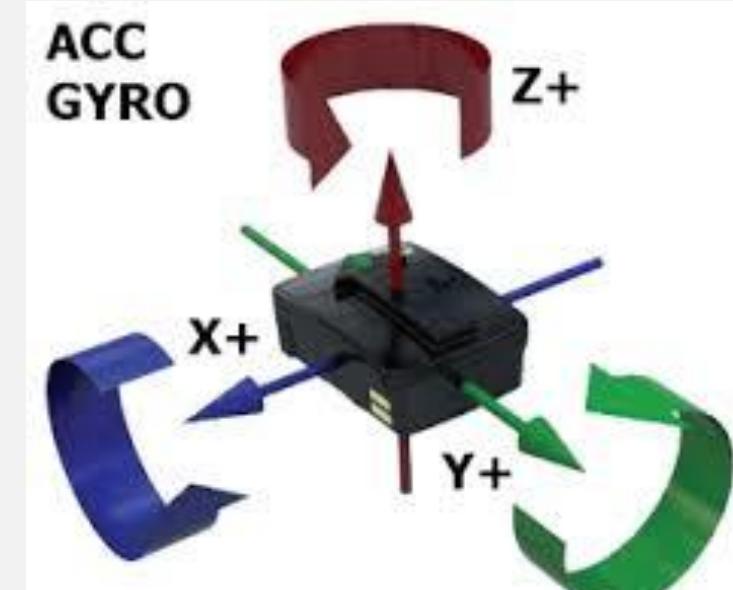


CLASSIFICATION OF HAND GESTURES FROM WEARABLE IMUs USING DEEP NEURAL NETWORK

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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.

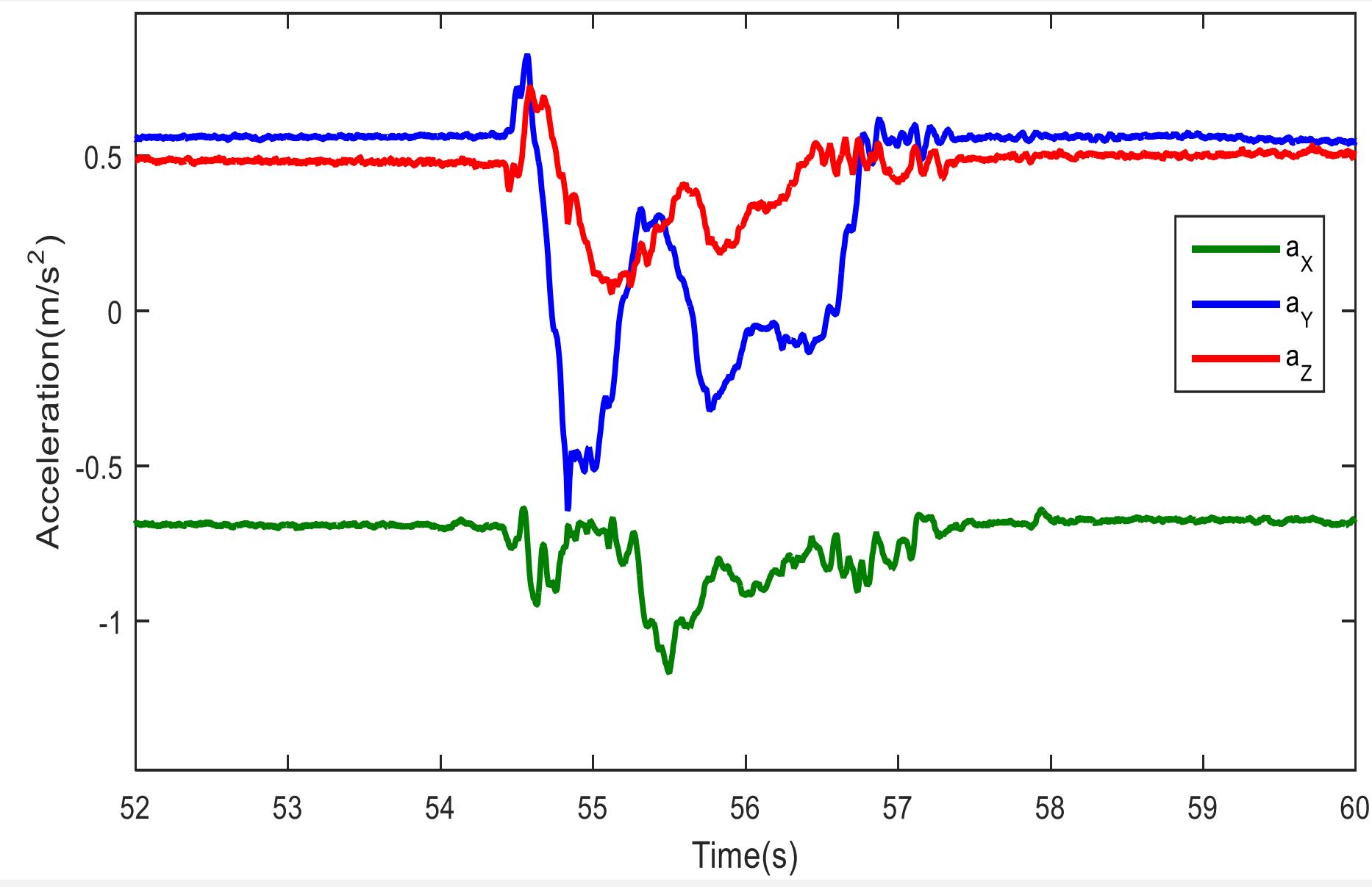


Wireless IMU Sensor System for Recording Hand Gestures



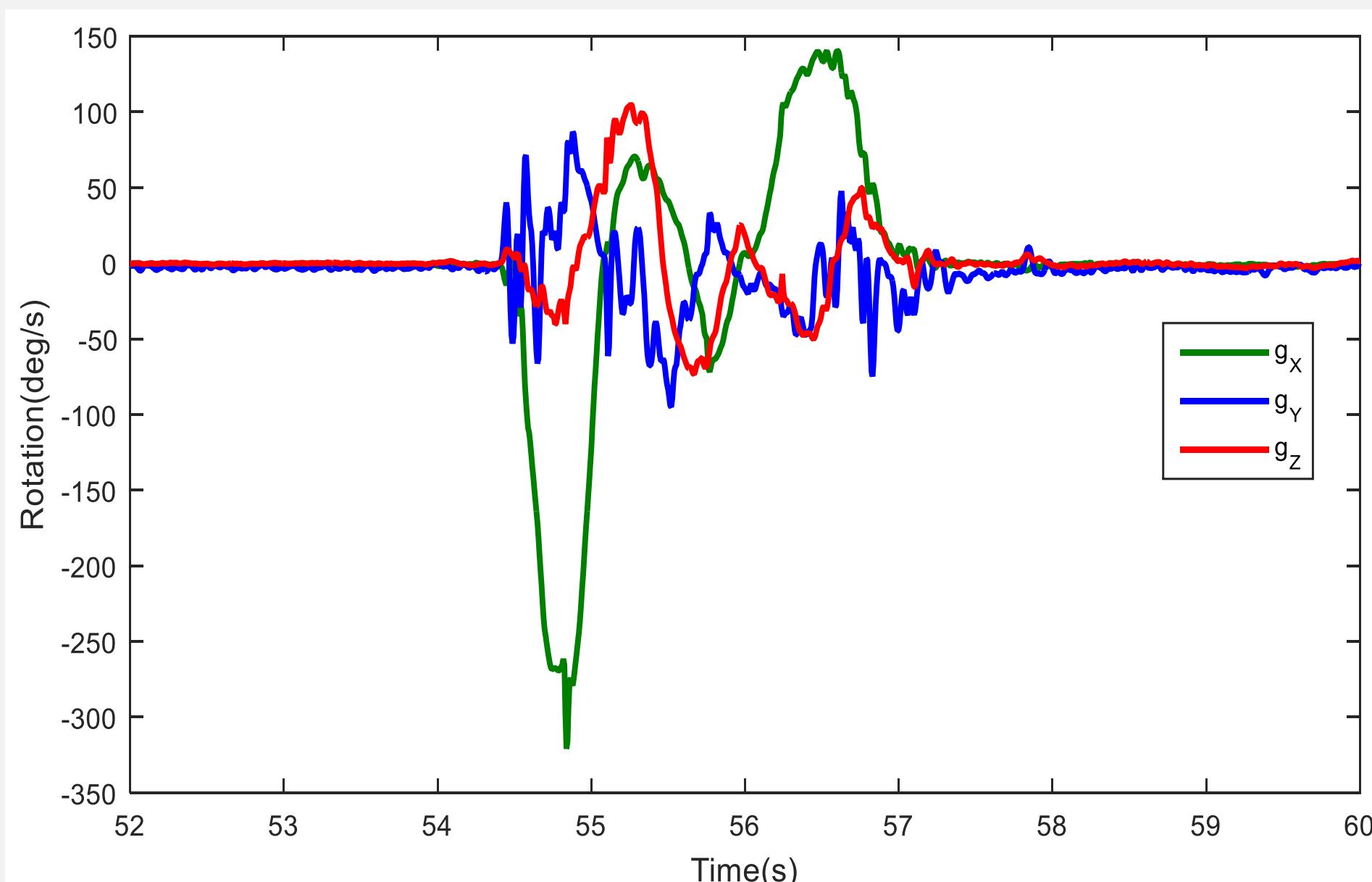
IMU SIGNALS USED FOR HAND GESTURE CLASSIFICATION

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



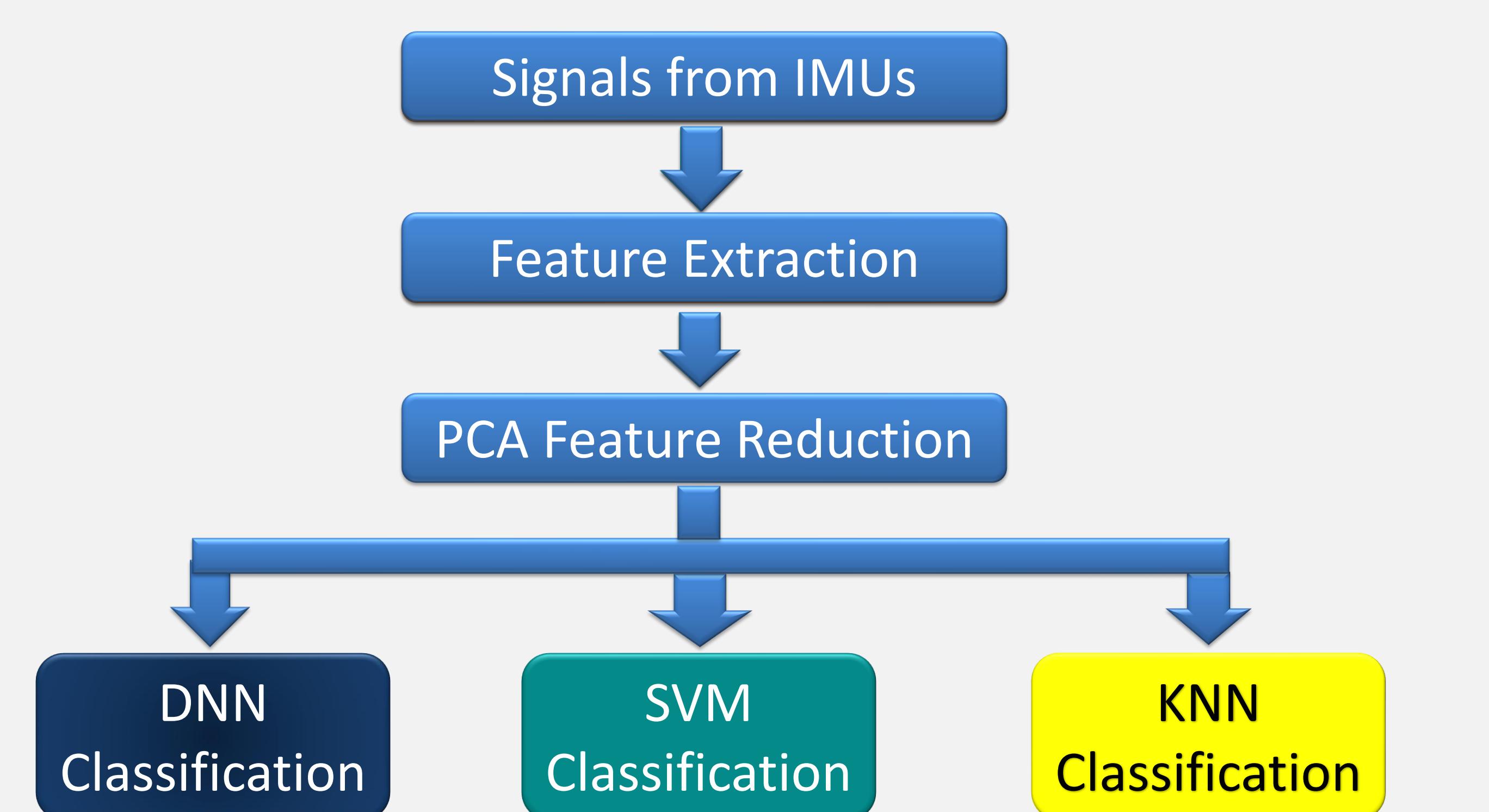
Sampling Period: 6.75 ms/axis
Resolution Depth: 16 bits

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

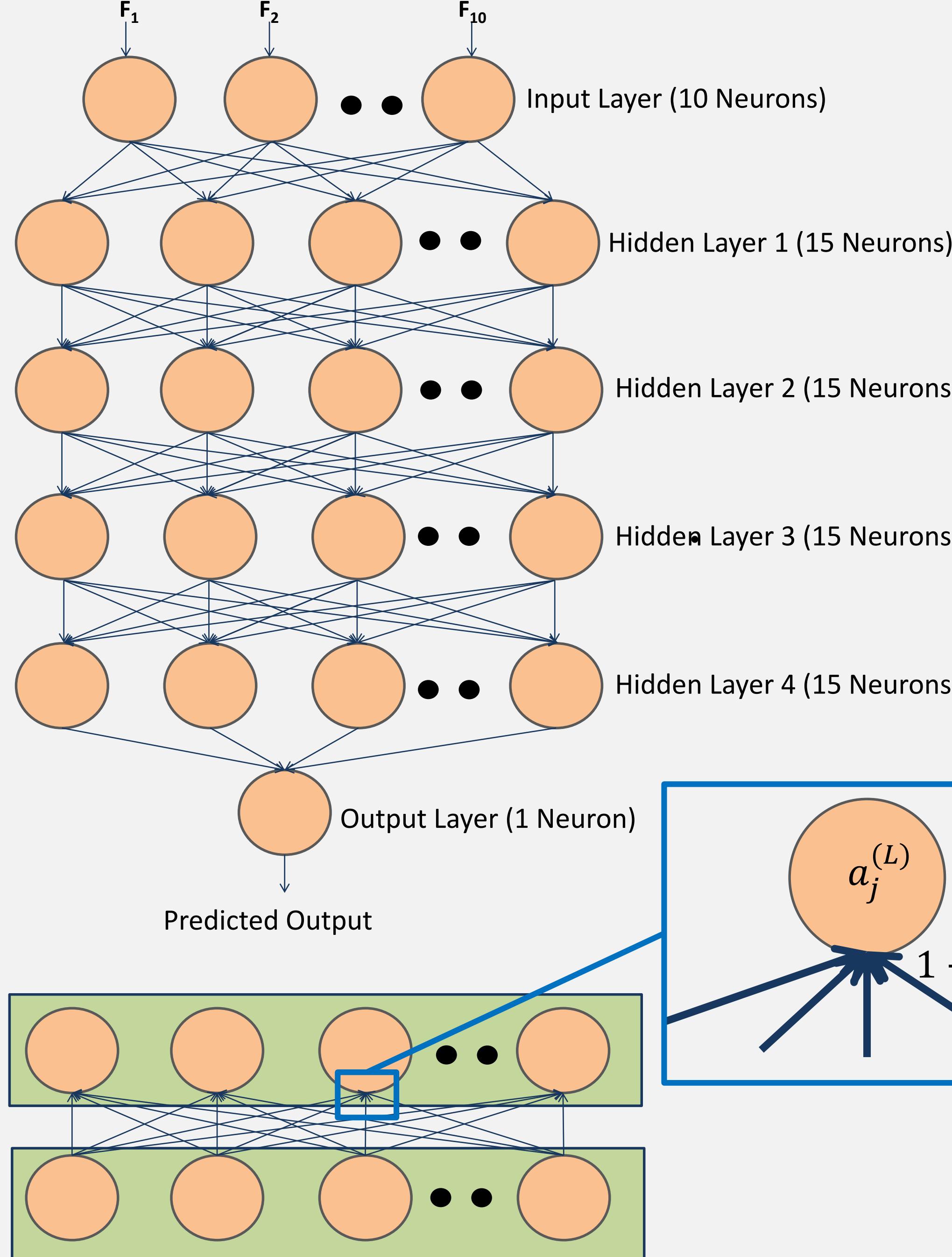


IMUs can capture information during dynamic hand motions and is hence, useful in Sign Classification

FLOW CHART OF THE PROPOSED METHOD



PROPOSED DNN CLASSIFICATION APPROACH



- Activation Function for the network

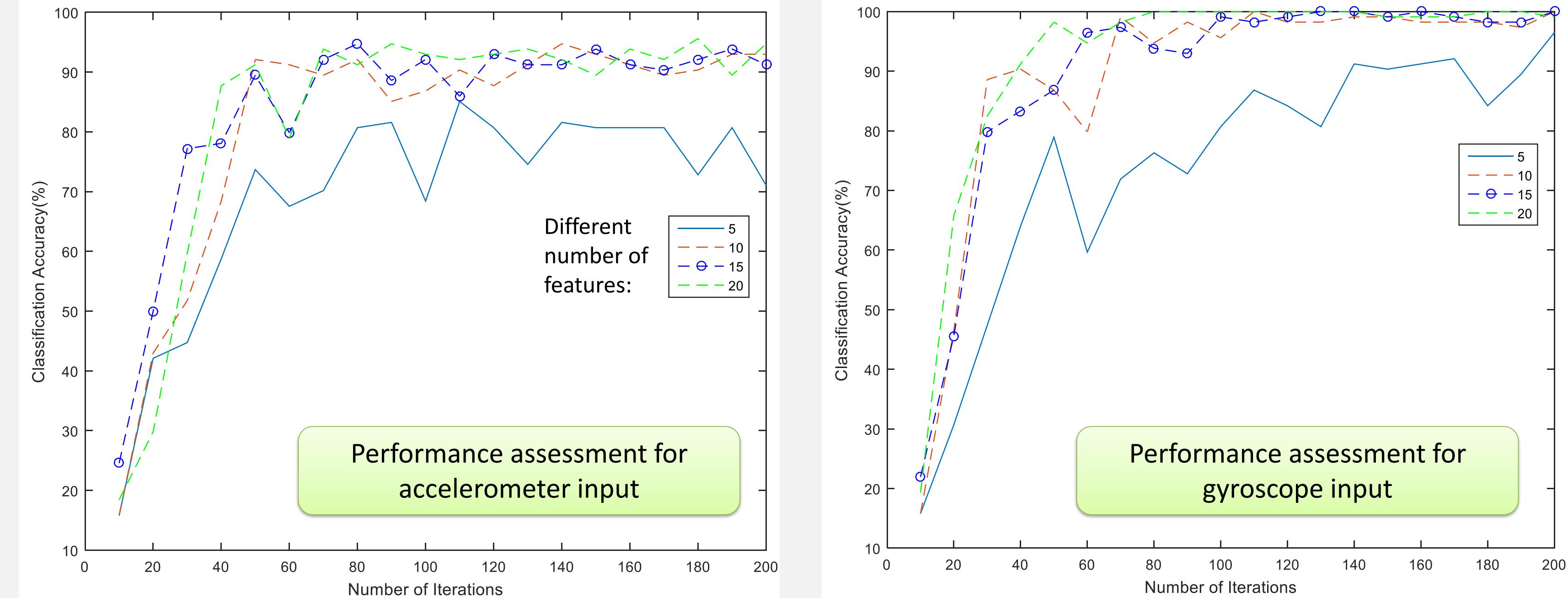
$$g(x^{(i)}) = \frac{1}{1 + e^{-x^{(i)}}}.$$
- Feed-forward computation of features yielding predicted output followed by back-propagation of errors.
- Error Minimization using back-propagation-

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

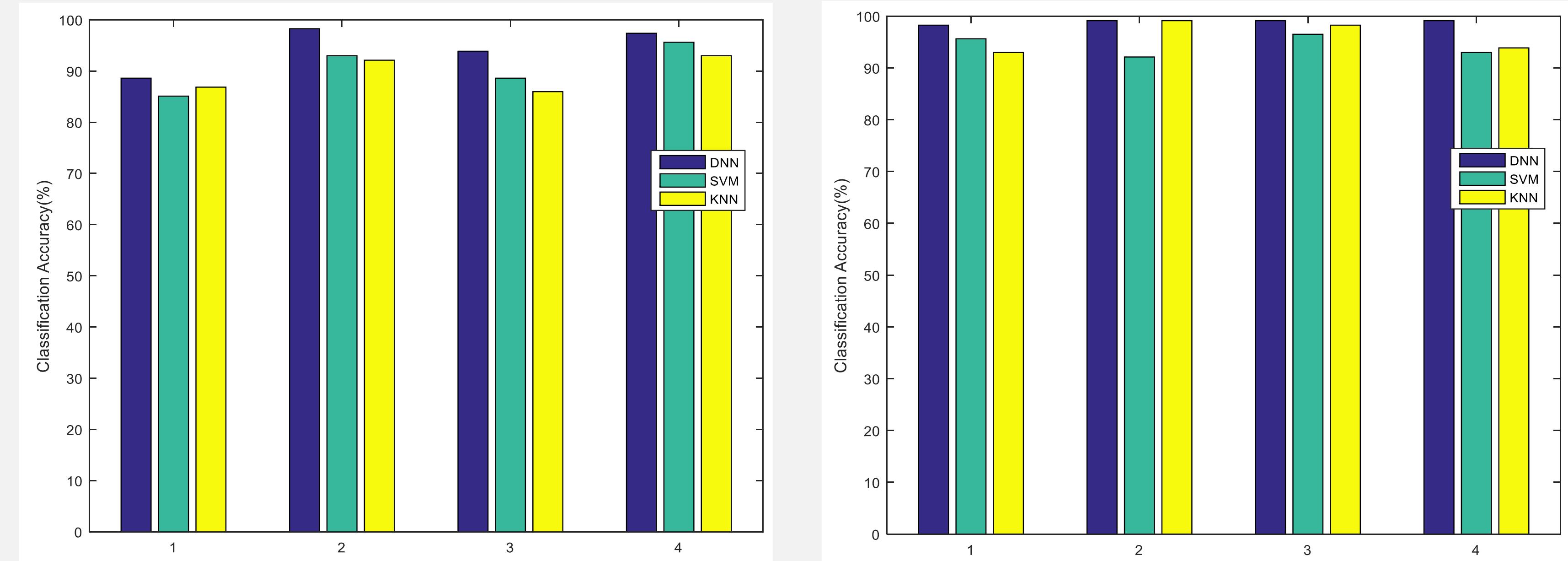
$$\delta_j^{(L)} = a_j^{(L)} * (1 - a_j^{(L)}).$$

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 2nd International Conference on Inventive Communication and Computational Technologies (ICICCT 2018), 20-21 April, pp. 1-6, 2018.

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