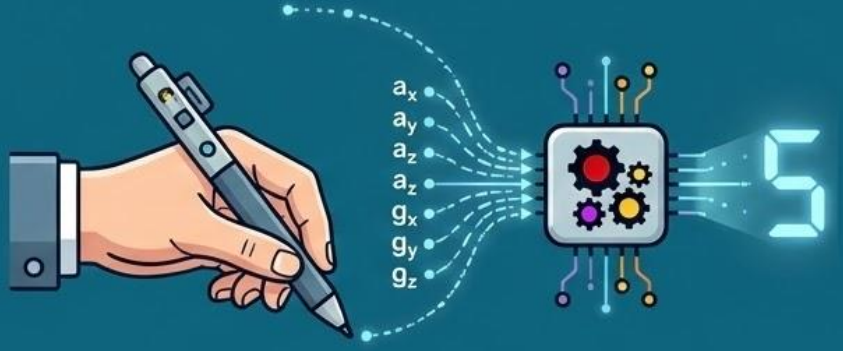
HACKATHON PROJECT:
HANDWRITTEN DETECTION

TEAM: Madhab paul choudhury
Khyati Sharma
Bhagwan
Abhinav
Gaurav

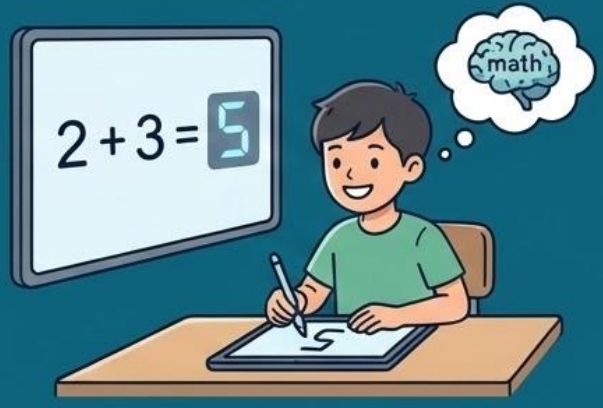
Problem Statement

The Goal: Detect Handwritten Digits via IMU



- Detect Handwritten Digits using Inertial Measurement Unit (IMU) data, distinct from traditional image-based methods.

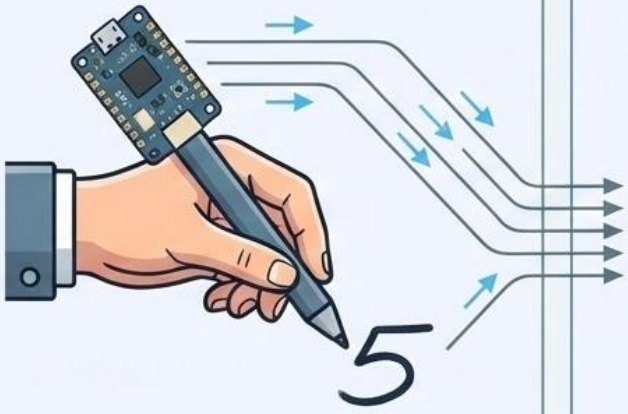
Key Use Case: Empowering Education



Online prediction (Training Local, Inference Edge) to enhance math capabilities for kids at school, regardless of handwriting.

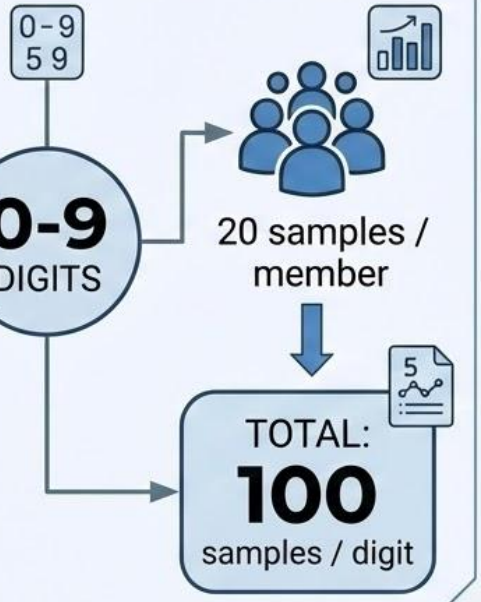
Data Collection

The Setup



Nicla Vision attached to marker. Handwritten digit IMU data collected for digits: 0-9.

Data Statistics



Challenges

- Various writing styles

- Size of the digit

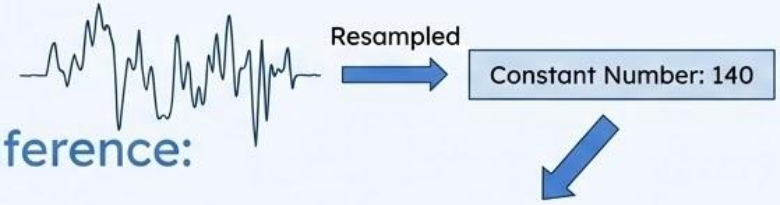
- Vibration / Noise

- Limited data size (tedious process)

Methodology

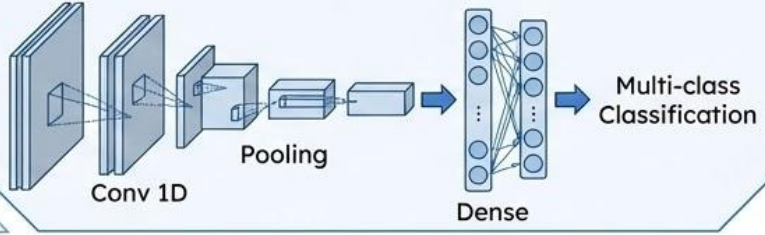
Training

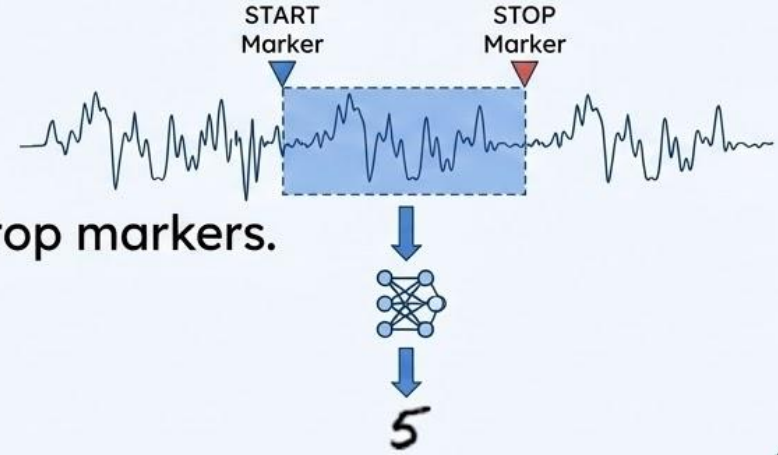
- Resampling the digit's time steps to a constant number: 140
- Training a 1-D CNN stack for the multi class classification



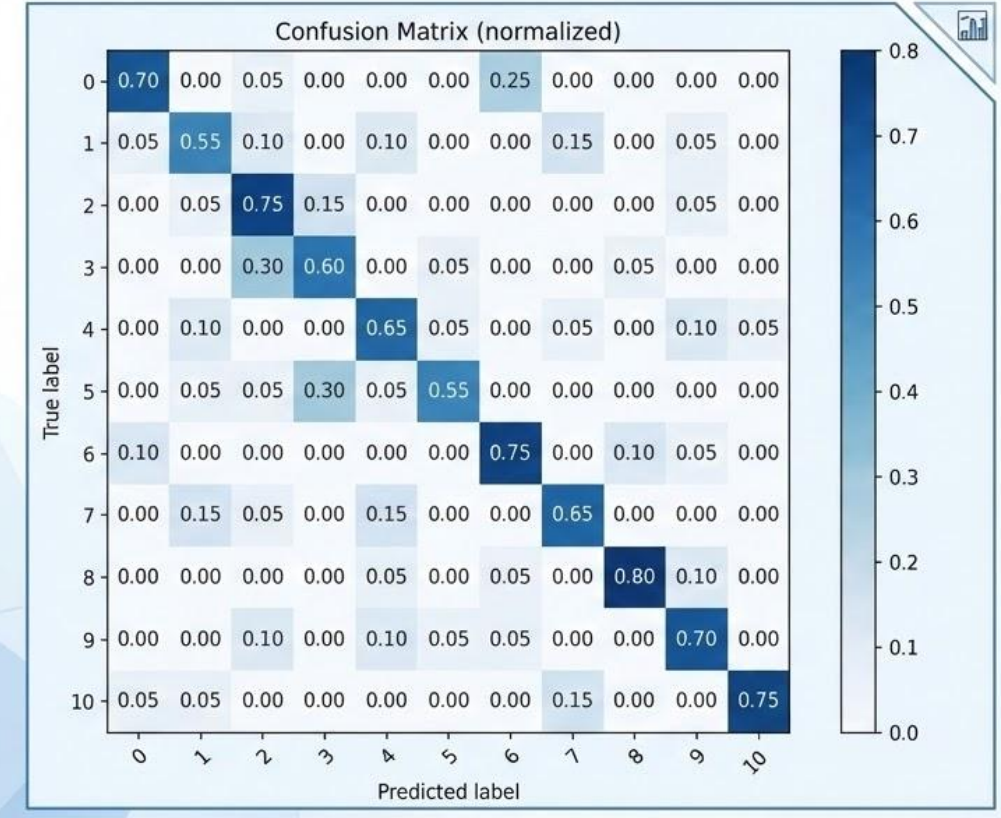
Inference:

- Predict the digit between start and stop markers.



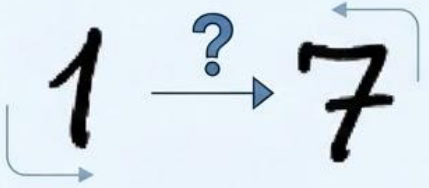


Results (on the test split - after training)

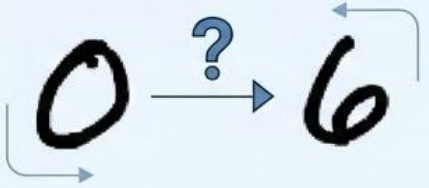


Error Analysis:

Digits with similar writing patterns are misclassified.



Example:
1 and 7



Example:
0 and 6

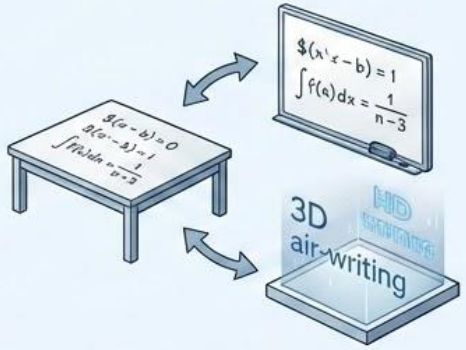
Future Work

Seamless Writing & Auto-Solving

Seamless Writing & Auto-Solving

Replace manual 'Start/Stop' buttons with automatic motion detection. The system will automatically 'group' characters into an equation (like 2 + 3$) and solve it the moment the user pauses.

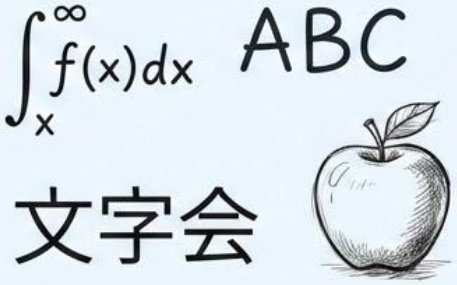
Any-Angle Writing



Any-Angle Writing

Upgrade the logic to work at any tilt or inclination, moving from flat table writing to Vertical boards and 3D Air-writing.

Beyond Digits



Beyond Digits

Expand the AI to recognize complex math symbols, letters for language learning, and even hand-drawn art.