Deep Learning HW3
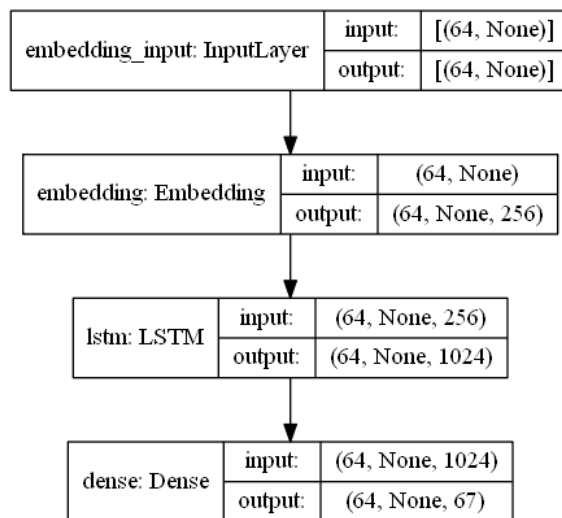
1. Architecture and learning curve

- LSTM
a. Network Architecture

embedding_input: InputLayer	input:	[(64, None)]
	output:	[(64, None)]

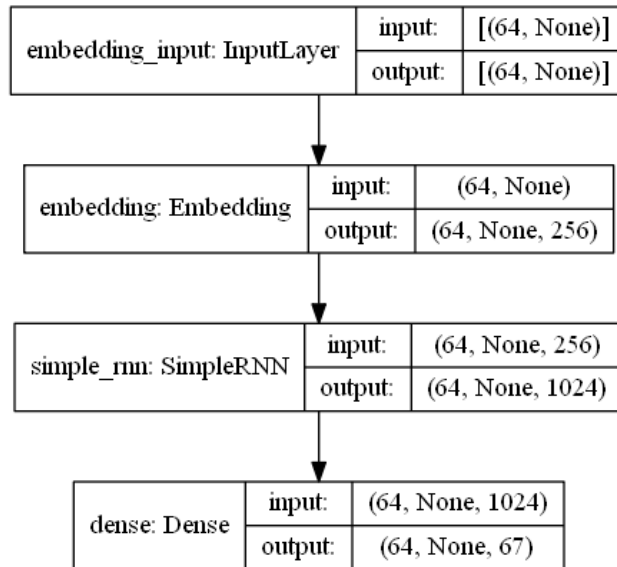| embedding: Embedding	input:	(64, None)
	output:	(64, None, 256)

lstm: LSTM	input:	(64, None, 256)
	output:	(64, None, 1024)

dense: Dense	input:	(64, None, 1024)
	output:	(64, None, 67)
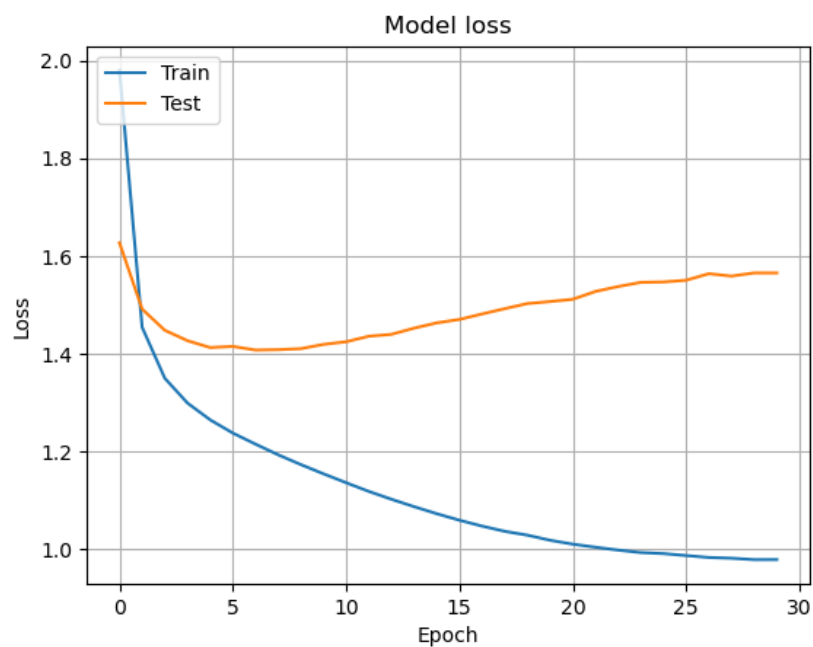
b. Learning curve

loss: 0.9854 - val_loss: 1.5711

- Simple RNN

a. Network Architecture

embedding_input: InputLayer	input:	[(64, None)]
	output:	[(64, None)]

embedding: Embedding	input:	(64, None)
	output:	(64, None, 256)

simple_rnn: SimpleRNN	input:	(64, None, 256)
	output:	(64, None, 1024)

dense: Dense	input:	(64, None, 1024)
	output:	(64, None, 67)

b. Learning curve
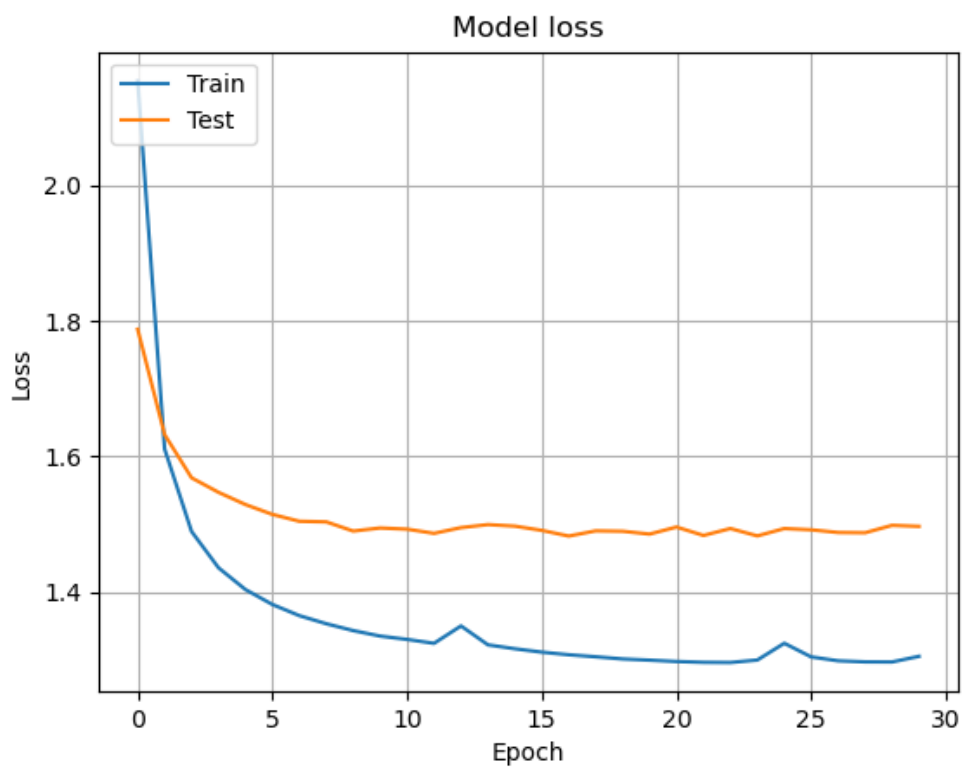
train_loss: 1.3049   val_loss: 1.4966

2. 5 breakpoints to show how output changes through more epochs

In this task, I used 30 epochs to train. The breakpoints I chose are on epoch 1, 7, 13, 19, 25. In this epochs, I fed "First Citizen:\nBefore we proceed any further, hear me speak." Into the network.

LSTM:

for epoch 1

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First Citizen:
Before we proceed any further, hear me speak.

PISTOL:
A man as the devil of the sense of the sense of the sense of the sense of the sense of the death,
And that I have so many and the sense of the sense of the sense of the sense of the sense of the sense of the sense of the death,
And that I have so many and the sense of the sense of the sense of the sense of the sense of the sense of the sense of the death,
And that I have so many and the
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for epoch 7

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For epoch 7

First Citizen:
Before we proceed any further, hear me speak.

GLOUCESTER:
The season of the state of death and hearts
Are now a stranger than the state of heaven,
And the strength of the state of heaven and hearts
Are now a stranger than the state of death.

KING HENRY VI:
What shall I do thee for the world?

FALSTAFF:
I will not be a stranger than the story of the world,
And the strength of the state of heaven and hearts
Are now a stranger than the state

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for epoch 13

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For epoch 13

First Citizen:
Before we proceed any further, hear me speak.

ANTIPHOLUS OF EPHESUS:
And this is the first man that should be so content
To see the senate to the state of hell,
That thou wilt not be satisfied in sea,
Which thou dost see the world that I may say,
And therefore I will see thee well.

ANTIPHOLUS OF SYRACUSE:
What says the first?

CASSIO:
I do not know my words.

POSTHUMUS LEONATUS:
Ay, my lord.

HAMLET:
I am sorry for thee, my lord.

HAMLET:


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for epoch 19

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For epoch 19

First Citizen:
Before we proceed any further, hear me speak.

First Clown:
Why, then, the worthier that I have seen the
countenance of his father's death.

PISTOL:
Be not afraid, the worthiness of men
Have sent a little patience to the crown.

KING HENRY VI:
How now, my lords!

CARDINAL:

KING HENRY VI:
Why, how now, sir! have you not seen the counterfeit?

FALSTAFF:
What dost thou say 'Good morrow, master shere! 'tis four
throats to me. I am a man of my s


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for epoch 25

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For epoch 25

First Citizen:
Before we proceed any further, hear me speak.

ANTIPHOLUS OF EPHESUS:
The king hath slain the crown of France,
And bear the sentence of the world and long,
And the detested son of Henry will have such a personal heart
As will not be received in him.

CARDINAL:
The king hath sent the crown and send the princess
And the detesting of the which is here.

WARWICK:
I will not for a man that makes the world
That ever loved on him.

IACHIMO:
That's
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RNN:

for epoch 1

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First Citizen:
Before we proceed any further, hear me speak.

SIMON:
What should not the counter to the counter to the counter to the counter to the counter to the counter to the counter to the counter to the counter to the counter to the counter
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for epoch 7

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For epoch 7

First Citizen:
Before we proceed any further, hear me speak.

SHALLOW:
It is not think the duke of men that I may be made a soul of men and the state,
That I may be made me stand at the state,
That I may be made me stand at the state,
That I may be made me stand at the state,
That I may be made me stand at the state,
That I may be made me stand at the state,
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That I may be made me stand at the state,
That I may be m

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for epoch 13

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For epoch 13

First Citizen:
Before we proceed any further, hear me speak.

First Senator:
The season was a precious for the season of the season of the season of the season of the season of the season of the season of the season of the season of the season of the seas
on of the season of the season of the season of the season of the season of the season of the season of the season of the season of the season of the season of the season of the
season of the season of the

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for epoch 19

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For epoch 19

First Citizen:
Before we proceed any further, hear me speak.

MISTRESS QUICKLY:
And therefore I will not be a part of the market-place,
That we have done the common shore of the market-place,
That we have done the common shore of the market-place,
That we have done the common shore of the market-place,
That we have done the common shore of the market-place,
That we have done the common shore of the market-place,
That we have done the common shore of the ma

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for epoch 25

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For epoch 25

First Citizen:
Before we proceed any further, hear me speak.

CASSIUS:
And therefore the which he was a thousand ducats is to be a prince and the world is the sun and shame to see the court of the world is the sun and shame to see the court of the w
orld is the sun and shame to see the court of the world is the sun and shame to see the court of the world is the sun and shame to see the court of the world is the sun and shame
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In this part, I found that the performance of LSTM is better than RNN. LSTM model learned better on changing line. I also found some problem on both two models. Sometimes they will repeat same line multiple times and this happened more often on RNN model. On the LSTM model, I also found that its sentences are more sensible, this indicated that the LSTM model learned better.

3. Different size of hidden states and different sequence length

Before this part, I used sequence length 100 to train the model. Now I adapt it to 50 and look for the difference. (Here I use LSTM)
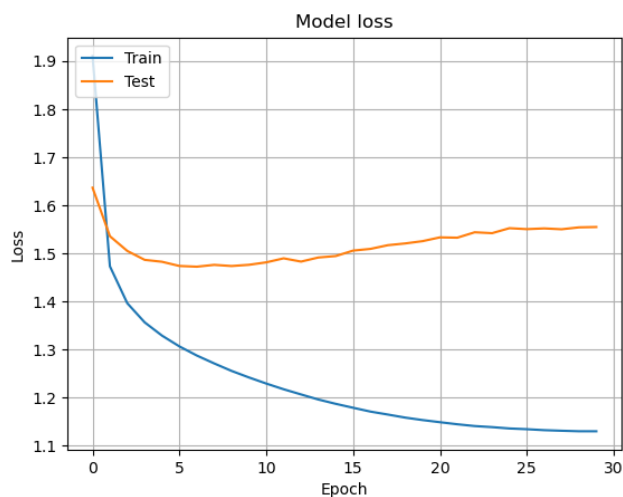
sequence length 50
loss: 1.1299 - val_loss: 1.5550
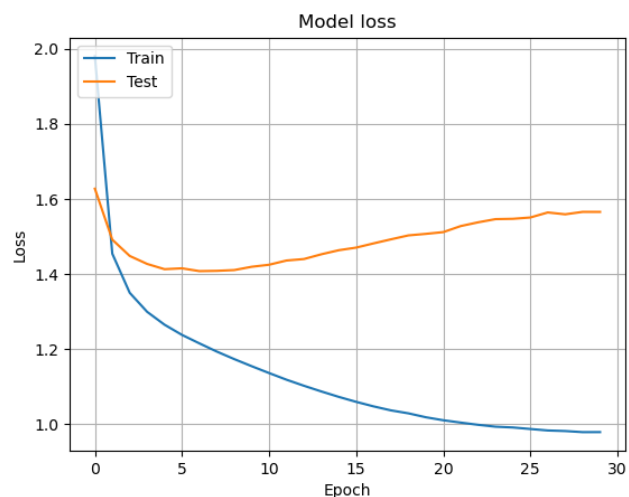
sequence length 100
loss: 1.3049   val_loss: 1.4966

From the result, I saw that with sequence length 50, we can fit the training data faster, but it's easier to overfit.

4. Difference between RNN and LSTM

RNN is the first kind of neural network that can memorize or remember the previous inputs in memory. Its characteristic is that it's not good at memorize long term data.

LSTM performs better when needing to memorize long term memory. It has more additional special units that can hold information longer. LSTM includes a **memory cell** that can maintain information in memory for a long periods of time.

It is important to memorize long term information on NLP problems. In my experiments, LSTM indeed performed better.

5. Text Generator

In this part, I used a method that include concept of probability to generate the output text, which will make the output different from each time. The parameter temperature controls how different it will be. Low temperatures results in more predictable text. Higher temperatures results in more surprising text.

Below is an example of generated text with 1000 output characters and temperature 1.0 on LSTM model: (The input text is: "ROMEO:") (The weight I chose is the less validation loss weight, hoping it to be less overfitting)

First time generate

Second time generate

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ROMEO:
Though now thus day to question of affrights
As use, grace seen the ground of deprages:
My wordm we hatch'd, which we proceed,
Staying thereof was his noticles great
Enex of desperate servant in that bracon for his season;
Bid him barren and roar'd that you cannot yield;
And none in him my heart to duse as they,
But, by the stale of calfis shall red winter slaves:
And do a new-precious well though well enough!

DOMITIUS ENOBARBUS:
Who ever din, with his best hasty, of hold and oaths, knights,
Troil his stock, and my cowards are at it:
By tom my salvanity,
Much sickness to divide like angel to the common woes to in.
The sovereign Moor! that rascal apple you hadmen
At your suspectancy, Frenchman!

FALSTAFF:
My lord, go.

KING HENRY VI:
So picting your youth, with token to this I shall do.

DESDEMONA:
A rose enough and be not sharp-bud too. This
familiar that of himself shall leave you France.

LANCASTER:
A stem of story,
Stay now to ritions: by your lapy's servant, let me sweep, stain
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ROMEO:
My night of Maine of France shall keep at home,
By thus I stir. Happily.

First Murderer:
Yes, but what will seal thyself?

Till outrested, from backle multitude,
Your blushings:
Granding in your days then again
BIAGHIMORD:
God soul in, sir:
Here as a trick as man here grow to spit of melted
As he than here again to follow seas
That thought to answer me.

OTHELLO:
You meant; and to that high that calls of us
Although they know when he is stardly dead:
And yet he frame of Sandarines, I am greated.

GLOUCESTER:
While I perceive that I am friendly and in near;
And say, I fear'd, this is the fire of night.
So, fare you well; while I was now, by my lamp,
Shall think I houses more: the argument bear me,
So I shall have thee of the sauce our gent.

APEMANTUS:
No, let me not strongly dress
Than leg and lengthen'd down and will and often, with found.
Well, as I shall keep that requite from flame
Being banish'd; whose deeds are welchter way than to my
behavior in pickey:--till even to laying ep
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