Mohammad Abd-Elmoniem

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Languages: Python, JavaScript/TypeScript, C++, SQL, Rust, MATLAB **Frontend & Mobile:** React, Flutter, iOS, Android, Swift, WebSockets, tRPC **Backend & Infrastructure:** PostgreSQL, Redis, MongoDB, Firebase, FastAPI, Docker, AWS, GCP, CI/CD, Git **ML & Systems:** PyTorch, TensorFlow, CUDA, Neural Networks, Dask, Distributed Systems, Embedded Systems, BLE, DSP

EDUCATION

University of Maryland - College Park | *B.S in Computer Engineering* | 3.6 GPA (Cumulative) **May 2025**

Coursework: Algorithms, Data Structures, Operating Systems, Computer Systems, Computer Organization, Programming Languages, Probability & Statistics, Linear Algebra**,** Discrete Structures **Involvements:** Co-founder and Tech Lead at the App Dev Club; Bitcamp Presenter and Mentor

EXPERIENCE

Founding Full Stack Engineer | *Autoblocks AI* **June 2025 - December 2025**

- Built adaptive AI tutoring platform where users upload materials for personalized sessions - LangGraph state machines adjusting quiz difficulty based on performance, RAG search via pgvector, real-time tRPC streaming with PostgreSQL persistence.
- Maintained LLM observability platform for HIPAA-compliant healthcare customers while shipping 3 pivots in 1-2 week cycles - AI testing tool simulating personas to detect chatbot failures, browser automation where testers describe tests in plain English executed by AI agent on live sites. Built full-stack TypeScript with multi-tenant auth, async queues, AI podcast generation, and analytics pipelines.

Software Project Lead (Contract) | *Children's National Hospital* **August 2024 - May 2025**

- Co-invented TrachHub (named on patent), leading 12 engineers building monitoring system for pediatric tracheostomy patients where airway blockages are fatal within minutes. Architected full stack: wearable CO_2 sensor streams via Bluetooth to Raspberry Pi hub for real-time detection and cloud sync, Flutter app alerts parents globally, React dashboard for multi-patient nurse monitoring.
- Built four React/Flutter apps processing 5.2M samples/day: Raspberry Pi GUI for Bluetooth pairing and calibration, Flutter mobile app with emergency push notifications, React clinical dashboard for multi-patient monitoring, React portal for patient registration. HIPAA-compliant with WiFi/cellular failover.
- Programmed embedded C++ firmware on ESP32 implementing DSP algorithms (adaptive thresholding, signal filtering) achieving sub-40ms obstruction detection, optimized BLE for 2-week battery life, validated at $98 unit cost.

Software Engineer Intern | *National Institutes of Health* **December 2024 - February 2025**

- Built deep learning pipeline for AI-powered cardiac MRI analysis to detect early heart dysfunction by generating synthetic training data (real patient scans are scarce). Added 708 synthetic datasets across 3 scan types to improve model generalization, built Python data pipeline processing 885+ medical images with parallelized preprocessing, trained PyTorch neural network on 2 NVIDIA RTX 6000 GPUs achieving 95.1% accuracy with sub-50ms inference (71% improvement over prior methods).

Machine Learning Engineer | *Duke University* **May 2023 - December 2024**

- Built deep learning pipeline for through-wall imaging where microwave signals detect objects but produce noisy images. Developed NEAR architecture in PyTorch/TensorFlow with attention-gated U-Net, transformers, and dual-channel phase/magnitude processing, achieving 96% reconstruction accuracy (SSIM), +18dB signal improvement (PSNR), sub-second inference.
- Generated 200K+ synthetic training examples via MIDAS framework modeling EM wave interactions through walls with randomized noise. Scaled models from 49K to 54M parameters with Swin Transformers and CUDA, implemented custom loss functions (Charbonnier, SSIM, perceptual, edge), mixed-precision training accelerating convergence 40%.
- Built Python/Arduino acquisition system for ±0.2-0.6mm positioning accuracy of antenna array, developing optical sensor firmware and calibration API. Designed 3D-printed mounting hardware, packaged pipeline as deployable Python class for end-to-end reconstruction.

Software Engineer Intern | *U.S. Army Research Laboratory* **May 2024 - August 2024**

- Built closed-loop neural imaging system processing 20Hz brain microscopy video, detecting neuron activity and triggering optical stimulation within 50ms latency. Engineered Python backend with Redis pub/sub, WebSockets, asyncio event-driven architecture, and Dask parallel computing tracking 40+ neurons simultaneously. Developed Flask/React web app controlling 800×500 pixel optical hardware, built Echo State Network ML models achieving 30% improved prediction accuracy.

Software Project Lead (Contract) | *General Dynamics Information Technology* **August 2023 - May 2024**

- Led team of 8 engineers building two enterprise applications. First, group coordination platform with real-time dashboards, geolocation analytics via Google Maps API with k-means clustering, Firebase sync, and TensorFlow NLP on GCP for email parsing. Second, interactive onboarding app (Kahoot-style) for new hires with Flutter, FastAPI, MongoDB, MVVM architecture, and CI/CD pipelines.

PROJECTS

Emergency Response Mobile Platform: Built a Flutter-based mobile platform for first responders to start location tracking before dangerous trips, enabling SOS alerts with geo-tagged images, videos, and notes during emergencies. Implemented OpenStreetMap-based GIS views with hybrid SQL/NoSQL storage, encrypted API sync, offline caching, and ACID-compliant data writes to ensure resilience in low-connectivity conditions