

Topic: Recurrent Neural Network (RNN)

Instructions

Please share your answers filled inline in the word document. Submit Python code and R code files wherever applicable.

Please ensure you update all the details:

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Topic: Recurrent Neural Network.

1. Business Problem

1.1. Objective

1.2. Constraints (if any)

2. Work on each feature of the dataset to create a data dictionary as displayed in the below image:

Name of Feature	Description	Type	Relevance
ID	Customer ID	Quantitative, Nominal	Irrelevant, ID does not provide useful information

2.1 Make a table as shown above and provide information about the features such as its Data type and its relevance to the model building, if not relevant provide reasons and provide description of the feature.

Using Python code perform:

3. Data Pre-processing

3.1 Data Cleaning, Feature Engineering, etc.

3.2 Outlier Imputation if applicable

4. Model Building

5.1 Build the Recurrent Neural Network

5.2 Train and Test the data

5.3 Briefly explain the model output in the documentation

5. Share the benefits/impact of the solution - how or in what way the business (client) gets benefit from the solution provided
6. Use Tensorflow for this assignment depending on your system configuration either Tensorflowgpu or Tensorflowcpu version.

Note:

The assignment should be submitted in the following format:

- Python code
- Code Modularization should be maintained
- Documentation of the model building (elaborating on steps mentioned above)

Problem Statement:-

1. Here is the time series data [110,125,133,146,158,172,187,196,210].
Build RNN/LSTM model to predict the next 10 digits.

Sol:

RNN/LSTM model is done using Python and the same is attached..

2. Write down the multiple applications of RNN.

Sol:

Applications of RNN are as follows:

- Prediction problems
- Language Modelling and Generating Text
- Machine Translation
- Speech Recognition
- Generating Image Descriptions
- Video Tagging
- Text Summarization

- Call Center Analysis
 - Face detection, OCR Applications as Image Recognition
 - Other applications like Music composition
3. How to do select the inputs for a LSTM/RNN models. Explain in the terms of timesteps, samples and feature.

Sol:

Samples - This is the $\text{len}(\text{dataX})$, or the amount of data points you have.

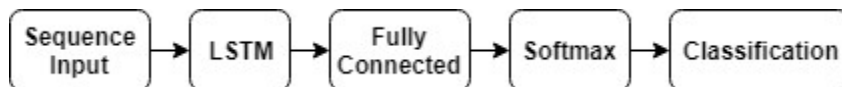
Time steps - This is equivalent to the amount of time steps you run your recurrent neural network. If you want your network to have memory of 60 characters, this number should be 60.

Features - this is the amount of features in every time step. If you are processing pictures, this is the amount of pixels. In this case you seem to have 1 feature per time step.

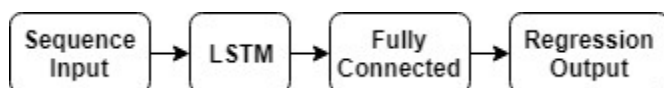
LSTM Network Architecture

The core components of an LSTM network are a sequence input layer and an LSTM layer. A *sequence input layer* inputs sequence or time series data into the network. An *LSTM layer* learns long-term dependencies between time steps of sequence data.

This diagram illustrates the architecture of a simple LSTM network for classification. The network starts with a sequence input layer followed by an LSTM layer. To predict class labels, the network ends with a fully connected layer, a softmax layer, and a classification output layer.

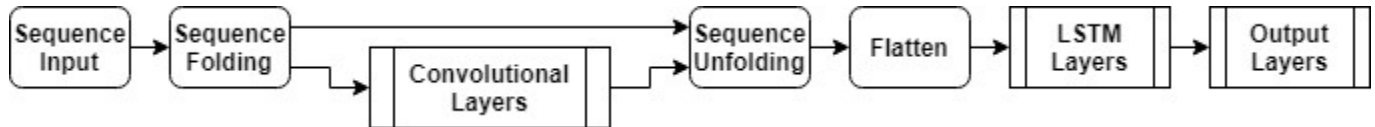


This diagram illustrates the architecture of a simple LSTM network for regression. The network starts with a sequence input layer followed by an LSTM layer. The network ends with a fully connected layer and a regression output layer.



This diagram illustrates the architecture of a network for video classification. To input image sequences to the network, use a sequence input layer. To use convolutional

layers to extract features, that is, to apply the convolutional operations to each frame of the videos independently, use a sequence folding layer followed by the convolutional layers, and then a sequence unfolding layer. To use the LSTM layers to learn from sequences of vectors, use a flatten layer followed by the LSTM and output layers.



4. What are the disadvantages of MLP when dealing with sequence data.

Sol:

Disadvantages of MLP include too many parameters because it is fully connected. Parameter number = width x depth x height. Each node is connected to another in a very dense web — resulting in redundancy and inefficiency.