

Week11 : Assignment 11

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implement an LSTM text generator

```
In [88]: # import required package

import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import keras
from keras import layers
from keras.models import Sequential
import requests
import string
import tensorflow as tf
import random
import sys

from IPython.core.interactiveshell import InteractiveShell
InteractiveShell.ast_node_interactivity = 'all'

In [14]: # load the data

file_path = '/Users/ganeshkale/work/virtual_envs/dsc650_Big_Data/dsc650/dsc650/assignments/assignment11/data/Tf

with open(file_path,'r') as file:
    for line in file:
        if line.startswith("PART ONE"): # start reading after this line
            response = file.readlines()

In [116]: # clean the text data by removing special chars and lowering the text case

string.punctuation = string.punctuation+'\n'

clean_responses = [word.lower() for line in response for word in line.split() if word not in string.punctuatio
text_data = ' '.join(clean_responses)

# text_data = text_data[:2577]

print('length of text data: ',len(text_data))

length of text data: 211096
```

char embeddings - vecotrizing the sequence of chars

```
In [117]: # creating sentences form text data by specific len

maxlen = 50
step =3
sentences = []
next_chars =[]

for i in range(0, len(text_data) - maxlen, step):
    sentences.append(text_data[1:i+maxlen])
    next_chars.append(text_data[i+maxlen])

print('Number of Sequences: ', len(sentences))

Number of Sequences: 70349

In [118]: # map unique chars to its index

chars = sorted(list(set(text_data)))
print('Unique characters:', len(chars))
char_indices = dict((char, chars.index(char)) for char in chars)

Unique characters: 60

In [119]: # vectorize the text data

x = np.zeros((len(sentences), maxlen, len(chars)), dtype=bool)
y = np.zeros((len(sentences), len(chars)), dtype=bool)
for i, sentence in enumerate(sentences):
    for t, char in enumerate(sentence):
        x[i, t, char_indices[char]] = 1
        y[i, char_indices[next_chars[t]]] = 1

In [120]: # using single dense layer & show summary

model = Sequential()
model.add(layers.LSTM(128,input_shape = (maxlen,len(chars))))
model.add(layers.Dense(len(chars),activation = 'softmax'))

model.summary()

Model: "sequential_1"

Layer (type) Output Shape Param #
-----
lstm_1 (LSTM) (None, 128) 96768

dense_1 (Dense) (None, 60) 7740
-----
Total params: 104,508
Trainable params: 104,508
Non-trainable params: 0
```

model compilation config

```
In [121]: optimizer = tf.keras.optimizers.RMSprop(learning_rate=0.01)
model.compile(loss = 'categorical_crossentropy',optimizer=optimizer,metrics=['acc'])

In [122]: # function sample the text char based on prediction

def sample(preds, temperature=1.0):
    preds = np.asarray(preds).astype('float64')
    preds = np.log(preds) / temperature
    exp_preds = np.exp(preds)
    preds = exp_preds / np.sum(exp_preds)
    probas = np.random.multinomial(1, preds, 1)
    return np.argmax(probas)

In [123]: # train the model for 20 epochs

model.fit(x, y, batch_size=128, epochs=20)

Epoch 1/20
550/550 [=====] - 38s 66ms/step - loss: 2.1283 - acc: 0.3951
Epoch 2/20
550/550 [=====] - 57s 104ms/step - loss: 1.6289 - acc: 0.5175
Epoch 3/20
550/550 [=====] - 45s 82ms/step - loss: 1.4471 - acc: 0.5666
Epoch 4/20
550/550 [=====] - 48s 88ms/step - loss: 1.3413 - acc: 0.5955
Epoch 5/20
550/550 [=====] - 48s 87ms/step - loss: 1.2708 - acc: 0.6120
Epoch 6/20
550/550 [=====] - 48s 88ms/step - loss: 1.2181 - acc: 0.6267
Epoch 7/20
550/550 [=====] - 50s 90ms/step - loss: 1.1789 - acc: 0.6379
Epoch 8/20
550/550 [=====] - 54s 99ms/step - loss: 1.1485 - acc: 0.6459
Epoch 9/20
550/550 [=====] - 50s 91ms/step - loss: 1.1210 - acc: 0.6537
Epoch 10/20
550/550 [=====] - 49s 89ms/step - loss: 1.0995 - acc: 0.6602
Epoch 11/20
550/550 [=====] - 51s 94ms/step - loss: 1.0766 - acc: 0.6670
Epoch 12/20
550/550 [=====] - 51s 92ms/step - loss: 1.0665 - acc: 0.6698
Epoch 13/20
550/550 [=====] - 51s 93ms/step - loss: 1.0487 - acc: 0.6735
Epoch 14/20
550/550 [=====] - 52s 95ms/step - loss: 1.0406 - acc: 0.6761
Epoch 15/20
550/550 [=====] - 53s 97ms/step - loss: 1.0246 - acc: 0.6804
Epoch 16/20
550/550 [=====] - 52s 94ms/step - loss: 1.0109 - acc: 0.6849
Epoch 17/20
550/550 [=====] - 54s 99ms/step - loss: 1.0087 - acc: 0.6840
Epoch 18/20
550/550 [=====] - 53s 97ms/step - loss: 1.0103 - acc: 0.6848
Epoch 19/20
550/550 [=====] - 54s 98ms/step - loss: 0.9866 - acc: 0.6918
Epoch 20/20
550/550 [=====] - 55s 100ms/step - loss: 0.9643 - acc: 0.6990
Out[123]: <keras.callbacks.History at 0x1347a4f40>

In [124]: # save the model

model.save('lstm_model.h5')

In [141]: # text generation loop & train the model

def generate_text(sample_text, temperatures):

    # start_index = random.randint(0, len(texttext_data) - maxlen - 1)
    generated_text = text_data[start_index: start_index + maxlen]
    generated_text = sample_text.lower()
    print('--- Generating with seed: "' + generated_text + '"')

    for temperature in temperatures:
        print('\n----- temperature:', temperature)
        sys.stdout.write(generated_text)
        for i in range(400):
            sampled = np.zeros((1, maxlen, len(chars)))
            for t, char in enumerate(generated_text):
                sampled[0, t, char_indices[char]] = 1.
            preds = model.predict(sampled, verbose=0)[0]
            next_index = sample(preds, temperature)
            next_char = chars[next_index]
            generated_text += next_char
            generated_text = generated_text[1:]
            sys.stdout.write(next_char)

    # with random seed

    # text generation loop & train the model

def generate_text_random_seed(temperatures):

    start_index = random.randint(0, len(text_data) - maxlen - 1)
    generated_text = text_data[start_index: start_index + maxlen]
    # generated_text = sample_text.lower()
    print('--- Generating with seed: "' + generated_text + '"\n')

    for temperature in temperatures:
        # print('\n----- temperature:', temperature)
        sys.stdout.write(generated_text)
        for i in range(400):
            sampled = np.zeros((1, maxlen, len(chars)))
            for t, char in enumerate(generated_text):
                sampled[0, t, char_indices[char]] = 1.
            preds = model.predict(sampled, verbose=0)[0]
            next_index = sample(preds, temperature)
            next_char = chars[next_index]
            generated_text += next_char
            generated_text = generated_text[1:]
            sys.stdout.write(next_char)

In [128]: # generate texts

sample_text = 'He swept the floor with his jacket and lay down, '
temperatures = [0.2, 0.5, 1.0, 1.2]

generate_text(sample_text, temperatures)

--- Generating with seed: "he swept the floor with his jacket and lay down, "
```

----- temperature: 0.2

he swept the floor with his jacket and lay down, he said that the boy was started the sun, and he had always a bout them and the since in the people who had been with the desert. the boy could strange ling the soul of the world. "i'll were the present of the soul of the world of the counert of the poundstoft the desert. the boy was become my treasure, and they said the sun, and the boy asked that the boy said that the sun he had sudenth of t he so

----- temperature: 0.5

the boy said that the sun he had sudenth of the soul of the world. "i'll were that they crostring went to end t he trabettie. "i need to him here with the fields. it was the liate't had always was the plaze that the old man would never have been fearinad was realizzo back something a currelld. "the transtal destiny's like the moenct o the desert. he had been the plaza. the boy reacus. "i learned you to something to stay understand the time t hat

----- temperature: 1.0

you to something to stay understand the time that he saw it was so starion in taboraquieued everything at lelan is hand go to sij yee. the only men pand reached you cronts," said the alchemist. a calle stars when now you ca it, and dold. "i'm resded his destiny, you wanted to the child, and they causedsted where they leocke. only all yours." the boy small said. "you said that me, i know where you trawing for amosed or my a ten with the language tiong

----- temperature: 1.2

awing for amosed or my a ten with the languaetiongy. he nothresus of transformment. if you here he, corted to h is bring someth of the world. "i have to is the point to the world was become one's started the sun if you have t o lives of what become tyouummo," hes, one of the came, and had a king wreacantiere sfcor of. "i'll duth weve de selbs: 's doing wus shale are was. how the sun and undist." the people went to the rooh, of the ware. and vound en 'ta

Generating Sample Texts for different Random seed:

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In [142]: # Sample text since temperature 0.2 generated more random text so used for sample texts

temperatures = [0.2]

for i in range(1,21):

    print(f'\n\n\n-----Sample Text#{i}-----:\n\n')
    generate_text_random_seed(temperatures)

-----Sample Text#1-----:
--- Generating with seed: "orse, rearing over him with a frightening scream. "

orse, rearing over him with a frightening scream. "i have to them about himself. it was the wind would be able to the sands, because it was the present of the desert. he had learned the present. if he was the trabely for a sun about the pounts of the desert. he had treasures than he had been with the desert. the boy said the trabely alchem ist. "i'm not to them to the soul of the world. "i have to imprommany to the soul of the world. "there was the camel drav



-----Sample Text#2-----:
--- Generating with seed: "he thought. it was because they moved around"



he thought. maybe it was because they moved around, and the sun the boy was alreadynad beaunded the desert. he had been the since of the poundstoft the desert. "it's the palm to the sand of the desert with the desert. he h ad noticed them, and the sun the boy thought. it was the wind would be able to the sands of the desert. he had been the trabem. the boy could strange the desert. the boy said the trabem. the boy could street than the oasis mone



-----Sample Text#3-----:
--- Generating with seed: "but never would they harness the wind. "you can't "



but never would they harness the wind. "you can't such the person was said that it was the plaza. the boy conti ng at the soul of the world. "i have to them about himself. it was the caravan, because it was the present. if he was the caravan, because it was the little than he had been with the desert. the boy said the trabely alchem ist. the boy could strange the present. the boy said the boy that had been with the desert. he had noll be a pr ieved



-----Sample Text#4-----:
--- Generating with seed: "tent, and the boy gave his friend enough gold to be able to understand the desert. the boy could street that the boy thought. "i have to eir lef you would learn that the sun was the caravan, but he had to see the present. the boy said the place of the silence of the desert. he had treasures the soul of the world. "i'll were the converse the desert when he had been the since them. "i'll was the chient of the desert was starso the sun about the pou ntion



-----Sample Text#5-----:
--- Generating with seed: "h could reveal the history of all things. one coul"



h could reveal the history of all things. one could be able to understand the present. the boy said the transfo ut himself and they were help the soul of the world. he was the sents to the world said the boy ask him to the soul of the world. "i have to is the point to the world was the language of the world at the b oin. the boy asked the present. he said that the sun the boy said the since of the poundstoft the sun the boy thoug t. "i'll we are the shepherd was the money to them to the soul of the world. "i have to them to blow, and they was s



-----Sample Text#6-----:
--- Generating with seed: "continue the conversation. "my name is melchizedek"



continue the conversation. "my name is melchizedekenll shepherishe had been would be able to travel. the boy was also the sun about the desert. "it's the palm to the soul of the world at the caravan. the sun the boy said t o himself. and they were only the sun about the sands, he would be able to the same to the chieftains, because they were because that they were because that he had noll he had to see them. "i have to stay the moners of the cryst



-----Sample Text#7-----:
--- Generating with seed: " have watched the caravan as it crossed the desert"



have watched the caravan as it crossed the desert. he had to say about them. "i have to do a child of the dese rt have that they were one doing to stull him. "i'll was the wind would be ineverly for a simple sun. there was the sun the present. it was the sand was the treasure. "i amboy actiss for a simple shepherd, and he had to in the present. he didn't could street than the sun the sun would be able to travel. and they was saw about the patars s of t



-----Sample Text#8-----:
--- Generating with seed: "s, and rode out in the direction of the pyramids o"



s, and rode out in the direction of the pyramids of the poundse of the pounes of the desert. he had been with t he desert. he said that the boy was alreadynad beaund the since them to be able to do them. the boy thought. i f he had not to them they were traveled the present. he said that the sun became for a simply. "i'll was the wi nd alr



-----Sample Text#9-----:
--- Generating with seed: "s entertaining guests that night, and the guests w"



s entertaining guests that night, and the guests was said. "then it wasn't to them they were the present. the boy said the salem, because it was the point that the sun was also the sun became one to the wind. "i'll went to him to be able to do one to the soul of the world. "i have to travel the sun about the desert. he had learned the soul of the world. "i have to is a child of the present. it was the man who had been there was the silence of t he pat how the desert, then he said that the wind was able to do them. "i have to end the present of stanted to the p



-----Sample Text#10-----:
--- Generating with seed: "t most of the time people don't realize i've done "



t most of the time people don't realize i've done to the soul of the world. "i have to do something weppen, the boy thought. "i'll have to them to be able to do them the desert. "it's something to the most of the pat had been with the d esert. "i'll we are the shepherd was the money to them to the soul of the world. "i have to them to blow, and they was s



-----Sample Text#11-----:
--- Generating with seed: "r. "i came to tell you just one thing," the boy sa"



r. "i came to tell you just one thing," the boy said the new the sun. "with the langer than the sun became for a the sands, he said that they were traveled the sun. "it's the going to them to the wind. "i'll went to him to be able to do one to the soul of the world. "i have to travel the sun about the desert. he had learned the soul of the world. "i have to is a child of the present. it was the man who had been there was the silence of t he pat how the desert, then he said that the wind was able to do them. "i have to end the present of stanted to the p



-----Sample Text#12-----:
--- Generating with seed: "d in terms of what i would like to see happen, not"



d in terms of what i would like to see happen, not the desert with the camel driver was alreadynad beaund to th e soul of the world. "i have to them to be able to do them the desert. "it's something to the most of the pat had been with the d esert. the boy asked the present. he said that the sun the boy said the since of the poundstoft the sun the boy thoug t. "i'll we are the shepherd was the money to them to the soul of the world. "i have to them to blow, and they was s



-----Sample Text#13-----:
--- Generating with seed: " the omens were that it was time to go. i'm going "



the omens were that it was time to go. i'm going to be able to understand the desert. the sun as he had to sav e the sands, he said that they were traveled the sun. "it's the going to them to the wind. "i'll went to him to be able to do one to the soul of the world. "i have to stay the desert. he had to save the desert. "the there was the soul of the world. "i'll we are the boy was the plaza. but there was the soul of the world was th e peo



-----Sample Text#14-----:
--- Generating with seed: "nsultation." another trick, the boy thought. but h"



nsultation." another trick, the boy thought. but he was a decision to the man who had been the trabefursal bett ed the sands, he had to see them about the since of the pounse, one than they were traveled the coment to the soul of the world. "i have to them to be able to do them the desert. "it's something to the most of the pat had been with the d esert. he pat how the desert, then he said that the wind was able to do them. "i have to end the present of stanted to the p



-----Sample Text#15-----:
--- Generating with seed: "h fear, but the alchemist helped him out of the te"



h fear, but the alchemist helped him out of the tent with the sun of the palms, the boy didn't know where he ha d to realized the present. he said that it was the liat then in the desert. the boy said that the sun of the soul of the world. "i have to them to be able to do them the desert. "it's something to the most of the pat had been with the d esert. up he had always was start the desert. he had a decisions to the group that the boy thought. "i'll we at the carav



-----Sample Text#16-----:
--- Generating with seed: " so, two customers had entered the shop and bought"



so, two customers had entered the shop and boughts. "i'll we are the wind would be able to the sands, he had t o see them they were for a simple such of the pountion to the poul of the poundstoft of the treasure. "i amboy acove the wind of the world. "i have to them to be able to do them the desert. "it's something to the most of the pat had been with the d esert. "i'm the pyramids, because it was the conversation. "it was the camel driver was the palm trees all the pre sent.



-----Sample Text#17-----:
--- Generating with seed: " he saw, in the comer of the room, his old shepherd"



he saw, in the comer of the room, his old shepherd women and look at the sands, because it was the person was startly the boy that the sun be a child. the boy could strange the desert. the boy didn't know what i had the p laze where he had to see the pointing of the desert. "it's something to the most of the pat had been with the d esert. he had been a silence of the desert. he had been the trabely than he had been with the desert. he had le arned



-----Sample Text#18-----:
--- Generating with seed: "eam. that's the point at which most people give up"



eam. that's the point at which most people give up the sun, and the boy was said that the boy was the trabem. t he boy said the trabem. the boy said the trabem. the chieb and the sun with a child of the desert. "i'm the palm to the soul of the world. "i have to them to be able to do them the desert. "it's something to the most of the pat had been with the d esert. the boy said the trabely sun, and the boy thought. "i am about them about the sun would be able to the soul of the w orld.



-----Sample Text#19-----:
--- Generating with seed: "in the present. if you pay attention to the presen"



in the present. if you pay attention to the present. the boy said the trabem. "they was sale had already his lo ved them to spent the boy that he had been the plaza. he said that it was the world and already understands to the soul of the world. "i have to them to be able to do them the desert. "it's something to the most of the pat had been with the d esert. "i'll went to them to be able to realize than the since that he had to them to be able to the wind. "i'll were the point



-----Sample Text#20-----:
--- Generating with seed: "e those who have found their treasure because i ne"



e those who have found their treasure because i need to them to be able to the soul of the people. they were tr avel alsim said that it was the transform me, because it was the trabely transform them. "i'll was the little th an he had been with the world. "i have to them to be able to do them the desert. "it's something to the most of the pat had been with the d esert. endle them the sun of the desert. he had to the soul of the world. "i have to impersis for a people were also b ecaus


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END