Smartphone active use recognition by movement sensors data

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Motivation & Objectives

- Succesfully apply Machine Learning techniques
- Be able to collect large amount of data ➡ Smartphone sensors

Recognize whether a mobile phone is being actively used by the user while moving:

Characterize if the device is on the hand or in the pocket of the user.

State of the Art

Related work:

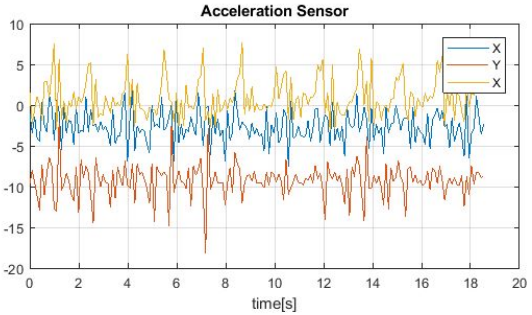
- Gait recognition for biometric identification (Kwapisz et al.)
- Phone context detection (Miluzzo et al.)
- Activity recognition

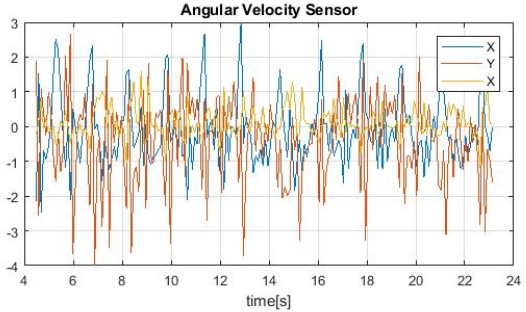
Methodology:

- Accelerometer, CO2, Camera,...
- Model per instance (true-false classification)
- Raw data: fixed time-series sensing

Proposed solution

- Fixed time-series accelerometer & angular velocity sensors
- Instances
  - 4 Main states (S1-S4)
  - 2 Transitions
  - 1 additional state
- Unique model





Implementation

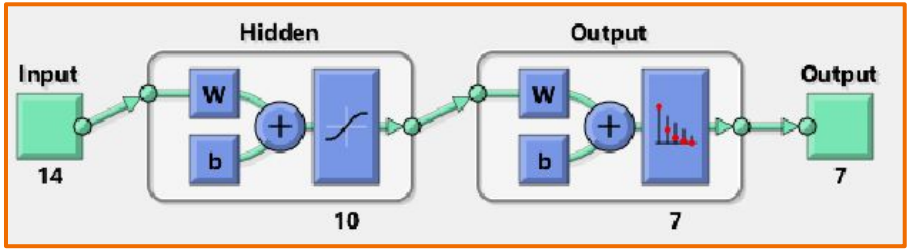
Feature vector (14)

- Acc. means [x y z]
- Acc. stdev. [x y z]
- Acc. energy
- Angv. means [x y z]
- Angv. stdev. [x y z]
- Angv. energy

$$\sqrt{(\sum_{i=0}^{N} x_i)^2 + (\sum_{i=0}^{N} y_i)^2 + (\sum_{i=0}^{N} z_i)^2}$$

Model: Pattern Recognition Neural Network

- Hidden Layer (1)
  - 10 Nodes
  - Hyperbolic Tangent Sigmoid function
- Output Layer
  - 7 Nodes
  - Softmax function



Results & Conclusions

- Model recognizes with 100% accuracy principal states + additional state
- Model performs well also for transitions

➡ Signal preprocessing could increase its performance