EESTEC Hackathon
Radar Based Vital Sensing

Team 4
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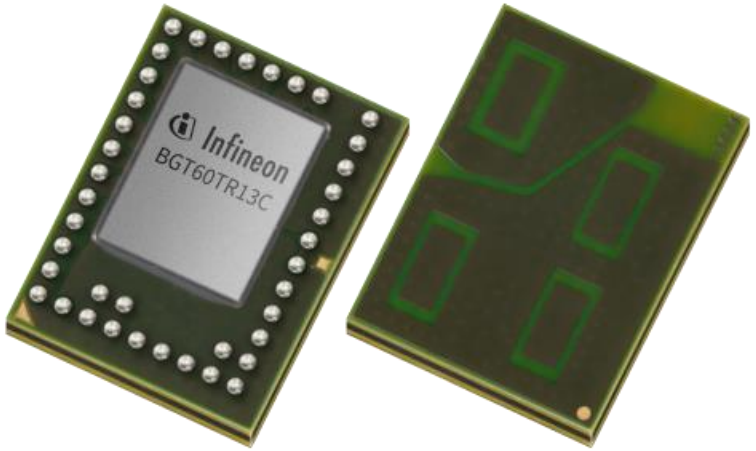
Infineon‘s BGT60TR13C Radar Chip

XENSIV™ 60GHz radar sensor for advanced sensing



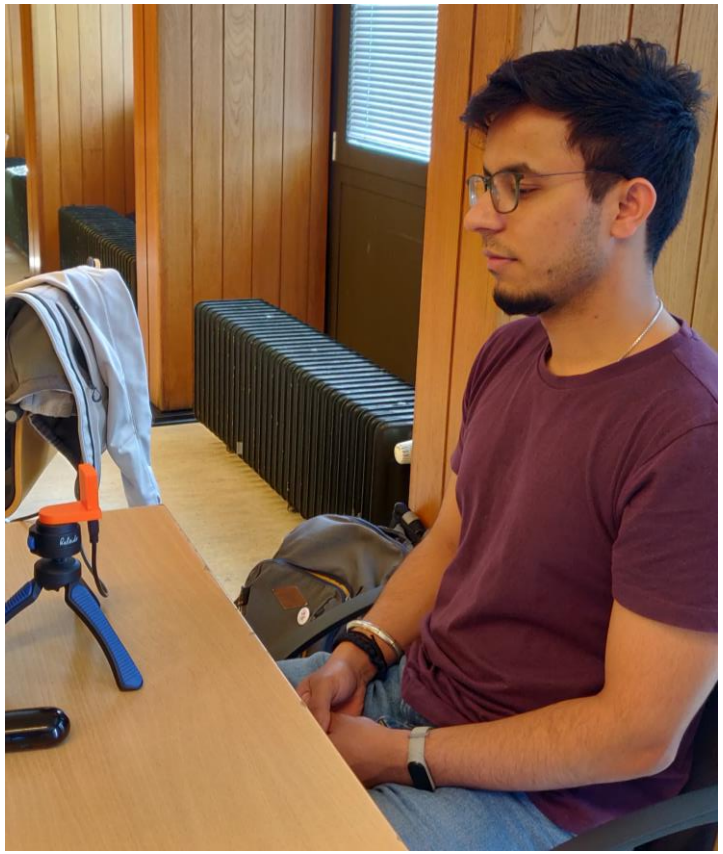
Presence detection/segmentation

Touchless interaction

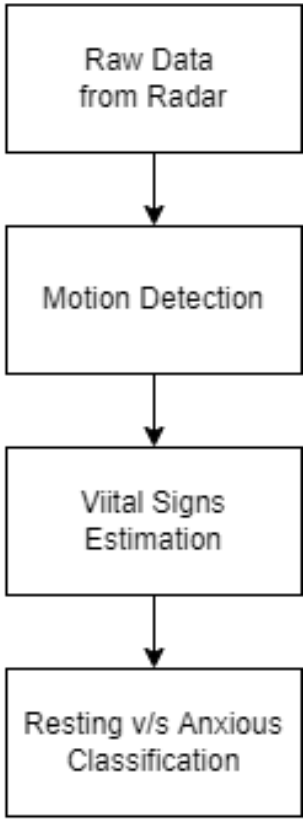
Vital sensing

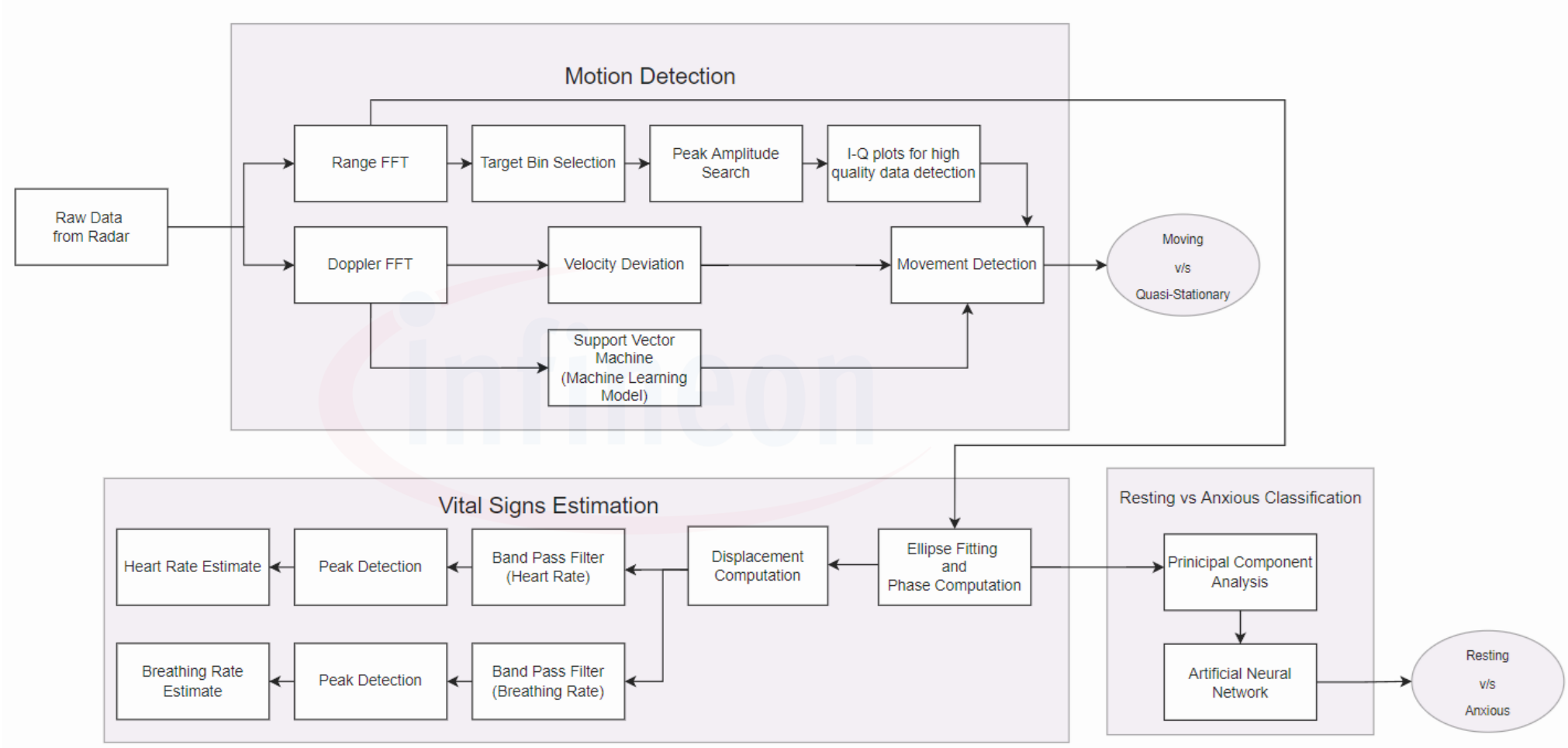
Target Scenario

A single person sitting in front of the radar (facing towards the chest) ~1m



Algorithm





Data Collection for Machine Learning

Support Vector Machines
(Movement v/s Quasi-Static Classification)

Data Specifications:

Data: Range_FFT Data
Classes: 2 (Movement, Quasi-Static)

No. of Training Samples: 120 per class

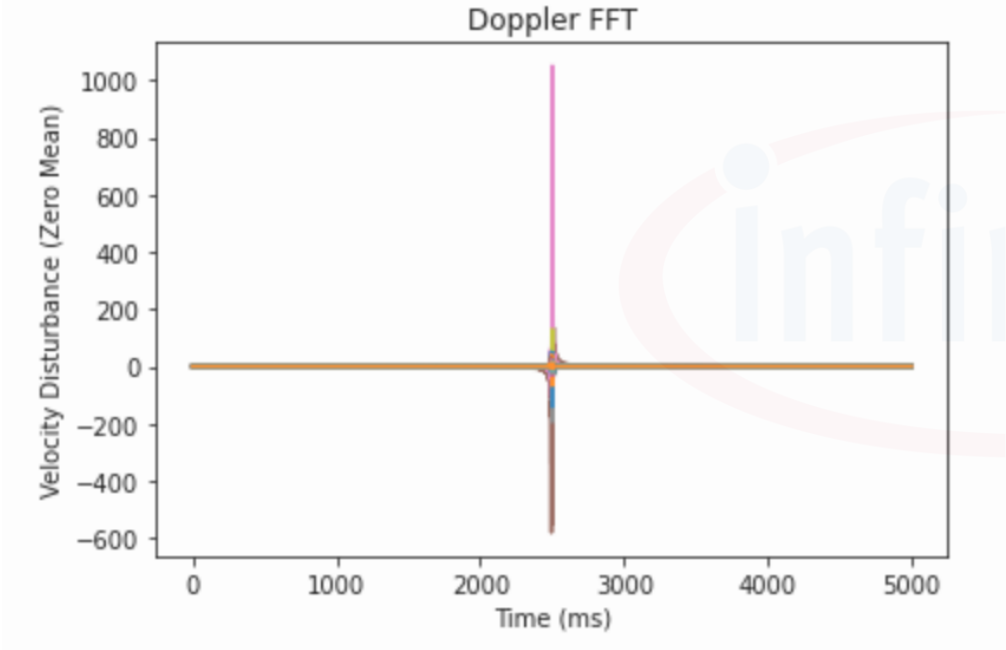
Artificial Neural Network
(Resting v/s Anxious State Classification)

Data Specifications:

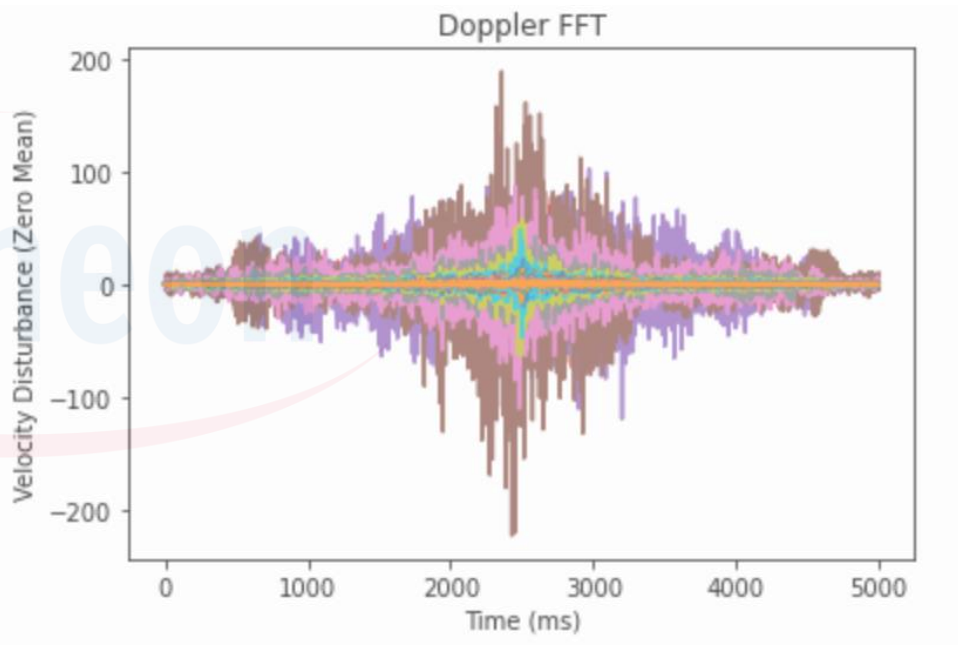
Data: Phase Data
Classes: 2 (Resting, Anxious)

No. of Training Samples: 180 per class

Moving and Quasi-Static State Classification

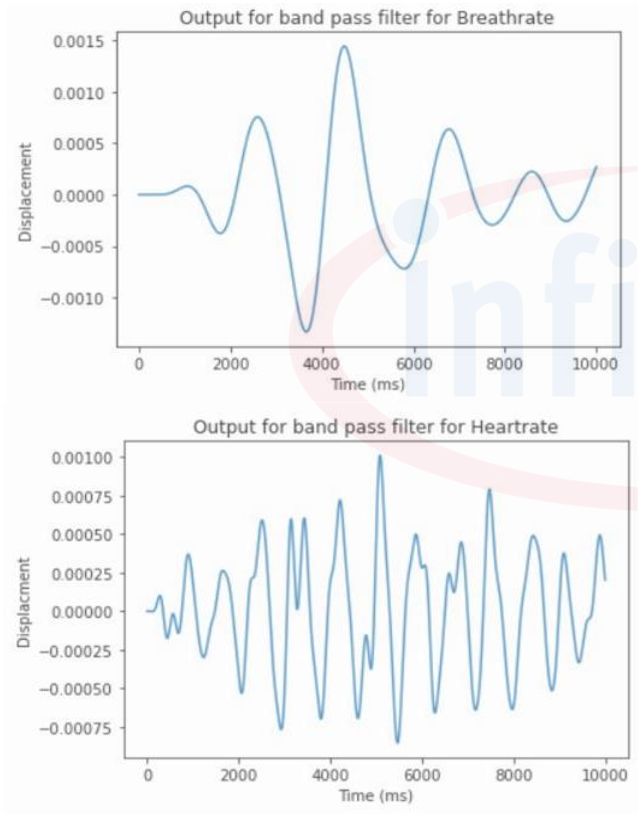


Velocity Deviation (Quasi-Static)

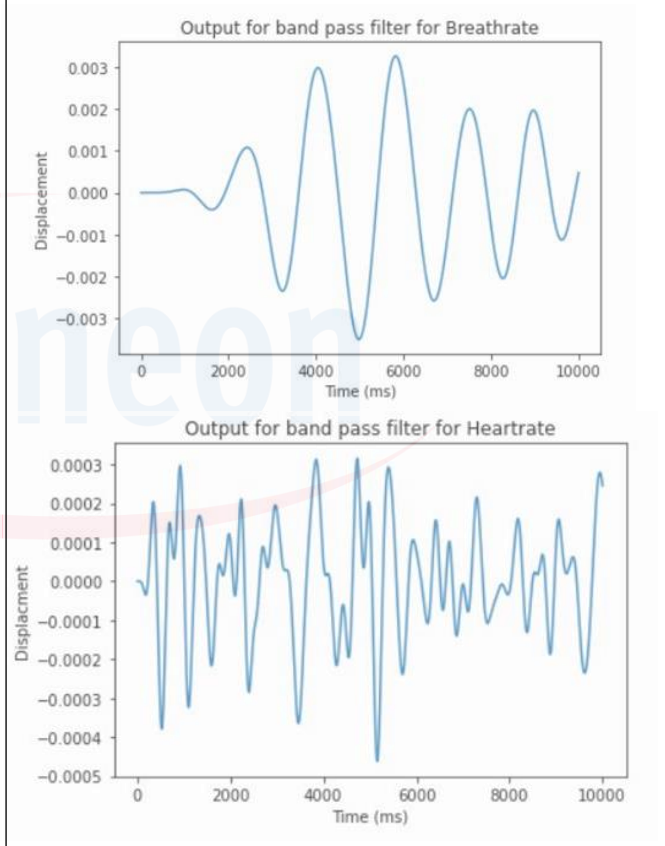


Velocity Deviation (Moving)

Resting and Anxious State Classification

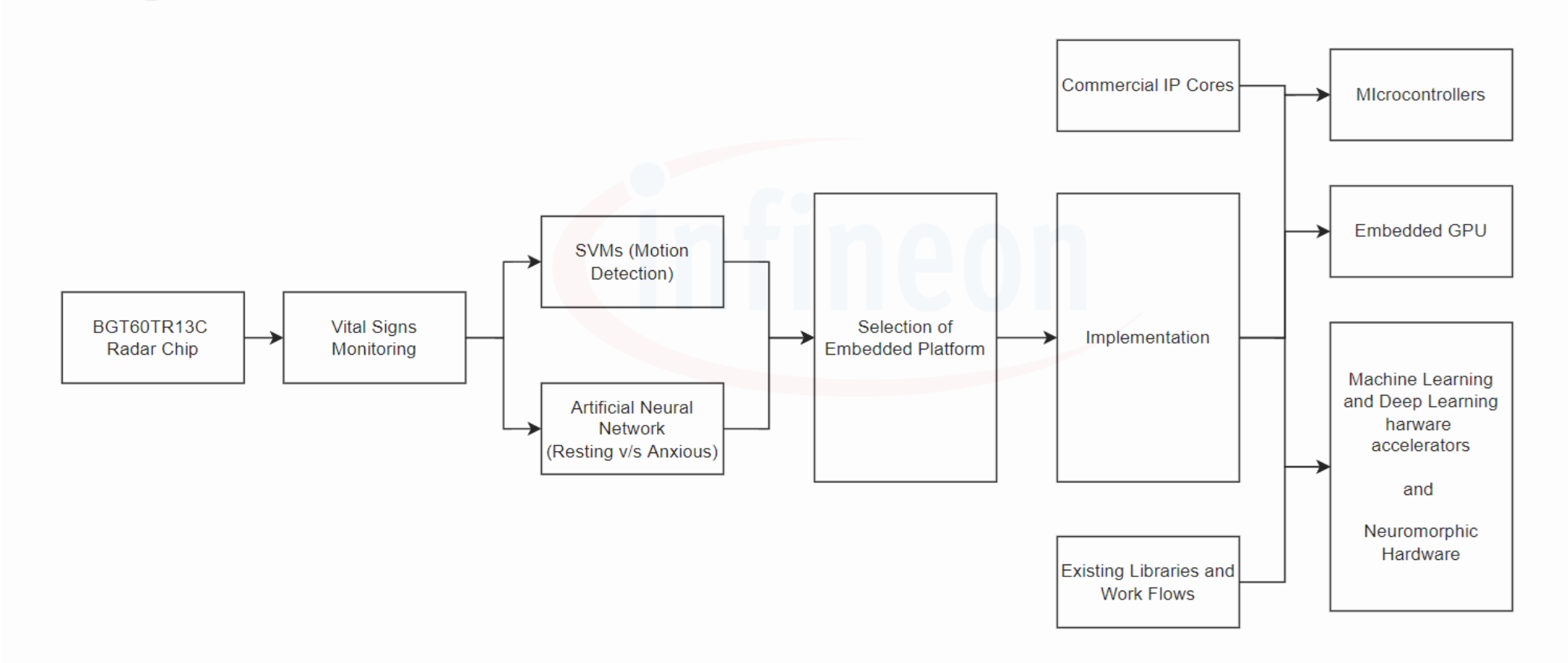


Heart Rate and Breathing Rate (Resting)



Heart Rate and Breathing Rate (Anxious)

Hardware Implementation (Embedded Perspective)



Hardware Implementation (Embedded Perspective)

Load Reduction

- Principal Component Selection
- Quantization

Conversion of skLearn models into C header files

- micromlgen — SVM, SVC, PCA (github project)
- Microsoft ELL — Neural Network (github project)
- Tensorflow Lite
- TinyML

Memory Management and Segmentation

Language

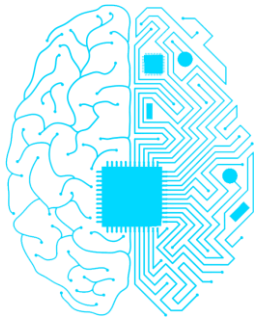
- C/C++
- Rust
- MicroPython

Embedded Learning

- Inference code generation
- FLASH programming
- Digital Filters Implementation

Interrupt handling

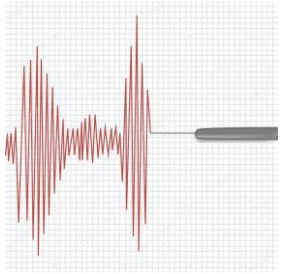
Future Scope and Possible Approaches



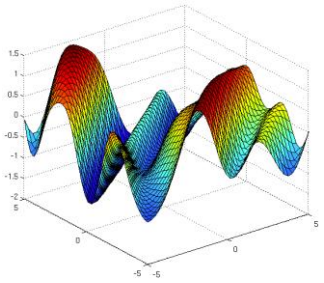
Better Machine Learning Models for Accurate Predictions

Information Fusion for Better Estimates

Drowsiness detection in vehicle drivers



Non-Contact Lie detectors



Probabilistic Output for Vital Sign Measurements

Connected Home IOT Devices