ENGR 478 Final Project: Gesture Recognition with sEMG

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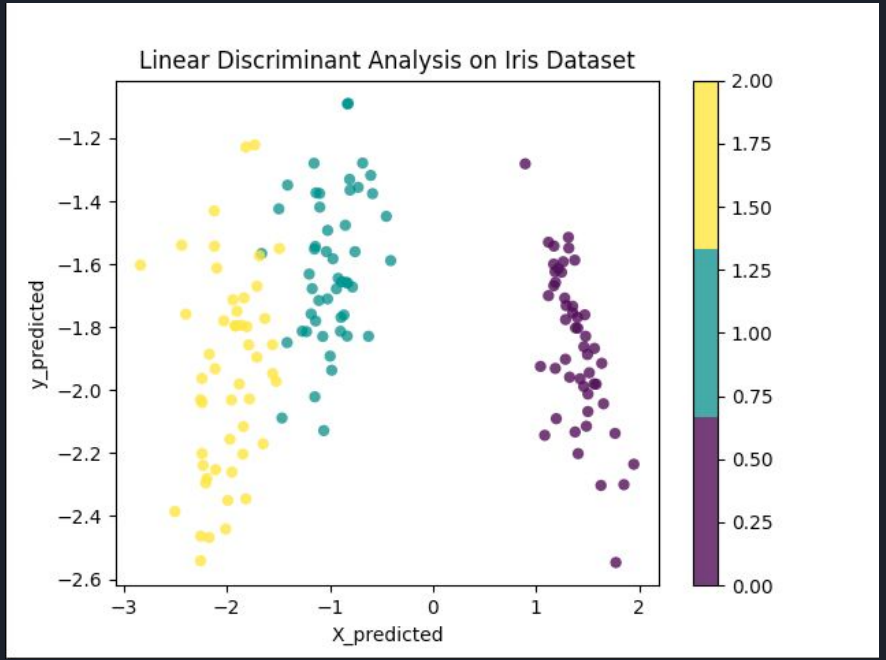
Project Overview

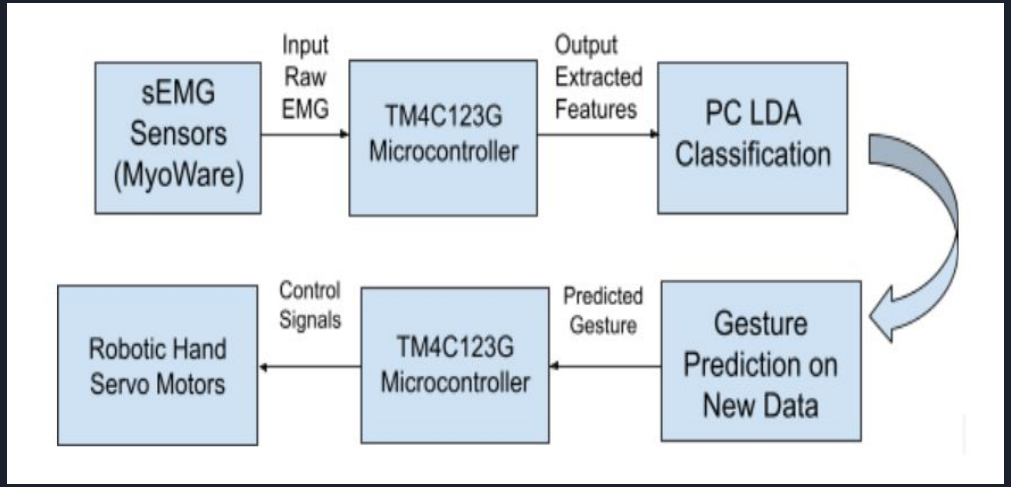
- Background:
  - sEMG signals
  - Pattern recognition
- Motivation:
  - Fascination with HMI
  - Potential of Machine Learning

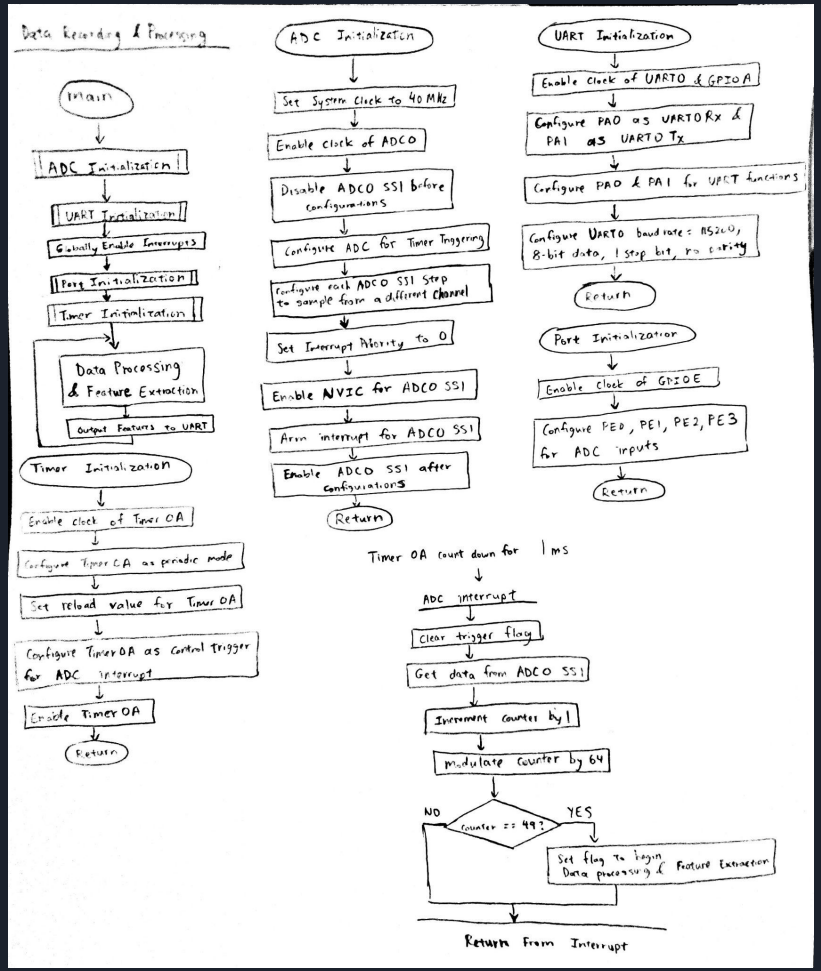


Design and Implementation

Module 1: Data Recording and Processing

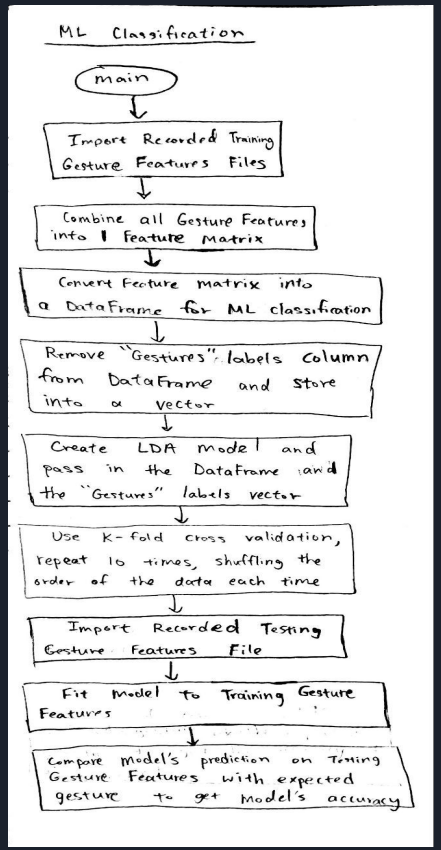
System Architecture



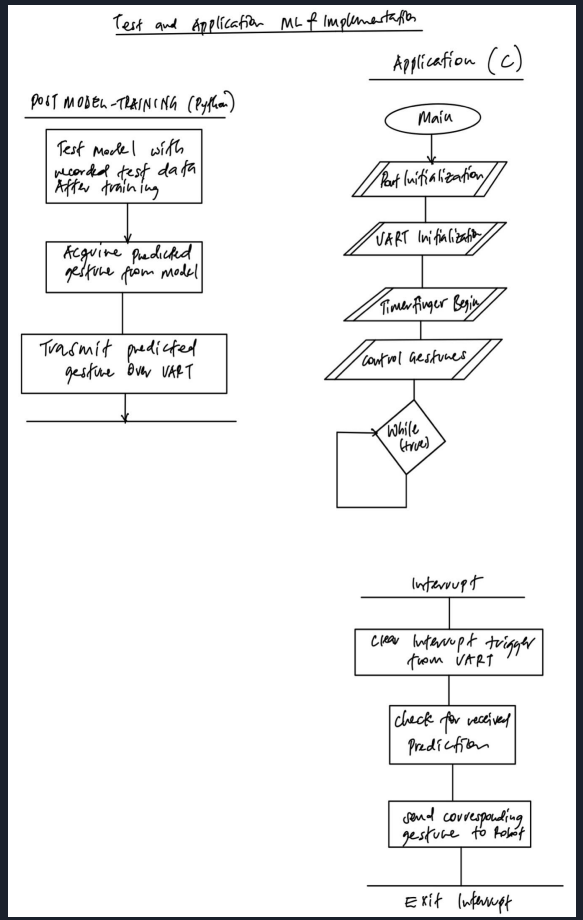


Design and Implementation (cont'd)

Module 2: ML Classification

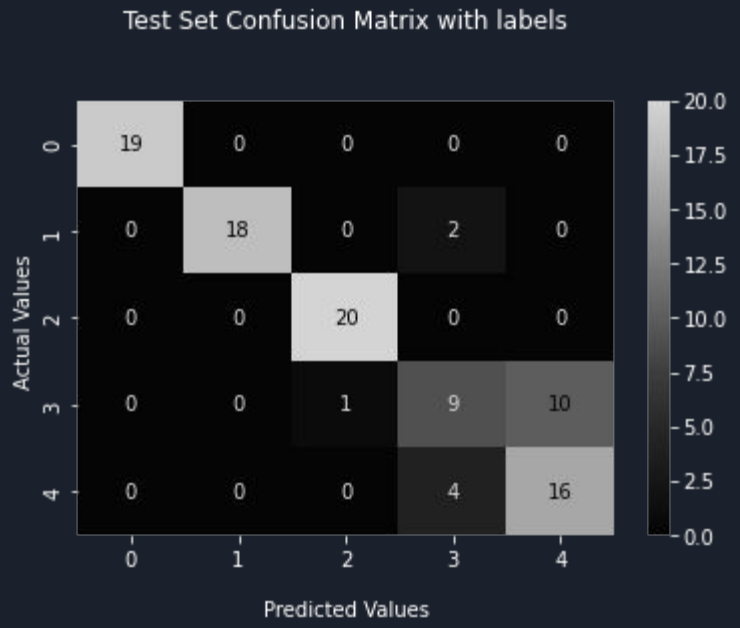


Module 3: ML Model Testing/Applications

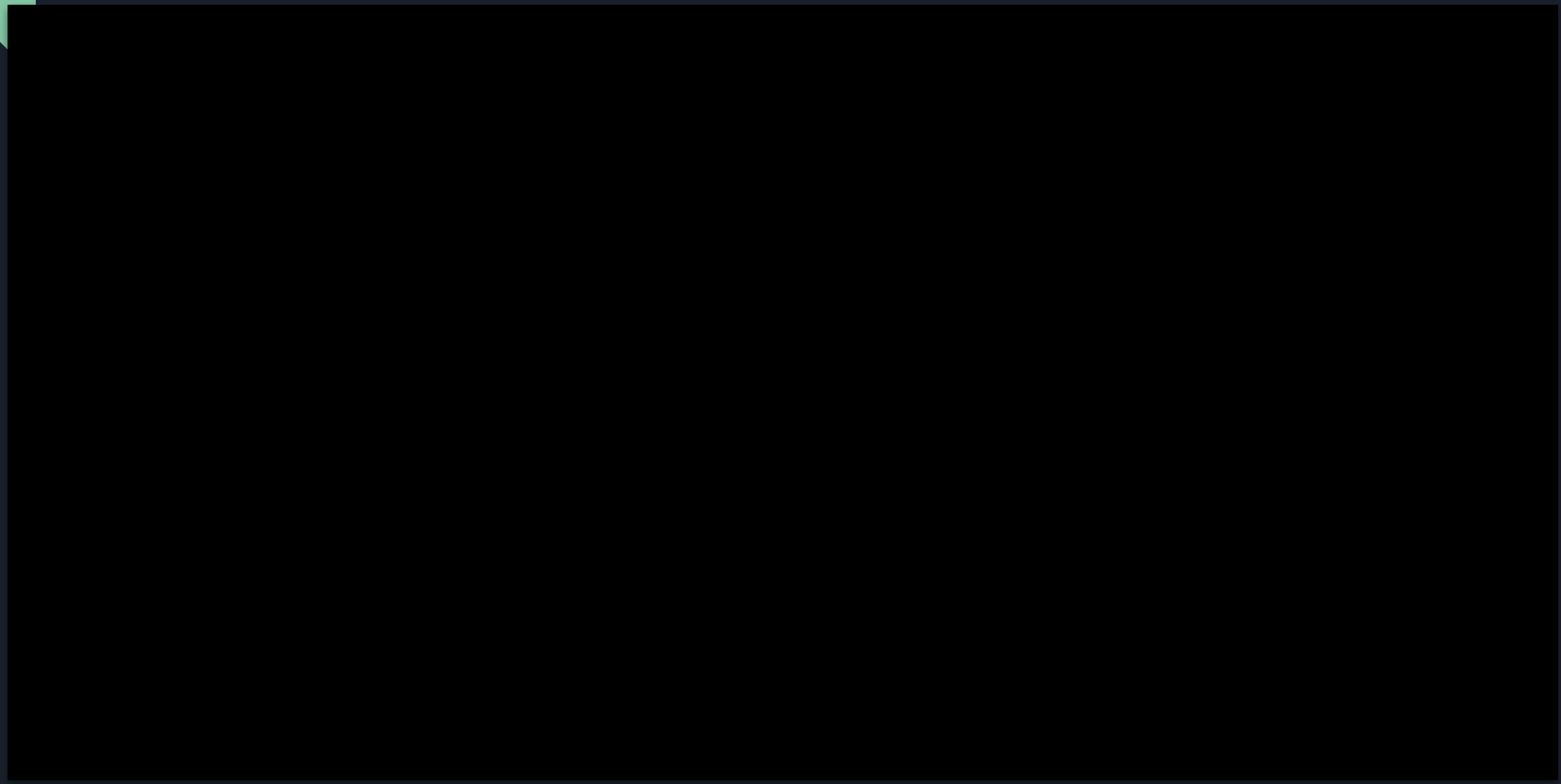


Project Outcomes

- Experiments:
  - ADC Input
  - Feature Calculation
  - Feature Outputting
  - ML Classification Model on Iris dataset from keras
  - Data File Uploading and Formatting
- Testing/Performance Metrics:
  - Accuracy
  - Robustness
- Results/Observations:
  - Up to 85% accuracy on Test Set



Demo Video



Future Works

- Immediate Next Steps:
  - Implementation of DMA
    - More efficient handling of input ADC data and output features
  - Feature Extraction Optimization using predefined math functions
- Future Expansions:
  - Fix serial connection issue between Python and Tiva
    - Live stream features and classification prediction to control the robotic hand
  - Testing other ML Classification Algorithms and compare performances
  - Try classification Deep Learning Algorithm for classification

References

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- Ian Donovan, (2021), MyoWare Sensor Introduction Presentation Slides

- Ian Donovan, Xiaorong Zhang, (2013), MATLAB LDA code

- Xiaorong Zhang, (2021), Sample PWM code