Section 1

Q1: *This SimpleRNN will beat a naive approach but not a simple linear model. Why do you think this is the case?*

This is because when we only have the one RNN neuron it is linear (XOR problem) so it can only do as good as a linear model.

Q2: *Why do we use 'return_sequences = True' in the previous layers, but not the output layer?*

We want the output layer to simply return a single value, its output prediction.

Q3: *Why do we remove 'return_sequences = True' from this 2nd layer?*

This is because we need to match the input of the single neuron to the output of the 2nd layer. This is instead of an RNN that can have an arbitrarily long input.

Section 2

For working the tuning the pretrained model I took the approach of using TensorFlow. I used the bert-base-uncased as was recommended in office hours as a similar but different model to the tutorial's bert-base-cased. The model has 109,483,778 total parameters in which almost all of those are in the bert model. The model is also then piped into a classifier. I followed assessing the "General Language Understanding Evaluation benchmark" (GLUE) with Corpus of Linguistic Acceptability (COLA) to make a determination of whether the input sentence is grammatically correct. Following this tutorial I found my trained model had a Matthews correlation of 0.7457.

A topic that I learned about that I had never heard of before was the Matthews correlation. According to ChatGPT prompted with "What is a Matthews correlation? Explain in two sentences.": *The Matthews correlation coefficient (MCC) is a single statistic that measures the quality of binary classifications by taking into account true positives, true negatives, false positives, and false negatives. It provides a balanced evaluation of a classification model's performance, with +1 indicating perfect classification, 0 indicating no better than random chance, and -1 indicating perfect disagreement with the true labels.*

Section 3

Few-Shot Prompting:
Complete the list below:

Audio_file.wav // wav
chessData.zip // zip
myModel.🔥 // mojo
fire_data.csv //

<u>ChatGPT</u>
It appears you'd like to complete the list by providing the corresponding file extensions for the given file names. Here's the list with the missing extension filled in:

1. Audio_file.wav // wav
2. chessData.zip // zip
3. myModel.🔥 // mojo
4. fire_data.csv // csv

<u>Bard</u>
fire_data.csv // csv

The file extension for fire_data.csv is csv, which stands for comma-separated values. CSV files are a common format for storing data in a tabular format, with each row representing a record and each column representing a field. CSV files are often used to exchange data between different applications, as they are simple and easy to read and write.

Here is a complete list of the file extensions you provided, along with their descriptions:

| File extension | Description |
|---|---|---|
| .wav | Audio file format |
| .zip | Compressed file format |
| .mojo | Machine learning model file format |
| .csv | Comma-separated values file format |

I hope this helps!

<u>Changing the order around I get this:</u>
Complete the list below:

Complete the list below:
myModel.🔥 // mojo
chessData.zip // zip
Audio_file.wav // wav
fire_data.csv //

ChatGPT
fire_data.csv // csv

Bard
The completed list is as follows:

myModel.🔥 // mojo
chessData.zip // zip
Audio_file.wav // wav
fire_data.csv // csv
The last file in the list, fire_data.csv, is a comma-separated values file, which is a common format for storing tabular data. CSV files are often used to store data such as sensor readings, financial transactions, and other types of structured data.

It seems like the model consistently determines the correct answer even when the examples are switched or there is a weird example such as 🔥// mojo.

Changing the format:
myModel.🔥 = mojo
chessData.zip = zip
Audio_file.wav = wav
fire_data.csv =

ChatGPT:
It looks like you've assigned file extensions or formats to some file names. Here's what those assignments mean:

1. `myModel.🔥 = mojo`: You've associated the 🔥 emoji (often used to represent fire or something hot) with a file named `myModel.mojo`. It suggests that the file named `myModel.mojo` might be related to a model or something that's "hot."

2. `chessData.zip = zip`: You've assigned the file extension "zip" to a file named `chessData.zip`. This typically indicates that `chessData.zip` is a compressed archive, commonly used for packaging multiple files or folders together.

3. `Audio_file.wav = wav`: You've associated the file extension "wav" with a file named `Audio_file.wav`. This suggests that `Audio_file.wav` is an audio file, likely in the WAV format.

4. You haven't provided a file name or format for "fire_data.csv." If you have a specific question or need information about this file, please provide more details, and I'll be happy to help.

If you have any specific questions or need assistance with these files, please let me know how I can assist you further.

The file extension for fire_data.csv is **csv**.

CSV stands for comma-separated values. It is a common file format for storing tabular data, such as spreadsheets. CSV files are typically plain text files with each record on a new line and each field separated by a comma.

Fire data is often stored in CSV files because it is a convenient way to store and exchange data between different software applications. For example, a fire department might use a CSV file to store data about all of the fires that have occurred in their city in the past year.

Here is an example of a CSV file containing fire data:

```

date,location,type,damage
2023-11-03,123 Main Street,residential,$100,000
2023-11-02,456 Elm Street,commercial,$250,000
```

CSV files can be opened by most spreadsheet programs, such as Microsoft Excel and Google Sheets. They can also be opened by many other types of software applications, such as database programs, text editors, and programming languages.

I hope this helps!

With changing the format interesting enough ChatGPT does not like the equal sign since it is assuming that I am writing code. Bard still does well though.

Chain-of-Thought Prompting

If it takes 3 towels 2 hours to dry on a drying rack, how long will it take 6 towels?

ChatGPT:
If it takes 3 towels 2 hours to dry on a drying rack, it means that the drying rack can handle the drying of 3 towels in 2 hours. To find out how long it will take for 6 towels to dry on the same drying rack, you can use the concept of proportion.

Let "x" be the time it takes for 6 towels to dry.

We can set up a proportion based on the drying rate:

(3 towels) / (2 hours) = (6 towels) / (x hours)

Now, you can solve for x by cross-multiplying and then dividing:

(3 towels) * (x hours) = (2 hours) * (6 towels)

3x = 12
Now, divide both sides by 3 to solve for x:
x = 12 / 3
x = 4 hours
So, it will take 6 towels 4 hours to dry on the drying rack.

<u>Bard</u>
*If it takes 3 towels 2 hours to dry, then it will take 6 towels **4 hours** to dry, assuming that all other factors, such as the drying conditions and the size and thickness of the towels, remain the same.*

This is because drying is a linear process, meaning that the time it takes to dry a towel is directly proportional to the number of towels being dried. In other words, if it takes 2 hours to dry 3 towels, then it will take 4 hours to dry 6 towels, 6 hours to dry 9 towels, and so on.

Of course, there may be some variation in the drying time depending on other factors, such as the humidity and temperature of the air, but in general, you can expect it to take twice as long to dry twice as many towels.

Without using Chain-of-Thought both of these models mess up the problem since they are saying that this is a linear problem while adding more towels will not change the time for them to dry. Adding a similar example we see:

Q: If it takes 5 tomatoes 10 days to ripen, how long will it take 15 tomatoes to ripen?
A: It still takes 10 days since the number of tomatoes has nothing to do with how long it takes to ripen tomatoes

Q: If it takes 3 towels 2 hours to dry on a drying rack, how long will it take 6 towels?
A:

<u>ChatGPT</u>
If it takes 3 towels 2 hours to dry on a drying rack, it will take 6 towels the same amount of time to dry, which is 2 hours. The number of towels doesn't affect the drying time in this scenario; it's the same for 3 towels as it is for 6 towels.

<u>Bard</u>
Answer to the second question:

If it takes 3 towels 2 hours to dry on a drying rack, it will still take 2 hours for 6 towels to dry, assuming that the drying conditions remain the same.

This is because the drying rate of each towel is independent of the number of towels on the drying rack. In other words, each towel will dry at the same rate, regardless of how many other towels are present.

Therefore, if you have 6 towels to dry, it will take 2 hours, just like it would take 2 hours to dry 3 towels.

However, it is important to note that this answer assumes that the drying conditions remain the same. If the drying conditions change, such as if the temperature or humidity changes, then the drying time may also change.

By providing our chain of though for an example question we get the models to act correctly!

Section 4
I watched 3Blue1Brown's YouTube video on backpropagation to motivate my calculations.

Additionally, I consulted Samson Zhang YouTube video to understand more about weight initialization