

# Vedant Bahadur

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## EDUCATION

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### University of Michigan

Bachelor of Science in Electrical Engineering | Dean's Honor List (Fall 2025)

- Coursework: Rocket Science, Programming & Intro Data Structures (C++), Proof-based Linear Algebra

Ann Arbor, MI

exp. grad. 2028

## EXPERIENCE

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### Research Intern

2025

Institute for Functional Intelligent Materials, NUS, Under Dr. Stephen Dale

Singapore

- Implemented an automated single-ended framework to map chemical potential energy surfaces using the  $k$ -HiSD saddle-point method with D4FT/Psi4; requires only a single input geometry and no predefined driving coordinates.
- Discovered 3 new minima and 20 novel transition states on the formic acid reaction route map; found 95% of high-energy transition states via higher-index saddle traversal, validating method; paper in preparation.

### Software Developer

2024

Republic of Singapore Air Force Agile Innovation Digital Department (RAiD)

Singapore

- Contributed back-end development to two operational products serving 500+ Air Defence personnel and ATCs; implemented rule-based auto-generation of squadron plans, cutting planning time by 4x.
- Collaborated with IBM to redesign ATC administrative workflows, reducing overhead by 60%; applied ATC domain expertise to validate requirements throughout development.

### Air Traffic Controller Trainee

2023 – 2024

Officer Cadet School, Republic of Singapore Air Force (RSAF)

Singapore

- Trained to control live aircraft on radar, manage radio failure emergencies, and execute wartime drills.
- Valedictorian and Best Knowledge in Air Operations Specialist Course. Achieved IPPT gold (top fitness score).
- Handled live air operations and multilateral exercises as a Signal Executive. Participated in Exercise Bersama Shield.

### Independent Researcher

2022 – 2023

A\*STAR, mentored by Dr. Jarvis Loh (Principal Scientist, AI for Materials)

Singapore

- Designed a DFT-free ML pipeline to screen hybrid organic-inorganic perovskites (HOIPs) for solar cells; trained a neural network with Bayesian Optimization on 1,300+ structures achieving  $R^2$  of 0.801 for bandgap.
- Screened 1,200+ novel HOIPs, narrowing to 7 high-priority structures for experimental follow-up.

### Research Intern

2021

A\*STAR Institute of High Performance Computing (IHPC), mentored by Dr. Jarvis Loh

Singapore

- Applied ML to QM9 and Lipophilicity datasets, constructing a structured latent chemical space via optimised UMAP embeddings and Gaussian Mixture Model clustering for geometry-aware property prediction.

## PROJECTS

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### Michigan Solar Car – Battery Management System Firmware | C++, Keil, STM32CubeIDE, I2C

2025 – Present

- Developed embedded C++ firmware for the BMS, including a full LTC2493 ADC driver; implemented temperature correction for hall effect current sensors and refactored SPI to I2C, reducing pin usage across the board.

### Generative Models from Scratch | PyTorch, Python

2025

- Built GANs and DDPM-style diffusion models from scratch in PyTorch (custom training loops, noise schedules, U-Net/MLP architectures) without high-level libraries, successfully generating coherent synthetic images trained on MNIST and CelebA.

### Lumenol | Flutter, Firebase, Figma, Cloud Functions, HTML/CSS

2022 – 2024

- Sole-built a full-stack platform (Flutter mobile app and web) for high school students to publish and share creative work; grew to 1.6K+ unique visitors, 19K+ page views, and #35 on Singapore Apple App Store (Education).

### GrowLah! | Flutter, ReactJS, Firebase, ESP32, TensorFlow, Cloud Functions

2020 – 2022

- Co-founded a social enterprise with TCS tackling food insecurity and senior isolation via IoT-enabled hydroponics; built a Flutter app, ReactJS dashboard, and ESP32 IoT toolkit deployed across schools, a senior care centre, and the Singapore Science Centre.

## TECHNICAL SKILLS

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**Languages:** Python, C++, JavaScript, HTML/CSS, Swift, Dart, Java SpringBoot

**ML & Data:** PyTorch, TensorFlow, scikit-learn, RDKit, UMAP, NumPy, Psi4

**Embedded & Hardware:** Altium PCB Design, Keil MDK, STM32CubeIDE, Arduino, ESP32, I2C/SPI

**Web & Mobile:** Flutter, ReactJS, Firebase, AWS, Cloud Functions

**Developer Tools:** Git, CAD

**Interests:** Guitar (Classical Grade 8), Badminton (U19 SEASAC Winner, Player of the Year 2022), Michigan Club Squash, Trekking (Climbed Mt. Fuji, Mt. Kinabalu, Annapurna Base Camp)