

Mohammad Abu Dagar

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Summary

Computer Engineering grad (UofT, 2025; cGPA 3.55, Dean's Honour List) and **Founding Engineer at Vimy Systèmes**, where I joined as the first engineering hire and now lead engineering across a 4-person Canadian deep-tech firm building explainable AI, autonomy, and decision-support software for aerospace and defence. Strongest in **graphics / visual systems**, **Python applied-AI and agentic systems**, and **robotics/autonomy stacks** (ROS, SLAM, MPC), with a prior 14-month silicon-software internship at **Tenstorrent** and a year-long **ECE496Y1 capstone** restoring and extending a Bell-412 helicopter autonomy stack in simulation (perception-driven replanning, NMPC, LVI-SAM, C++17 on ROS/Gazebo). Targeting graphics, applied-AI, autonomy-systems, and defence-tech engineering roles.

Education

University of Toronto - Faculty of Applied Science & Engineering, *graduated June 2025*

- **B.A.Sc. Computer Engineering with Certificate in Artificial Intelligence Engineering**
- **Cumulative GPA: 3.55 / 4.0 · Dean's Honour List**
- **Capstone: ECE496Y1 - Autonomous Bell-412 Helicopter Flight Stack** (*4-person team, NRC*)
- **Selected coursework:** computer graphics; machine learning, deep learning, and AI search; operating systems, algorithms/data structures, networks, security, controls, probability, software design, and advanced C++.

International Baccalaureate Diploma - Math HL · Physics · Chemistry · English Literature

Experience

Founding Engineer - Vimy Systèmes · Toronto, ON · Aug 2025 – present

Vimy Systèmes (vimy.ai) is a 4-person Canadian deep-tech firm building explainable AI, autonomy, sensor-fusion, and decision-support software for aerospace and defence partners. First engineering hire; lead engineering across nearly all active programs, and drive product demos, technical architecture, proposal engineering, and the public web presence.

- **5GCx Pilot AI Evaluation** (*5gcx.ai*): Support active program delivery and next-stage funding materials for 5GCx, a public AI/ML defence-tech platform for 5th Gen fighter lead-in training and pilot operational readiness; public materials describe Sensor Fusion Capacity, F-35 procurement fit, NORAD/NATO interoperability, and Canadian defence technology/data sovereignty.
- **GPS-Denied Navigation Product R&D**: Lead an ongoing company product thread for flight-controller-agnostic GPS-denial support on small UAVs. Built a working demo that fuses vision, inertial, and lidar-derived state into MAVLink-compatible GPS/odometry outputs; continue hardening architecture, replay tooling, and license-clean dependency posture toward productization.
- **Multi-Modal Sensor Fusion (FinalFusion)** (*DND IDEaS multi-modal AI CFP*): Architected a **10-service FastAPI sensor-fusion platform** (~24K-LoC pnpm + uv monorepo, 23 packages) with a **flow-pluggable fusion core** (4 mission flows register via declarative YAML, zero core edits), end-to-end **W3C PROV-O provenance**, and **policy-as-code** access control (7 OPA/Rego policies + Cerbos) — a situational-awareness pipeline scoped to DND/CAF's public multi-modal AI challenge.
- **Drone Surge / Cardboard UAS (DND IDEaS UAS Competition, Round 2)**: Co-authored the Round 2 design package after the team was selected in Round 1 and awarded \$35,000 for DND's "Drone Surge" challenge. Contributed the system-engineering matrix, schematic package, manufacturability arguments, and scalable low-cost attritable UAS concept work aligned with DND/CAF goals: operational effectiveness, interoperability, and domestic industrial capacity.
- **AMMVER / Fast Forward Emerging Threats (DND IDEaS)**: Led engineering for the \$25,000 Fast Forward grant project, **Dynamically Forecasting Global Emerging Threats Using a Hybrid Neural Network and Hidden Markov Model**. Built and presented an explainable conflict-forecasting model using public information, statistical methods, and machine-learning models to forecast global flashpoints and emerging threats. Presented live at DND to a technical and military review audience including PhD-qualified officials and senior military personnel.
- **Standards & Engineering Posture**: Drove adoption across the org of DO-178C avionics-software practices, IEEE 7001 (transparency) and IEEE 7003 (algorithmic bias) considerations, and ISO/IEC 42001 AI-management-system framing for proposals. Instituted **OpenLineage + PROV-O** lineage capture for ML pipelines and **gitleaks** pre-commit scanning across the engineering org.

- **Web presence:** Owned a large share of the current public **vimy.ai** site experience, including content architecture, visual direction, motion, 3D/Spline embeds, React 19/Vite/Tailwind implementation, and deployment polish.

Qualification Engineering Intern - Tenstorrent · Toronto, ON · May 2023 – Jul 2024 (~14 months)

Worked on the qualification and bring-up infrastructure for Tenstorrent's **Wormhole** and **Grayskull** AI-accelerator silicon, high-throughput inference parts targeting transformer workloads.

- Owned a slice of the **PCIe and on-chip-memory qualification** test plan; wrote and maintained Python + C/C++ test harnesses exercising link-training, error-injection, and memory-stress scenarios across multiple silicon revisions.
- Maintained and improved **automation tooling** for multi-hour bring-up sequences, turning recurring manual steps into repeatable sweeps and improving regression turn-around for the qualification team.
- Triaged silicon-level bugs end-to-end: reproduced from logs, narrowed via instrumented test cases, and wrote post-mortem write-ups consumed by the design and DV teams.
- Contributed to the **continuous-integration** pipeline used by qualification engineers; added new test categories and stabilized flaky cases.
- Helped onboard and train **three incoming interns** on test-harness conventions, lab workflows, and qualification debugging practices.
- Collaborated cross-team with hardware, firmware, and system-software engineers on bring-up of new silicon revisions and pre-production parts.

Flagship Project

ECE496Y1 Capstone: Autonomous Bell-412 Helicopter Flight Stack (NRC)

University of Toronto · Sept 2024 – May 2025 · 4-person team

Year-long ECE496Y1 capstone integrating and extending an autonomous flight stack for a **Bell-412** medium-twin helicopter in high-fidelity simulation, built for the **National Research Council of Canada's** autonomous-rotorcraft program. Team: Mohammad Abu Dagar, Suyesh Kumar Porwal, Alexander Miller-Murphy, Ahmed Elkoushy. **My role on the team: the online path-replanning / time-parametrization algorithm (co-designed, implemented in MATLAB) and environment integration / DevOps. Perception and Gazebo visualization were owned by a teammate.**

- Co-designed and implemented the online path-replanning algorithm: modeled obstacle avoidance as Dubins-style circular arcs, derived the intermediate velocities and accelerations, and stitched quintic splines into a dynamically feasible trajectory (MATLAB).
- Owned environment integration and DevOps across two Linux setups: resolved dependency conflicts, cleaned the NRC's initial ROS codebase, and stood up the shared GitHub repo.
- Built for the National Research Council of Canada's autonomous-rotorcraft program; the team system spans a full perception-to-control pipeline (OpenCV/YOLO perception, LVI-SAM/OctoMap SLAM, ACADO/qPOASES NMPC) in X-Plane + Gazebo + ROS, with an end-to-end mission rehearsal (waypoint cruise, obstacle re-plan, safe landing).
- **Stack:** MATLAB · ROS · OMPL · C++ · Linux · Git.

Selected Personal Projects

gnssdeny_offboard_mvp - GPS-Denied UAV Navigation Module

Active R&D under Vimy Systèmes; cross-referenced with company experience above. ~7,700 LoC Python · 6-layer architecture · 18 test suites.

- **Problem:** produce reliable GPS-equivalent state estimation for small UAVs operating in jammed, spoofed, or otherwise GNSS-denied environments without locking the customer to a specific flight controller.
- **Architecture:** flight-controller-agnostic offboard module that ingests vision, inertial, and lidar streams; runs an **error-state EKF fuser** emitting honest-covariance pose and publishes MAVLink GPS_INPUT + odometry messages to the FC (simulated VIO source today; Kimera-VIO integration in progress). Six-layer design (foundations → sources → estimators → pipeline → orchestration → ui) with a failsafe cascade + phase supervisor.
- **Tooling:** no-GPL-in-core license policy enforced in CI (+ SBOM), Docker-based build, deterministic replay; evaluated against EuRoC MH_01 with TUM-format trajectory output. 18 tests (unit + Hypothesis property + regression + license-gate).
- **Stack:** Python · NumPy · SciPy · OpenCV · EKF · PX4 / MAVLink · Hypothesis · Docker · GitHub Actions.

limiliminal.com - Personal Site (deployed from my_universe)

Sole builder · ~5,400 LoC TS · 16 components (12 in 3D) · live on Vercel + Netlify

- 3D solar-system portfolio with **React Three Fiber + Drei** scene graph (**16 components, 12 in 3D**); per-planet routes for individual works, Tailwind + Radix UI for chrome.
- **Custom GLSL planet shaders** with **object-space normal sampling** for seam-free spheres; a cinematic "rift" camera state machine transitions between two scene "universes" on one scene graph.
- Performance-tuned 3D scene (LOD, frustum culling) so the site stays interactive on mid-tier laptops.
- Deployed live on **Vercel + Netlify** with build-on-push from the GitHub mainline.
- **Stack:** Next.js · React 18 · TypeScript · React Three Fiber · @react-three/drei · Tailwind · Radix UI primitives · Vercel Analytics · Netlify.

Reel_block - IG Reels Blocker (Android Accessibility Service)

Sole author · shipped APK · published-to-Play-Store pending

- **Premise:** Instagram's app does not let you disable Reels, but DM-shared reels remain useful. Built an **Accessibility Service** that detects when the user navigates into the Reels surface from the bottom-bar (vs. opens a reel from a DM), and gently routes them out.
- **Implementation:** Kotlin Android Accessibility Service hooked to view-tree events; minimal-permission posture; runs as a foreground service so the OS doesn't kill it.
- **Status:** working APK in personal use, broader Play Store publish planned.
- **Stack:** Kotlin · Android Accessibility Service · AndroidX · Gradle (Kotlin DSL).

Redline - Voice-Coached Fitness Tracker (Android)

Sole author · pre-publish

- Kotlin + **Jetpack Compose** native Android app combining **voice-coached cadence/tempo coaching, nutrition tracking,** and run-tracking with location.
- Architecture: **Hilt DI, Room** local database (DAO + entity layer per feature), modular feature packages (tempo, nutrition, voice, settings), DND-aware notification handling.
- Permissions surface: RECORD_AUDIO, location (fine + coarse), vibration, notification policy, all with runtime-permission-rationale flows.
- **Stack:** Kotlin · Jetpack Compose · Hilt · Room · Coroutines · Android SDK 26+ · Java 17 · KSP.

GeniusActivities - Algorithmic Trading on IBKR ForecastEx

Sole author · live-money personal use

- Multi-strategy trading runner against **Interactive Brokers ForecastEx** (event-contract / outcome markets) via **ib_async**.
- **Risk discipline:** hard **\$12/day loss circuit-breaker** that tears down all open orders on trip; **8-point trade-approval gate** that every prospective entry must clear before submission.
- **Stack:** Python · **ib_async** · IBKR TWS/Gateway · Postgres for trade ledger · APScheduler.

Pokémon DCGAN - APS360 Term Project

Co-author with ahhmed-e (github.com/ahhmed-e/dcgan-pokemon) · UofT APS360 Applied Fundamentals of Deep Learning

- **Deep Convolutional GAN** trained on a Pokémon sprite dataset; generator + discriminator iterated through training stability fixes (label smoothing, learning-rate scheduling, balanced batch composition).
- Final write-up covered training-collapse modes encountered, mitigation, and qualitative-vs-quantitative evaluation discussion.
- **Stack:** Python · PyTorch · NumPy · Matplotlib · CUDA.

5GCx program support - Public 5GCx.ai reference

Per public material at 5gcx.ai; site itself built by partner organization, not by me.

- Supported engineering for a public AI/ML defence-tech platform focused on 5th Gen fighter lead-in training, pilot operational readiness, and human-machine interface evaluation.
- Public-facing framing only; implementation specifics intentionally omitted.
- **Relevant skills:** Python · computer vision · applied AI · sensor fusion.

Additional Projects

- **CSC384 - Introduction to AI** (UofT, ~1,446 LoC Python): Sokoban solver in **A*** with admissible heuristics; **Futoshiki** constraint-satisfaction solver with backtracking + AC-3 propagation; adversarial **Othello** AI with alpha-beta pruning and iterative-deepening time control.
- **ECE297 - Mapper** (UofT, C++): Routing, search, and rendering on real **OpenStreetMap** data; team project with weekly graded milestones.
- **ECE344 - Operating Systems** (UofT, C): Cooperative + preemptive thread library, virtual-memory subsystem, and basic file-system implementation against the course OS skeleton.
- **ECE243 - Pinball on Hardware** (UofT, C, co-authored): Interactive pinball game targeting **ARM DE1-SoC** dev board; from-scratch 2D physics engine + software framebuffer renderer, VGA framebuffer + PS/2 keyboard input on memory-mapped I/O.
- **MyDrumPad** - Kotlin Android drum/loop pad with **SoundPool** audio engine, BPM/loop control. Co-authored with aaronyuedou (~36% by commits).
- **drone-bom-linker** - Procurement scraper for drone bills-of-materials (Playwright + BeautifulSoup). Scaffold; production ingestion deferred until contracted use case lands.
- **JobFinder personal pipeline** (*omitted from this résumé to avoid recursion; this résumé is itself the input to that pipeline*).

Skills

Languages Python · C++17 · C · Kotlin · TypeScript · JavaScript · Bash · SQL · CMake · Gradle (Kotlin DSL) · LaTeX

Robotics, Autonomy & Control ROS · Gazebo (SITL/HIL) · LVI-SAM · Kimera-VIO · OctoMap · EKF / UKF / particle filters · ACADO Toolkit · qpOASES · NMPC · MPC · MAVLink · PX4 / ArduPilot interop · classical & visual SLAM · sensor fusion (IMU, lidar, vision, GNSS-fallback)

AI / ML PyTorch · scikit-learn · OpenCV · YOLO / YOLOv8 · DCGANs · transformers (applied) · A* search · CSP solvers · adversarial-search & game-tree algorithms · embeddings (nomic-embed-text, sentence-transformers) · RAG pipelines · Ollama for local inference · Anthropic API (Haiku, Sonnet)

Backend & Infrastructure FastAPI · psycpg3 (async) · SQLAlchemy · Alembic · Postgres 16 · pgvector · Redis · Docker · Linux · GitHub Actions CI · Netlify · Vercel · htmx + Jinja2 server-rendered UIs

Web & Frontend React 18 / 19 · Next.js · TypeScript · Tailwind · Radix UI · React Three Fiber + Drei · Framer Motion · Vite · ESLint · Spline 3D embeds

Mobile / Embedded / Systems Kotlin · Jetpack Compose · Hilt DI · Room · Android Accessibility Service · ARM bare-metal (DE1-SoC) · low-level C / kernel-style code · PCIe / memory-system bring-up

Defence & Compliance Posture DO-178C (avionics software) · IEEE 7001 (transparency) · IEEE 7003 (algorithmic bias) · ISO/IEC 42001 (AI management systems) · OpenLineage + PROV-O (data/model lineage) · gitleaks pre-commit · license-audit / no-GPL CI gates

Trading & Quant Interactive Brokers TWS/Gateway · `ib_async` · IBKR ForecastEx · risk-circuit-breaker patterns · multi-strategy backtest harnesses

Tooling Git · GitHub · pre-commit · pytest · ESLint · Docker Compose · uv (Python) · poetry · Typer (CLI ergonomics)

Languages

- **English** - full professional fluency (primary working language)
 - **Arabic** - native fluency (Modern Standard + Levantine dialect)
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Selected Public Links

- **Vimy Systèmes**: <https://vimy.ai> (heavy contributor to site, content, and deployment)
 - **limiliminal.com**: <https://limiliminal.com> (sole builder)
 - **5gcx.ai**: <https://5gcx.ai> (*program I contribute to; site itself built by partner organization*)
 - **GitHub**: <https://github.com/madirewolf>
 - **LinkedIn**: <https://www.linkedin.com/in/mohammad-abu-dager/>
 - **Pokémon DCGAN co-repo**: <https://github.com/ahhmed-e/dcgan-pokemon>
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Naming note: legal/passport spelling is Mohammad Abu Dagar; public profiles use Mohammad Abu Dager, same person.