

# ECE 544NA HW5

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## 1 TensorFlow

In this portion of the assignment, you will use a vanilla RNN and a LSTM to perform digit classification on the MNIST dataset.

- **Setting 1 (Sequence of Pixels):** It is assumed that each  $28 \times 28$  image,  $x$ , in the MNIST dataset is a sequence of single pixels,  $x(1), \dots, x(784)$ , where  $x(t)$  is a single scalar value. The network reads one pixel at a time from the top left corner of the image to the bottom right of the image.
- **Setting 2 (Sequence of Columns):** It is assumed that each  $28 \times 28$  image,  $x$ , in the MNIST dataset is a sequence of vectors,  $x(1), \dots, x(28)$ , where  $x(t)$  is a  $28 \times 1$  vector representing one column in the image. The network reads one column at a time from left to right.

Train a basic (vanilla) RNN and a LSTM for each the two settings using a single layer RNN and LSRM with 100 hidden nodes. Perform classification on the last frame using cross entropy loss.

**Relevant Tensorflow Doc:** Tensorflow provides some API for recurrent neural network, please use the following:

- `tf.nn.rnn`: [https://github.com/tensorflow/tensorflow/blob/master/tensorflow/g3doc/api\\_docs/python/functions\\_and\\_classes/shard0/tf.nn.rnn.md](https://github.com/tensorflow/tensorflow/blob/master/tensorflow/g3doc/api_docs/python/functions_and_classes/shard0/tf.nn.rnn.md)
- `tf.nn.rnn_cell`: [https://www.tensorflow.org/versions/r0.11/api\\_docs/python/rnn\\_cell.html#neural-network-rnn-cells](https://www.tensorflow.org/versions/r0.11/api_docs/python/rnn_cell.html#neural-network-rnn-cells)

### 1.1 Methods

- Describe the functions you wrote, and the overall structure of your code.

## 1.2 Results

- Provide one figure with four subfigures, showing convergence plots of all four (2 settings, 2 models) classifiers (abscissa = training iteration, ordinate = training-corpus accuracy)
- Provide a table reporting the testing accuracies.