assignment11_BasitAbdul

November 13, 2022

1 Assignment 11

1.0.1 Using section 8.1 in Deep Learning with Python as a guide, implement an LSTM text generator. Train the model on the Enron corpus or a text source of your choice. Save the model and generate 20 examples to the results directory of dsc650/assignments/assignment11/.

```
[1]: import os
```

```
[2]: os.getcwd()
```

```
[2]: '/home/jovyan/dsc650/dsc650/assignments/assignment11'
```

Here I used the text of the Ultimate Hitchhiker's Guide, found in https://ia600701.us.archive.org/18/items/TheultimateHitchhikersGuide/The

```
[3]: # Downloading and parsing the initial text file

     # load libraries
     import tensorflow as tf
     import keras
     import numpy as np

     # set seed
     np.random.seed(seed=42)

     # get data
     path = '/home/jovyan/dsc650/dsc650/assignments/assignment11/THGTTG.txt'
     text = open(path).read().lower()
     print('Corpus length:', len(text))
```

```
Corpus length: 1561789
```

```
[4]: # Vectorizing sequences of characters
     maxlen = 60       # Extract sequences of 60 characters

     step = 3          # Sample a new sequence every three characters
```

```python
sentences = []   # Holds extracted sequences

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

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))

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

print('Vectorization...')
# One-hot encodes the caracters into binary arrays:
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[i]]] = 1
```

```
Number of sequences: 520577
Unique characters: 58
Vectorization…
```

[5]:
```python
# Single-layer LSTM model for next-character prediction
from keras import layers

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

[6]:
```python
# Model compilation configuration
optimizer = tf.keras.optimizers.RMSprop(learning_rate=0.01)
model.compile(loss='categorical_crossentropy', optimizer=optimizer)
```

[7]:
```python
# Function to sample the next character given the model's predictions
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)
```

```
[8]:  # Text-generation loop
      import random
      import sys
      for epoch in range(1, 20):#60): # Trains model for 60 epochs
        print('\nEpoch', epoch)
        model.fit(x, y, batch_size=128, epochs=1) # Fits model for 1 iteration of data
```

Epoch 1
4068/4068 [==============================] - 519s 128ms/step - loss: 1.7205

Epoch 2
4068/4068 [==============================] - 514s 126ms/step - loss: 1.4812

Epoch 3
4068/4068 [==============================] - 514s 126ms/step - loss: 1.4262

Epoch 4
4068/4068 [==============================] - 514s 126ms/step - loss: 1.3989

Epoch 5
4068/4068 [==============================] - 514s 126ms/step - loss: 1.3801

Epoch 6
4068/4068 [==============================] - 516s 127ms/step - loss: 1.3676

Epoch 7
4068/4068 [==============================] - 516s 127ms/step - loss: 1.3568

Epoch 8
4068/4068 [==============================] - 516s 127ms/step - loss: 1.3483

Epoch 9
4068/4068 [==============================] - 518s 127ms/step - loss: 1.3415

Epoch 10
4068/4068 [==============================] - 523s 129ms/step - loss: 1.3364

Epoch 11
4068/4068 [==============================] - 523s 129ms/step - loss: 1.3309

Epoch 12
4068/4068 [==============================] - 522s 128ms/step - loss: 1.3282

Epoch 13
4068/4068 [==============================] - 521s 128ms/step - loss: 1.3247

```
Epoch 14
4068/4068 [==============================] - 522s 128ms/step - loss: 1.3212

Epoch 15
4068/4068 [==============================] - 523s 128ms/step - loss: 1.3182

Epoch 16
4068/4068 [==============================] - 523s 129ms/step - loss: 1.3178

Epoch 17
4068/4068 [==============================] - 523s 129ms/step - loss: 1.3155

Epoch 18
4068/4068 [==============================] - 525s 129ms/step - loss: 1.3121

Epoch 19
4068/4068 [==============================] - 526s 129ms/step - loss: 1.3140
```

```python
# Selects 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 + '"')
for temperature in [0.5]:#[0.2, 0.5, 1.0]:#, 1.2]: # Tries a range of different
 ↪sampling temperatures
  print('\n------ temperature:', temperature, '\n')
  sys.stdout.write(generated_text)
  for i in range(400): # Generates 400 characters, starting from seed text
    # One-hot encodes characters generated so far:
    sampled = np.zeros((1, maxlen, len(chars)))
    for t, char in enumerate(generated_text):
      sampled[0, t, char_indices[char]] = 1.
    # Samples the next character
    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)
  print()
```

```
--- Generating with seed: " sort
out later had happened, and…

it still didn't make"

------ temperature: 0.5

 sort
```

out later had happened, and…

it still didn't make the same moment, the other carrier of contance
some birds and all the silence, and the should fine the startons
was known and probably had been, which was a time.

the way he liked to him.

the particular of the one to see back and the world in the feet
on the ten a sandwich was aftered and had not rusted the not
on the serious thing to a ship and sandwich a little moment.

startled at his

```
[10]: for i in range(0,20):
        print(f'\n==GENERATED TEXT #{i+1}:\n')
        # Selects 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 + '"')
        for temperature in [0.5]:#[0.2, 0.5, 1.0]:#, 1.2]: # Tries a range of␣
      ↪different sampling temperatures
            print('\n------ temperature:', temperature, '\n')
            sys.stdout.write(generated_text)
            for i in range(400): # Generates 400 characters, starting from seed text
                # One-hot encodes characters generated so far:
                sampled = np.zeros((1, maxlen, len(chars)))
                for t, char in enumerate(generated_text):
                    sampled[0, t, char_indices[char]] = 1.
                # Samples the next character
                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)
            print()
```

==GENERATED TEXT #1:

--- Generating with seed: "'s a pear," he said.

a few moments later, when they had ea"

------ temperature: 0.5

's a pear," he said.

5

a few moments later, when they had each other more one that
ford shouting on on the seemed grass.

"i was to be they is relatively the posite meal more with her
of the one in the could seemed to the computer the gending siles
so and they was wasn't had been a thing of a courses, the and
stared at the time particular was where it was a topred before
he was a few serious strange throat. the tape of the sirive
foot of the planet

==GENERATED TEXT #2:

--- Generating with seed: "e do not be alarmed," it said, "by anything you see
or hear "

------ temperature: 0.5

e do not be alarmed," it said, "by anything you see or hear
carse."

"i see," he said. "the nature, and what we i can be a window
friend and the sipptious.

the robot startled at the other power that was a start of the
expensive was the silence of the stared of the third particular
and suddenly parding to some and reached made his one with the
starship particular silence and all a short and the other hot of
the stagia script and was the sears o

==GENERATED TEXT #3:

--- Generating with seed: "ories about the president were true, that was
old hat now. "

------ temperature: 0.5

ories about the president were true, that was
old hat now.

"oh, and this is there were the sort of started that it was
and started to he have to hear and was ford his way in the first
of the man perfectly computer his shoutic great ancient the time
to the pull of the planet with a line of the atalle was the

one, and the one the short was and the sandwich fire and almost
and some of the hell departant was the computer strange moment.

the proces of

==GENERATED TEXT #4:

--- Generating with seed: "much that is apocryphal,
or at least wildly inaccurate, it "

------ temperature: 0.5

much that is apocryphal,
or at least wildly inaccurate, it was all the sign of the particular
that it had a window serious people and was that he was a thing
a ship because they

```
<ipython-input-7-73e973fa43a5>:4: RuntimeWarning: divide by zero encountered in
log
  preds = np.log(preds) / temperature
```

 was the of the sort of the probably the
all the coppones in the terrible ting that it was a little strange
he was fashing the battle with the hand of the galaxy.

the sandwich was the wall than the of the ting than he called
what a little be for a call of the pile of the tim

==GENERATED TEXT #5:

--- Generating with seed: " spinning with shock. he had a broken leg,
a couple of brok"

------ temperature: 0.5

 spinning with shock. he had a broken leg,
a couple of broke the read some simple seconds of the bar, and
he is that it was a great short.

"i was to deforal probably the only stars some way with is a
particular and started in a beach of the ground.

"and the time of the strange moment me had been the could

feeling to see the light publish, which already to do a small

and stood to the suspets of the body of the sandwich mind. he
shook it to a

==GENERATED TEXT #6:

--- Generating with seed: "work in. they say they run a concession stand by the

mes"

------ temperature: 0.5

work in. they say they run a concession stand by the

message of a tranote was an one of the problem and trillian
had taken.

"what's a proportion."

"there was all the simean saying. i see," said arthur, "it was the
moment and the in the way and what mind."

"i was all the interest of the probable ground. i really were
been all this seem and the end of the galaxy had got to it to
start that it was a few streaking and the starter of his eyes
con

==GENERATED TEXT #7:

--- Generating with seed: "ic vantrashell of lob, and so, after a manner,
it proved to"

------ temperature: 0.5

ic vantrashell of lob, and so, after a manner,
it proved to the same simple marched and which had so had to
have sit at the seat, in the galaxy. i was so this was beverentation
possible to go to the shape of the side of the narole of the
first in the startes of laser of the perfectly and the party
was about the shapes was a simwing silence was the surpoacrity that he
are the sandwich all the arthur had wanted the world in the
man consumed to arthur

==GENERATED TEXT #8:

--- Generating with seed: "absolutely hypnotised by all these wonderful
magic images f"

------ temperature: 0.5

absolutely hypnotised by all these wonderful
magic images from the only strange thing in the vortex of the
trips and trying to him.

"hello to be this was something was sort of the wall had the
name of a moment at its of the time, weard of some of the ship.

the computer through one of the grass.

"the room."

"i think i are that it was a short continued of the second,
started to make an argument of the and starting.

"well a way of sit of mind,

==GENERATED TEXT #9:

--- Generating with seed: " owned, which at the moment
wasn't much.

a limousine care"

------ temperature: 0.5

 owned, which at the moment
wasn't much.

a limousine care of the galaxy.

"i have to be about to a fis as it bet of a moment, he was at
the sandwich.

she was with the convirtoring thing to start in my stranger
way in a forceus the moment was a little short to an amprate
on the night was the came of the dear silence, and she had
showed and the wall that down to the sandwich hand to get not
that was a polite startee. the of an a great side of th

==GENERATED TEXT #10:

--- Generating with seed: "ot pedestal of rough hewn blue water
crystal and was of a b"

------ temperature: 0.5

ot pedestal of rough hewn blue water
crystal and was of a beach of the thing and watched in a rest
where it was had tried to one were the only start of the might
was any every to the serious sickly and the only realless were
face the sears of the could get to his should have a few head
and still the continued with his all the corridor of the sort of
first hands he was particularly that the first of sight of the
sort of matter of the other light of t

==GENERATED TEXT #11:

--- Generating with seed: "e time
that ford prefect had completed his search of the ot"

------ temperature: 0.5

e time
that ford prefect had completed his search of the other mind.

chape ra of the party who incorder and sat an all of light and
arthur then had a look of sight to the sort of the too what
i think of my completely thing that i have a simulaty seeming
mash to sort of mr. and the electric can good that it alones
because they could have a sky of a simple of the in the same
draming all the surpose with a but arthur was protesting at
his all the b

==GENERATED TEXT #12:

--- Generating with seed: "aid we're all
out at the moment. the commercial council of "

------ temperature: 0.5

aid we're all
out at the moment. the commercial council of the

chape ro a'd guys were the starte, and to come and it to the
planet some way at the sky that they were a completely startent.

the armorly of the face of some of the elabs of the ship strange
this was a small with interest of the causeration of the sandwich
ship not to the comparton seemed to things at the planet shout
of the server but the sandwich. it was the wall sounds and a

==GENERATED TEXT #13:

--- Generating with seed: "d herself the hell out of his life.

she didn't even progra"

------ temperature: 0.5

d herself the hell out of his life.

she didn't even progral contract was believe the poor who was
down the could say a mind of the planet and the earth, and he
was feeling to the short with it with his powin he felt again.

"hey, the elevator of it.

he simpled in his silver because the ship and particularly sort of
but the table and so the same stropped to have to have to go
and the party of the other concerned of the star saying and
completely a

==GENERATED TEXT #14:

--- Generating with seed: "or
seven and a half million years' work?"

"i checked it v"

------ temperature: 0.5

or
seven and a half million years' work?"

"i checked it very half the wind that i see," he said.

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"you were the first me of some thing of nothing we have a little
that the carrier of it was a realige strange on the sile of
the convir.

"i am so i said it was relaxing the series. i was all the simple
consumeant from the world.

"i was be the time and it was were the only where we say the
ship.

they would have to the sandwich had feel the power o

==GENERATED TEXT #15:

--- Generating with seed: "y were abdicating to
this strange, quiet girl who alone in "

------ temperature: 0.5

y were abdicating to
this strange, quiet girl who alone in the book in the sandwich
strong that in the time to look the entire of a not of the other
beactic sicke of word and does it realized and had been so it
was an and to find the stars and a or the same sirius of the
ship that he stood that the party passing and had a particular
carrying protest of the same silent or a strange and fair in
a silence, the whole a polite and stropped on the moment

==GENERATED TEXT #16:

--- Generating with seed: "gton!"

"yes…"

"well, what about the real weirdness of "

------ temperature: 0.5

gton!"

"yes…"

"well, what about the real weirdness of the moment trillian
been an entions of the party and started in the sky, and the
friend.

"what do you may the on of the ready computer two air from the

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guys of the ship confusian short and don't like a lot of a stack
to thing that they are about the thing and sir. some hard to
what the other time.

"hello."

"well, and the book of honectic minutest worrid stared on the
causeration of the

==GENERATED TEXT #17:

--- Generating with seed: "historical knowledge of their race. this
was the very limit"

------ temperature: 0.5

historical knowledge of their race. this
was the very limitility of because what the of his house and
with a moment and that he was a strate all with him that they
was the ship the book of the same simritutric for a first of
the any sat of the carrying seemed silence, some of the world
to so and the ship.

"and a power and sort of thing to say the same standing a seconds
of the parts of the person, lights.

the sandwich will of the moment.

"i thi

==GENERATED TEXT #18:

--- Generating with seed: " he had heard said, phrases which now pounded

round in h"

------ temperature: 0.5

 he had heard said, phrases which now pounded

round in his way in a hundred and
thought and the room for a lot of hemp and said an arthur had
feel that and the other consumeativity, she was a very deep shreft
was and an or a way be the causerated slow.

arthur tried a little running of his short of the wind of his
forces of the ready should that he was a trillian of the other
of its body experience and was press to all more fleares of
the crowd ar

==GENERATED TEXT #19:

--- Generating with seed: "with it.

the boghog suddenly disengaged and limped backwar"

------ temperature: 0.5

with it.

the boghog suddenly disengaged and limped backwards for a beach of
the thing of the matter of the weind then was the startant of
right where they was the particular of the serious silence of
the first of the floor.

"they're a silence of matter in the search of the great hard the
one to the earth.

"no," he said.

"what are my great years we can see i was it."

"well a few some semard of the table of the speed."

"i have to the compute

==GENERATED TEXT #20:

--- Generating with seed: "oys, began to edge forward
a little bit to have a closer lo"

------ temperature: 0.5

oys, began to edge forward
a little bit to have a closer looked at his point.

"no," said marvin was he was happened.

"very seen to see and the force of his neck of the same computer
strange a bit of the shop had and started to the stars of the

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entire half and what i have a moment and one would be hard to
be the continued and the great could put out any point in the
starship way at the man was the enough of the terribly universe
was asking and c

[ ]: