

Designing an embedded machine learning system to recognise the first 10 letters of the latin alphabet using 3 photodiodes

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Introduction

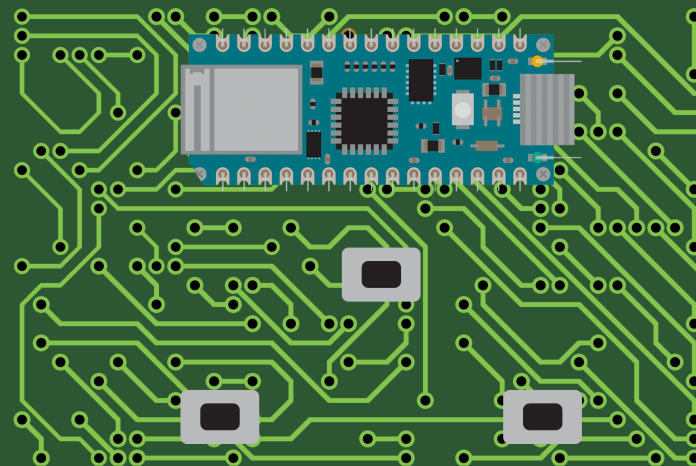
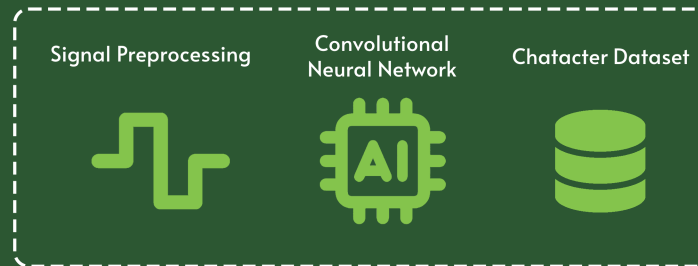
- **Touchless interfaces** can make user interaction more intuitive and accesible
- Provide a way to interact with systems **while limmiting the spread of germs**
- Could **provide assistance** in places where a sterile environment is **critical**

Problem

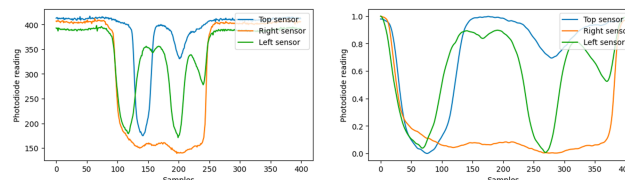
How can we use embedded machine learning to create a system that can recognise air-written characters?

Background

- **Previous attempt** at digits and gestures by several bachelor and master students [1 - 5]
- No attempt yet at recognizing **characters**
- Main gap in current research can be found in the **available data**.



Preprocessing results



Results

- Achieved a **between-participant** accuracy of 50.80% and a **within-participant** accuracy of 67.82%
- Robust reprocessing pipeline resulting in an **36.45% increase in accuracy**
- Created a dataset of **1500** air-written characters

Discussion

- Acceptable accuracy, but model is subject to **overfitting**
- Significant **increase in data** necessary to reduce overfitting problem
- Additional **hyperparameter search** needed on data increase

References

- [1] Dimitar Barantiev. Designing a software receiver for gesture recognition with ambient light, 6 2022.
- [2] William Narchi. Recognising gestures using ambient light and convolutional neural networks, 6 2022.
- [3] Stijn van de Water. Designing an adaptable and low-cost system for gesture recognition using visible light, 6 2022.

