# Rajan Maghera

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## EDUCATION

**University of Alberta**                                                                              Sep 2020 – present
*BSc. Specialization Computing Science, Business Minor, **GPA 3.97/4.0**, Dean's Honour Roll*          *Edmonton, AB*
- *Courses*: Computer Architecture, Data Structures, Compiler Design, Algorithms

**McNally High School**                                                                               Sep 2017 – Jun 2020
*Alberta Diploma, IB Certificate, Valedictorian*                                                      *Edmonton, AB*

## AWARDS

2023. **Undergraduate Student Research Award (USRA)**. NSERC. National. Research. $8,400.
*Project Title*: Static Analysis Applied to Lint Assembly Programming.

2022. **Undergraduate Student Research Award (USRA)**. NSERC. National. Research. $8,400.
*Project Title*: Investigating the Effectiveness of Inline Cache Implementations for JavaScript.

2022. **Undergraduate Scholarship**. University of Alberta. Institutional. Academic. $1,500.

2021. **Summer Research Studentships (SRS)**. Alberta Innovates. Local. Research. $6,000.
*Project Title*: Automated handling of big data, and the application of machine learning to advance the generation of stem-cell derived therapies for patients with diabetes.

2021. **Leadership Award in Computing Science**. Microquest. Local. Leadership. $2,000.

2021. **Economics Merit Scholarship**. University of Alberta. Institutional. Academic. $3,000.

2020. **Schulich Leaders Scholarship**. University of Alberta. National. Leadership. $80,000.

2020. **Max Wyman Memorial Entrance Leadership Scholarship**. University of Alberta. Institutional. Academic. $5,000.

## RELEVANT EXPERIENCE

**Storage Software Engineer**                                                                         Sept 2023 – Aug 2024
*Toronto Emerging Storage Laboratory, Huawei Canada*                                                  *Toronto, ON*
- Developed **Linux kernel drivers** and accompanying **user-land libraries** for high-performance **NVMe drives** for **LLM** inferencing workloads, with automated tests for multiple system-drive topologies emulated in **QEMU**.
- Optimized and refactored **CUDA kernels** to conform to clean-code guidelines for high-speed storage access with **nvvp**.
- Orchestrated emulated network load testing for custom topologies in **Docker Compose** with profiling tools (**perf**/**bcc**).
- Led team-wide effort transitioning to **Bazel** as a build tool, developing custom rules and aspects for **hermetic CI/CD pipelines**, orchestrating a distributed artifact cache, and enabling fast incremental builds with high code conformance.

**Research Assistant**                                                   May 2022 – Aug 2022 and May 2023 – Aug 2023
*Compiler Design and Optimization Lab*                                                                *Edmonton, AB*
- Conducted research and analysis on **Inline Caching in SpiderMonkey** focusing on emitting JIT IR and evaluating the potential for optimizing the order of lists utilized for caching frequently executed operations at call sites in **JavaScript**.
- Performed a comprehensive limit study to assess the impact of size limits on the linked lists employed for operation caching.
- Developed an internal reporting tool using **Next.js, React, and MongoDB**, designed specifically for JS benchmarks. This tool enabled efficient tracking and analysis of benchmark data, enhancing performance evaluation and optimization efforts.

**Teaching Assistant**                                                                                Sept 2022 – Apr 2023
*University of Alberta*                                                                               *Edmonton, AB*
- Developed lab assignments for CMPUT 229 (Computer Architecture I), including the creation of lab content, animated explanatory videos with **Manim**, and automated grading scripts in **Python** and **Bash**.
- Received positive student review scores, consistently **surpassing the median**, for teaching lessons, live lab demonstrations, and consultation.

**Research Assistant**                                                                                May 2021 – Aug 2021
*MacDonald Islet Biology Lab*                                                                         *Edmonton, AB*
- Developed CellSTORE, a React and Rust-powered web-based bio-bank tool to catalogue genetic data for stem-cell research.
- Worked closely with clients as a software engineer to develop a general-purpose application for use in the lab.

## RESEARCH WORKS

**Maghera, R.**, Ulmer, N., and Amaral, J. 2024. **RISC-V Analyzer: verify assembly code compliance to register and procedure calling conventions**. 34th International Conference on Collaborative Advances in Software and COmputiNg (CASCON). Poster presentation.

**Maghera, R.**, Ulmer, N., and Amaral, J. 2024. **RISC-V Analyzer: verify assembly code compliance to register and procedure calling conventions**. 20th Workshop on Compiler-Driven Performance (CDP). 20-minute workshop.

## Skills and Interests

*Research interests*: compiler optimization, static analysis, language design, code verification, type systems, parallel computing
*Languages*: C++, C, Rust, CUDA, JavaScript, TypeScript, Starlark, Nix, Dart, Julia, Python, Bash
*Technologies*: CUDA Toolkit, NVIDIA GPUDirect, NVMe, Linux, QEMU, Bazel, LLVM, WASM, SQL, Docker, Kubernetes

## Relevant Projects

**RISC-V Assembly Static Analysis Tool**, *Compiler Design and Optimization Lab*      May 2023 – present
- Developed a **VSCode** Extension in **Rust**, providing linting, calling convention, and control flow error detection for **RISC-V** assembly, addressing common mistakes made by novice assembly programmers adhering to register and calling conventions.
- Implemented parser and static analysis algorithms based on dataflow analysis, liveness analysis, and available expressions.
- Enabled real-time feedback in an IDE without external dependencies via cross-compilation to **WASM**.
- Presented work at **CASCON 2024** and **CDP 2024**.
- Extending work as a target for **LLVM code-gen** and multiple architectures, including **ARM**.

**CheckMyLab**, *Compiler Design and Optimization Lab*      May 2023 – Aug 2023
- Developed an online homework checker in **NextJS** and **Dart** for CS courses allowing students to test solutions with collectively pooled tests against the instructor's solutions, with instant feedback provided.
- Orchestrated deployment of web and runner services, including optimizations for **250 students** simultaneously testing.

**Gazprea Compiler**      Sep 2022 – Dec. 2022
- Collaborated with a team of four to design and implement a compiler in **C++** for the **Gazprea Language**, targeting **LLVM**.
- Successfully utilized **ANTLR4** to generate the parser and emitted LLVM IR, achieving passing results on approximately 90% of teaching team tests.
- Demonstrated the ability to plan and distribute work effectively in large software engineering projects.

## Community Involvement

**Orientation Volunteer & Team Facilitator**      2021 – 2023
*University of Alberta Student's Union, Week of Welcome*      *Edmonton, AB*
- Organized and led campus tours and activities, directly managing **12** general volunteers.

**Treasurer, Fundraising Chair**      2021 – 2023
*Phi Gamma Delta*      *Edmonton, AB*
- Managed yearly budget of **$50k+**, including weekly reimbursements and bookkeeping.
- Coordinated with **50+** volunteers in ticket-selling booths at the Taste of Edmonton festival, including day-of logistics.

**Communications Director**      2019 – 2022
*Millennium STEM Alberta*      *Edmonton, AB*
- Created province-wide advertisement campaigns around STEM-themed conferences and events.
- Led a nationwide re-brand to create a coherent image, including website mock-ups, logo designs, and related assets.
- Transitioned all conferences to YouTube Live, streaming **11 hours** of content to approx. **1400 viewers** over 3 events.

**Marketing Director**      2020 – 2021
*TEDxUAlberta*      *Edmonton, AB*
- Created marketing campaigns and graphics for **3** virtual TEDx conferences.
- Transitioned conference online, including editing all conference talks and running day-of Zoom logistics.

**Student Advisory Committee**      2020 – 2021
*University of Alberta*      *Edmonton, AB*
- Attended administration-led sessions providing student feedback on topics of interest.

## Other Experience

**Digital Marketing Consultant**      May 2022 – Aug 2022
*Alberta School of Business Consulting Group*      *Edmonton, AB*
- Collaborated with **10+** businesses in the Edmonton region to enhance their digital presence through content development.
- Utilized CRM tools (HubSpot, Monday) to streamline client relationships and deliver digital marketing recommendations.

**IT Developer & Designer**      Jun 2020 – Aug 2020
*I Challenge Diabetes*      *Edmonton, AB*
- Developed a new social media identity and full website redesign in WordPress to reflect the group's evolving image.
- Edited and distributed social media videos in Adobe Premiere Pro for multiple channels.