Soumodeep Karmakar

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Education

B.E. Electrical Engineering 2024 – Present
Jadavpur University, Kolkata *Kolkata, India*

- **CGPA:** 7.82 (Up to 2nd Semester)
- **Key Coursework:** Electrical Machines, Circuit Theory, Control Systems, Analog & Digital Electronics, DSP, Signals & Systems, C Programming, Microprocessors

Senior School Certificate Examination (Class XII) 2023
*Scottish Public School, Katihar (CBSE) – **84%** (Best of 5)*

Secondary School Examination (Class X) 2021
*Manipal Public School, Katihar (CBSE) – **92.2%** (Aggregate)*

Experience

Software Team Member Aug 2025 – Present
Jadavpur University Mechatronics Club (JUMTC) *Kolkata, India*

- **International Rover Challenge (IRC) 2026:** Collaborating with a cross-functional team of 20+ students to engineer the rover's **vision system** for tool detection and the **Base Station dashboard** for real-time telemetry monitoring.

Skills

Languages: C/C++, Python, JavaScript, HTML/CSS
Frameworks & Libraries: PyTorch, Pandas, Node.js, React, Electron.js
AI & ML: Machine Learning, Deep Learning, Computer Vision (YOLOv8, OpenCV)
Databases: MongoDB **Developer Tools:** Git, GitHub, Docker, VS Code

Projects

Netra Vaani | *Python, MediaPipe, OpenCV* |

- Built a real-time assistive system for patients with **ALS and severe motor disabilities**, enabling communication via eye movements using Python, MediaPipe, and OpenCV.
- Accurately tracks iris gaze direction (left, right, center) and counts blinks with low-latency processing to translate eye gestures into commands.
- Implemented the **Eye Aspect Ratio (EAR)** method for robust blink detection with intelligent pause mechanisms to prevent false readings during natural eye closure.

Audio Deepfake Detection | *PyTorch, ResNet18, XGBoost, Librosa*

- Developed a hybrid audio deepfake detection system achieving **99.7% accuracy** by combining deep learning and ensemble methods.
- Leveraged a ResNet18 CNN on mel spectrograms to extract 512-dimensional embeddings.
- Combined embeddings with 86 handcrafted audio features (MFCCs, Delta MFCCs, Chroma) and fitted an XGBoost classifier on 598 composite features.

Mechanical Tool Detection System | *YOLOv8, PyTorch, Ultralytics*

- Designed a custom object detector using the **YOLOv8n** architecture to identify mechanical tools with **0.80 mAP@0.50**.
- Optimized model performance through hyperparameter tuning and **Mosaic data augmentation**, addressing class imbalances in the dataset.
- Utilized Ultralytics and PyTorch for model training, validation, and export, ensuring compatibility for edge deployment.

Micrograd | *Python, NumPy*

- Engineered a lightweight, scalar-valued autograd engine from first principles to deconstruct the mechanics of modern deep learning frameworks (like PyTorch).
- Constructed reverse-mode automatic differentiation over dynamically built Directed Acyclic Graphs (DAGs).
- Trained Multi-Layer Perceptrons (MLPs) from scratch using SGD, validating the core mathematics behind neural networks.

ThermoNet | *Python, PyTorch* |

- Explored the thermodynamics of neural network learning through ThermoNet, drawing parallels between gradient descent optimization and physical phase transitions.
- Demonstrated that training dynamics exhibit "crystallization" behavior when proper regularization (weight decay) is applied.
- Showed how this enables networks to discover underlying mathematical structures rather than memorizing training data.