Tanmay Bishnoi

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Education

Toronto Metropolitan University (TMU) — Toronto, ON
Bachelor of Engineering in Electrical Engineering — *Aug 2019 – Exp Aug 2025*

- Dean's List

Professional Experience

Software Solutions Engineering Intern - Display R&D — May 2023 – Present
Advanced MicroDevices Inc. (AMD) — *Markham, ON*

- Supported AMD in optimizing software power and performance for next-gen Display and Video IPs
- Researched and simulated power measurement data and OS events to model and quantize architecture limitations
- Implemented signal processing algorithms and statistical techniques to extract features for quantitative analysis
- Increased research productivity by developing tools for data collection, simulation, and insight generation
- Directed project development by delivering regular insights to cross-functional teams and stakeholders

Machine Learning Engineer — Jan 2023 – Sep 2023
UofT Machine Intelligence Student Team (UTMIST), UofT — *Toronto, ON*

- Developed ML solution for Wind Turbine Audibility and Noise Contamination project for Aercoustics ltd. (AEL)
- Assisted with dataset composition, exploratory data analysis, and audio classification literature reviews
- Implemented SimCLR based "Contrastive Learning of General-Purpose Audio Representations" (COLA, 2020)
- Delivered baseline model to match performance of existing AEL pipeline with 96% accuracy on validation dataset

Software Engineering Lead - Rover Autonomy — Feb 2022 – Jun 2023
R3 Robotics, TMU — *Toronto, ON*

- Developed full-stack autonomy software in Python and ROS 2 for a 6-wheeled 50 lbs Mars Rover
- Implemented pointcloud+RGB based navigation algorithms using OpenCV and Zed stereo cameras
- Achieved <2m accuracy for point-to-point robust autonomous traversal on wide range of terrains
- Secured position in top 5% at the prestigious University Rover Competition (URC) held at MDRS, Utah, USA
- Contributed 8K+ lines of code via Git and mentored team members on leadership and problem solving

Projects

RISC-V Assembly Firmware Simulator | *Python, Plotly Dash, Websockets* — Aug 2023 – Present

- Developed a RISC-V assembly firmware simulator for a 32-bit microprocessor on a next-gen AMD SoC
- Enhanced development workflow via register-level visualization of program control flow and algorithm compute
- Increased team productivity by enabling rapid prototyping via real time feedback of FW performance

Computational Neuroscience Capstone Project | *SciPy, PyTorch* — Jun 2021 – Jul 2021

- Supervised by Dr. Matthew Krauss (McGill University) for capstone project titled "Feedforward Functional Hierarchy of Information Processing in the Mouse Brain during a Sensorimotor Task"
- Researched Computational and Statistical techniques in Neuroscience contexts for >160 hours
- Presented project virtually at the Neuromatch Academy Computational Neuroscience 2021 capstone meet

Simple General-Purpose Processor | *VHDL* — Aug 2020 – Jan 2021

- Implemented a simple processor using custom designed Storage Unit, ALU and Control Unit
- Processor able to carry out AND, OR, NOT, XOR, NOR, ADD, SUB operations on 2 8-bit numbers

Technical Skills

Languages: C/C++, Java, JavaScript, Python, RISC-V Assembly
Frameworks: Qt, ROS 2, Gstreamer, React, NodeJS, TensorFlow, PyTorch
Libraries: OpenCV, Pandas, NumPy, SciPy, Matplotlib, Plotly, Tkinter, D3.js
Tools and technologies: Linux/UNIX, Git, Docker, VM, CMake, CUDA
Hardware/Interface: ARM, I2C, I2S, CAN

TANMAY BISHNOI

ELECTRICAL ENGINEERING AT TORONTO METROPOLITAN UNIVERSITY

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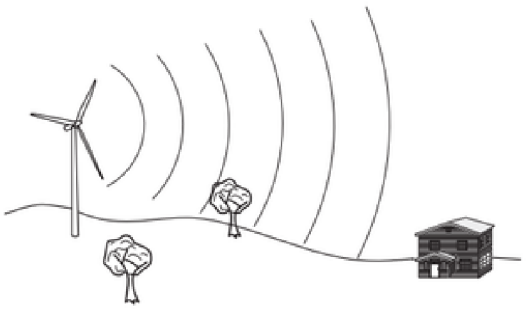
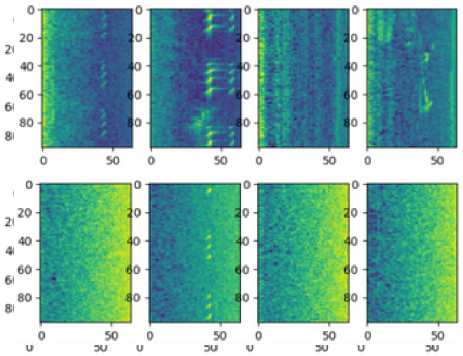
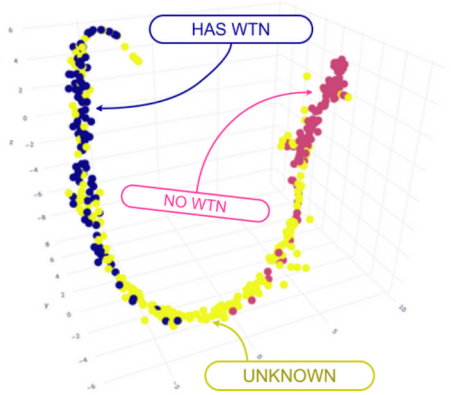
WIND TURBINE NOISE DETECTION - ML MODEL - UTMIST X AEL







What?

- **Aercoustics Engineering Ltd. (AEL)** sponsored to develop ML solution to detect **Wind Turbine Noise (WTN)** pollution in Ontario Farms.
- Project aimed at saving time and labor by **automating WTN detection** for stakeholders interested in **minimizing health impact** of WTN.

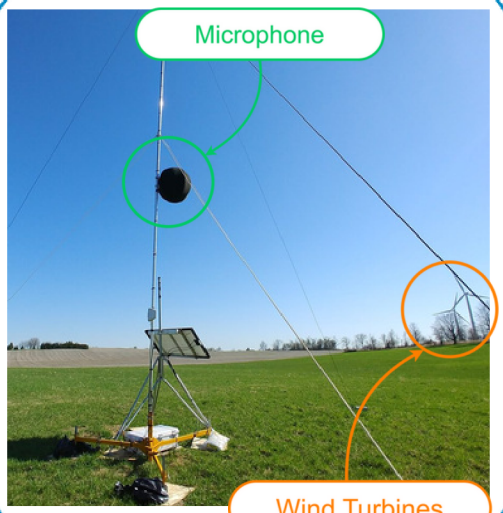
How?

- Conducted Literature Review and selected model architecture.
- Implemented **Contrastive Learning** model (**COLA** by Google Research, 2020) with **Tensorflow** and **CUDA** to solve for WTN detection.
- Spearheaded **full MLOps Lifecycle** (Dataset Gen, to Model Val.).

Results

- Final model able to predict WTN noise on labelled **validation datasets** with **96% accuracy**.
- Interpretability study showed **t-SNE embeddings** of model's encodings **seperated** different audio classes fairly well.

Field Setup



Model	Training Dataset	Validation Dataset	Validation Accuracy	Batch Size (n=)	Epochs
COLA	R03 (n=848)	R01 (n=600)	81.99%	64	50
			95.99%	1024	50
EfficientAT	R01 (n=600)	R03 (n=848)	**91.00%**	32	5

Contrastive Loss

$$\mathcal{L} = -\log \frac{\exp\left(s(x, x^{+})\right)}{\sum_{x^{-} \in \mathcal{X}^{-}(x) \cup \{x^{+}\}} \exp\left(s(x, x^{-})\right)}$$

Anchor, Positive, Negative

- The similarity between **"anchor" example** and a **related example** should be greater than between **anchor** and **unrelated examples**.
- **positives** are chosen from the same audio class as the **anchor**, and **negatives** are chosen from other audio classes.

1 Literature Review → 2 Exploratory Data Analysis → 3 Model Selection → 4 Dataset Creation → 5 Model Training → 6 Model Validation → 7 Delivery (Output)

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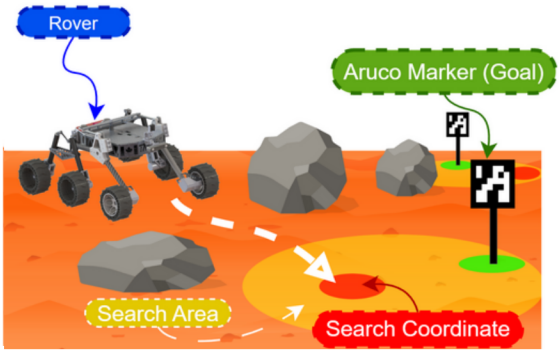
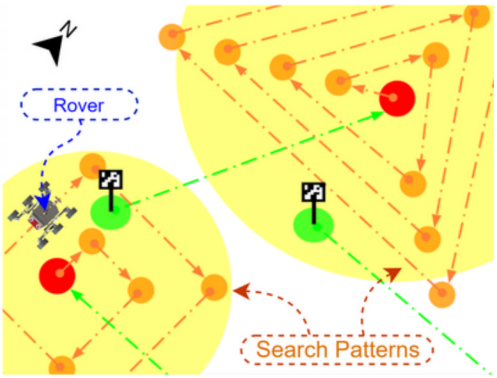
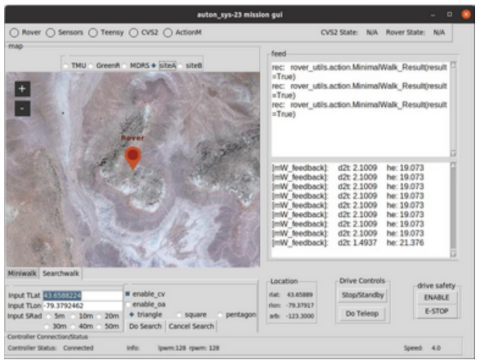
MARS ROVER - AUTONOMY SOFTWARE - R3 ROBOTICS







What?

- Wrote **complete autonomy software** for Mars Rover for **University Rover Challenge (URC) 2023**.
- The rover **navigates** to and **searches** for visual markers (AR Tags) at specified search coordinates.
- The Rover navigates **full course autonomously** and **avoids obstacles** like rocks and ditches.

How?

- Designed **point-to-point** navigation algorithm by integrating **GNSS**, **INS**, and **RGB Stereo** sensor data.
- Designed **Search Patterns** for searching at target coordinates.
- Created **Computer Vision** Algorithm for **scanning** and **approach**.
- Implemented software using **Python**, **ROS 2**, **OpenCV** and **GStreamer.**

Results

- Achieved **<2m** accuracy on p2p autonomous navigation task,
- Completed **60%** of obstacle course under record time.
- Achieved **6th** place out of 38 teams for autonomous mission.
- Mentored **3 members** to lead the team for following URC missions