Coursework 7

1. Implement a single-layer Extreme Learning Machine with a fixed fully connected layer of randomly initialized neurons. Experiment with different numbers of hidden unit (10 to 1000) and record the training and test accuracies of the ELM with 10 output units on the Digit MNIST database. **(1 Point)**
2. Explore the effect of the activation function by varying the initial standard deviation (0.01 to 10) of the random number generator that assigns the weight values. Vary the standard deviation of the random number generator and observe how it affects the accuracy and report your results. **(1 Point)**
3. Implement a two-layer ELM by adding a second random fixed hidden layer fully connected layer to the architecture. Again, experiment with different hidden unit sizes and layer initializations, and record the performance. **(1 Point)**
4. Compare the performance of the single-layer and two-layer ELMs. Which architecture performs better on the chosen task, and why do you think that is the case? **(1 Point)**
5. Now, make fully connected layers trainable repeat questions 1-3, compare your results with ELMs. **(1 Point)**
6. Summarize your findings in a report, including a table that illustrate the results of your experiments. Discuss the implications of your findings for the use of ELMs in real-world applications. **(1 Point)**

Bonus Question: One way to achieve better performance is to combine trainable neural networks with ELMs. In this question, we ask you to combine an ELM with a single layer trainable convolutional front end with a 5x5 filter size (receptive field). Compare the results of this combined architecture with the results from question 1 **(1 Point)**