Task A45

Group 2

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24.12.2020

Team Members and Work Distribution

Abimathi Siva Subramanian 403592   (Member 1)
Anna Garoufali   405801   (Member 2)
Daria Gelbich   405860   (Member 3)
Rohan Krishna Balaji   403596   (Member 4)

Pre-processing
- Reading data and Frequency estimation : Members 1, 2,3 ,4
- Filters   : Members 1,2
- Cropping data   : Member 1
- Rotation   : Members 1,3
- Segmentation   : Members 4,3
- Resampling   : Members 4,2
- Removing malicious sequences   : Member 4

Neural Networks
- Optimizing parameters   : Members 1,2,3,4
- Code Unification and Structuring   : Members 1,4
- Code Comments   : Member 1
- Presentation slide preparation   : Member 2,3,4

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Project Description

Data source: Smartphone 3 and sex and age

Sensor signal: Acceleration and Gyroscope Data

Validation: 5 fold subject-wise

Compare the Results obtained based on different anthropometric parameters (sex & age)
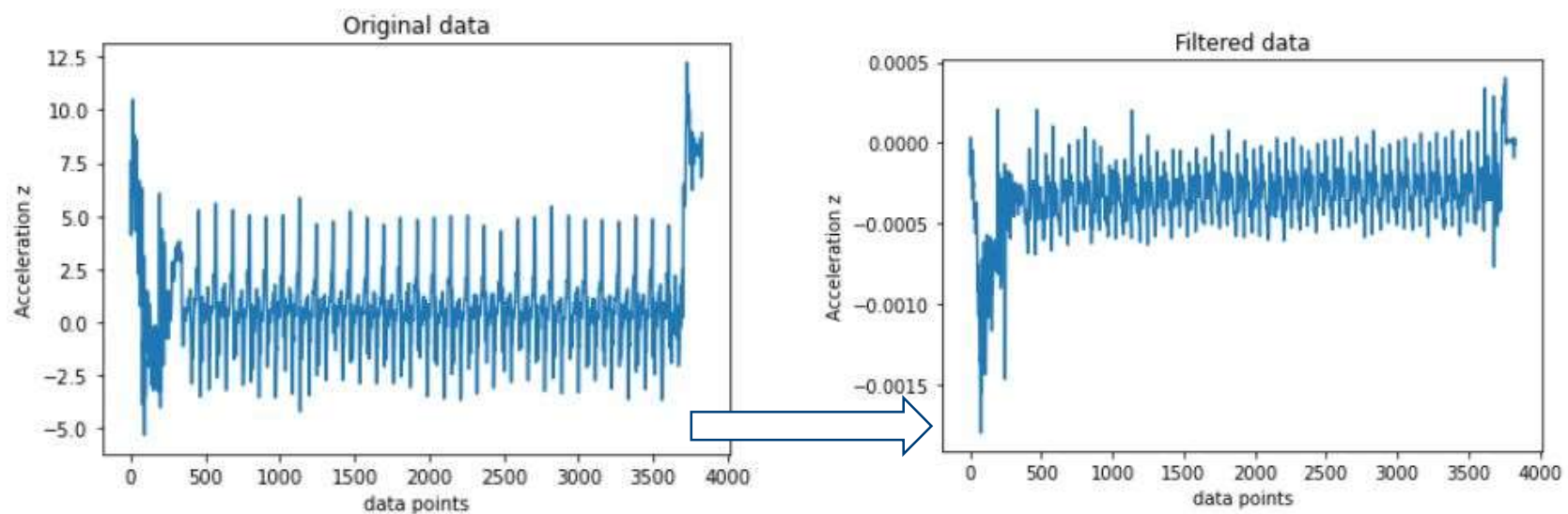
Step 1&2: Reading Files and passing them into functions

Read the CSV file to numpy array. This data is passed as parameters into function to perform specific preprocessing tasks (filtering, cropping, rotation, segmentation and resampling).

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Data Preprocessing

Step 3: Implementation of Filter

Butterworth filter is used to filter the high frequency noise present in the data.

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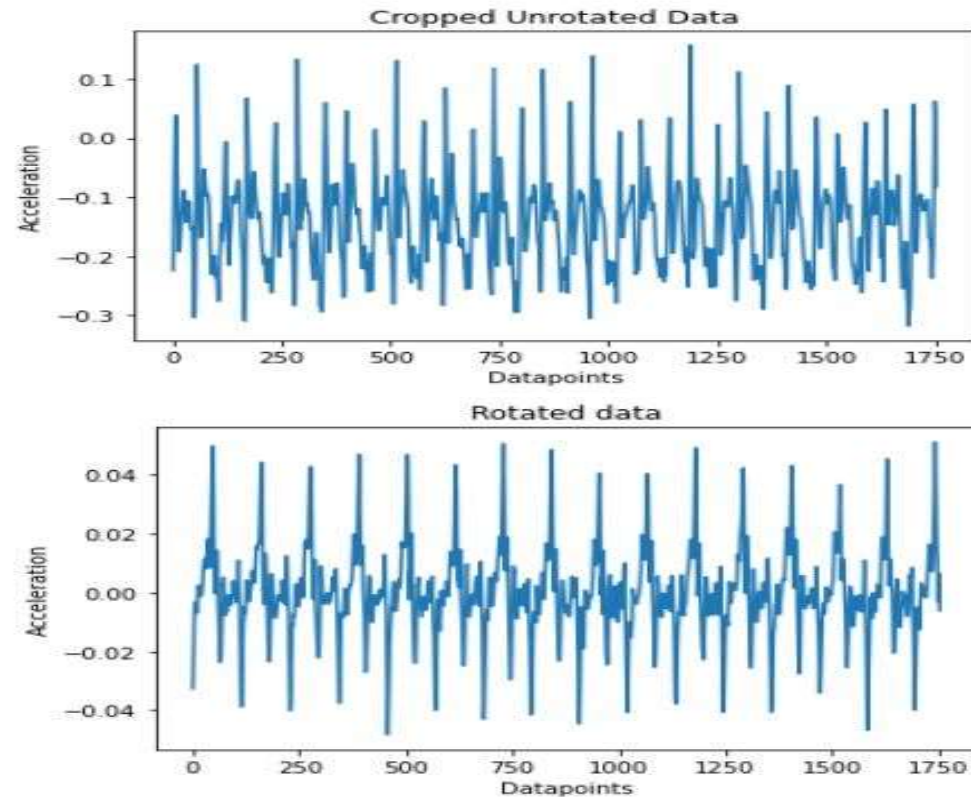Abimathi Siva Subramanian, Anna Garoufali, Daria Gelbich, Rohan Krishna Balaji
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Data Preprocessing

Step 4: Cropping

Elimination of undesirable
data, to obtain the starting
and ending points of the
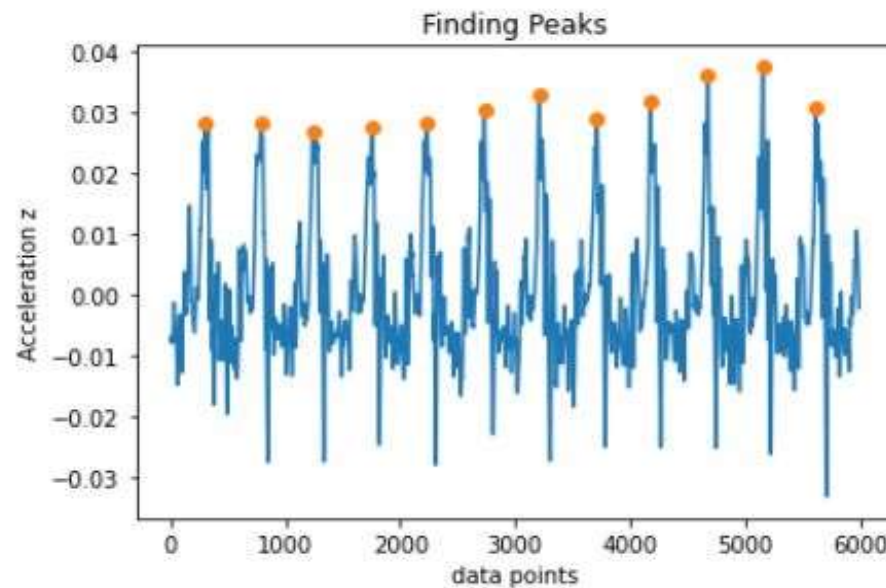trail.

Before cropping
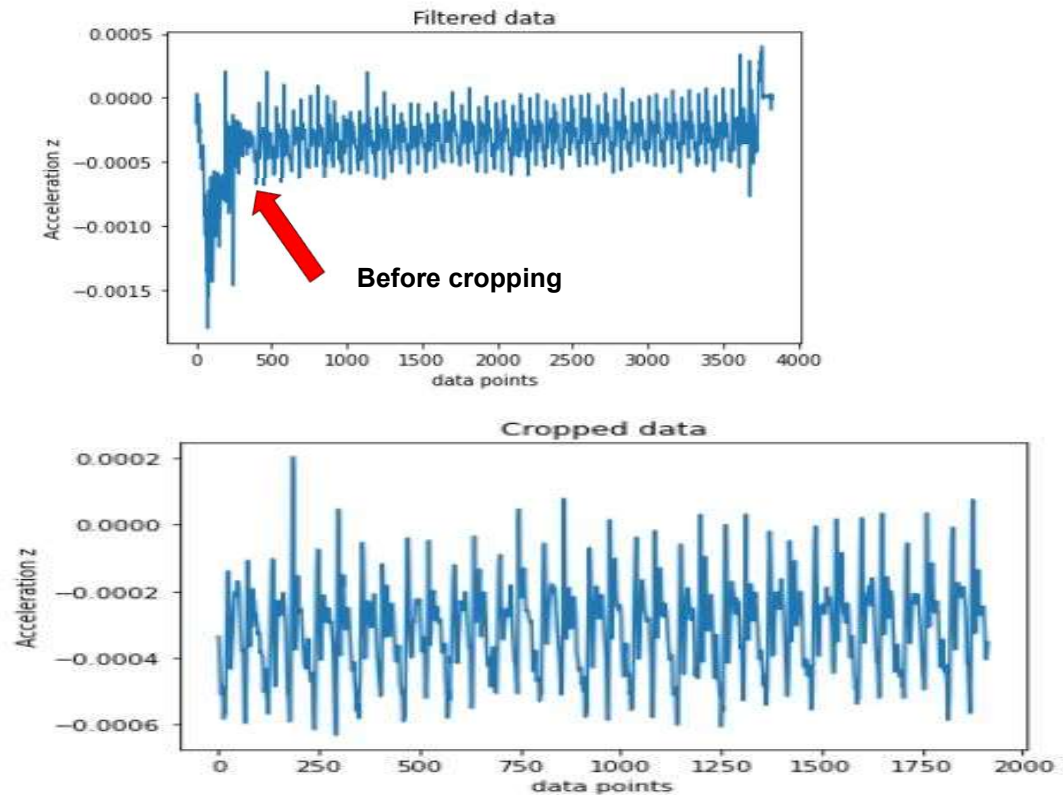
Data Preprocessing

Step 5: Rotation

The scaled data is centered
and then the data is rotated
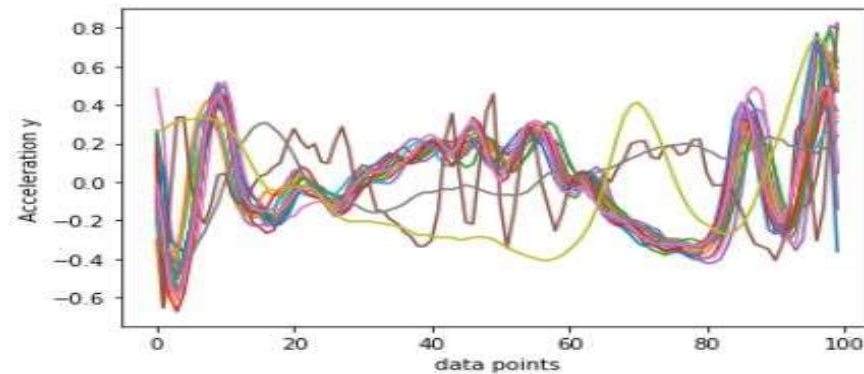such that the acceleration is
maximum along one axis

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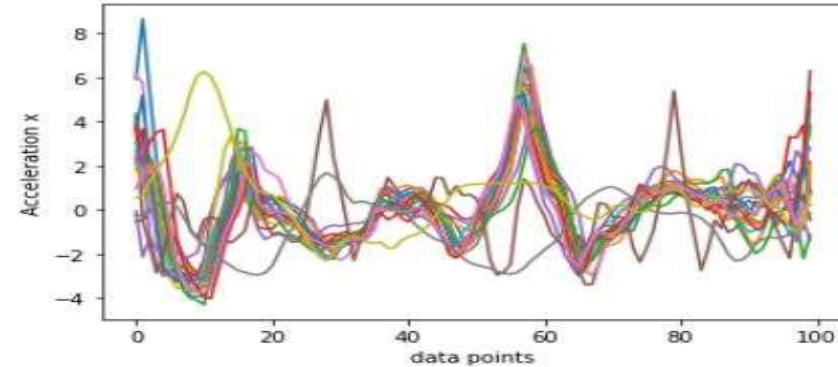24.12.2020

Data Preprocessing

Step 6: Segmentation

The peaks in the data are
identified so that the whole
motion sequence is segmented
into different steps.

Finding Peaks

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Data Preprocessing

Step 7: Resampling
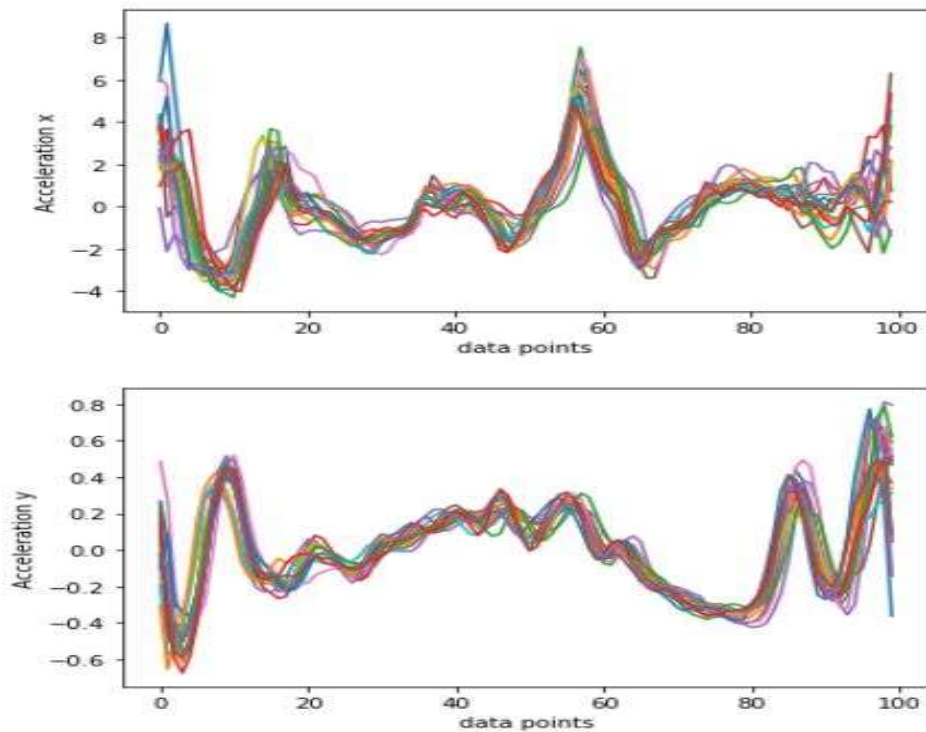
The different samples have
different number of data points,
so resample them such that all
the samples have equal number
of data points.

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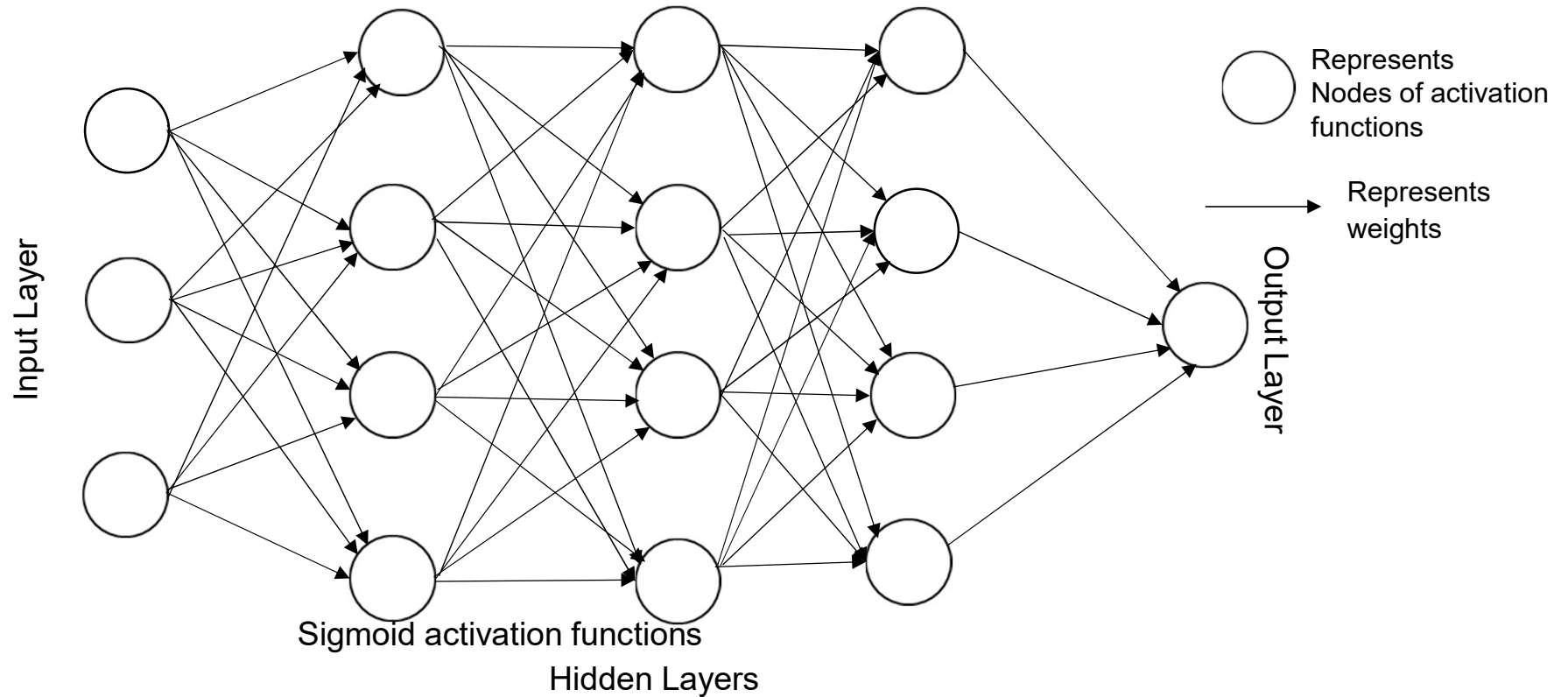24.12.2020

Data Preprocessing

Step 8: Elimination of Malicious Sequences

The mean and standard deviation of all the data at each point is calculated. If the points in the sample lie outside the threshold (mean + or - std) then they are removed as outliers.

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Neural Networks (1/2)

Represents
Nodes of activation
functions

Represents
weights

Input Layer

Output Layer

Sigmoid activation functions

Hidden Layers

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Results

Age		Sex	
Accuracy (in %)	Loss	Accuracy (in %)	Loss
56.14	0.683	51.42	0.698
57.23	0.674	56.12	0.686
51.42	0.698	51.74	0.705
56.45	0.673	57.23	0.683
63.24	0.632	**63.25**	0.676

Average Loss Based on Sex   : 0.682
Average Accuracy Based on Sex: 56.89 %
Average Loss Based on Age   : 0.692
Average Accuracy Based on Age: 55.97 %

Note: Accuracy represents the fraction (percentage) of correct classification of predicted data to label data (i.e., Normal or Impaired)

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Conclusion

Observations and Conclusion:
- Quality of Data and Pre-processing has significant influence on performance of Neural Network
- Influence of Anthropometric data is less significant in classification
- Structure of Neural network, activation functions and other parameters had very limited influence on results

- **We can predict if the subject walking has Normal or Impaired gait using motion data with a probability of just over 55% irrespective of his age or sex.**

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Thank You

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