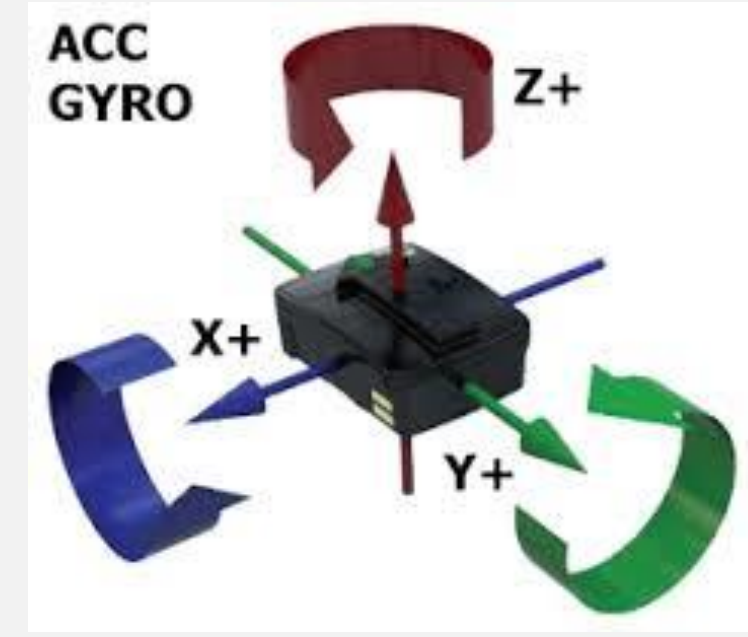


# CLASSIFICATION OF HAND GESTURES FROM WEARABLE IMUs USING DEEP NEURAL NETWORK

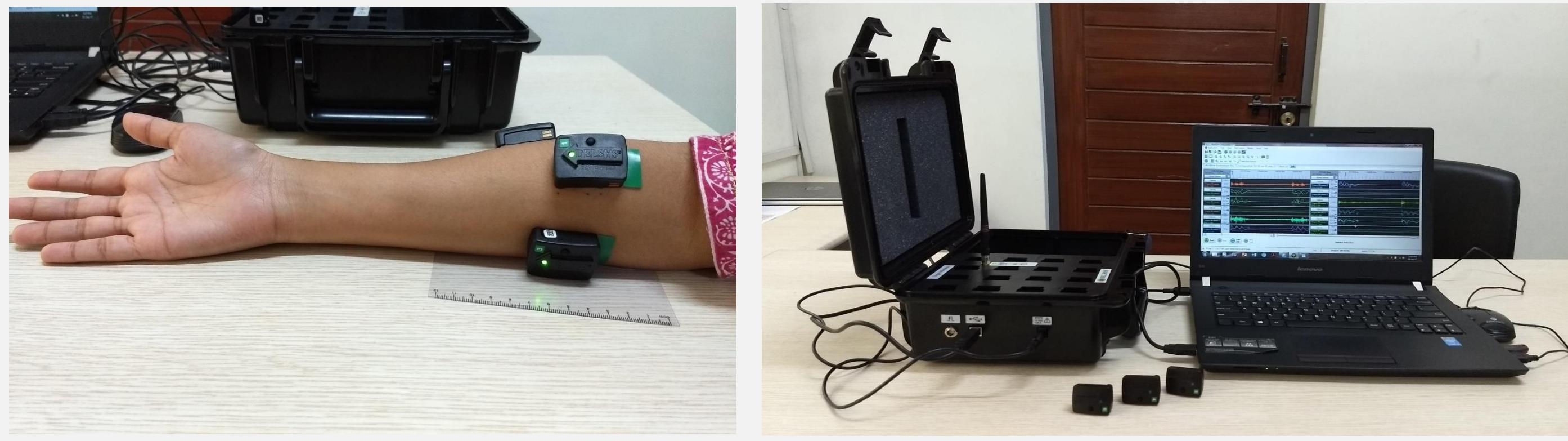
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## INTRODUCTION

An Inertial Measurement Unit (IMU) consists of tri-axial accelerometers and gyroscopes which can together be used for motion analysis.



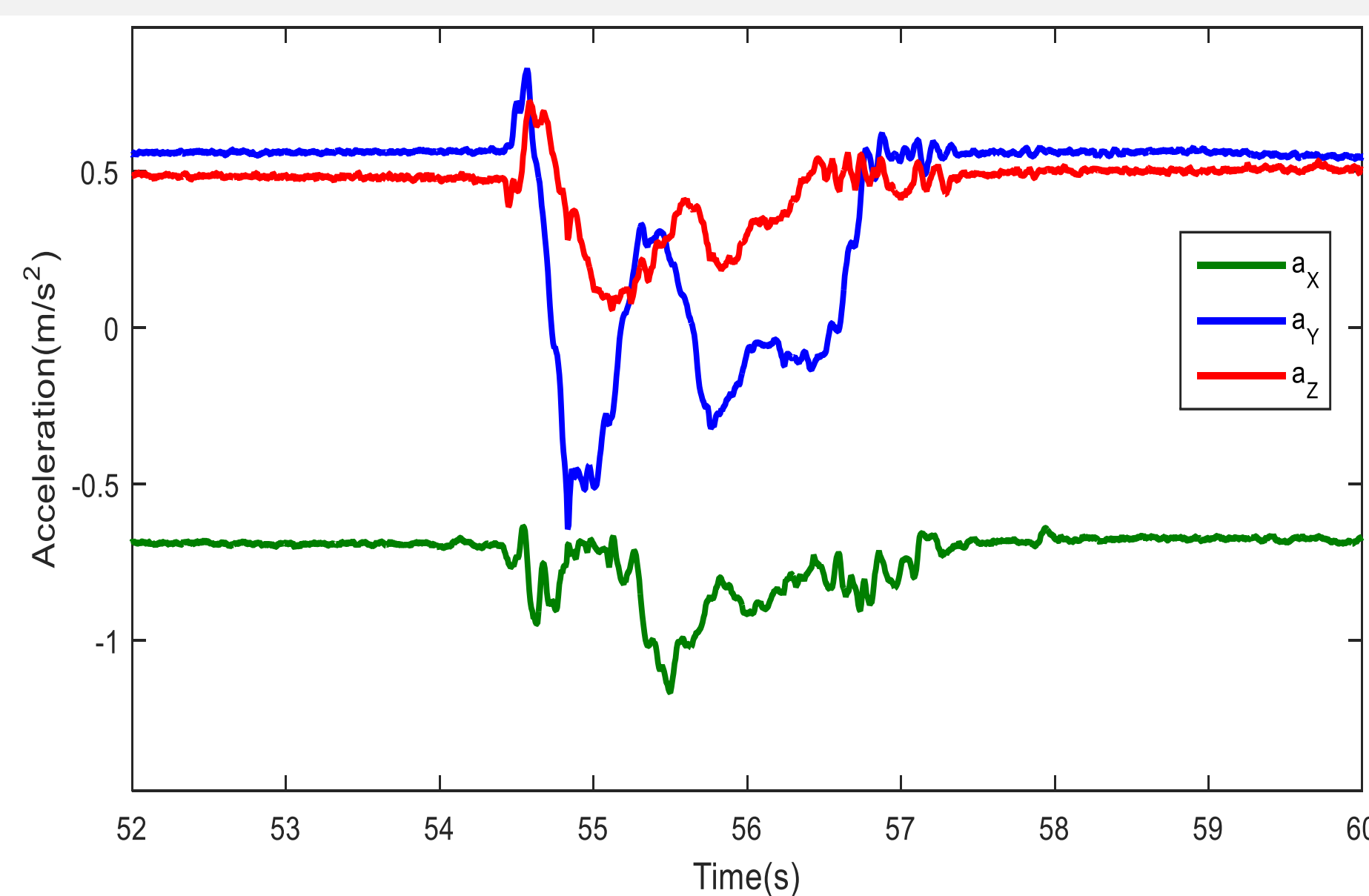
### Wireless IMU Sensor System for Recording Hand Gestures



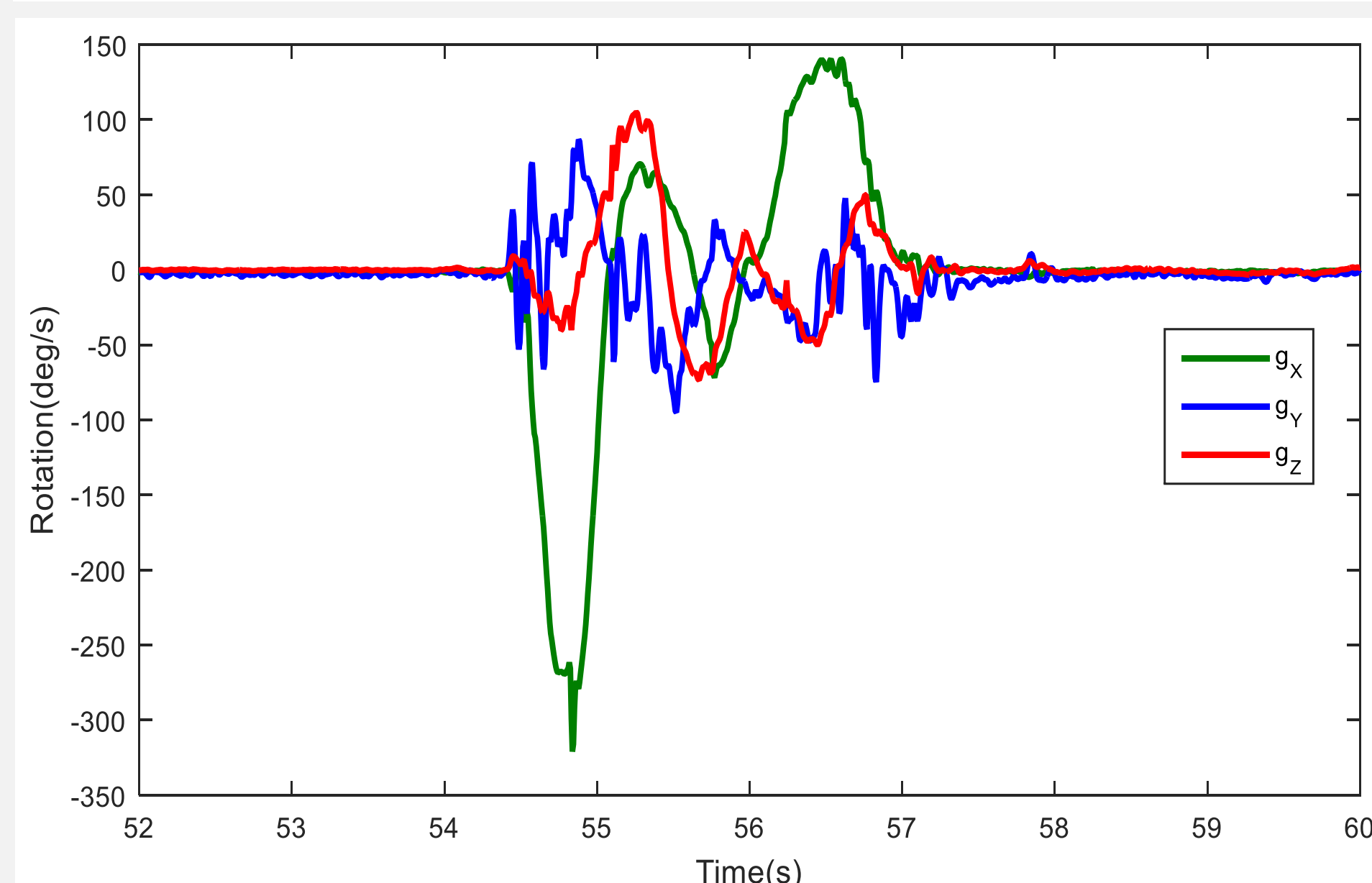
## IMU SIGNALS USED FOR HAND GESTURE CLASSIFICATION

Accelerometers measure specific force along the x-, y- and z-directions

Sampling Period: 6.75 ms/axis  
Resolution Depth: 16 bits

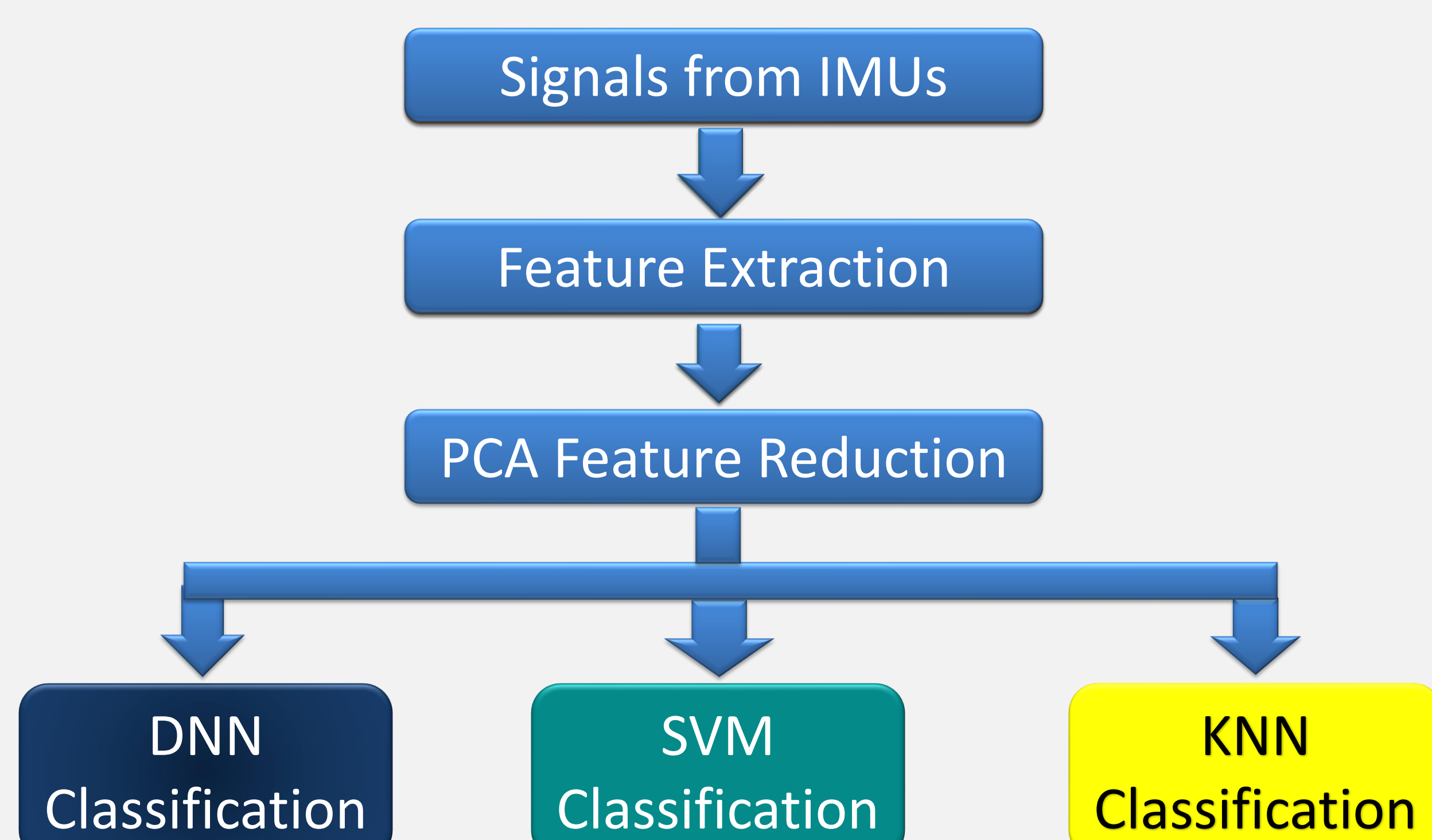


Gyroscopes measure the rotation rate along the x-, y- and z-directions

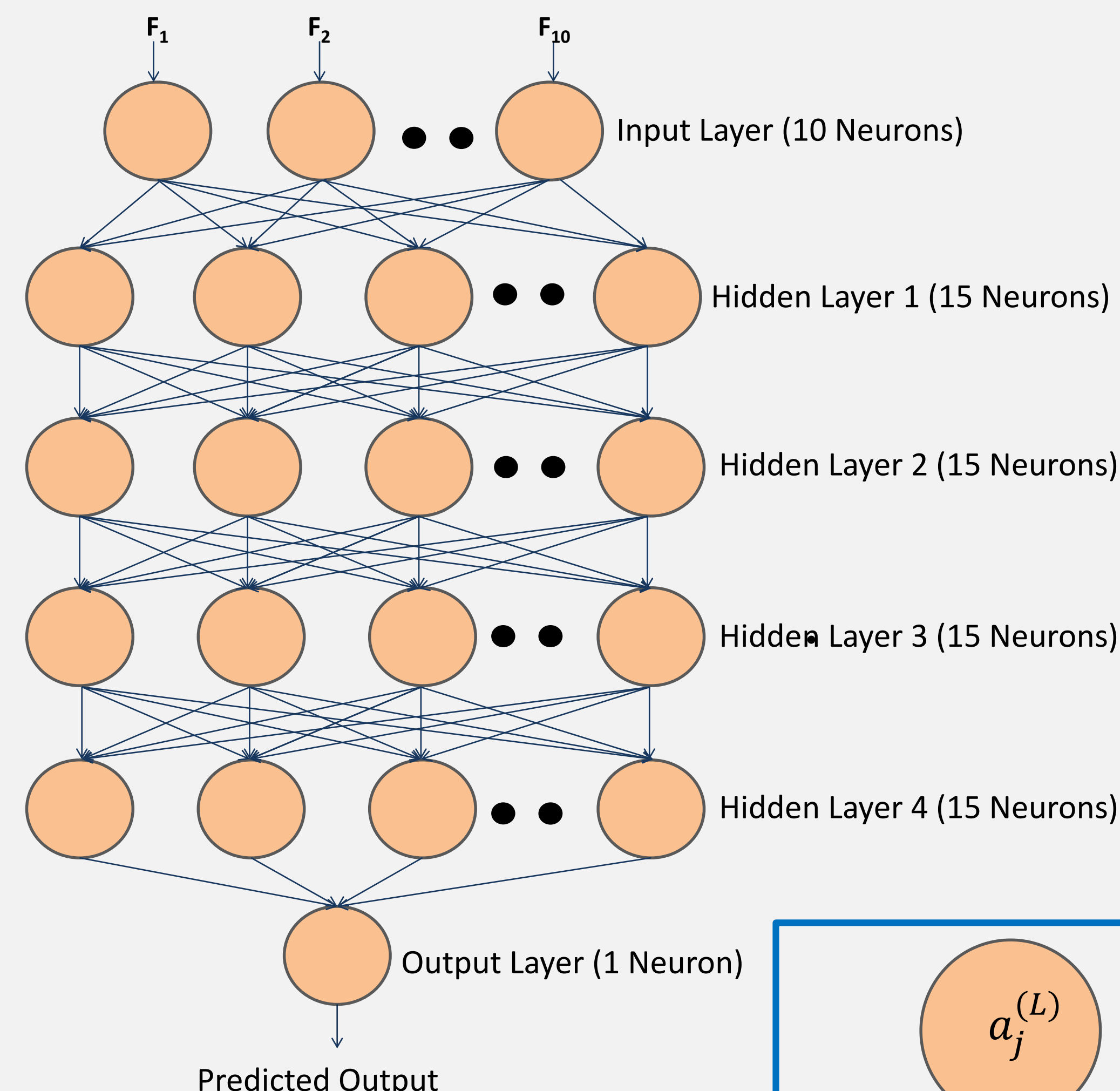


IMUs can capture information during dynamic hand motions and is hence, useful in Sign Classification

## FLOW CHART OF THE PROPOSED METHOD



## PROPOSED DNN CLASSIFICATION APPROACH



- Activation Function for the network

$$g(x^{(i)}) = \frac{1}{1 + e^{-x^{(i)}}}$$

- Feed-forward computation of features yielding predicted output followed by back-propagation of errors.

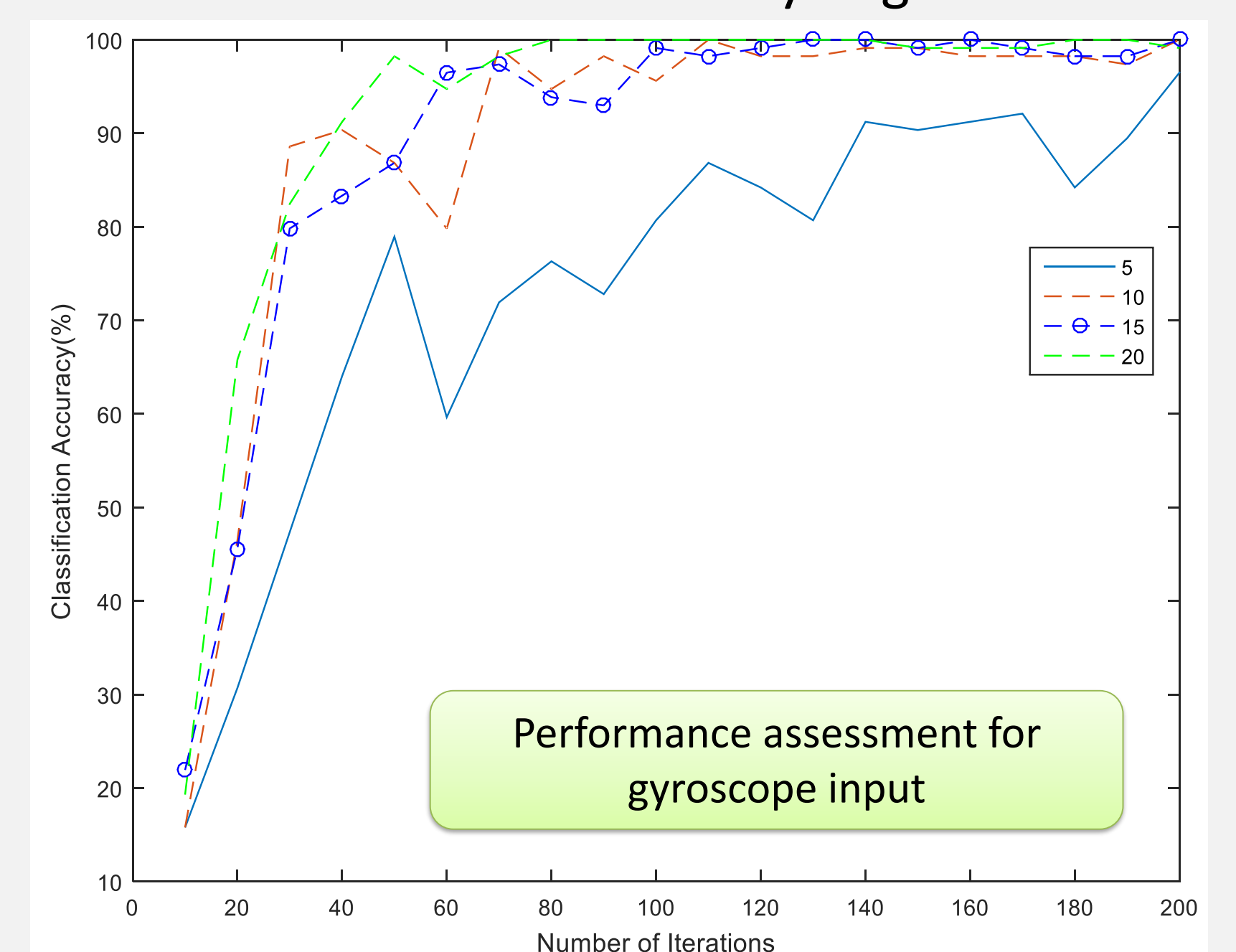
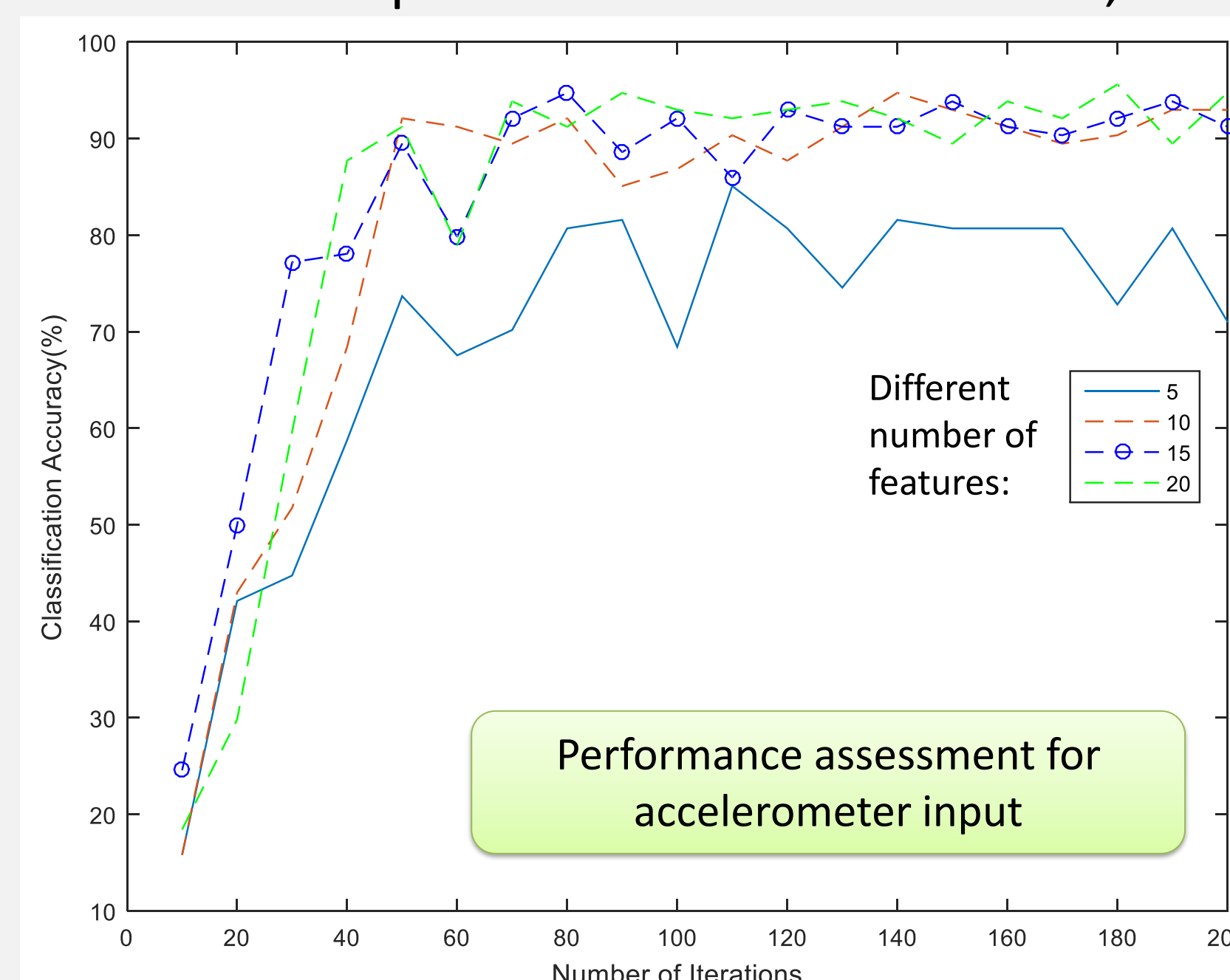
- Error Minimization using back-propagation-

$$\delta_j^{(5)} = a_j^{(5)} - y_j$$

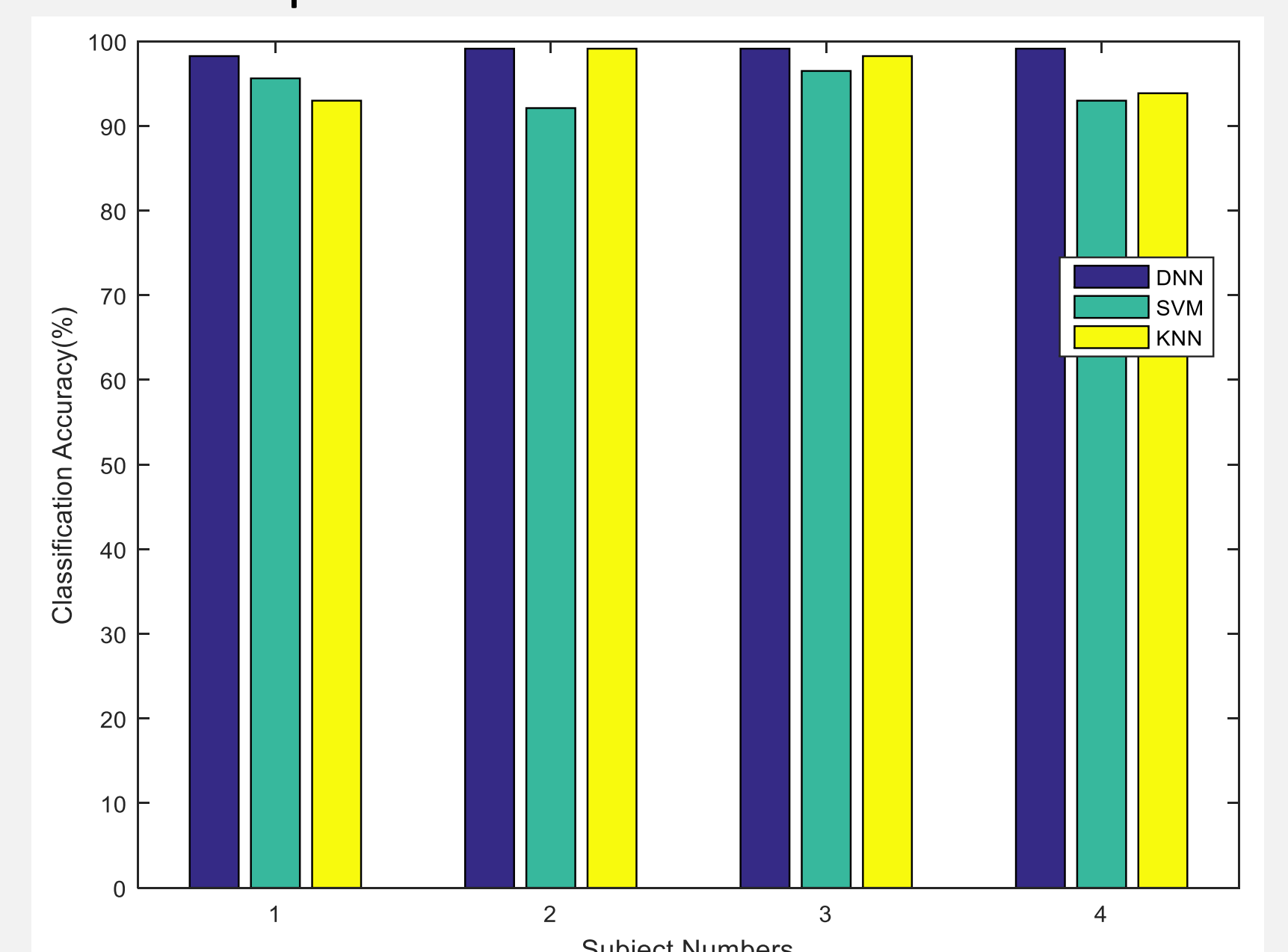
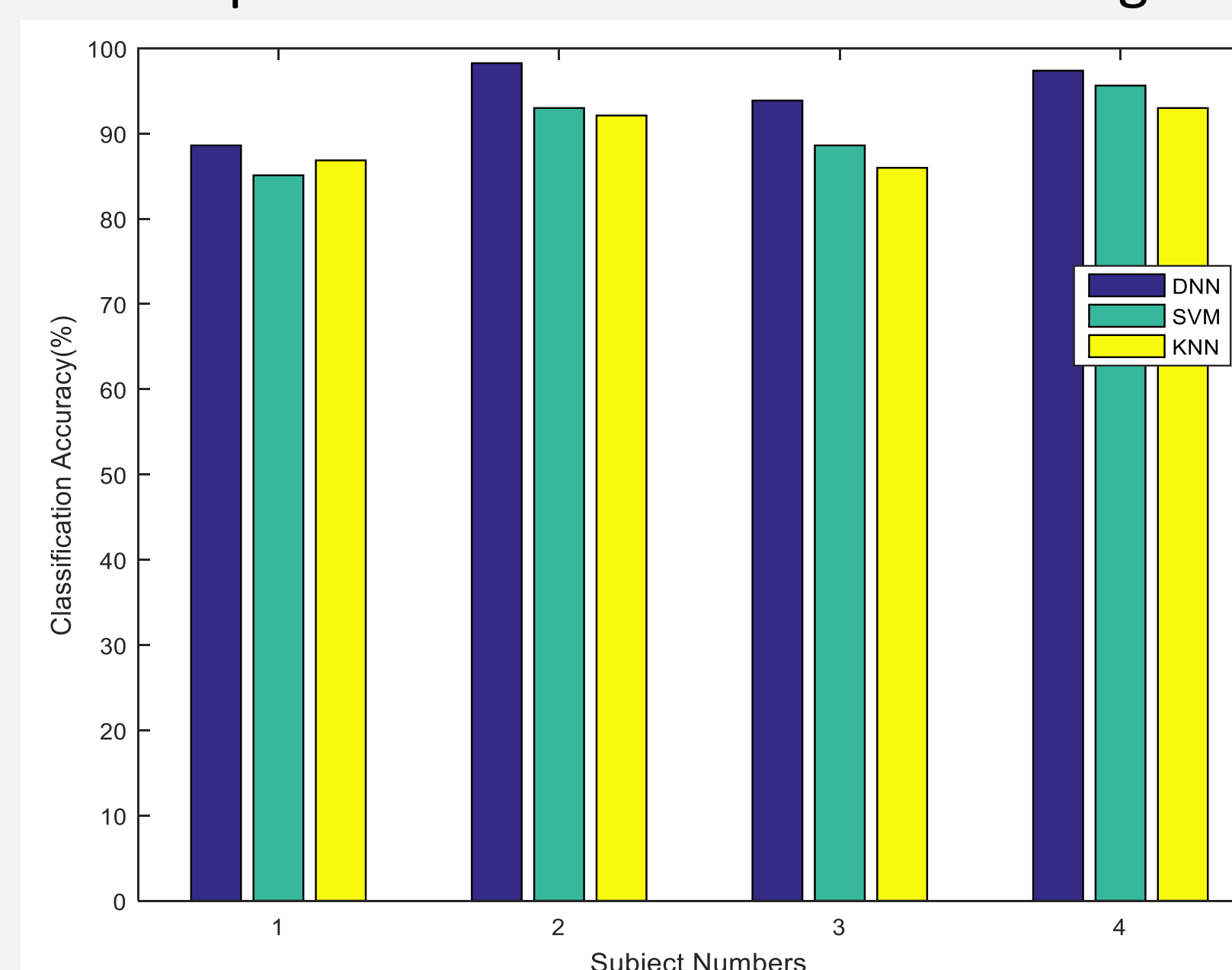
$$\delta_j^{(L)} = a_j^{(L)} * (1 - a_j^{(L)})$$

## RESULTS AND DISCUSSION

At around an Optimal Number of Iterations, the variation in Classification Accuracy begins to settle:



Better performance of the DNN-based algorithm when compared to the conventional classifiers:



Paper based on this research: Karush Suri, Rinki Gupta "Classification of Hand Gestures from Wearable IMUs using Deep Neural Network," *IEEE 2<sup>nd</sup> International Conference on Inventive Communication and Computational Technologies (ICICCT 2018)*, 20-21 April, pp. 1-6, 2018.

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