TU Delft 22/23

Detect chewing with IMU sensor

around the ear

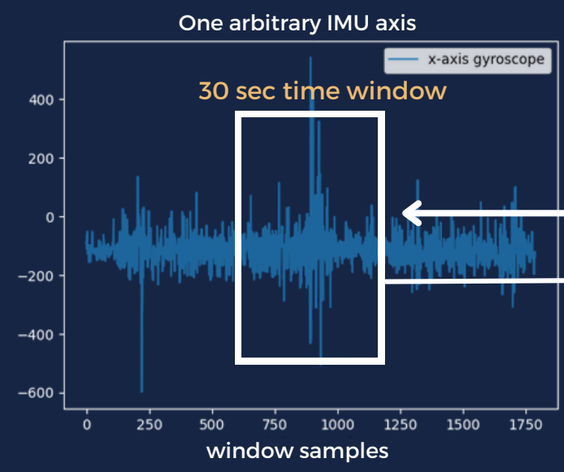
Background info

Overall Goal: track food intake
- beneficial for health industry

How: use IMU sensor to detect chewing episodes around the ear
- x, y , z-axis accelerometer
- x, y, z-axis gyroscope

Why:
- automatic food intake tracking
- sensor location around the ear can collect useful data
- easier integration in daily life (earable)

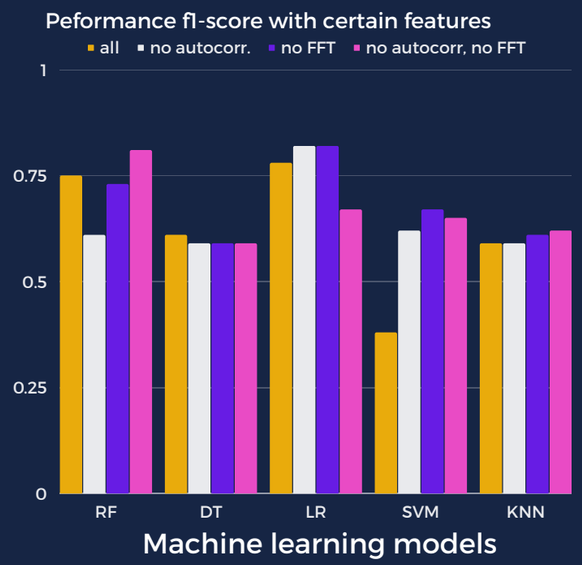
Research method



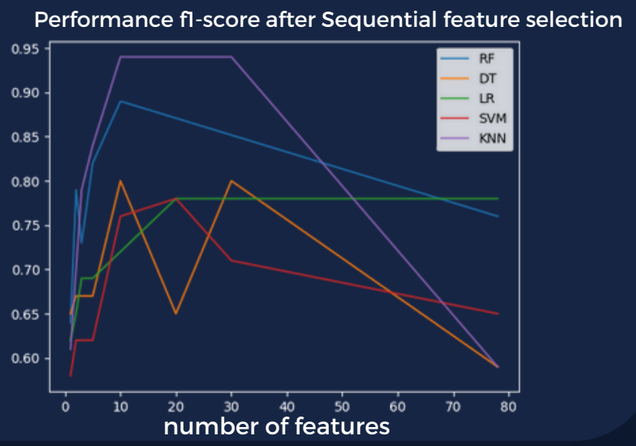
13 possible features

Data gathering
Downsampling (20Hz)
Low pass filtering
Osscilate around 0
30 sec time windows
Feature selection
Hyper parameter tuning
Performance analysis of ML models

Results



- Linear regression performs well
- RF performs best without autocorrelation and FTT features
- After sequential forward feature selection with size [1, 2, 3, 5, 10, 20, 30], most features seem to use the accelerometer data



Conclusion

- Detecting chewing episodes with one IMU around the ear seems to be promising with window frames, f1 score 0.6-0.8
- Combination of autocorrelation, FFT, other features seems to give higher performance f1-score
- Around 10/20 features to give highest performance

Further research:
- Collect data from more various participants
- Measure more activities, and do them simultaneously; for better representation of real use
- To try out on real embedded system, do analysis cost
- Next step in detecting food intake, e.g. swallowing, quantity

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