypeScript using React

Sep 2018 – Feb 2019 **Software Developer**, *MPS Team*, JetBrains s.r.o., Prague.
- — Language engineering using MPS
- — Building and maintaining *Domain Specific Languages* and IDE support for them

Jul 2018 – Aug 2018 **Internship**, *MPS Team*, JetBrains s.r.o., Prague.
- — DSL engineering and language engineering in general
- — Converting Antrl4 grammar into MPS project
- — Automatic detection of formatting for a given language

Feb 2018 – Aug 2018 **Java Full Stack Developer**, *Aura*, Aura s.r.o., Brno.
- — Worken on an information system using JavaEE, Spring and Hibernate
- — JSF on the presentation layer and Spring and Hibernate in the backend

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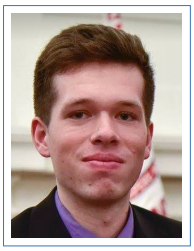

Jun 2015 – Dec 2017 **Java Developer in Research**, *Automated Analysis and Verification Research Group - VeriFIT*, FIT BUT, Brno.
- — *Search-based testing* of concurrent Java programs using *noise injection*
- — Integrated SearchBestie with RoadRunner, an open-source tool for dynamic analysis of concurrent Java programs
- — Designed and evaluated new heuristics for noise injection

Jan 2015 – Dec 2015 **Android Developer**, *BeeeOn*, FIT BUT, Brno.
- — An application for an IoT system
- — Automated testing support for the app

Education

2021 – now **Brno University of Technology**, *Doctor of Philosophy*, *Static Analysis, Compilers, Virtual Machines*.

2017 – 2020 **Brno University of Technology**, *Master of Computer Science*, *Information Systems*.

Master Thesis

Title *Indexing of Big Text Data and Searching in the Indexed Data*

Supervisors Ing. Jaroslav Dytrych, Ph.D.

Description Distributed systems, search engines, domain-specific languages, compilers.

Feb 2019 – Jul 2019 **Escola Superior de Tecnologia e Gestao**, *Erasmus student*, *Software engineering*.

Sep 2018 – Jan 2019 **University of Southern Denmark**, *Erasmus student*, *Software engineering*.

Feb 2017 – Jul 2017 **Technological Educational Institute of Crete**, *Erasmus Student*, Heraklion, Crete, Greece.

2014 – 2017 **Brno University of Technology**, *Bachelor of Computer Science*, *Information Technology*.

Bachelors Thesis

Title *Fine-Grain Noise-Injection Heuristics for SearchBestie Infrastructure*

Supervisors Ing. Bohuslav Křena, Ph.D.

Description Testing and runtime verification of concurrent Java programs.

2010 – 2014 **Grammar School, Svitavy**.

Volunteering

Sep 2019 – Dec 2019 **Vicepresident**, *ESN BUT*, ESN CZ.
- — Organized and moderated meetings
- — Maintained the ESN office
- — Helped the president with running the student club

Jul 2017 – Sep 2019 **ESN member**, *ESN BUT*, ESN CZ.
- — Helped foreign students during their Erasmus in Brno
- — Taught Czech lessons
- — Organized events for hundreds of Erasmus students
- — Communicated and cooperated with people from different cultures and backgrounds

Skills

General Problem-solving, algorithms and data structures, software design and architecture.

Interest Compilers, interpreters, static & dynamic analysis, domain-specific languages, integrated development environments.

Languages Kotlin, JavaScript/TypeScript, Java, Python.

Frameworks and libraries React & Redux, JavaFX, Java EE, JPA/Hibernate, Spring.

Soft skills Public speaking, teaching, teamwork.

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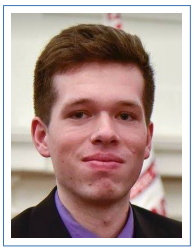

Achievements

Sep 2020 **Dean's award**, *for excellent master thesis*.
May 2020 **Expert Panel Award**, *Excel@FIT*.
Apr 2018 **UnIT Hackaton - Webapps**, *third place*.
Dec 2017 **8 from BUT**, *first place*.
Sep 2017 **Red Diploma**, *for excellent results in Bachelor studies*.
Sep 2017 **Dean's award**, *for excellent results in Bachelor studies*.
Sep 2017 **Rector's award**, *for excellent results in Bachelor studies*.
Mar 2016 **EBEC Brno**, *second place*.

Interests

- Competitive programming
- Teaching and learning
- Personal development
- Dancing
- Travelling
- Foreign languages
- Philosophy
- Public speaking