

VARUN PATHAK

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Education

McMaster University

Software Engineering and Management Co-op (B.Eng.Mgt.)

Expected Graduation: May 2027

Hamilton, ON

- Dean's Honors List (2023 - 2025), **CGPA: 3.8/4.0**

- **Relevant Courses:** Data Structures and Algorithms, Object-Oriented Programming, Databases, Software Design, Agile Methodology, Probability and Statistics, Client Requirements.

Relevant Experience

AI/Machine Learning Engineer

Oct. 2024 – Present

Hamilton, ON

McMaster Artificial Intelligence Society (MacAI)

- Currently collaborating with a **multidisciplinary research team alongside Dr. Istvan David** to develop and evaluate human-guided multi-agent reinforcement learning (MARL) frameworks, improving coordination and decision-making across agents by **up to 34%** in simulated environments.
- Designed and implemented custom MARL simulation environments in Python to test policy/reward shaping methods, achieving **42% faster convergence compared to unguided baselines**.
- Conducted over **200 training trials** comparing unguided vs. human-guided MARL, **demonstrating 21% higher collective task success and improved stability** in complex cooperative tasks.

Instructional Assistant Intern (Co-op)

Sept. 2025 - Present

Hamilton, ON

McMaster University

- Led Python and engineering design (Autodesk Inventor) to **450+ students** weekly through labs and tutorials, while providing personalized support during office hours.
- Built a Python automation utility that flagged potential academic dishonesty cases by **scanning 1100+ Autodesk Inventor files** for metadata irregularities, improving grading integrity and **saving manual review time by 80%**.
- Supervised a team of **30+ teaching assistants**, coordinated grading duties, and conducted weekly meetings to maintain instructional consistency and performance.
- Created an automated grading and assignment-tracking spreadsheet that streamlined TA workflows by allocating students, tracking project submission deadlines, and setting marking deadlines for **1000+ students**.

Personal Projects

Biometric & AI-Driven Medical Assistance Exchange | DeltaHacks XII Winner |

Jan. 2026

Swift, XCode, Firebase (Auth, Firestore), Google Gemini API, Vision OCR, Arduino.

- Won Canada's largest student-ran **hackathon** by developing an iOS emergency response platform enabling **real-time medical assistance coordination** using biometric triggers, geolocation-based alerts, and AI-powered medical guidance.
- Engineered a **secure Firebase-backed architecture** with triggered cloud messaging and Firestore data models to manage emergency broadcasts, user profiles, and verified medic workflows.
- Developed a **Gemini-powered medical AI system** featuring context-restricted chat, on-device OCR-based medic verification (Vision + PDFKit), and **instant structured incident reports** accessible to both patients and responding medics.
- Integrated an **ESP32-based sensor pipeline** using accelerometer-driven fall detection and manual trigger inputs, enabling reliable real-time incident signaling from embedded hardware to the mobile cloud backend.

AI Receipt Management System |

Dec. 2024 – Jan 2025

Python, AWS S3, Flask, PostgreSQL.

- Built a Python-based receipt management application that extracts, categorizes, and analyzes expenses from receipt images to enable automated budget tracking and financial insights for large-scale businesses.
- Integrated Tesseract OCR & LLMs to extract text from receipt images with **95%+ accuracy**, automating data parsing and **reducing manual entry time by 50%**.
- Designed and managed a PostgreSQL database to **store 10,000+ receipt records** for local businesses across the GTA.
- Leveraged AWS S3 buckets & AWS IAM roles for scalable storage of uploaded images, **reducing storage cost by 30%**.

Technical Skills

Languages: Python, Java, SQL, Bash/Unix, HTML, CSS, JavaScript, R

Developer Tools: Git, GitHub, AWS, React/React Native, Maven, MongoDB, Apache Log4j, UML, Office 365 (Excel)

Certifications: DELF B1 (French, 2022)