
# Task

Group 28

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# Motivation and Aim

**Project A1**
Data Source: **Smartphone 1**
Sensor Signal: **acc**
Validation: **2, 5 and 10 fold subject-wise**
Compare Error based on **Number of folds in cross validation**

**Motivation:**

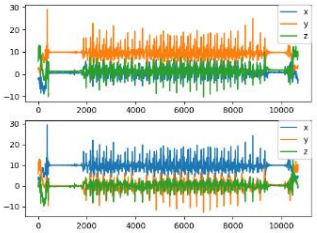
1. Everyone has a smartphone. Easy tracking and early indication of health problems
2. Subject wise should be better than record wise in biomechanics. More subjects → better prediction for new subjects

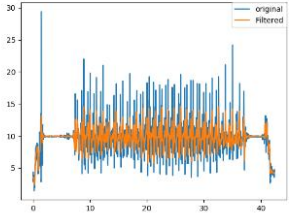
**Aim:**
Carry out binary classification of normal walking and impaired walking based on data collected using smartphone app - Phyphox

# Data pre-processing

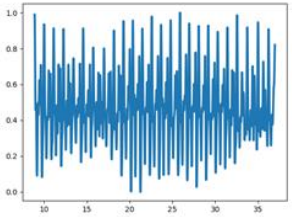
Read data → Get Frequency → Rotation → Filtering Noise

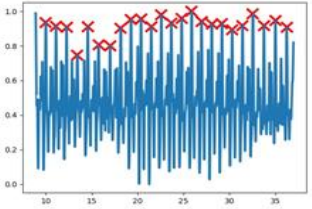
Smartphone 1 ≈ 400Hz
Smartphone 2 ≈ 200Hz
Smartphone 3 ≈ 250Hz
Smartphone 4 ≈ 100Hz

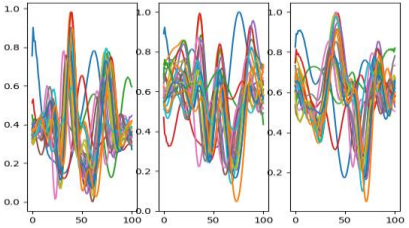


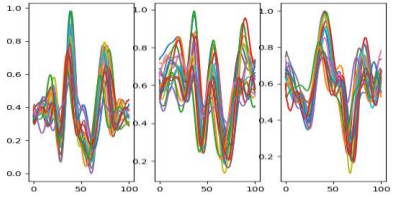




Extracting motion sequence → Segmentation → Resample into same time frame → Check and remove malicious sequence (Not Used)





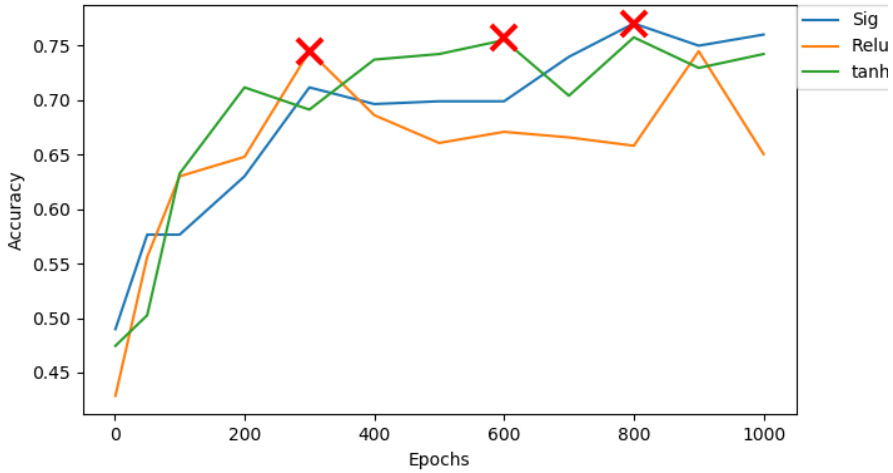




# Neural Network Model

## Parameters Studied:

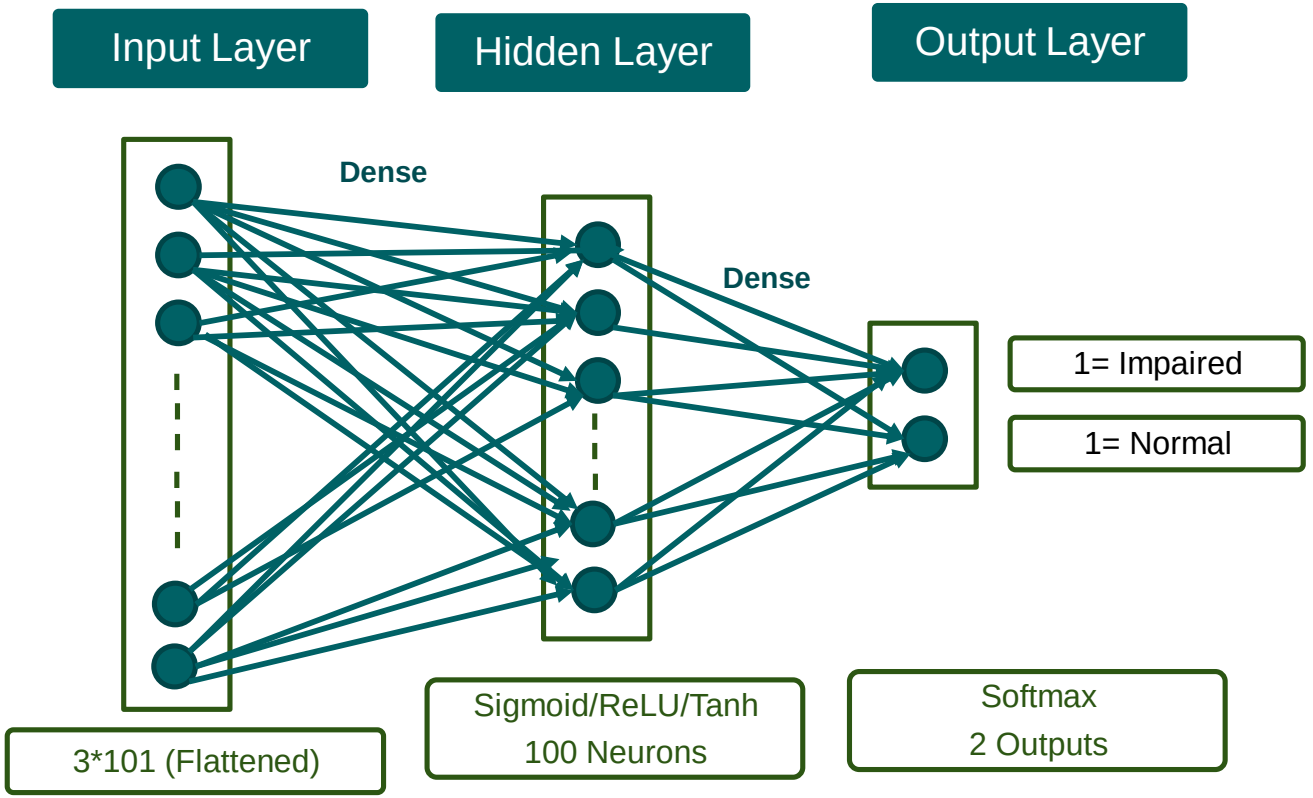
- Number of Hidden Layers
  - 0, 1, 2, 3, 4, 5
- Number of Neurons in each layer
  - 4-303
- Activation functions in each layer
  - Sigmoid
  - ReLU
  - Tanh
  - Softmax/Sigmoid




## Compiling & Fitting

- Optimizer: Adam
  - Varying Learning Rates
- Loss
  - Binary Crossentropy/ Sparse Categorical Crossentropy
- Epochs, Batch Size, Shuffle

# Neural Network Model




Epochs=800/300/600

Learning Rate=0.001

Shuffled Data

Sparse Categorical Crossentropy

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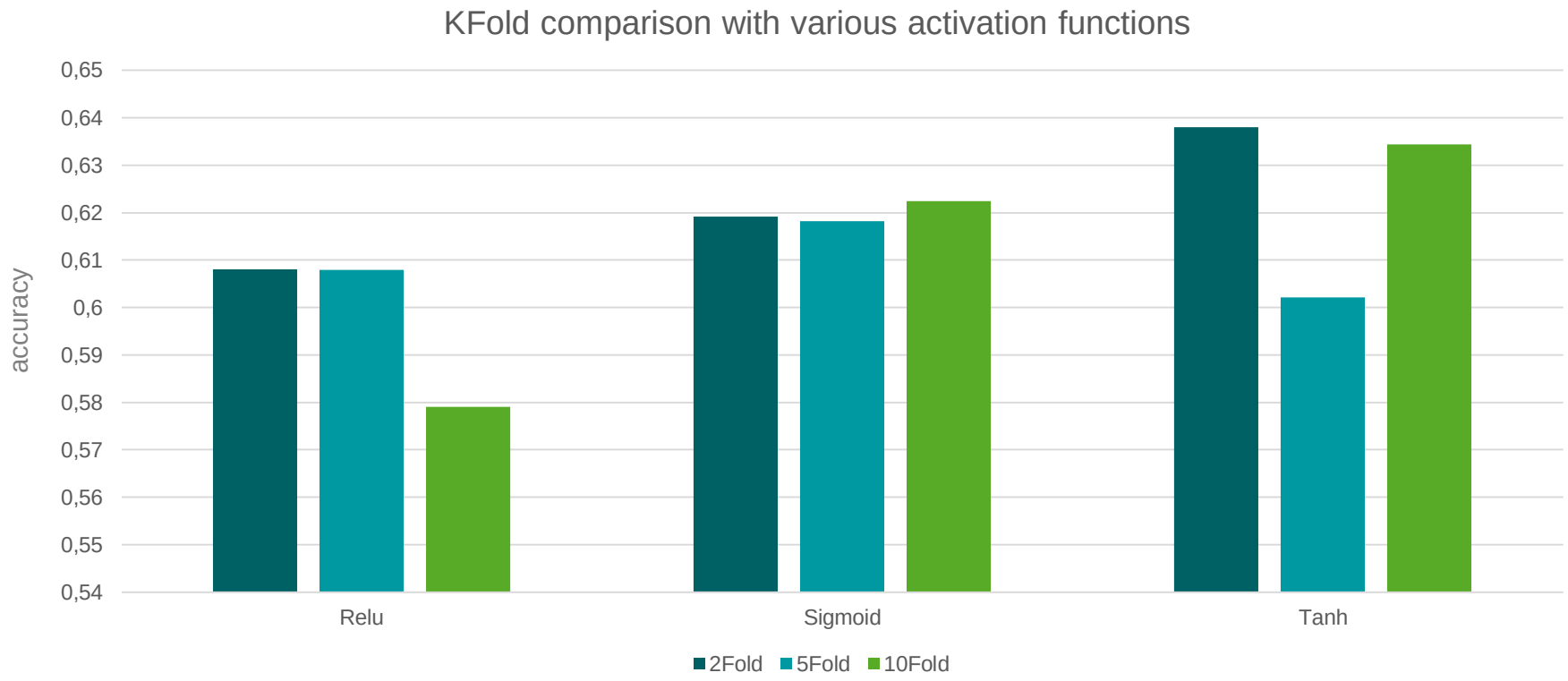
Class weights (Impaired>Normal)

# Results


KFold comparison with various activation functions
accuracy
0,65
0,64
0,63
0,62
0,61
0,6
0,59
0,58
0,57
0,56
0,55
0,54
Relu
Sigmoid
Tanh
2Fold
5Fold
10Fold

# Discussion and conclusion

KFold CV did **not improve** accuracy with bigger K

1. Higher K decreases likelihood of bias, 2Fold not overfitting in the first place
2. If in Subject-wise CV bad Subject used for testing, incorrect prediction
3. Neuronal Network Model is not sufficient

**Improving Neural Network:**

- Increase number of hidden layers
- Change activation function
- Vary the number of neurons
- Optimize neural network model (eg. New optimizer, loss function, etc.)

# Thank you for your attention!