Zhekai Jiang

zhekai.jiang@mail.mcgill.ca

Personal Website: ece.mcgill.ca/~zjiang27
LinkedIn Homepage: linkedin.com/in/zkjiang
GitHub Homepage: github.com/zhekai-jiang

Education

McGill University
Montréal, Québec, Canada

Bachelor of Software Engineering (BSE), Engineering Internship Program (EIP) Sep 2019 – May 2024 (Expected)

- **Cumulative Grade Point Average:** 4.00 / 4.00
- **Course highlights:**

  Software engineering and computer science theories: Model-Based Programming (Top performer), Software Validation (Top performer), Software Requirements Engineering, Programming Languages and Paradigms, Theory of Computation, Compiler Design (Graduate-level, In progress), Software Language Engineering (In progress)

  Computer and database systems: Database Systems, Parallel Computing, Operating Systems (100%, Top 3 best projects winner)

  Language and Communication: Communication in Engineering, Oral and Written French (B2 level, In progress)

  Other Personal Interests: Physics of Music, Introduction to Psychology (Advanced Placement)

The University of Hong Kong (HKU)
Hong Kong, China

Visiting Jul 2018 – Aug 2018

- **Course:** Mathematical Laboratory and Modeling, **Grade:** A+, 4.30 / 4.30

Research and Development Experiences

McGill University
Montréal, Québec, Canada

Freelance Researcher **Model-based software and systems engineering** May 2021 – Apr 2022

Supervisor: Prof. Dániel Varró

Refinery: an efficient graph solver as a service to generate consistent, well-formed models based on partial models

- Based on a novel language Problem, developed part of an online service to specify models in the language and visualize partial models and the process of model generation in real time, using React, D3, and Xtext web editor supports, in TypeScript and Java
- Applicable to automated test data synthesis, feature modelling, and design tool certification for critical and cyber-physical systems
- Implemented and experimented a force-directed layout algorithm in Python to solve models with constraints and automatically generate concrete models of test cases involving objects in the surrounding environment in the context of autonomous driving

Capstone Design Project Student **Model-based software and systems engineering** Sep 2023 – Apr 2024

Supervisor: Prof. Dániel Varró

Optimizing formal specification and metaheuristic-search-based automated generation of test scenarios for autonomous vehicles

- Extending the Scenic specification language with partial model semantics based on 4-valued logic to support specification of traffic scenarios with high-level constraints
- Implementing validation using the Z3 theorem prover to detect inconsistencies in the specification in the early stage
- Optimizing metaheuristic search algorithms to generate concrete scenarios from the specification

EPFL (Swiss Federal Institute of Technology in Lausanne)
Lausanne, Vaud, Switzerland

Excellence Research Intern **Database systems and data management** May 2022 – Aug 2022

Supervisor: Prof. Christoph Koch, Data Analysis Theory and Applications (DATA) Laboratory

Sudokube: an online analytical processing (OLAP) data cube engine for the aggregation and exploration of high-dimensional data

GitHub repository

- Extending from existing system, implemented new query solvers in Scala based on algorithms of probabilistic graphical models for marginal problems with maximum-entropy constraint optimization to approximate results using partially materialized data cubes
- Proposed and implemented in Scala new heuristic methods to balance model complexity and approximation accuracy
- Developed automated tests, experiments, and demos in Scala for the new solvers; executed experiments on remote Linux servers with realistic data sets; plotted diagrams using Python; compared and analyzed performance across all solvers

Freelance Researcher and Developer **Data management application development** Mar 2023 – Jun 2023

Followup work: web-based data management application development and demo at SIGMOD '23

Publication with demo video at ACM Digital Library | GitHub repository

- Proposed, designed, and implemented a React-based web frontend interface for users to interact with the system and visualize results and metrics
- Designed and specified interfaces of remote procedural calls between the Scala backend and React frontend using gRPC
- Demonstrated major use cases of the application at SIGMOD ’23 both as a video and in person during the conference

Oracle Labs Zürich, Zürich, Switzerland

Research and Development Intern **Open-source corporate architecture** Jan 2023 – Aug 2023

Testimonial by Oracle

Statistics analytics dashboard for the GraalVM Download Service

- Communicated with stakeholders, analyzed requirements, and composed proposals of requirements, design, and test specifications
- Implemented statistics visualization with a zoomable chart and paginated load-more-on-scroll tables, supporting flexible filtering and grouping criteria
- Specified and implemented REST API endpoints in Java using Dropwizard, designed SQL query templates with JDBI, implemented frontend components in TypeScript using Oracle JET, built application using Maven, deployed as Docker containers to Oracle Cloud Infrastructure (OCI)
- Followed Kanban-based agile development process, using Git and Atlassian suite (Jira, Confluence, Bitbucket)

Other tasks

- Gave a 1-hour tech talk at Oracle's Morocco Development Center (MADC) on the motivations, features, architecture design, and future work of the project, with a live demo of major use cases
- Configured, enabled, and optimized automated testing in continuous integration builds on the Oracle Cloud Infrastructure
- Authored and enhanced customer documentations, project contribution guidelines, and onboarding guides for new hires

Teaching Experiences

McGill University Montréal, Québec, Canada

Tomlinson Engagement Awardee for Mentoring (TEAM Mentor) Sep 2020 – Dec 2022

- **Fall 2022 – Linear Algebra and Geometry:** Hosted in-person office hours at the SciLearn Peer Collaboration
- **Winter 2022 – Programming Languages and Paradigms:** Hosted virtual office hours via Zoom
- **Fall 2021 – Linear Algebra and Geometry:** Authored reading materials on applications of linear algebra in other areas of mathematics and computer science (available on my personal website); monitored and answered questions on the discussion board
- **Winter 2021 – Introduction to Software Engineering:** Monitored discussion board and advised students on a semester-long group project (full-stack software for an auto repair shop, including backend, web frontend, and Android application) and general materials
- **Fall 2020 – Linear Algebra and Geometry:** Hosted office hours at the virtual $\overrightarrow{F}\,\mathrm{Re}(z)\,\mathrm{Ca}$ (First Year Residence Cafeteria tutorial program) via Microsoft Teams

Teaching Assistant – Grader Oct 2021

- **Fall 2021 – Introduction to Software Engineering:** Graded design problems on requirements analysis and specification, use case and activity modelling, domain modelling, relational database design, and object-relational mapping, in an online midterm exam; resulted in zero complaints or regrading requests

Publication

Sachin Basil John, Peter Lindner, Zhekai Jiang, and Christoph Koch. 2023. Aggregation and Exploration of High-Dimensional Data Using the Sudokube Data Cube Engine. In *Companion of the 2023 International Conference on Management of Data (SIGMOD-Companion '23), June 18–23, 2023, Seattle, WA, USA*. ACM, New York, NY, USA, 4 pages. https://doi.org/10.1145/3555041.3589729

Sachin Basil John, Peter Lindner, Zhekai Jiang, and Christoph Koch. 2023. Fast Approximate Reconstruction of Joint Distributions from Low-Dimensional Projections. Under submission to *Proceedings of the VLDB Endowment.*

Honours and Awards

McGill **Dean's Honour List** for ranking in the top 10% of the Faculty of Engineering Jul 2020, Jul 2021, Jul 2022, Sep 2023

McGill **Tomlinson Engagement Award for Mentoring (TEAM)** for mentoring in courses Dec 2020, Apr 2021, Dec 2021, Apr 2022, Dec 2022

EPFL **Scholarship of Excellence** for participating in the Excellence Research Internship Program (ERIP) May–Aug 2022

McGill **Hatch Scholarship in Engineering** for my academic merit Jul 2022

McGill **Schull–Yang International Experience Award / Summer Undergraduate Research Award in Engineering (SURE International Award)** for my visit at EPFL (Swiss Federal Institute of Technology in Lausanne) for research internship May 2022

McGill **Engineering Class of 1983 Scholarship** for my academic standing and overall contribution to university life Jul 2021

McGill **John V. Galley Scholarship** for my distinguished academic standing Jul 2020

McGill **Rio Tinto – Richard Evans International Exchange Award** for my academic achievements, as well as leadership values of personal responsibility, integrity, accountability, and mutual respect Jul 2020

HKU **Award of Excellence** for achieving distinction in the undergraduate-level course during my visit during high school Sep 2018

Services

McGill University Montréal, Québec, Canada

McGill International Experience Awards (MIEA) Ambassador Oct 2022 – Present

- Shared my international experience with the McGill community and perspective Excellence Research Interns of EPFL
- Endorsing and promoting international experiences to inspire the future cohort of McGill International Experience Awardees
- Presented my international experience as well as relevant thoughts as part of a video presented for the topic of experiential learning opportunities (at local, national, and international levels) during the McGill Annual Joint Board-Senate Meeting

Organization Affiliations

Student member, **Association for Computing Machinery (ACM)**

Student member, **ACM Special Interest Group on Management of Data (SIGMOD)**

Student member, **Institute of Electrical and Electronics Engineers (IEEE)**

Lifetime member, **Golden Key International Honour Society**

Skills

Languages: English (Proficient – C2), French (Intermediate – B1), Mandarin Chinese (Native)

Programming, scripting, and query languages: Java, Scala, C, C++, Python, JavaScript, TypeScript, OCaml, Bash, SQL, Cypher Query Language, Pig Latin, ARMv7-Assembly

Professional software, tools, and frameworks:

Integrated development environments and editors: Eclipse, IntelliJ IDEA, Xcode, Android Studio, Visual Studio Code, Vim

Version control, collaboration, and continuous integration: Git, GitHub, Jira, Confluence, Bitbucket, GitLab, Travis CI

Build Tools and platforms: Gradle, Maven, Docker

Frameworks: Spring Boot, Dropwizard, React, Vue, Angular, Oracle JET, Node.js, Express.js, Flask

Database systems: PostgreSQL, Oracle, IBM DB2, Neo4j, MongoDB

Software testing, static analysis, and formal verification: JUnit, SonarQube, Infer, GraphWalker, UPPAAL

Big data and cloud computing: Heroku, Apache Pig, Google Cloud Platform

Software, systems, requirements, domain, and behaviour modelling: Umple, jUCMNav, UML Lab, Yakindu, VIATRA, Eclipse Modelling Framework, Cucumber

Numeric computing: MATLAB, Scilab

Graphics and visualization: OpenGL, Data-Driven Documents (D3)

Operating systems: macOS, Windows, Linux, Unix

Software engineering practice: Object-oriented development, Model-based engineering, Behaviour-driven development, Test-driven development, Agile project management (scrum, kanban)