# Assignment 4 - CS747

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## 1 Part 1

In this part, I built a RNN network which is able to handle both the task of Classification and Generation. The RNN network was constructed based on LSTM components. The first component is Embedding components which converts the text data into tensor type. The last component is a Linear layer which convert the output of LSTM into a probability of letters or languages.

There was an error in the provided code: *generate* and *evaluate* functions, which made failing to run my RNN. I made some modification (reduce the tensor dimension of the predicted result), then they worked well with my RNN. The results are presented in the following sections.

### 1.1 RNN Generation

In this task, the RNN's output dimension is the number of letters in the ASCII. This RNN will predict what is the next letter if it receives a letter. After performing adjustment on the batch_size, learning rate, and number of LSTM layers, the following configuration provided the best performance of the RNN.

- batch_size = 1
- learning_rate = 0.002
- number of layers in LSTM: 4
- hidden_size = 120
- Number of iteration = 6000

The generation results was good and shown in the following Fig. 1: There is still a gap between the

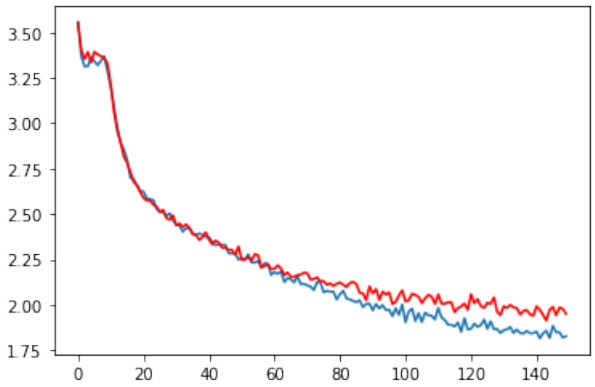


Figure 1: The losses of RNN in Generation Task

training dataset and the test dataset.

### 1.2 RRN Classification

In this task, we need to classify the language of the input text. There are 20 languages in the dataset, so we set the output's size is 20.

After performing adjustment on the batch_size, learning rate, and number of LSTM layers, the following configuration provided the best performance of the RNN.

- batch_size = 100
- learning_rate = 0.003
- number of layers in LSTM: 4
- hidden_size = 120
- Number of iteration = 10000

The losses of the RNN is shown on Fig. 2.

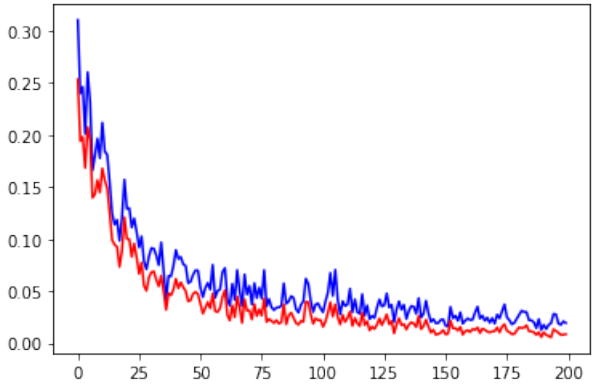


Figure 2: The losses of RNN in Classification Task

With this RNN, the accuracy was 0.797 on test data, and as submitting to Kaggle competition, the core reached: 0.507.

## 2 Part 2 - New Dataset and RNN

In this section, the new dataset was the book *Alice's Adventures in Wonderland* by Lewis Carroll (link to download https://www.gutenberg.org/ebooks/11/).

To build a Recurrent Neural Network, I still relied on the RNN - generation from Part 1. The structure are similar, however, the components were changed. The LSTM was substituted by GRU components, which can save memory for the models. In GRU components, I have done the modification of number of layers, batch_size, and learning rate. The optimal configuration for this network and dataset were:

- batch_size = 1
- Number of layers in GRU: 5
- learning rate = 0.0025
- hidden_size = 150

The plot in Fig. 3 presented the losses of training data (blue) and test data (red) during the training.
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There was a gap between the training and test data, and I think that the reason can be the overfit. However, I got difficulty to fix it.

This is an output of the RNN:

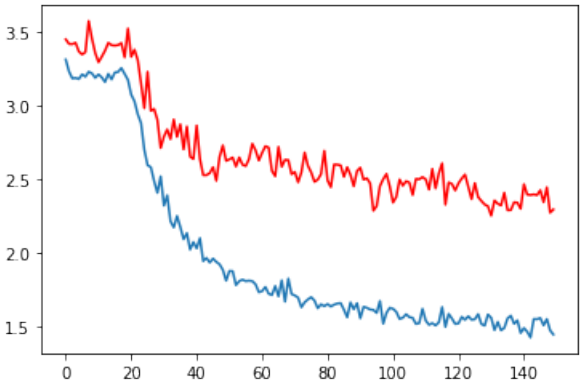


Figure 3: Losses of training and test dataset

*The had going to go to sitten mouth: and they glove all crowded his said.*
*"I great grin clust they for the trees! that you think the must?" said the King little "perply: I go you mistemally important to the 'eds."*
*"What I you, I tuppir! This ming!" said the Hatter suppression at the pap; His its of the Mouse of the conversation.*
*"But it was remark," said the Gryphon ruept.*
*"And what sat the twell little door I can patter!" said the Gryphon, interried into the WhHite well pates of the doubting out to their twingl gatter, and taild at she striously to go rattle the little had not the great curious in the baby of dowreat of going, and had nazy getting out with time to him little rapping to see, the Mock Turtle a lowever my of it, and had jumbling clied herstand off the hedgehogs; and she was a look into a curious out of it, and the least buting out her head she knew.*
*"You caur! "I'd thing I can the remark," she said explay in a doing to sut. "I wonder yeatly curious never in his sittand*

## References