Stoneburner, Kurt

- ## DSC 650 - Assignment 11 Generative Text Modeling
- Using LSTM to predict characters based on the works of Edgar Allen Poe

In [1]:
```
import os
import sys
# //*** Imports and Load Data
#import matplotlib.pyplot as plt
import numpy as np
#import pandas as pd


from pathlib import Path


#//*** Use the whole window in the IPYNB editor
from IPython.display import display, HTML
display(HTML("<style>.container { width:100% !important; }</style>"))

#//*** Maximize columns and rows displayed by pandas
#pd.set_option('display.max_rows', 100)
#pd.set_option('display.max_columns', None)

import email
from email.policy import default
from email.parser import Parser



from chardet.universaldetector import UniversalDetector
from bs4 import BeautifulSoup

#//*** Quiet the BS4 warnings
import warnings
```

In [78]:
```
def parse_html_payload(payload):
    #from bs4 import BeautifulSoup

    #//*** Quiet the BS4 warnings
    #import warnings
    #warnings.filterwarnings("ignore", category=UserWarning, module='
    """
    This function uses Beautiful Soup to read HTML data
    and return the text.  If the payload is plain text, then
    Beautiful Soup will return the original content
    """
    soup = BeautifulSoup(payload, 'html.parser')
    #print(soup.find_all("p"))
```

```
    return str(soup.get_text()).encode('utf-8').decode('utf-8')
    #return soup
#//*******************************************************
#//*** Plot a Fitted Models History of Loss and Accuracy
#//*******************************************************
def plot_model_history(input_history):
    import matplotlib.pyplot as plt


    loss_key, acc_key = list(input_history['history'].keys())[:2]


    acc = input_history['history'][acc_key]
    loss = input_history['history'][loss_key]


    epochs = range(1, len(loss) + 1)
    plt.plot(epochs, acc, "b", label="Training Accuracy")
    plt.title("Training Accuracy\nAccuracy should go up")
    plt.xlabel("Epochs")
    plt.ylabel("Loss")
    plt.legend()
    plt.show()

    plt.plot(epochs, loss, "bo", label="Training Loss")

    plt.title("Training Loss \nLoss should go down")
    plt.xlabel("Epochs")
    plt.ylabel("Loss")
    plt.legend()
    plt.show()

    #//*** Quit if only accuracy and Loss
    if len(list(input_history['history'].keys())) == 2:
        return


    val_loss_key, val_acc_key = list(input_history.history.keys())[2:

    val_loss = input_history.history[val_loss_key]
    val_acc = input_history.history[val_acc_key]

    plt.plot(epochs, loss, "bo", label="Training loss")
    plt.plot(epochs, val_loss, "b", label="Validation loss")
    plt.title("Training and validation loss")
    plt.xlabel("Epochs")
    plt.ylabel("Loss")
    plt.legend()
    plt.show()

    #//*** Plot the Validation Set Accuracy
    plt.clf()

    plt.plot(epochs, acc, "bo", label="Training accuracy")
    plt.plot(epochs, val_acc, "b", label="Validation accuracy")
    plt.title("Training and validation accuracy")
```

```
    plt.xlabel("Epochs")
    plt.ylabel("Accuracy")
    plt.legend()
    plt.show()
```

In [2]:
```
import ebooklib
from ebooklib import epub
from html.parser import HTMLParser

#book = epub.read_epub('./books/Moby-Dick-Herman-Melville.epub')


#book = epub.read_epub('./books/Moby-Dick-Herman-Melville.epub')
```

In [3]:
```
import tensorflow.compat.v1 as tf
import tensorflow as tf
#tf.enable_eager_execution(tf.ConfigProto(log_device_placement=True))
```

```
tf.Tensor([4. 6.], shape=(2,), dtype=float32)
```

In [4]:
```
```

In [110]:
```
"""
Moby Dick Cleaning
raw_text = ""
for x in book.get_items():
    if x.get_type() == 9:
        raw_text += parse_html_payload(x.get_body_content())

#//*** Manually remove all text before chapter1 - This is the header
text = raw_text[raw_text.find("Chapter 1 Loomings"):]
"""
raw_text = ""
for x in book.get_items():
    if x.get_type() == 9:
        raw_text += parse_html_payload(x.get_body_content())


print("Length Before Cleaning: ", len(raw_text))
#//********************
#//*** Light cleaning
#//********************
#//*** Manually remove all text before the first original Poe Story
raw_text = raw_text[raw_text.find("THE UNPARALLELED ADVENTURES OF ONE

#//*** Find the end of his collected works, this will remove all the
end_dex = raw_text.find("NOTES\nOf the many verses from time to time
raw_text = raw_text[raw_text.find("THE UNPARALLELED ADVENTURES OF ONE


#//*** Remove \xa0 spacing characters
while "\xa0" in raw_text:
    raw_text = raw_text.replace("\xa0","")
print("Length After Cleaning: ", len(raw_text))
```

```
Length Before Cleaning:  2592579
```

In [ ]:
```
import random
import sys

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)

```

Build and Save an LSTM model and additional Parameters for reproduction

This is the final results after numerous model testing runs. Some these tests models have been preserved.

In [129]:
```
# Length of extracted character sequences
maxlen = 60

# We sample a new sequence every `step` characters
step = int(maxlen *.1)

if step <= 0:
    step=1

print(step)

pct = 1
tensor_count = 256
text = raw_text[:int(len(raw_text)*pct)]

# This holds our extracted sequences
sentences = []

# This holds the targets (the follow-up characters)
next_chars = []

for i in range(0, len(text) - maxlen, step):
    sentences.append(text[i: i + maxlen])
    next_chars.append(text[i + maxlen])
print('Number of sequences:', len(sentences))

# List of unique characters in the corpus
chars = sorted(list(set(text)))
print('Unique characters:', len(chars))
# Dictionary mapping unique characters to their index in `chars`
char_indices = dict((char, chars.index(char)) for char in chars)

# Next, one-hot encode the characters into binary arrays.

```

```
print('Vectorization...')
x = np.zeros((len(sentences), maxlen, len(chars)), dtype=np.bool)
y = np.zeros((len(sentences), len(chars)), dtype=np.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[i]]] = 1

print(x.shape)
print(y.shape)

from tensorflow import keras
from keras import layers

model = keras.models.Sequential()
model.add(layers.LSTM(tensor_count, input_shape=(maxlen, len(chars))))
#model.add(layers.Dropout(0.5))
#model.add(layers.LSTM(64))
model.add(layers.Dense(len(chars), activation='softmax'))

model.compile(loss='categorical_crossentropy', optimizer="rmsprop",me

model.summary()

seeds  = []

for i in range(0,3):
    start_index = random.randint(0, len(text) - maxlen - 1)
    seeds.append(text[start_index: start_index + maxlen])

print(seeds)

import random
import sys
train = x
targets = y
history = {
    'loss' : [],
    'accuracy':[]
}

seed_text = "Once upon a midnight dreary, while I pondered, weak and



predictions = []
for epoch in range(1, 8):
    print('epoch', epoch)
    # Fit the model for 1 epoch on the available training data
    result = model.fit(train, targets,
              batch_size=128,
              epochs=5)

    # Select a text seed at random
    #start_index = random.randint(0, len(text) - maxlen - 1)
    #generated_text = text[start_index: start_index + maxlen]
```

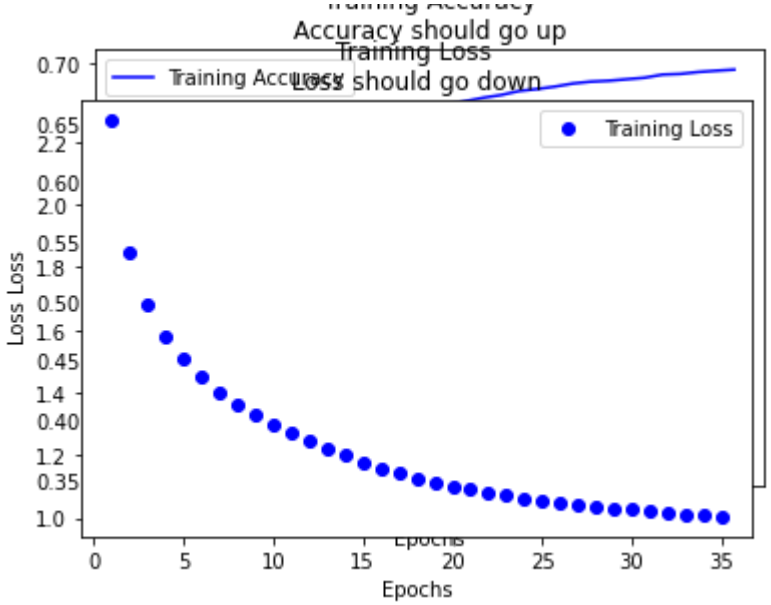
```
    #print('--- Generating with seed: "' + generated_text + '"')

    history['loss'] = history['loss'] + result.history['loss']
    history['accuracy'] = history['accuracy'] + result.history['accur

    generated_text = seed_text[:maxlen]
    predict = f"[ {generated_text} ]"

    # We generate 400 characters
    for i in range(120):
        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_char = chars[np.argmax(preds)]

        predict += next_char

        generated_text += next_char
        generated_text = generated_text[1:]

        #sys.stdout.write(next_char)
        #sys.stdout.flush()
    print(predict)
    predictions.append((epoch*5,predict))

plot_model_history({"history":history})
for pred in predictions:
    print(pred)



import pickle

filename = f"./results/model_EdgarAllenPoe_Letters_PCT{pct*100}_ML{ma

#//*** Save The Model
from keras.models import load_model
model.save(f"{filename}.h5")

#//*** Save dictionaries parameters and ngrams
pickle_collection = {

    "chars" : chars,

    "char_indices" : char_indices,

    "history" : {"history":history},

    "params" : {
```

```
        "max_len" : maxlen,
        "pct":pct,
        "step" : step,
        "tensor_count" : tensor_count
    },
    "predictions" : predictions,
}

with open(f"{filename}.pkl",'wb') as f:
    pickle.dump(pickle_collection, f)

#print(filename)
#print("Done")
```

```
Number of sequences: 415626
Unique characters: 151
Vectorization...
(415626, 60, 151)
(415626, 151)
Model: "sequential_49"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
lstm_54 (LSTM)               (None, 256)               417792
_________________________________________________________________
dense_45 (Dense)             (None, 151)               38807
=================================================================
Total params: 456,599
Trainable params: 456,599
Non-trainable params: 0
_________________________________________________________________
['iend.\nOINOS. But does not The Most High know all?\nAGATHOS. T', 'er
from my thoughts—"Dammit," I suggested—"the gentleman say', 'e "peculi
ar shape of that box"; and, as I spoke the words, I']
epoch 1
Epoch 1/5
3248/3248 [==============================] - 694s 213ms/step - loss:
2.2683 - accuracy: 0.3620
Epoch 2/5
3248/3248 [==============================] - 691s 213ms/step - loss:
1.8503 - accuracy: 0.4614
Epoch 3/5
3248/3248 [==============================] - 692s 213ms/step - loss:
1.6837 - accuracy: 0.5058
Epoch 4/5
3248/3248 [==============================] - 691s 213ms/step - loss:
1.5795 - accuracy: 0.5355
Epoch 5/5
3248/3248 [==============================] - 691s 213ms/step - loss:
1.5058 - accuracy: 0.5557
[ Once upon a midnight dreary, while I pondered, weak and wear ]th the
strange of the strange of the strange of the strange of the strange of
the strange of the strange of the strange
epoch 2
Epoch 1/5
```

```
3248/3248 [==============================] - 692s 213ms/step - loss:
1.4493 - accuracy: 0.5707
Epoch 2/5
3248/3248 [==============================] - 682s 210ms/step - loss:
1.4031 - accuracy: 0.5831
Epoch 3/5
3248/3248 [==============================] - 682s 210ms/step - loss:
1.3640 - accuracy: 0.5938
Epoch 4/5
3248/3248 [==============================] - 691s 213ms/step - loss:
1.3300 - accuracy: 0.6029
Epoch 5/5
3248/3248 [==============================] - 692s 213ms/step - loss:
1.2988 - accuracy: 0.6121
[ Once upon a midnight dreary, while I pondered, weak and wear ]s of t
he seven of the bottom of the seas of the seven of the bottom of the s
eas of the bottom of the seas of the seven o
epoch 3
Epoch 1/5
3248/3248 [==============================] - 694s 214ms/step - loss:
1.2701 - accuracy: 0.6203
Epoch 2/5
3248/3248 [==============================] - 686s 211ms/step - loss:
1.2441 - accuracy: 0.6272
Epoch 3/5
3248/3248 [==============================] - 686s 211ms/step - loss:
1.2209 - accuracy: 0.6343
Epoch 4/5
3248/3248 [==============================] - 685s 211ms/step - loss:
1.1991 - accuracy: 0.6406
Epoch 5/5
3248/3248 [==============================] - 685s 211ms/step - loss:
1.1784 - accuracy: 0.6465
[ Once upon a midnight dreary, while I pondered, weak and wear ]s the
personal ruby of the board and the thing, and the personal region of t
he constractic and the state of the manner o
epoch 4
Epoch 1/5
3248/3248 [==============================] - 693s 213ms/step - loss:
1.1592 - accuracy: 0.6517
Epoch 2/5
3248/3248 [==============================] - 694s 214ms/step - loss:
1.1423 - accuracy: 0.6572
Epoch 3/5
3248/3248 [==============================] - 693s 213ms/step - loss:
1.1284 - accuracy: 0.6609
Epoch 4/5
3248/3248 [==============================] - 693s 213ms/step - loss:
1.1136 - accuracy: 0.6646
Epoch 5/5
3248/3248 [==============================] - 694s 214ms/step - loss:
1.1024 - accuracy: 0.6680
[ Once upon a midnight dreary, while I pondered, weak and wear ]s she
said that I had been suppered the point of the surface of the cornspar
atical and the sounds. I had not been attemp
epoch 5
```

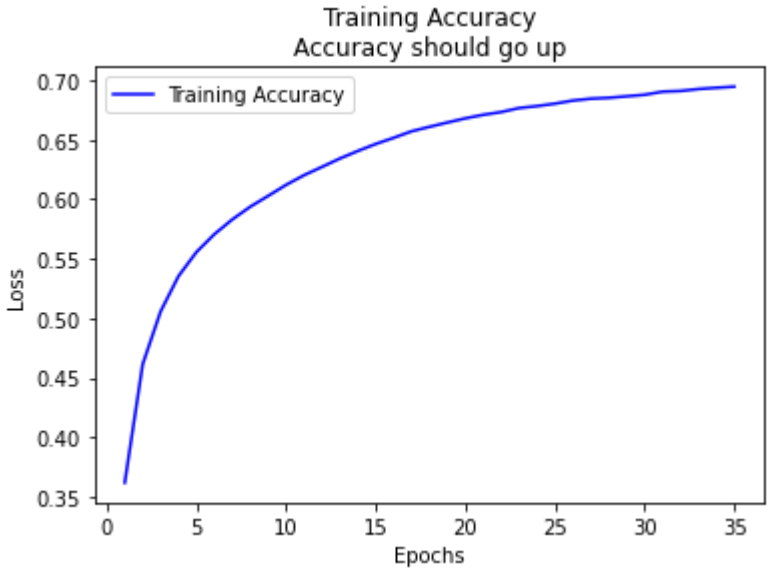
```
Epoch 1/5
3248/3248 [==============================] - 683s 210ms/step - loss:
1.0914 - accuracy: 0.6710
Epoch 2/5
3248/3248 [==============================] - 683s 210ms/step - loss:
1.0810 - accuracy: 0.6733
Epoch 3/5
3248/3248 [==============================] - 683s 210ms/step - loss:
1.0715 - accuracy: 0.6767
Epoch 4/5
3248/3248 [==============================] - 683s 210ms/step - loss:
1.0644 - accuracy: 0.6783
Epoch 5/5
3248/3248 [==============================] - 682s 210ms/step - loss:
1.0561 - accuracy: 0.6804
[ Once upon a midnight dreary, while I pondered, weak and wear ]s succ
eeded in the same time, the most intentions of the true, and the consc
ious of the corpse, the contiment of the thi
epoch 6
Epoch 1/5
3248/3248 [==============================] - 688s 212ms/step - loss:
1.0490 - accuracy: 0.6830
Epoch 2/5
3248/3248 [==============================] - 688s 212ms/step - loss:
1.0432 - accuracy: 0.6846
Epoch 3/5
3248/3248 [==============================] - 688s 212ms/step - loss:
1.0375 - accuracy: 0.6853
Epoch 4/5
3248/3248 [==============================] - 688s 212ms/step - loss:
1.0317 - accuracy: 0.6866
Epoch 5/5
3248/3248 [==============================] - 688s 212ms/step - loss:
1.0279 - accuracy: 0.6878
[ Once upon a midnight dreary, while I pondered, weak and wear ]s and
a security which should have been the most exalt to the seas to the se
a. I saw the way brought to the summer withi
epoch 7
Epoch 1/5
3248/3248 [==============================] - 678s 209ms/step - loss:
1.0215 - accuracy: 0.6904
Epoch 2/5
3248/3248 [==============================] - 679s 209ms/step - loss:
1.0171 - accuracy: 0.6910
Epoch 3/5
3248/3248 [==============================] - 679s 209ms/step - loss:
1.0122 - accuracy: 0.6926
Epoch 4/5
3248/3248 [==============================] - 679s 209ms/step - loss:
1.0083 - accuracy: 0.6937
Epoch 5/5
3248/3248 [==============================] - 679s 209ms/step - loss:
1.0044 - accuracy: 0.6947
[ Once upon a midnight dreary, while I pondered, weak and wear ]s, and
that the more through the most sight of the most silence of the sea, a
```

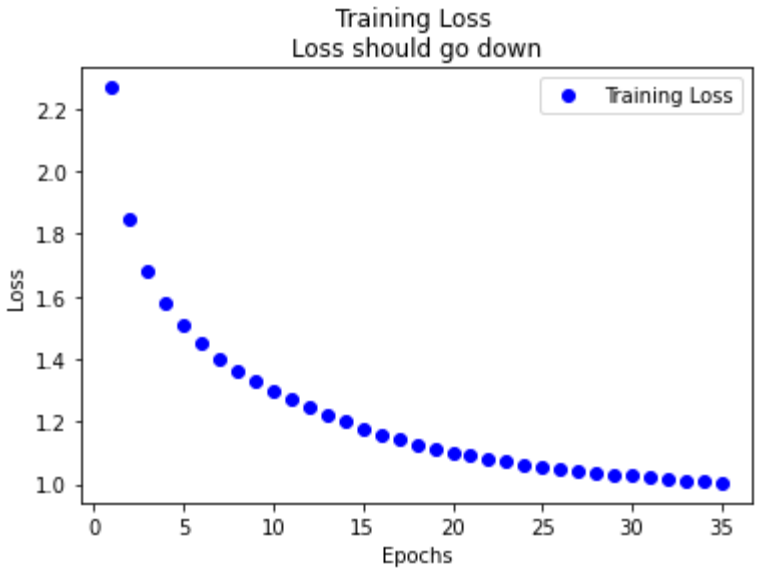



```
(5, '[ Once upon a midnight dreary, while I pondered, weak and wear ]t
h the strange of the strange of the strange of the strange of the stra
nge of the strange of the strange of the strange ')
(10, '[ Once upon a midnight dreary, while I pondered, weak and wear ]
s of the seven of the bottom of the seas of the seven of the bottom of
the seas of the bottom of the seas of the seven o')
(15, '[ Once upon a midnight dreary, while I pondered, weak and wear ]
s the personal ruby of the board and the thing, and the personal regio
n of the constractic and the state of the manner o')
(20, '[ Once upon a midnight dreary, while I pondered, weak and wear ]
s she said that I had been suppered the point of the surface of the co
rnsparatical and the sounds. I had not been attemp')
(25, '[ Once upon a midnight dreary, while I pondered, weak and wear ]
s succeeded in the same time, the most intentions of the true, and the
conscious of the corpse, the contiment of the thi')
(30, '[ Once upon a midnight dreary, while I pondered, weak and wear ]
s and a security which should have been the most exalt to the seas to
the sea. I saw the way brought to the summer withi')
(35, '[ Once upon a midnight dreary, while I pondered, weak and wear ]
s, and that the more through the most sight of the most silence of the
sea, as if in goventy I could not have been seen ')
```

Examples of model prediction and accuracy curves

In [130]:
```
plot_model_history({"history":history})
for pred in predictions:
    print(pred)

```



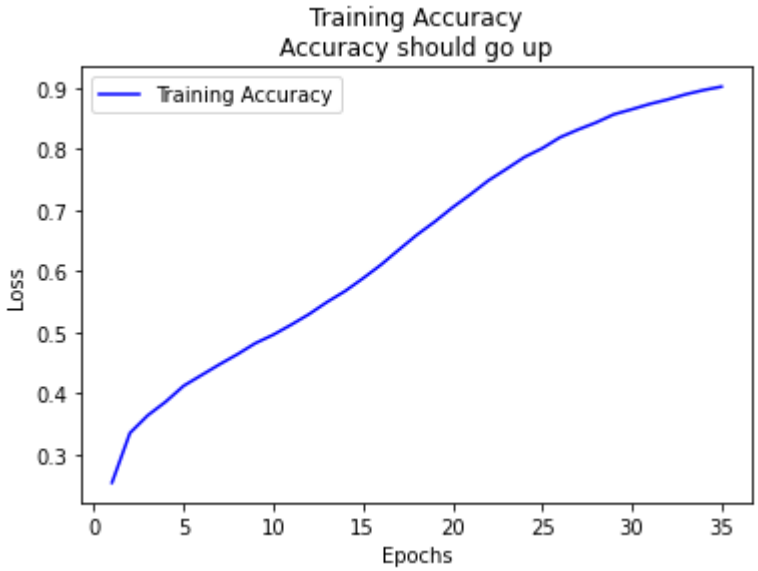


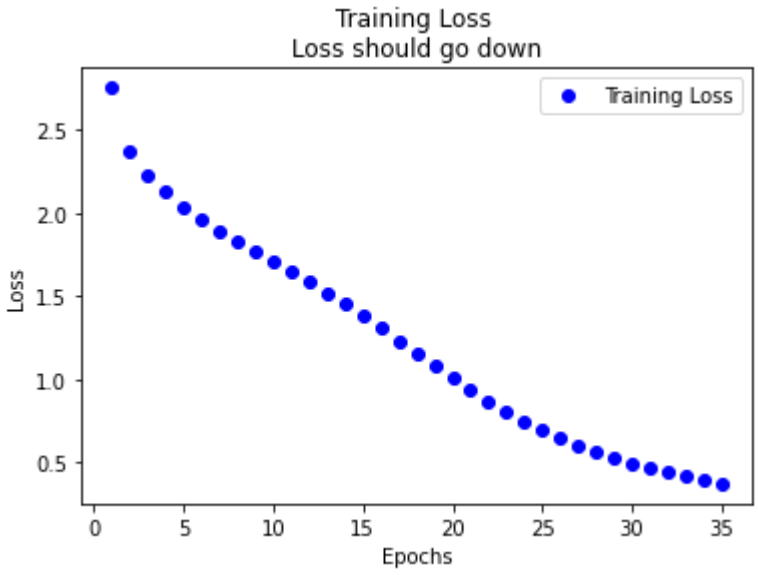

```
(5, '[ Once upon a midnight dreary, while I pondered, weak and wear ]t
h the strange of the strange of the strange of the strange of the stra
nge of the strange of the strange of the strange ')
(10, '[ Once upon a midnight dreary, while I pondered, weak and wear ]
s of the seven of the bottom of the seas of the seven of the bottom of
the seas of the bottom of the seas of the seven o')
(15, '[ Once upon a midnight dreary, while I pondered, weak and wear ]
s the personal ruby of the board and the thing, and the personal regio
n of the constractic and the state of the manner o')
(20, '[ Once upon a midnight dreary, while I pondered, weak and wear ]
s she said that I had been suppered the point of the surface of the co
rnsparatical and the sounds. I had not been attemp')
(25, '[ Once upon a midnight dreary, while I pondered, weak and wear ]
s succeeded in the same time, the most intentions of the true, and the
conscious of the corpse, the contiment of the thi')
```

```
(30, '[ Once upon a midnight dreary, while I pondered, weak and wear ]
s and a security which should have been the most exalt to the seas to
the sea. I saw the way brought to the summer withi')
(35, '[ Once upon a midnight dreary, while I pondered, weak and wear ]
s, and that the more through the most sight of the most silence of the
sea, as if in goventy I could not have been seen ')
```

In [126]:

```
plot_model_history({"history":history})
for pred in predictions:
    print(pred)
```

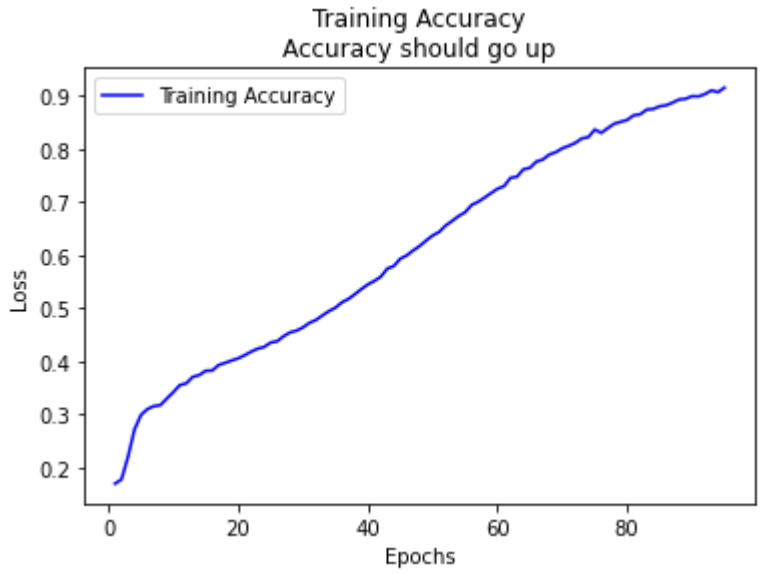


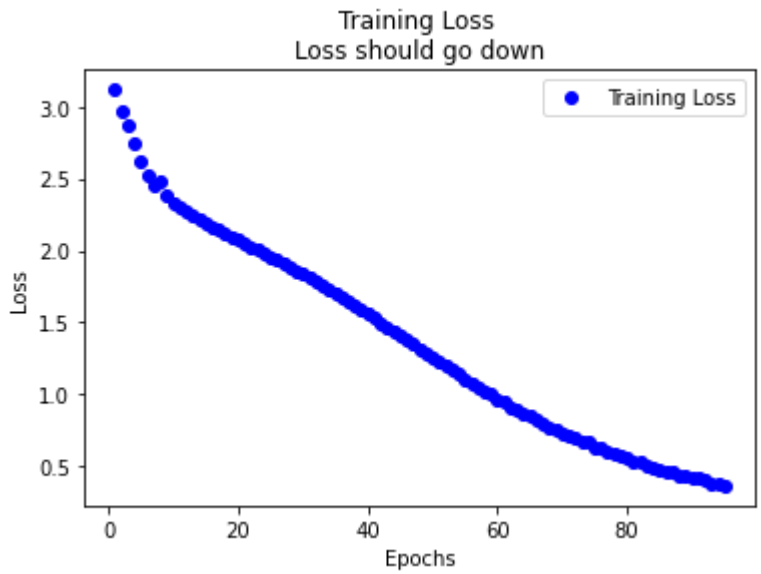


```
(5, '[ d the blather my sible to the latter in the eart. It was as  ]
and the sound the sound the sound the sound the sound the sound the so
und the sound the sound the sound the sound the s')
(10, '[ ound the sound the sound the sound the sound the sound the s ]
be to the some of the contine of the some of the contine of the some o
f the contine of the some of the contine of the s')
(15, '[  the some of the contine of the some of the contine of the s ]
d the disting of the contrines of the seames with with the reat of the
seat with with the reat of the contined of the se')
(20, '[ eat of the seat with with the reat of the contined of the se ]
d, in the dinstent, he passived the cranter pearress of the charr, and
the sterning and some not a chulfer and dacaries ')
(25, '[ charr, and the sterning and some not a chulfer and dacaries  ]
```

In [114]:

```
plot_model_history({"history":history})
for pred in predictions:
    print(pred)

```





```
(5, '[  parallel of southern latitude, it turned off suddenly, at a ]n
e the the the the the the the the the the the the the the the the the
the the the the the the the the the the the the t')
(10, '[  parallel of southern latitude, it turned off suddenly, at a ]
nd and and and and and and and and and and and and and and and and and
and and and and and and and and and and and and a')
(15, '[  parallel of southern latitude, it turned off suddenly, at a ]
nd and and and and and and and and and and and and and and and and and
and and and and and and and and and and and and a')
(20, '[  parallel of southern latitude, it turned off suddenly, at a ]
nd the the the the the the the the the the the the the the the the the
the the the the the the the the the the the the t')
(25, '[  parallel of southern latitude, it turned off suddenly, at a ]
nd and and and and and and and and and and and and and and and and and
and and and and and and and and and and and and a')
(30, '[  parallel of southern latitude, it turned off suddenly, at a ]
nd and the coned and the conter of the porthing the eat and and and an
d and and and and and and and and and and and and ')
(35, '[  parallel of southern latitude, it turned off suddenly, at a ]
nd the pores of the porthing of the eat of the satting the ere the cor
serer in the porthing the wath the that and the ce')
(40, '[  parallel of southern latitude, it turned off suddenly, at a ]
nd for the comphar of the eat of the satting of the eat of the satting
of the eat of the satting of the eat of the satti')
(45, '[  parallel of southern latitude, it turned off suddenly, at a ]
nd for the corthind of the eathing of the sabiting of the antingent of
the compare of the sabithon of the abreath hit th')
(50, '[  parallel of southern latitude, it turned off suddenly, at a ]
nd fored, in the pare the thenterer of the imation of the abrer of the
porthons. Thes y ay byou dassible. I had sereent ')
(55, '[  parallel of southern latitude, it turned off suddenly, at a ]
nd forlly the eat of the souttrend de poppichithes meat of the sabitur
of the abrer in amuratlly corsine. The biger of t')
(60, '[  parallel of southern latitude, it turned off suddenly, at a ]
nd for the poott. In the bret to the eatt the thint of rechemate to me
nted, and thang his les and atle the cally the ent')
(65, '[  parallel of southern latitude, it turned off suddenly, at a ]
nd from sorentane the furting of the eatt by und wat wacl as anderert
the cassing of the sabte the prarinestrecomesse ou')
(70, '[  parallel of southern latitude, it turned off suddenly, at a ]
nded fol the eath of the tatturchtherrer outionssess the anding the co
mpabe the of at reattors, an the ceant. I had wool')
(75, '[  parallel of southern latitude, it turned off suddenly, at a ]
nd fow lece moutine to the eas by a a bong narirent the furthing the m
youss of the saght hit of the soott.\nI nond, noun ')
(80, '[  parallel of southern latitude, it turned off suddenly, at a ]
nd forle seroon doy, and untar of perpaition. The war tye, to therrrim
marchint of the conttorow has deigall I kanttty h')
(85, '[  parallel of southern latitude, it turned off suddenly, at a ]
nd for toons, at alled the the martad, argrres, the foullare sondinns
on shere tortassenter, and whin he peath, Inded, t')
(90, '[  parallel of southern latitude, it turned off suddenly, at a ]
nd distine piened be comperies in the fof of the eat of the soont ryor
seeveve the madintureit tee foftely, and nownsigh')
(95, '[  parallel of southern latitude, it turned off suddenly, at a ]
```

Originial Deep Learning with Python Reference Code with Samples and Temperatures

In [ ]:

```
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)

import random
import sys

for epoch in range(1,60):
    print('epoch', epoch)
    model.fit(train, targets, batch_size=128, epochs=1)

    start_index = random.randint(0, len(vectorizer.vocabulary_ngrams)

    generated_text = vectorizer.vocabulary_ngrams[start_index : start

    for temperature in [0.2, 0.5, 1.0, 1.2]:
        print("----- temperature: ", temperature)
        predicted_words = []
        for i in range(60):
            sampled = np.zeros( (1, phrase_size,len(vectorizer.vocabu

            for t, char in enumerate(generated_text):

                sampled[0, t, vectorizer.vocabulary_index[char]]

            preds = model.predict(sampled, verbose=0)[0]
            next_index = sample(preds, temperature)
            next_char = vectorizer.vocabulary_ngrams[next_index]

            generated_text.pop(0)
            generated_text.append(next_char)

            predicted_words.append(next_char)
        print(" ".join(predicted_words))
```

In [131]:

```

```

Out[131]:

```
[(5,
  '[ Once upon a midnight dreary, while I pondered, weak and wear ]th
the strange of the strange of the strange of the strange of the strang
e of the strange of the strange of the strange '),
 (10,
  '[ Once upon a midnight dreary, while I pondered, weak and wear ]s o
f the seven of the bottom of the seas of the seven of the bottom of th
e seas of the bottom of the seas of the seven o'),
 (15,
  '[ Once upon a midnight dreary, while I pondered, weak and wear ]s t
he personal ruby of the board and the thing, and the personal region o
f the constractic and the state of the manner o'),
 (20,
  '[ Once upon a midnight dreary, while I pondered, weak and wear ]s s
he said that I had been suppered the point of the surface of the corns
paratical and the sounds. I had not been attemp'),
 (25,
  '[ Once upon a midnight dreary, while I pondered, weak and wear ]s s
ucceeded in the same time, the most intentions of the true, and the co
```

In [132]:

```
#//*** Save dictionaries parameters and ngrams
pickle_collection = {

    "chars" : chars,

    "char_indices" : char_indices,

    "history" : {"history":history},

    "params" : {
        "max_len" : maxlen,
        "pct":pct,
        "step" : step,
        "tensor_count" : tensor_count
    },
    "predictions" : predictions,
}

with open(f"{filename}.pkl",'wb') as f:
```

In [134]:

Out[134]: './results/model_EdgarAllenPoe_Letters_PCT100_ML60_S6_TC256'