



In the name of God
Deep Learning Course (Fall 2021)
Final Project: LSTM Network
Due date: 15th February

**In this project, you are going to be familiar with the implementation of
LSTM Networks for Sequential data**

Long short-term memory (LSTM) is an artificial recurrent neural network architecture. LSTM networks are well suited for classifying, processing, and making predictions based on time series data.

In this project, you are supposed to classify the given dataset into 10 classes (digits 0 to 9) by means of LSTM networks. The dataset contains time series of Mel-frequency cepstrum coefficients (MFCCs), corresponding to spoken Arabic digits.

- Number of instances (blocks): 8800
- Number of attributes: 13

Each line in Train_Arabic_Digit.txt or Test_Arabic_Digit.txt represents 13 coefficients, separated by spaces.

Lines are organized into blocks, which are a set of 4-93 lines, separated by blank lines, and correspond to a single speech utterance of a spoken Arabic digit. Each spoken digit is a set of consecutive blocks.

In Train_Arabic_Digit.txt, there are 660 blocks for each spoken digit. Blocks 1-660 represent the spoken digit '0', blocks 661-1320 represent the spoken digit '1', and so on up to digit '9'.

In Test_Arabic_Digit.txt, digits '0' to '9' have 220 blocks for each one. Therefore, blocks 1-220 represent digit '0', blocks 221-440 represent digit '1', and so on. Speakers in the test dataset are different from those in the training dataset.



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- **Your tasks are:**

1. We want to use batch learning. Therefore, you should sort the training data by sequence length and choose a mini-batch size such that sequences in a mini-batch have a similar length. Then you should pad the sequences in each mini-batch to have the same length. (Training process in some languages automatically adds paddings to batches). This is necessary to prevent too much padding that may have negative effects.
2. After the data is preprocessed, build the LSTM network for classification and train it.
3. Repeat step 1 for the test data and then classify them.
4. Calculate the classification accuracy of the predictions.
5. Plot the loss and accuracy for test and train data over 500 iterations in separate figures.
6. Use 5 different combinations of batch sizes (batch sizes are arbitrary in the range [100 500]) and train epochs (in the range [50-250]), repeat tasks 4 and 5, and calculate training time for each setup. Which setup is the best and the worst? Why?
7. Provide a thorough explanation for each desired task.

Notes:

- Pay extra attention to the due date. It will not extend.
- Be advised that submissions after the deadline would not grade.
- Prepare your entire report in PDF format and include the figures and results.
- Submit your assignment using a zipped file with the name of "StdNum_FirstName_LastName".zip
- Using other students' codes or the codes available on the internet will lead to zero.