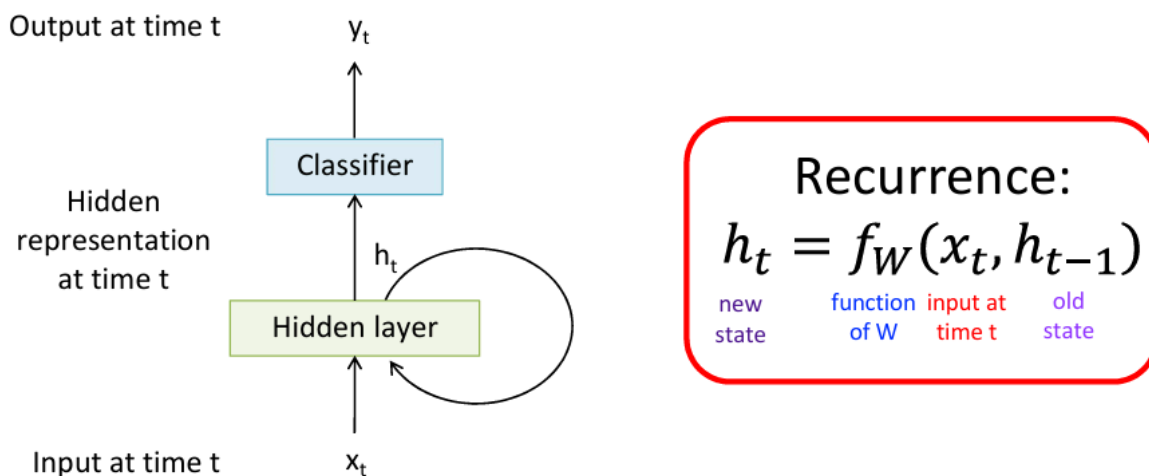


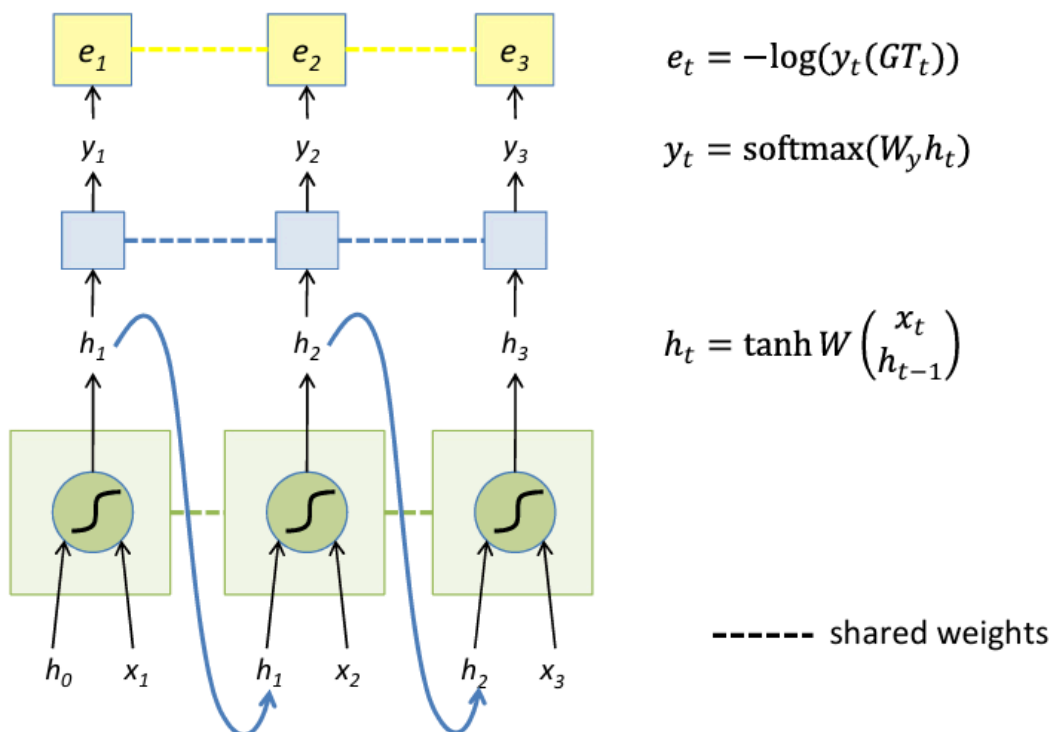
RNN

Recurrent Neural Network (RNN)



Recurrent Neural Networks (RNNs) are a type of neural network designed for sequential data, where the output depends not just on the current input but also on the history of previous inputs. Unlike traditional feedforward neural networks, RNNs have connections that loop back, allowing information to persist and be used across time steps.

RNN Forward Pass

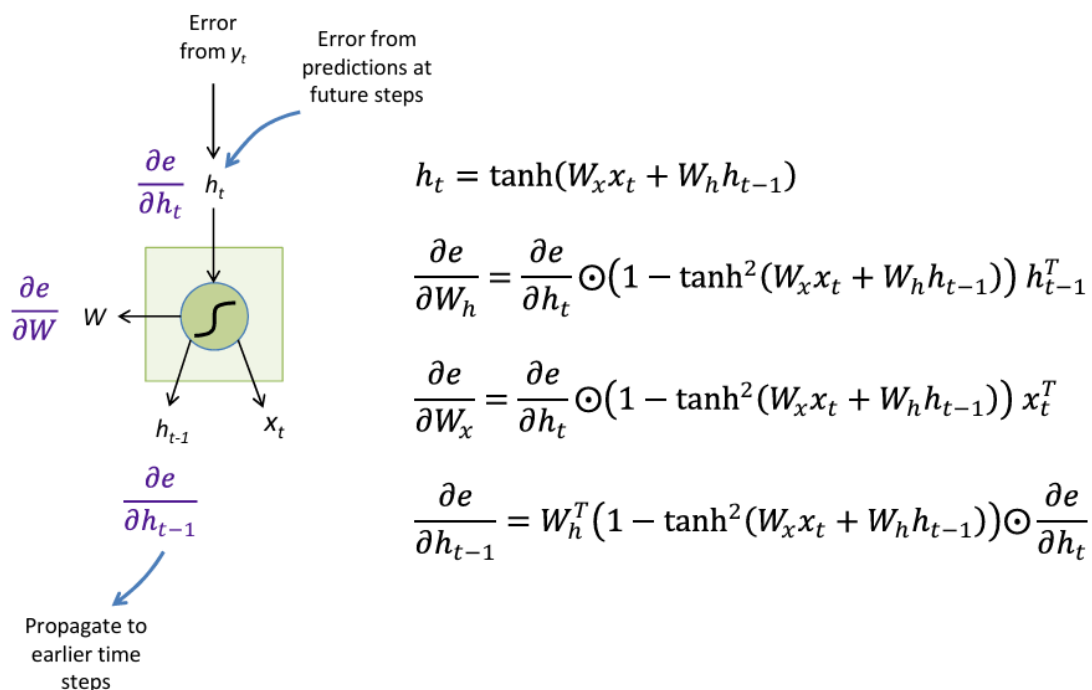


How to build a naive RNN model? Focus on the figure above! The structure of RNN is quite clear. So, we should set the parameters we need and the right forward function. Below is a part of an example code for RNN model, like pseudo code. Hope that you can learn what you need from it.

```
# initiate parameters needed in model
wx = torch.nn.Parameter(torch.randn(input_size, hidden_size) * 0.01)
wh = torch.nn.Parameter(torch.randn(hidden_size, hidden_size) * 0.01)
wy = torch.nn.Parameter(torch.randn(hidden_size, output_size) * 0.01)
bh = torch.nn.Parameter(torch.zeros(hidden_size))
by = torch.nn.Parameter(torch.zeros(output_size))

# forward
h = torch.zeros(batch_size, hidden_size) # initiate the hidden state first
for t in range(seq_length):
    h = torch.tanh(torch.matmul(xt, wx) + torch.matmul(h, wh) + bh)
    y = torch.matmul(h, wy) + by
```

RNN Backward Pass



Back-propagation has been mentioned in previous labs, so here we do not spend more time on it. You should take enough time to understand the BPTT process. Also, RNN is quite slow since its backpropagation process is not friendly to GPU, so it's normal to see a low speed. In this assignment, we use Pytorch, so we don't need to complement it manually.

About report

- How to make a **good report**?
 - First of all, answer the specific questions of each task completely and meet all the specific requirements. If you have done these things well, you can probably get a score of around 90.
 - Clear structure, logical content, good looking.

- State clearly what you have done to make the model perform better, or some important or interesting things you have discovered during this process. This is important to reach a higher score.
- A good summary of your results is significant.

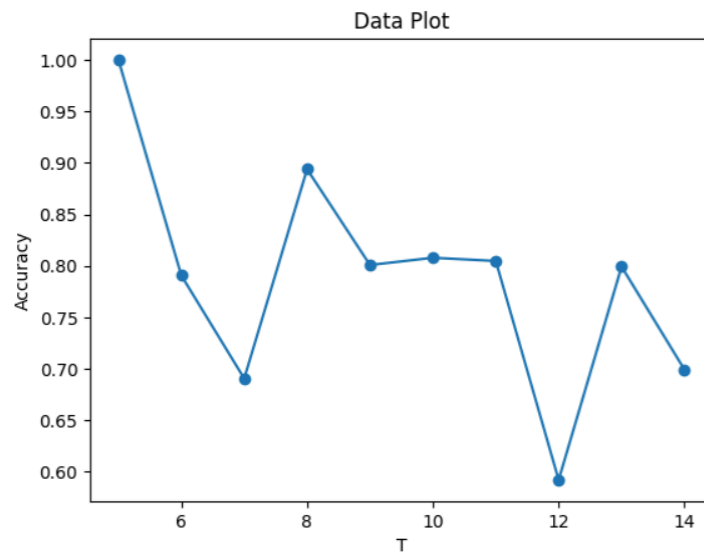
There are lots of things you can do and involve in your report. Note that accuracy is important, but we are more interested in your efforts and thinking through the assignment.

- In your **.ipynb** file

Try to make it easy to understand and run by us. In order to facilitate the reproduction of the same experimental results, you can set some random seeds in your code.

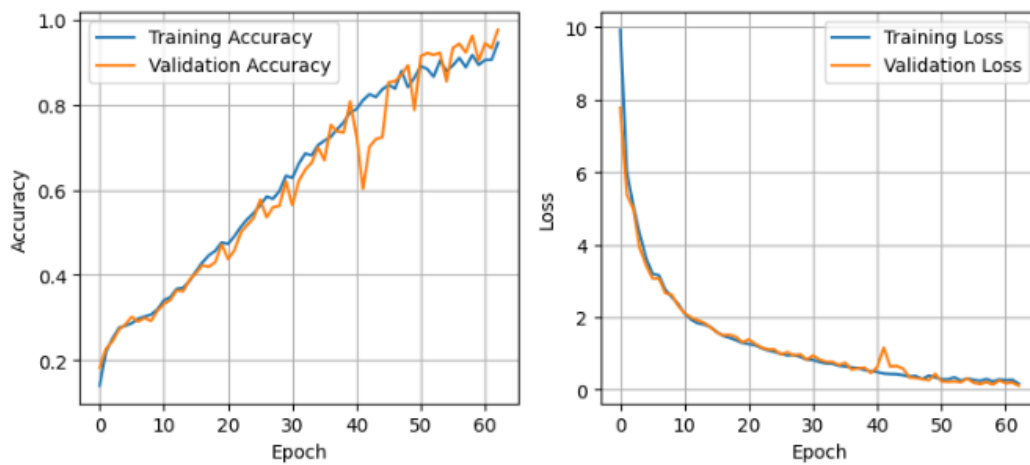
- How to better show the result?

For **Part III**, I strongly encourage you to show it in a curve plot which shows the relationship between the highest accuracy and lengths like below:

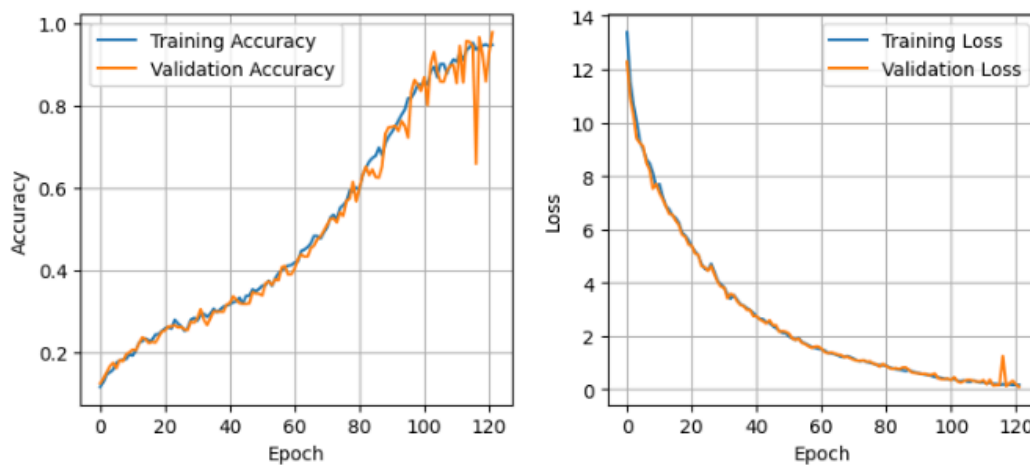


Other forms are also accepted, as long as they are clear. For example, you can show plots for each length.

Length = 6



Length = 7



- It costs **too much time?**
 - Firstly, we should realize that it's normal to spend more time on longer lengths and batch sizes, and especially RNN model.
 - Try to reduce your **epochs**. The accuracy we need should be captured at the time where the loss curve shows convergence.
 - Other parameters like **learning rate** or **batch size**.

If you tried your best, but it is still quite slow, and you are concerned about your HUAWEI cloud Quota, don't worry, we have enough resources. But do not abuse them.