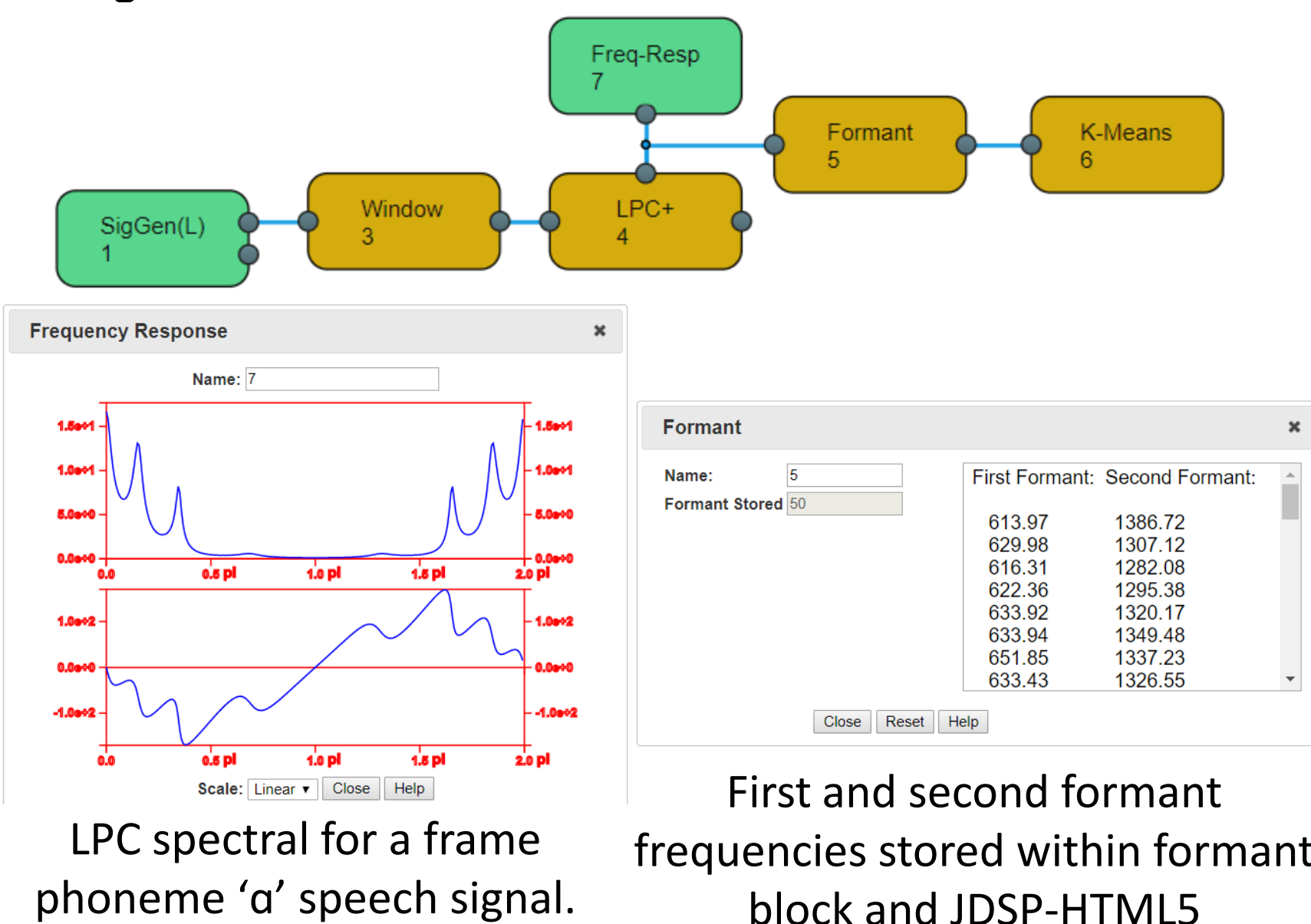


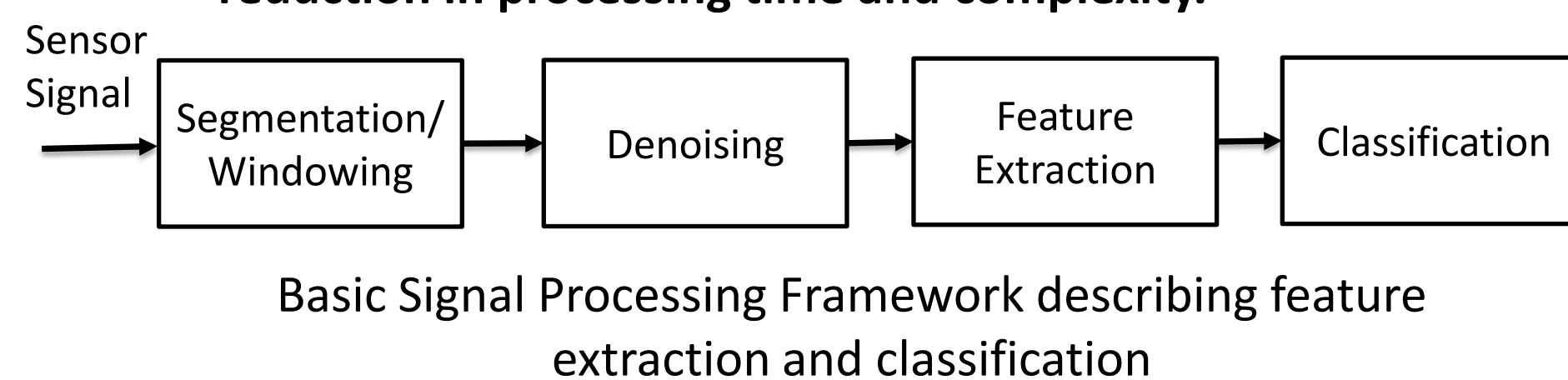
MOTIVATION

- Integrating sensing and machine learning in Internet of Things (IoT) and mobile applications .
- Create modules with online web-based laboratories for training undergraduate students in sensors and machine learning.
- Create modules to help students with visualizing and understanding the inner workings of various machine learning algorithms .
- Microphone sensors were used for acquiring speech signals.



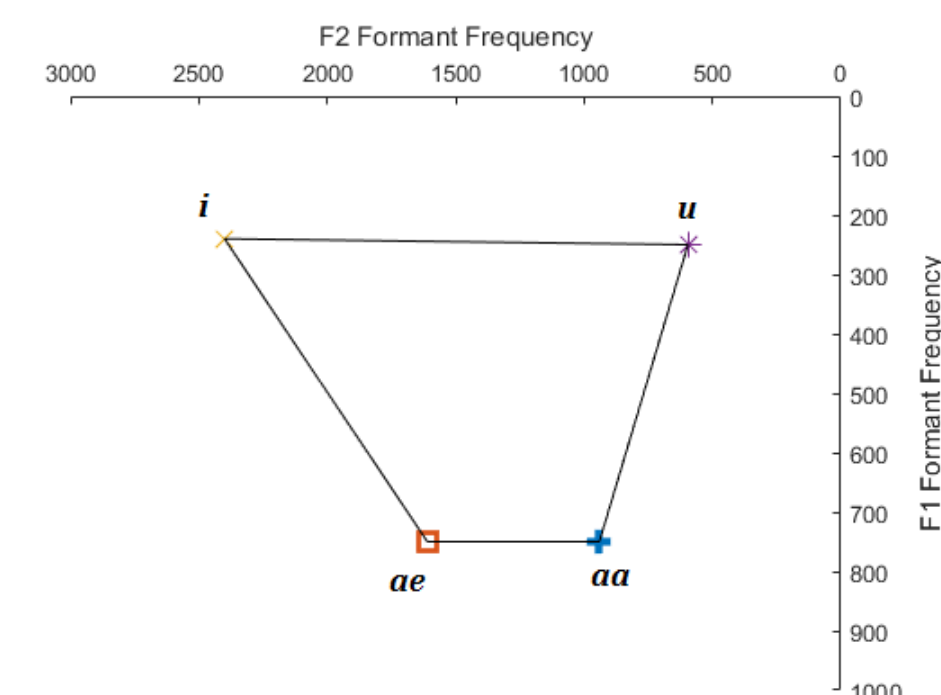
FEATURE EXTRACTION FROM SENSORS

- Acquiring signal data from the sensors.
- Perform pre-processing such as filtering and denoising.
- Reduced dimension of extracted features ensures a great reduction in processing time and complexity.

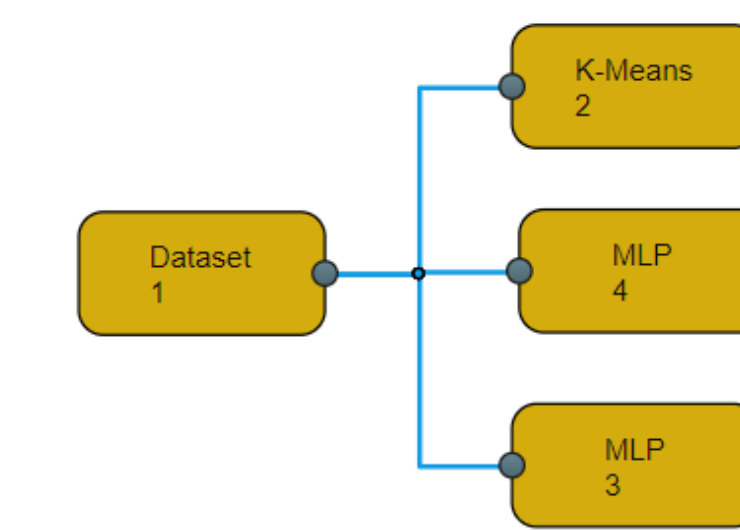


FORMANT EXTRACTION FROM SPEECH

- Extract formant frequencies F1 and F2 for four different vowels, namely: /i/, /u/, aa, and ae using Linear Predictive Coding.



Vowel chart showing four different vowels: aa, ae, i, and u.

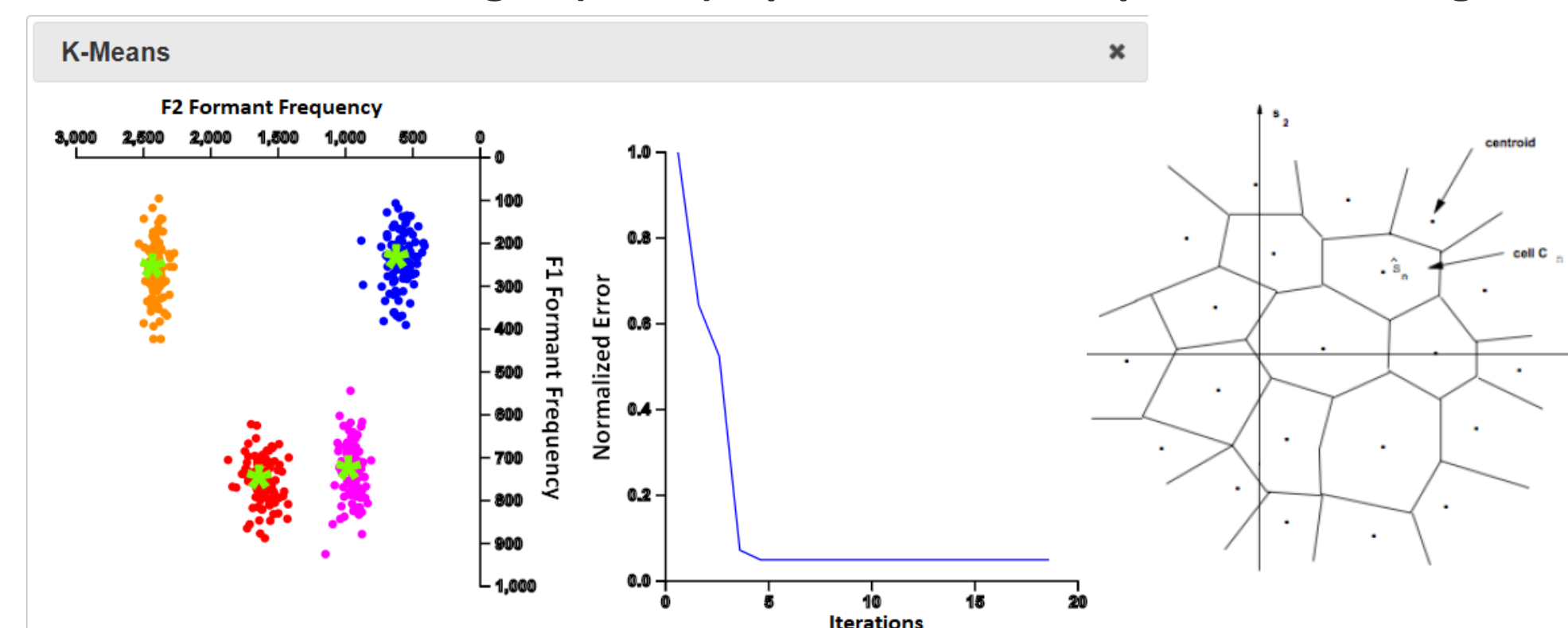


Block diagram for K-means, SVM and Multilayer Perceptron in JDSP-HTML5

MACHINE LEARNING ALGORITHMS

K-Means

- Euclidean distance is used as a metric and variance is used as a measure of cluster scatter.
- Feature learning in (semi-)supervised or unsupervised training.



K-means algorithm implemented on formant data in JDSP-HTML5

Voronoi Diagram

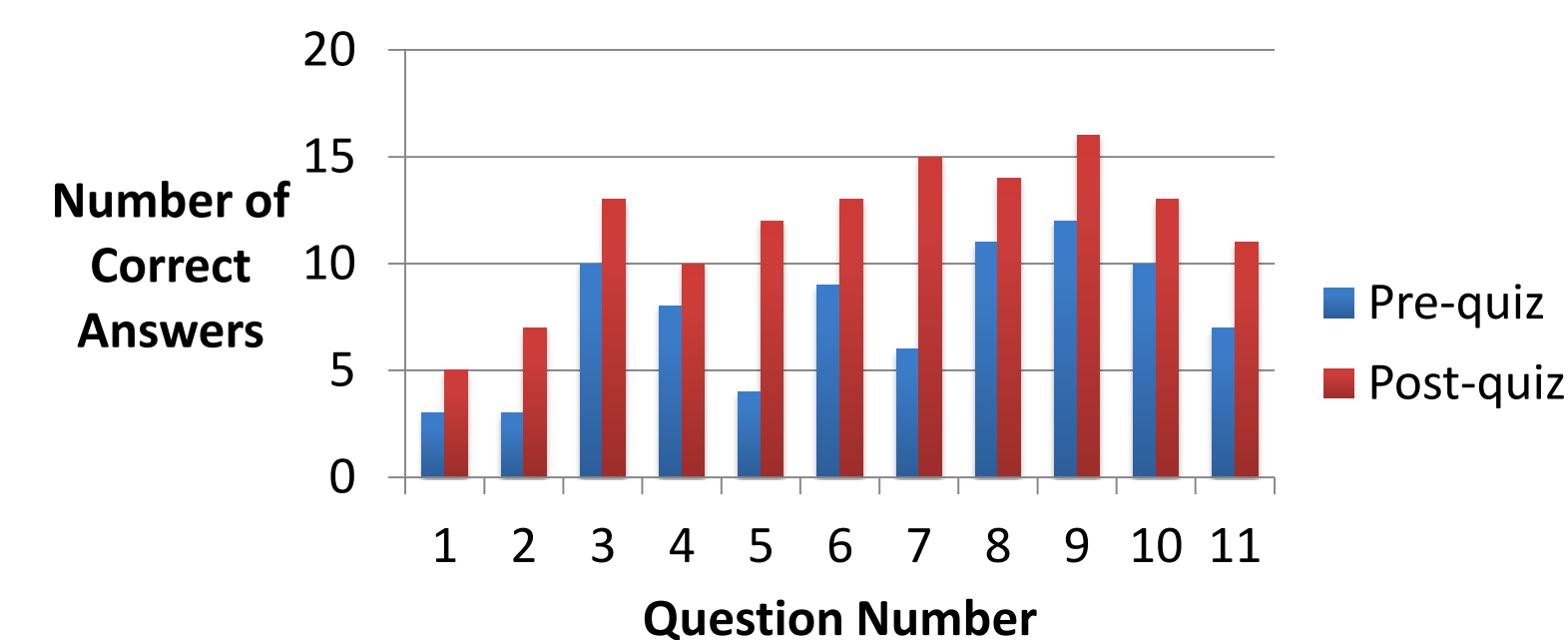
Support Vector Machine For Classification

- SVM provides a hyperplane or a boundary of separation which separates positive examples from negative samples.
- Accuracy is much higher compared to other classification algorithms like k-NN or logistic regression.

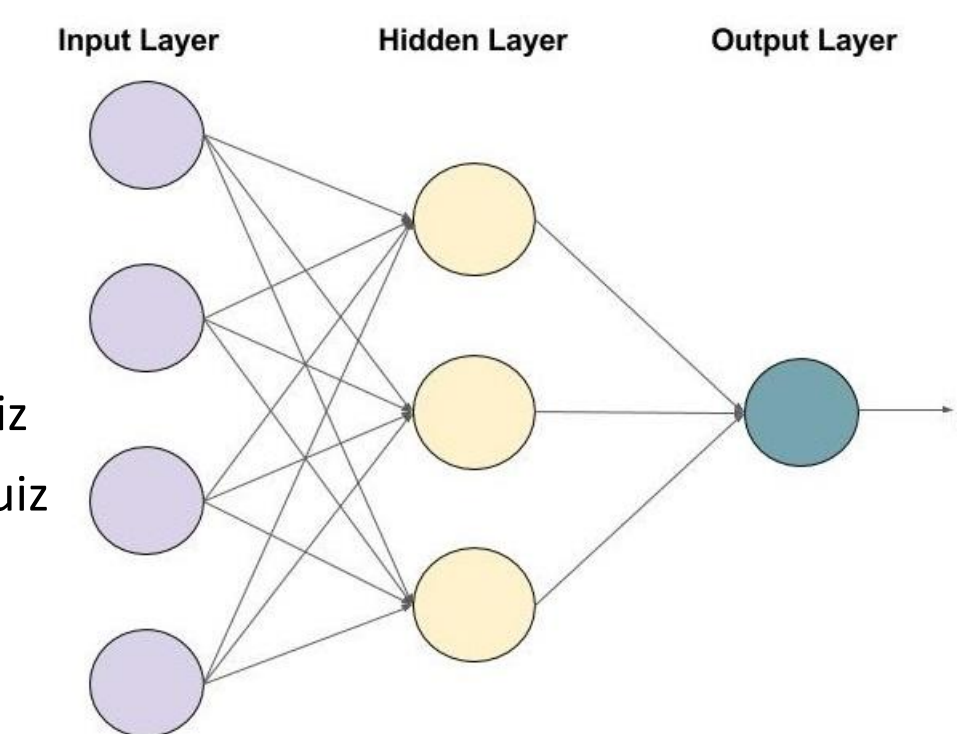
ASSESSMENT AND EVALUATION

- Pre-assignment quiz based on the K-means algorithm and clustering exercise was given to undergraduate and graduate students.
- Simple multiple-choice questions and True or False based questions were asked .
- Assessment questions related to K-means clustering scheme and mean square error curves were posed.
- A post-quiz was also given to the same class after completion of the exercise.

Machine Learning Pre-quiz vs Post-quiz



Pre-assignment and post-assignment quiz result.



Artificial Neural Network with a hidden layers.

- We have seen improvements in some of the questions, particularly those associated with feature extraction
- The basic clustering process seems to have been understood reasonably well before the post quiz, and hence some scores did not have significant difference

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ACKNOWLEDGEMENTS

- The work at Arizona State University is supported in part by the NSF DUE award 1525716 and the SenSIP Center. The work at Clarkson University is supported in part by the NSF DUE award 1525224.

