Rishi Shah

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Education

McMaster University **Apr. 2029**
B.Eng. Computer Engineering | Schulich Leader Scholar ($120K, 1 of 50 in Canada) *Hamilton, Ontario*

Experience

E3A Healthcare **May 2026 – Present**
Machine Learning Engineer *Shenzhen, China*

- Engineered a TCN to localize fetal S1 heart sounds inside a wearable phonocardiogram (PCG) stream, recovering a clean fetal heart-rate trace beneath maternal sounds, motion, and probe-contact noise
- Scaled training to 22 patients with leave-one-patient-out validation and a semi-supervised pipeline (auto-labeling self-sorter, consistency regularization, masked-span pretraining), validated by a 6-metric panel against a Doppler ground truth

The Centre for Mechatronics and Hybrid Technologies **Oct. 2025 – Apr. 2026**
Research Engineer *Hamilton, ON*

- Designed a physics-ML hybrid battery voltage model (PyBaMM SPMe electrochemical simulator plus a seq2seq LSTM learning the residual error), cutting test RMSE from 12.82 mV to 2.03 mV (84%) while preserving interpretability
- Deployed the model from a PyTorch prototype to a real-time Simulink BMS block via ONNX and MATLAB, verifying bit-exact parity across all three runtimes to ship a production-ready component
- Implemented Extended Kalman Filter and SVSF state-of-charge estimators from scratch in NumPy with a genetic-algorithm 2RC-ECM parameter ID (0.58 mV mean HPPC RMSE), now a co-authored paper under submission

Western University **Apr. 2024 – Aug. 2025**
Machine Learning Researcher *London, ON*

- Architected a recurrent, denoising CORnet-S variant (learnable retinal prefilter, gated recurrent blocks, variance-aware denoise scaling) that outperforms MIT's CORNet-S in adversarial robustness with no adversarial training
- Achieved 97.82% PGD accuracy on MNIST, surpassing ResNet-18 and AlexNet on PGD, CW, and patch attacks, and generalizing to 89.3% (CIFAR-100) and 84.7% (ImageNet100) at ∼15% inference overhead

Robarts Research Institute **Nov. 2022 – May 2024**
Computer Vision Researcher *London, ON*

- Trained a U-Net on 300 labeled Modus V exoscope frames by collaborating with Synaptive Medical for real-time surgical-tool segmentation, hitting 95% DICE at <0.12 s/frame
- Developed CNN-based DICOM segmentation models and a marker-based AR system for surgical guidance and arterial-disease visualization, plus a 3D ultrasonic tracking pipeline for surgical-instrument localization

Projects

CGM-on-Chip | *C++17, S4D, OSDN, ESP32-S3 | on-device ML, zero ML libraries* **May 2026**

- Implemented a complete deep-learning stack in pure C++17 with zero ML libraries (∼5,500 lines): a from-scratch reverse-mode autograd engine, a hand-rolled Adam optimizer, and a fork-join training thread pool
- Reproduced S4D's diagonal structured state-space model and OSDN's online-preconditioned delta-rule recurrence and fixed a box-projection clamp missing from OSDN's algorithm that NaN-crashed FP32 inference
- Delivered 60-minute-ahead hypoglycemia prediction (test AUROC 0.9113) on a $4 ESP32-S3 using 20% RAM, matching the FP64 trainer to 8×10^{-7}

Adaptive Learning Robot | *Cohere LLM, Python, Arduino | Top 32 at Hack the North* **Sept. 2025**

- Built a dual-system robot (Kahneman System 1/2) that learns new skills from one sentence, no pre-training
- Engineered a Cohere LLM and live-search pipeline that converts messy instructions into structured JSON motion guides for two custom 3-DOF arms via inverse kinematics and trajectory smoothing, cutting invalid motions from 40% to <5%

Sentinel | *TypeScript, Node.js LSP, C++ | Best Developer Tool at HackWestern 12* **Nov. 2025**

- Solo developed a hardware-aware static analyzer with a custom Language Server running 50+ silicon-level checks (RAM/Flash budgets, GPIO/strapping-pin hazards, I^2C/SPI/UART conflicts) live at ∼47 ms latency
- Shipped 800+ installs across VS Code and Open VSX, backed by a 200+ device database and full editor integration

Technical Skills

Languages: Python, C++, Java, MATLAB, TypeScript, SQL, Bash, Triton
Frameworks: PyTorch, Keras, OpenCV, JAX, Django, Flask, Node.js, Electron, CUDA
Tools: Arduino, Raspberry Pi, ESP32, Unity, Git, AWS, Fusion 360, Blender, OnShape, KiCad, Docker, Linux