```python
import pandas as pd
import nltk
import numpy
import sys
from keras.models import Sequential
from keras.layers import Dense
from keras.layers import Dropout
from keras.layers import LSTM
from keras.callbacks import ModelCheckpoint
from keras.utils import np_utils
import string
import numpy as np
from tensorflow.keras.preprocessing.text import Tokenizer
from tensorflow.keras.utils import to_categorical
from tensorflow.keras.models import Sequential
from keras.layers import Dense, LSTM, Embedding
from tensorflow.keras.preprocessing.sequence import pad_sequences
```

Opening the nursery rhymes and separating them based on line

```python
file = open('nursery_rhymes.txt','r')
with open('nursery_rhymes.txt') as f:
    contents = f.read()
    data=contents.split('\n')
```

```python
len(data)
```

```
5071
```

```python
data = " ".join(data)
```

Cleaning data and separating by individual words

```python
def clean_text(doc):
    tokens = doc.split()
    #Removing punctuation
    table = str.maketrans('', '', string.punctuation)
    tokens = [w.translate(table) for w in tokens]
    #Removes non alphabet characters
    tokens = [word for word in tokens if word.isalpha()]
    #Makes everything lowercase
    tokens = [word.lower() for word in tokens]
    return tokens
```

```python
tokens = clean_text(data)
print(tokens[:10])
```

```
['the', 'queen', 'of', 'hearts', 'the', 'queen', 'of', 'hearts', 'she', 'made']
```

I can now see that the data has been tokenized and now it is easy to read with no random characters included with everything in a unliform character set

```python
print("There are: "+ str(len(set(tokens)))+ " unique words")
print("There are: "+ str(len(tokens))+ " total words")
```

```
There are: 2444 unique words
There are: 16786 total words
```

```python
length = 10 + 1
lines = []
#Appending 10 words to a line that is fed in to create a sequence where the model will then determine what the following word
# will be until it has finished the nursery Rhyme
for i in range(length, len(tokens)):
    seq = tokens[i-length:i]
    line = ' '.join(seq)
    lines.append(line)
    if i>200000:
        break
print(len(lines))
```

```
16775
```

```python
lines[3]
```

```
'hearts the queen of hearts she made some tarts all on'
```

Assigning integer values to each word so it can be fed into the model

```python
tokenizer = Tokenizer()
tokenizer.fit_on_texts(lines)
sequences = tokenizer.texts_to_sequences(lines)
```

```python
sequences=np.array(sequences)
X, y = sequences[:, :-1], sequences[:,-1]
```

```python
wordDictSize = len(tokenizer.word_index) + 1
y = to_categorical(y, num_classes=wordDictSize)
sequence_length = X.shape[1]
```

Building model

```python
print(sequence_length)
model = Sequential()
model.add(Embedding(wordDictSize, 50, input_length = sequence_length))
model.add(LSTM(100, return_sequences= True))
model.add(LSTM(100))
model.add(Dense(100, activation = 'relu'))
model.add(Dense(wordDictSize, activation='softmax'))
model.summary()
```

```
10
Model: "sequential_11"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 embedding_8 (Embedding)     (None, 10, 50)            122250

 lstm_18 (LSTM)              (None, 10, 100)           60400

 lstm_19 (LSTM)              (None, 100)               80400

 dense_18 (Dense)            (None, 100)               10100

 dense_19 (Dense)            (None, 2445)              246945

=================================================================
Total params: 520,095
Trainable params: 520,095
Non-trainable params: 0
_________________________________________________________________
```

Compile and fit

```python
model.compile(loss = 'categorical_crossentropy', optimizer = 'adam', metrics = ['accuracy'])
```

```python
model.fit(X, y, batch_size=256, epochs = 300)
```

```
Epoch 1/300
66/66 [==============================] - 4s 56ms/step - loss: 6.3838 - accuracy: 0.0547
Epoch 2/300
66/66 [==============================] - 4s 55ms/step - loss: 6.3002 - accuracy: 0.0547
Epoch 3/300
66/66 [==============================] - 4s 55ms/step - loss: 6.2838 - accuracy: 0.0532
Epoch 4/300
66/66 [==============================] - 4s 56ms/step - loss: 6.2538 - accuracy: 0.0545
Epoch 5/300
66/66 [==============================] - 4s 57ms/step - loss: 6.2311 - accuracy: 0.0549
Epoch 6/300
66/66 [==============================] - 4s 57ms/step - loss: 6.1898 - accuracy: 0.0548
Epoch 7/300
66/66 [==============================] - 4s 59ms/step - loss: 6.1012 - accuracy: 0.0549
Epoch 8/300
66/66 [==============================] - 4s 56ms/step - loss: 6.0307 - accuracy: 0.0550
Epoch 9/300
66/66 [==============================] - 4s 57ms/step - loss: 5.9534 - accuracy: 0.0576
Epoch 10/300
66/66 [==============================] - 4s 56ms/step - loss: 5.8493 - accuracy: 0.0636
Epoch 11/300
66/66 [==============================] - 4s 57ms/step - loss: 5.7209 - accuracy: 0.0700
Epoch 12/300
66/66 [==============================] - 4s 57ms/step - loss: 5.5978 - accuracy: 0.0744
Epoch 13/300
66/66 [==============================] - 4s 57ms/step - loss: 5.4970 - accuracy: 0.0761
Epoch 14/300
66/66 [==============================] - 4s 58ms/step - loss: 5.3983 - accuracy: 0.0810
Epoch 15/300
66/66 [==============================] - 4s 58ms/step - loss: 5.3103 - accuracy: 0.0832
Epoch 16/300
66/66 [==============================] - 4s 57ms/step - loss: 5.2342 - accuracy: 0.0860
Epoch 17/300
66/66 [==============================] - 4s 58ms/step - loss: 5.1581 - accuracy: 0.0899
Epoch 18/300
66/66 [==============================] - 4s 58ms/step - loss: 5.0831 - accuracy: 0.0919
Epoch 19/300
66/66 [==============================] - 4s 57ms/step - loss: 5.0096 - accuracy: 0.0937
Epoch 20/300
66/66 [==============================] - 4s 57ms/step - loss: 4.9400 - accuracy: 0.0983
Epoch 21/300
66/66 [==============================] - 4s 57ms/step - loss: 4.8684 - accuracy: 0.1026
Epoch 22/300
66/66 [==============================] - 4s 56ms/step - loss: 4.7998 - accuracy: 0.1068
Epoch 23/300
66/66 [==============================] - 4s 55ms/step - loss: 4.7385 - accuracy: 0.1112
Epoch 24/300
66/66 [==============================] - 4s 55ms/step - loss: 4.6731 - accuracy: 0.1126
Epoch 25/300
66/66 [==============================] - 4s 55ms/step - loss: 4.6078 - accuracy: 0.1193
Epoch 26/300
66/66 [==============================] - 4s 55ms/step - loss: 4.5460 - accuracy: 0.1243
Epoch 27/300
66/66 [==============================] - 4s 55ms/step - loss: 4.4876 - accuracy: 0.1277
Epoch 28/300
66/66 [==============================] - 4s 55ms/step - loss: 4.4193 - accuracy: 0.1353
Epoch 29/300
66/66 [==============================] - 4s 54ms/step - loss: 4.3705 - accuracy: 0.1365
Epoch 30/300
66/66 [==============================] - 4s 55ms/step - loss: 4.3036 - accuracy: 0.1409
Epoch 31/300
66/66 [==============================] - 4s 55ms/step - loss: 4.2551 - accuracy: 0.1448
Epoch 32/300
66/66 [==============================] - 4s 54ms/step - loss: 4.1946 - accuracy: 0.1529
Epoch 33/300
66/66 [==============================] - 4s 54ms/step - loss: 4.1406 - accuracy: 0.1556
Epoch 34/300
66/66 [==============================] - 4s 55ms/step - loss: 4.0816 - accuracy: 0.1652
Epoch 35/300
66/66 [==============================] - 4s 55ms/step - loss: 4.0199 - accuracy: 0.1716
Epoch 36/300
66/66 [==============================] - 4s 54ms/step - loss: 3.9689 - accuracy: 0.1770
Epoch 37/300
66/66 [==============================] - 4s 54ms/step - loss: 3.9026 - accuracy: 0.1840
Epoch 38/300
66/66 [==============================] - 4s 54ms/step - loss: 3.8446 - accuracy: 0.1904
Epoch 39/300
66/66 [==============================] - 4s 55ms/step - loss: 3.7996 - accuracy: 0.1969
Epoch 40/300
66/66 [==============================] - 4s 55ms/step - loss: 3.7413 - accuracy: 0.2051
Epoch 41/300
66/66 [==============================] - 4s 55ms/step - loss: 3.6785 - accuracy: 0.2129
Epoch 42/300
66/66 [==============================] - 4s 55ms/step - loss: 3.6139 - accuracy: 0.2197
Epoch 43/300
66/66 [==============================] - 4s 55ms/step - loss: 3.5610 - accuracy: 0.2302
Epoch 44/300
66/66 [==============================] - 4s 55ms/step - loss: 3.5042 - accuracy: 0.2351
Epoch 45/300
66/66 [==============================] - 4s 55ms/step - loss: 3.4472 - accuracy: 0.2445
Epoch 46/300
66/66 [==============================] - 4s 56ms/step - loss: 3.3771 - accuracy: 0.2573
Epoch 47/300
66/66 [==============================] - 4s 55ms/step - loss: 3.3299 - accuracy: 0.2626
Epoch 48/300
66/66 [==============================] - 4s 55ms/step - loss: 3.2687 - accuracy: 0.2703
Epoch 49/300
66/66 [==============================] - 4s 54ms/step - loss: 3.2078 - accuracy: 0.2845
Epoch 50/300
66/66 [==============================] - 4s 55ms/step - loss: 3.1446 - accuracy: 0.2907
Epoch 51/300
66/66 [==============================] - 4s 55ms/step - loss: 3.0831 - accuracy: 0.3071
Epoch 52/300
66/66 [==============================] - 4s 55ms/step - loss: 3.0376 - accuracy: 0.3102
Epoch 53/300
66/66 [==============================] - 4s 55ms/step - loss: 2.9869 - accuracy: 0.3204
Epoch 54/300
66/66 [==============================] - 4s 55ms/step - loss: 2.9286 - accuracy: 0.3306
Epoch 55/300
66/66 [==============================] - 4s 55ms/step - loss: 2.8754 - accuracy: 0.3381
Epoch 56/300
66/66 [==============================] - 4s 55ms/step - loss: 2.8150 - accuracy: 0.3525
Epoch 57/300
66/66 [==============================] - 4s 56ms/step - loss: 2.7680 - accuracy: 0.3589
Epoch 58/300
66/66 [==============================] - 4s 55ms/step - loss: 2.7200 - accuracy: 0.3686
Epoch 59/300
66/66 [==============================] - 4s 55ms/step - loss: 2.6665 - accuracy: 0.3808
Epoch 60/300
66/66 [==============================] - 4s 56ms/step - loss: 2.6023 - accuracy: 0.3962
Epoch 61/300
66/66 [==============================] - 4s 55ms/step - loss: 2.5535 - accuracy: 0.4004
Epoch 62/300
66/66 [==============================] - 4s 55ms/step - loss: 2.5045 - accuracy: 0.4132
Epoch 63/300
66/66 [==============================] - 4s 55ms/step - loss: 2.4616 - accuracy: 0.4205
Epoch 64/300
66/66 [==============================] - 4s 55ms/step - loss: 2.4280 - accuracy: 0.4236
Epoch 65/300
66/66 [==============================] - 4s 56ms/step - loss: 2.3660 - accuracy: 0.4379
Epoch 66/300
66/66 [==============================] - 4s 55ms/step - loss: 2.3161 - accuracy: 0.4508
Epoch 67/300
66/66 [==============================] - 4s 56ms/step - loss: 2.2807 - accuracy: 0.4581
Epoch 68/300
66/66 [==============================] - 4s 56ms/step - loss: 2.2416 - accuracy: 0.4643
Epoch 69/300
66/66 [==============================] - 4s 56ms/step - loss: 2.2033 - accuracy: 0.4749
Epoch 70/300
66/66 [==============================] - 4s 57ms/step - loss: 2.1508 - accuracy: 0.4841
Epoch 71/300
66/66 [==============================] - 4s 55ms/step - loss: 2.1127 - accuracy: 0.4927
Epoch 72/300
66/66 [==============================] - 4s 56ms/step - loss: 2.0669 - accuracy: 0.5046
Epoch 73/300
66/66 [==============================] - 4s 56ms/step - loss: 2.0300 - accuracy: 0.5101
Epoch 74/300
66/66 [==============================] - 4s 55ms/step - loss: 1.9957 - accuracy: 0.5229
Epoch 75/300
66/66 [==============================] - 4s 60ms/step - loss: 1.9496 - accuracy: 0.5275
Epoch 76/300
66/66 [==============================] - 4s 61ms/step - loss: 1.9127 - accuracy: 0.5378
Epoch 77/300
66/66 [==============================] - 4s 62ms/step - loss: 1.8756 - accuracy: 0.5444
Epoch 78/300
66/66 [==============================] - 4s 59ms/step - loss: 1.8513 - accuracy: 0.5508
Epoch 79/300
66/66 [==============================] - 4s 58ms/step - loss: 1.8251 - accuracy: 0.5559
Epoch 80/300
66/66 [==============================] - 4s 60ms/step - loss: 1.7814 - accuracy: 0.5656
Epoch 81/300
66/66 [==============================] - 4s 59ms/step - loss: 1.7433 - accuracy: 0.5734
Epoch 82/300
66/66 [==============================] - 4s 55ms/step - loss: 1.7167 - accuracy: 0.5785
Epoch 83/300
66/66 [==============================] - 4s 55ms/step - loss: 1.6899 - accuracy: 0.5863
Epoch 84/300
66/66 [==============================] - 4s 55ms/step - loss: 1.6614 - accuracy: 0.5940
Epoch 85/300
66/66 [==============================] - 4s 55ms/step - loss: 1.6218 - accuracy: 0.6041
Epoch 86/300
66/66 [==============================] - 4s 55ms/step - loss: 1.5848 - accuracy: 0.6126
Epoch 87/300
66/66 [==============================] - 4s 55ms/step - loss: 1.5678 - accuracy: 0.6159
Epoch 88/300
66/66 [==============================] - 4s 57ms/step - loss: 1.5254 - accuracy: 0.6276
Epoch 89/300
66/66 [==============================] - 4s 58ms/step - loss: 1.5012 - accuracy: 0.6302
Epoch 90/300
66/66 [==============================] - 4s 59ms/step - loss: 1.4684 - accuracy: 0.6398
Epoch 91/300
66/66 [==============================] - 4s 56ms/step - loss: 1.4461 - accuracy: 0.6442
Epoch 92/300
66/66 [==============================] - 4s 55ms/step - loss: 1.4229 - accuracy: 0.6498
Epoch 93/300
66/66 [==============================] - 4s 55ms/step - loss: 1.3916 - accuracy: 0.6581
Epoch 94/300
66/66 [==============================] - 4s 56ms/step - loss: 1.3580 - accuracy: 0.6655
Epoch 95/300
66/66 [==============================] - 4s 56ms/step - loss: 1.3367 - accuracy: 0.6699
Epoch 96/300
66/66 [==============================] - 4s 56ms/step - loss: 1.3117 - accuracy: 0.6779
Epoch 97/300
66/66 [==============================] - 4s 55ms/step - loss: 1.2881 - accuracy: 0.6832
Epoch 98/300
66/66 [==============================] - 4s 56ms/step - loss: 1.2696 - accuracy: 0.6878
Epoch 99/300
66/66 [==============================] - 4s 56ms/step - loss: 1.2495 - accuracy: 0.6921
Epoch 100/300
66/66 [==============================] - 4s 56ms/step - loss: 1.2367 - accuracy: 0.6936
Epoch 101/300
66/66 [==============================] - 4s 56ms/step - loss: 1.2167 - accuracy: 0.6989
Epoch 102/300
66/66 [==============================] - 4s 56ms/step - loss: 1.1786 - accuracy: 0.7097
Epoch 103/300
66/66 [==============================] - 4s 55ms/step - loss: 1.1532 - accuracy: 0.7171
Epoch 104/300
66/66 [==============================] - 4s 58ms/step - loss: 1.1124 - accuracy: 0.7295
Epoch 105/300
66/66 [==============================] - 4s 57ms/step - loss: 1.1135 - accuracy: 0.7283
Epoch 106/300
66/66 [==============================] - 4s 55ms/step - loss: 1.0899 - accuracy: 0.7320
Epoch 107/300
66/66 [==============================] - 4s 56ms/step - loss: 1.0496 - accuracy: 0.7420
Epoch 108/300
66/66 [==============================] - 4s 57ms/step - loss: 1.0126 - accuracy: 0.7500
Epoch 109/300
66/66 [==============================] - 4s 57ms/step - loss: 0.9978 - accuracy: 0.7600
Epoch 110/300
66/66 [==============================] - 4s 56ms/step - loss: 0.9871 - accuracy: 0.7582
Epoch 111/300
66/66 [==============================] - 4s 56ms/step - loss: 0.9777 - accuracy: 0.7592
Epoch 112/300
66/66 [==============================] - 4s 56ms/step - loss: 0.9593 - accuracy: 0.7655
Epoch 113/300
66/66 [==============================] - 4s 56ms/step - loss: 0.9570 - accuracy: 0.7623
Epoch 114/300
66/66 [==============================] - 4s 56ms/step - loss: 0.9584 - accuracy: 0.7636
Epoch 115/300
66/66 [==============================] - 4s 56ms/step - loss: 0.9288 - accuracy: 0.7726
Epoch 116/300
66/66 [==============================] - 4s 56ms/step - loss: 0.8959 - accuracy: 0.7812
Epoch 117/300
66/66 [==============================] - 4s 56ms/step - loss: 0.8755 - accuracy: 0.7873
Epoch 118/300
66/66 [==============================] - 4s 56ms/step - loss: 0.8571 - accuracy: 0.7911
Epoch 119/300
66/66 [==============================] - 4s 56ms/step - loss: 0.8592 - accuracy: 0.7883
Epoch 120/300
66/66 [==============================] - 4s 56ms/step - loss: 0.8318 - accuracy: 0.7974
Epoch 121/300
66/66 [==============================] - 4s 56ms/step - loss: 0.8144 - accuracy: 0.8029
Epoch 122/300
66/66 [==============================] - 4s 56ms/step - loss: 0.7880 - accuracy: 0.8113
Epoch 123/300
66/66 [==============================] - 4s 56ms/step - loss: 0.7548 - accuracy: 0.8194
Epoch 124/300
66/66 [==============================] - 4s 56ms/step - loss: 0.7424 - accuracy: 0.8237
Epoch 125/300
66/66 [==============================] - 4s 56ms/step - loss: 0.7145 - accuracy: 0.8320
Epoch 126/300
66/66 [==============================] - 4s 56ms/step - loss: 0.7014 - accuracy: 0.8334
Epoch 127/300
66/66 [==============================] - 4s 56ms/step - loss: 0.6909 - accuracy: 0.8399
Epoch 128/300
66/66 [==============================] - 4s 57ms/step - loss: 0.6965 - accuracy: 0.8332
Epoch 129/300
66/66 [==============================] - 4s 56ms/step - loss: 0.7081 - accuracy: 0.8284
Epoch 130/300
66/66 [==============================] - 4s 57ms/step - loss: 0.7031 - accuracy: 0.8310
Epoch 131/300
66/66 [==============================] - 4s 57ms/step - loss: 0.6901 - accuracy: 0.8331
Epoch 132/300
66/66 [==============================] - 4s 57ms/step - loss: 0.6798 - accuracy: 0.8370
Epoch 133/300
66/66 [==============================] - 4s 56ms/step - loss: 0.6599 - accuracy: 0.8426
Epoch 134/300
66/66 [==============================] - 4s 56ms/step - loss: 0.6397 - accuracy: 0.8471
Epoch 135/300
66/66 [==============================] - 4s 56ms/step - loss: 0.6194 - accuracy: 0.8520
Epoch 136/300
66/66 [==============================] - 4s 56ms/step - loss: 0.5872 - accuracy: 0.8638
Epoch 137/300
66/66 [==============================] - 4s 56ms/step - loss: 0.5553 - accuracy: 0.8718
Epoch 138/300
66/66 [==============================] - 4s 57ms/step - loss: 0.5243 - accuracy: 0.8809
Epoch 139/300
66/66 [==============================] - 4s 57ms/step - loss: 0.5123 - accuracy: 0.8852
Epoch 140/300
66/66 [==============================] - 4s 57ms/step - loss: 0.5070 - accuracy: 0.8847
Epoch 141/300
66/66 [==============================] - 4s 57ms/step - loss: 0.4902 - accuracy: 0.8898
Epoch 142/300
66/66 [==============================] - 4s 57ms/step - loss: 0.4866 - accuracy: 0.8917
Epoch 143/300
66/66 [==============================] - 4s 57ms/step - loss: 0.4776 - accuracy: 0.8952
Epoch 144/300
66/66 [==============================] - 4s 57ms/step - loss: 0.4539 - accuracy: 0.9009
Epoch 145/300
66/66 [==============================] - 4s 57ms/step - loss: 0.4542 - accuracy: 0.8994
Epoch 146/300
66/66 [==============================] - 4s 57ms/step - loss: 0.4490 - accuracy: 0.9017
Epoch 147/300
66/66 [==============================] - 4s 57ms/step - loss: 0.4586 - accuracy: 0.8986
Epoch 148/300
66/66 [==============================] - 4s 57ms/step - loss: 0.4848 - accuracy: 0.8873
Epoch 149/300
66/66 [==============================] - 4s 57ms/step - loss: 0.5068 - accuracy: 0.8788
Epoch 150/300
66/66 [==============================] - 4s 57ms/step - loss: 0.5266 - accuracy: 0.8729
Epoch 151/300
66/66 [==============================] - 4s 57ms/step - loss: 0.5042 - accuracy: 0.8795
Epoch 152/300
66/66 [==============================] - 4s 57ms/step - loss: 0.4605 - accuracy: 0.8950
Epoch 153/300
66/66 [==============================] - 4s 58ms/step - loss: 0.4328 - accuracy: 0.9004
Epoch 154/300
66/66 [==============================] - 4s 58ms/step - loss: 0.4076 - accuracy: 0.9115
Epoch 155/300
66/66 [==============================] - 4s 57ms/step - loss: 0.3752 - accuracy: 0.9209
Epoch 156/300
66/66 [==============================] - 4s 58ms/step - loss: 0.3460 - accuracy: 0.9278
Epoch 157/300
66/66 [==============================] - 4s 60ms/step - loss: 0.3183 - accuracy: 0.9381
Epoch 158/300
66/66 [==============================] - 4s 57ms/step - loss: 0.3088 - accuracy: 0.9392
Epoch 159/300
66/66 [==============================] - 4s 57ms/step - loss: 0.2883 - accuracy: 0.9442
Epoch 160/300
66/66 [==============================] - 4s 57ms/step - loss: 0.2891 - accuracy: 0.9446
Epoch 161/300
66/66 [==============================] - 4s 57ms/step - loss: 0.2921 - accuracy: 0.9432
Epoch 162/300
66/66 [==============================] - 4s 57ms/step - loss: 0.3087 - accuracy: 0.9376
Epoch 163/300
66/66 [==============================] - 4s 57ms/step - loss: 0.3153 - accuracy: 0.9344
Epoch 164/300
66/66 [==============================] - 4s 57ms/step - loss: 0.3276 - accuracy: 0.9306
Epoch 165/300
66/66 [==============================] - 4s 57ms/step - loss: 0.3178 - accuracy: 0.9319
Epoch 166/300
66/66 [==============================] - 4s 57ms/step - loss: 0.3429 - accuracy: 0.9239
Epoch 167/300
66/66 [==============================] - 4s 58ms/step - loss: 0.3672 - accuracy: 0.9160
Epoch 168/300
66/66 [==============================] - 4s 57ms/step - loss: 0.3995 - accuracy: 0.9027
Epoch 169/300
66/66 [==============================] - 4s 58ms/step - loss: 0.3755 - accuracy: 0.9117
Epoch 170/300
66/66 [==============================] - 4s 58ms/step - loss: 0.3746 - accuracy: 0.9096
Epoch 171/300
66/66 [==============================] - 4s 59ms/step - loss: 0.3274 - accuracy: 0.9252
Epoch 172/300
66/66 [==============================] - 4s 58ms/step - loss: 0.2872 - accuracy: 0.9400
Epoch 173/300
66/66 [==============================] - 4s 58ms/step - loss: 0.2487 - accuracy: 0.9531
Epoch 174/300
66/66 [==============================] - 4s 57ms/step - loss: 0.2308 - accuracy: 0.9577
Epoch 175/300
66/66 [==============================] - 4s 57ms/step - loss: 0.2116 - accuracy: 0.9618
Epoch 176/300
66/66 [==============================] - 4s 58ms/step - loss: 0.1846 - accuracy: 0.9689
Epoch 177/300
66/66 [==============================] - 4s 58ms/step - loss: 0.1748 - accuracy: 0.9718
Epoch 178/300
66/66 [==============================] - 4s 58ms/step - loss: 0.1604 - accuracy: 0.9741
Epoch 179/300
66/66 [==============================] - 4s 57ms/step - loss: 0.1570 - accuracy: 0.9741
Epoch 180/300
66/66 [==============================] - 4s 58ms/step - loss: 0.1513 - accuracy: 0.9760
Epoch 181/300
66/66 [==============================] - 4s 57ms/step - loss: 0.1496 - accuracy: 0.9765
Epoch 182/300
66/66 [==============================] - 4s 58ms/step - loss: 0.1537 - accuracy: 0.9753
Epoch 183/300
66/66 [==============================] - 4s 58ms/step - loss: 0.1662 - accuracy: 0.9731
Epoch 184/300
66/66 [==============================] - 4s 59ms/step - loss: 0.1814 - accuracy: 0.9674
Epoch 185/300
66/66 [==============================] - 4s 59ms/step - loss: 0.2591 - accuracy: 0.9409
Epoch 186/300
66/66 [==============================] - 4s 58ms/step - loss: 0.4823 - accuracy: 0.8668
Epoch 187/300
66/66 [==============================] - 4s 58ms/step - loss: 0.5833 - accuracy: 0.8405
Epoch 188/300
66/66 [==============================] - 4s 59ms/step - loss: 0.5143 - accuracy: 0.8601
Epoch 189/300
66/66 [==============================] - 4s 58ms/step - loss: 0.3706 - accuracy: 0.9063
Epoch 190/300
66/66 [==============================] - 4s 58ms/step - loss: 0.2711 - accuracy: 0.9398
Epoch 191/300
66/66 [==============================] - 4s 58ms/step - loss: 0.1841 - accuracy: 0.9655
Epoch 192/300
66/66 [==============================] - 4s 58ms/step - loss: 0.1437 - accuracy: 0.9778
Epoch 193/300
66/66 [==============================] - 4s 58ms/step - loss: 0.1211 - accuracy: 0.9825
Epoch 194/300
66/66 [==============================] - 4s 57ms/step - loss: 0.1077 - accuracy: 0.9855
Epoch 195/300
66/66 [==============================] - 4s 58ms/step - loss: 0.1006 - accuracy: 0.9863
Epoch 196/300
66/66 [==============================] - 4s 58ms/step - loss: 0.0942 - accuracy: 0.9887
Epoch 197/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0904 - accuracy: 0.9886
Epoch 198/300
66/66 [==============================] - 4s 58ms/step - loss: 0.0868 - accuracy: 0.9896
Epoch 199/300
66/66 [==============================] - 4s 58ms/step - loss: 0.0844 - accuracy: 0.9898
Epoch 200/300
66/66 [==============================] - 4s 58ms/step - loss: 0.0829 - accuracy: 0.9897
Epoch 201/300
66/66 [==============================] - 4s 58ms/step - loss: 0.0809 - accuracy: 0.9902
Epoch 202/300
66/66 [==============================] - 4s 58ms/step - loss: 0.0794 - accuracy: 0.9909
Epoch 203/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0772 - accuracy: 0.9906
Epoch 204/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0764 - accuracy: 0.9905
Epoch 205/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0741 - accuracy: 0.9908
Epoch 206/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0748 - accuracy: 0.9909
Epoch 207/300
66/66 [==============================] - 4s 58ms/step - loss: 0.0781 - accuracy: 0.9908
Epoch 208/300
66/66 [==============================] - 4s 58ms/step - loss: 0.0876 - accuracy: 0.9873
Epoch 209/300
66/66 [==============================] - 4s 58ms/step - loss: 0.1640 - accuracy: 0.9652
Epoch 210/300
66/66 [==============================] - 4s 59ms/step - loss: 0.4365 - accuracy: 0.8795
Epoch 211/300
66/66 [==============================] - 4s 59ms/step - loss: 0.6686 - accuracy: 0.8218
Epoch 212/300
66/66 [==============================] - 4s 58ms/step - loss: 0.6413 - accuracy: 0.8240
Epoch 213/300
66/66 [==============================] - 4s 58ms/step - loss: 0.4202 - accuracy: 0.8821
Epoch 214/300
66/66 [==============================] - 4s 59ms/step - loss: 0.2571 - accuracy: 0.9361
Epoch 215/300
66/66 [==============================] - 4s 58ms/step - loss: 0.1696 - accuracy: 0.9641
Epoch 216/300
66/66 [==============================] - 4s 59ms/step - loss: 0.1027 - accuracy: 0.9840
Epoch 217/300
66/66 [==============================] - 4s 58ms/step - loss: 0.0823 - accuracy: 0.9902
Epoch 218/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0708 - accuracy: 0.9915
Epoch 219/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0628 - accuracy: 0.9930
Epoch 220/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0579 - accuracy: 0.9933
Epoch 221/300
66/66 [==============================] - 4s 58ms/step - loss: 0.0545 - accuracy: 0.9937
Epoch 222/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0519 - accuracy: 0.9937
Epoch 223/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0510 - accuracy: 0.9939
Epoch 224/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0494 - accuracy: 0.9940
Epoch 225/300
66/66 [==============================] - 4s 58ms/step - loss: 0.0483 - accuracy: 0.9936
Epoch 226/300
66/66 [==============================] - 4s 58ms/step - loss: 0.0466 - accuracy: 0.9942
Epoch 227/300
66/66 [==============================] - 4s 58ms/step - loss: 0.0457 - accuracy: 0.9939
Epoch 228/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0456 - accuracy: 0.9937
Epoch 229/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0442 - accuracy: 0.9940
Epoch 230/300
66/66 [==============================] - 4s 58ms/step - loss: 0.0433 - accuracy: 0.9941
Epoch 231/300
66/66 [==============================] - 4s 58ms/step - loss: 0.0421 - accuracy: 0.9945
Epoch 232/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0420 - accuracy: 0.9943
Epoch 233/300
66/66 [==============================] - 4s 58ms/step - loss: 0.0406 - accuracy: 0.9941
Epoch 234/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0408 - accuracy: 0.9941
Epoch 235/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0413 - accuracy: 0.9942
Epoch 236/300
66/66 [==============================] - 4s 58ms/step - loss: 0.0406 - accuracy: 0.9940
Epoch 237/300
66/66 [==============================] - 4s 58ms/step - loss: 0.0424 - accuracy: 0.9936
Epoch 238/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0460 - accuracy: 0.9927
Epoch 239/300
66/66 [==============================] - 4s 58ms/step - loss: 0.0842 - accuracy: 0.9847
Epoch 240/300
66/66 [==============================] - 4s 58ms/step - loss: 0.4678 - accuracy: 0.8762
Epoch 241/300
66/66 [==============================] - 4s 58ms/step - loss: 0.9199 - accuracy: 0.7577
Epoch 242/300
66/66 [==============================] - 4s 58ms/step - loss: 0.6617 - accuracy: 0.8168
Epoch 243/300
66/66 [==============================] - 4s 58ms/step - loss: 0.3765 - accuracy: 0.8950
Epoch 244/300
66/66 [==============================] - 4s 59ms/step - loss: 0.2050 - accuracy: 0.9493
Epoch 245/300
66/66 [==============================] - 4s 59ms/step - loss: 0.1063 - accuracy: 0.9813
Epoch 246/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0650 - accuracy: 0.9918
Epoch 247/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0498 - accuracy: 0.9932
Epoch 248/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0435 - accuracy: 0.9941
Epoch 249/300
66/66 [==============================] - 4s 60ms/step - loss: 0.0400 - accuracy: 0.9944
Epoch 250/300
66/66 [==============================] - 4s 60ms/step - loss: 0.0384 - accuracy: 0.9947
Epoch 251/300
66/66 [==============================] - 4s 60ms/step - loss: 0.0365 - accuracy: 0.9945
Epoch 252/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0356 - accuracy: 0.9944
Epoch 253/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0349 - accuracy: 0.9942
Epoch 254/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0353 - accuracy: 0.9942
Epoch 255/300
66/66 [==============================] - 4s 61ms/step - loss: 0.0336 - accuracy: 0.9942
Epoch 256/300
66/66 [==============================] - 4s 58ms/step - loss: 0.0332 - accuracy: 0.9944
Epoch 257/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0322 - accuracy: 0.9948
Epoch 258/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0328 - accuracy: 0.9940
Epoch 259/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0319 - accuracy: 0.9946
Epoch 260/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0305 - accuracy: 0.9945
Epoch 261/300
66/66 [==============================] - 4s 58ms/step - loss: 0.0298 - accuracy: 0.9946
Epoch 262/300
66/66 [==============================] - 4s 58ms/step - loss: 0.0303 - accuracy: 0.9944
Epoch 263/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0287 - accuracy: 0.9948
Epoch 264/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0287 - accuracy: 0.9948
Epoch 265/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0289 - accuracy: 0.9946
Epoch 266/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0292 - accuracy: 0.9942
Epoch 267/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0281 - accuracy: 0.9946
Epoch 268/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0292 - accuracy: 0.9942
Epoch 269/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0280 - accuracy: 0.9946
Epoch 270/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0277 - accuracy: 0.9942
Epoch 271/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0289 - accuracy: 0.9944
Epoch 272/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0371 - accuracy: 0.9928
Epoch 273/300
66/66 [==============================] - 4s 59ms/step - loss: 0.1362 - accuracy: 0.9673
Epoch 274/300
66/66 [==============================] - 4s 59ms/step - loss: 0.8098 - accuracy: 0.7917
Epoch 275/300
66/66 [==============================] - 4s 59ms/step - loss: 0.9150 - accuracy: 0.7649
Epoch 276/300
66/66 [==============================] - 4s 59ms/step - loss: 0.4964 - accuracy: 0.8631
Epoch 277/300
66/66 [==============================] - 4s 62ms/step - loss: 0.2461 - accuracy: 0.9326
Epoch 278/300
66/66 [==============================] - 4s 61ms/step - loss: 0.1210 - accuracy: 0.9741
Epoch 279/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0705 - accuracy: 0.9880
Epoch 280/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0452 - accuracy: 0.9931
Epoch 281/300
66/66 [==============================] - 4s 60ms/step - loss: 0.0353 - accuracy: 0.9944
Epoch 282/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0328 - accuracy: 0.9947
Epoch 283/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0307 - accuracy: 0.9947
Epoch 284/300
66/66 [==============================] - 4s 60ms/step - loss: 0.0296 - accuracy: 0.9950
Epoch 285/300
66/66 [==============================] - 4s 60ms/step - loss: 0.0282 - accuracy: 0.9947
Epoch 286/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0278 - accuracy: 0.9948
Epoch 287/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0267 - accuracy: 0.9951
Epoch 288/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0274 - accuracy: 0.9947
Epoch 289/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0265 - accuracy: 0.9946
Epoch 290/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0255 - accuracy: 0.9949
Epoch 291/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0255 - accuracy: 0.9948
Epoch 292/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0255 - accuracy: 0.9946
Epoch 293/300
66/66 [==============================] - 4s 59ms/step - loss: 0.0249 - accuracy: 0.9949
Epoch 294/300
66/66 [==============================] - 4s 60ms/step - loss: 0.0255 - accuracy: 0.9945
Epoch 295/300
66/66 [==============================] - 4s 61ms/step - loss: 0.0241 - accuracy: 0.9949
Epoch 296/300
66/66 [==============================] - 4s 60ms/step - loss: 0.0243 - accuracy: 0.9946
Epoch 297/300
66/66 [==============================] - 4s 60ms/step - loss: 0.0252 - accuracy: 0.9942
Epoch 298/300
66/66 [==============================] - 4s 60ms/step - loss: 0.0247 - accuracy: 0.9945
Epoch 299/300
66/66 [==============================] - 4s 60ms/step - loss: 0.0257 - accuracy: 0.9943
Epoch 300/300
66/66 [==============================] - 4s 61ms/step - loss: 0.0235 - accuracy: 0.9951
```

```
<keras.callbacks.History at 0x17ad1d6ffa0>
```

I am actually really surprised with this accuracy as it is extremely high.

Creating the rhyme by generating text based on what the model learned

```python
def create_rhyme(model, tokenizer, text_seq_length, seed, num_words):
    rhyme=[]
    for _ in range(num_words):
        encoded = tokenizer.texts_to_sequences([seed])[0]
        encoded=pad_sequences([encoded], maxlen = text_seq_length, truncating='pre')

        predict_y=model.predict(encoded)
        y_pred=np.argmax(predict_y,axis=1)
        pred_word =''
        for word, index in tokenizer.word_index.items():
            if (index == y_pred):
                pred_word = word
                break
        seed = seed + " " + pred_word
        rhyme.append(pred_word)
    return ' '.join(rhyme)
```

This creates a rhyme by trying to predict the next word continuously until the number of words it generates is complete

```python
# choosing random seed to make the nursery rhymes for
import random
seedLen=(len(lines))
seedIndex=random.randrange(seedLen)
seed=lines[seedIndex]
#Creating Rhyme
raw_rhyme=create_rhyme(model, tokenizer, sequence_length, seed, 600)
```

Formatting the rhyme to 30 lines with 20 words each

```python
rhyme=raw_rhyme.split()
counter=0
temp=""
print("Model Generated Nursery Rhyme: ")
print(" ")
for i in range(len(rhyme)):
    temp+=rhyme[i]+" "
    if (i+1)%20==0 and i!=0:
        counter+=1
        print(temp)
        print("")
        temp=""
```

```
Model Generated Nursery Rhyme:

woman went fortunetelling by cherrystones one i love two i love three i love i say four i love with

all my heart five i cast away six he loves seven she loves eight both love nine he comes ten

he tarries eleven he courts and twelve he marries little bopeep little bopeep has lost her sheep and cant tell

where to find them let them alone and theyll come home and bring their tails behind them little bopeep fell

fast asleep and dreamt she heard them bleating and when she awoke she found it a joke for still they

were all fleeting then up she took her little crook determined for to find them she found them indeed but

it made her heart bleed for theyd left all their tails behind them it happened one day as bopeep did

stray into a meadow hard by there she espied their tails side by side all hung on a tree to

dry she heaved a sigh and wiped her eye and went over hill and dale oh and tried what she

could as a shepherdess should to tack to each sheep its tail oh to bed come lets to bed says

sleepyhead sit up a while says slow put on the pan says greedy nan lets sup before we go of

going to bed go to bed first a golden purse go to bed second a golden pheasant go to bed

third a golden bird grace before meat here a little child i stand heaving up my either hand cold as

paddocks though they be here i lift them up to thee for a benison to fall on our meat and

on us all there was a butcher there was a butcher cut his thumb when it did bleed then blood

did come there was a chandler making candle when he them stript he did them handle there was a cobbler

clouting shoon when they were mended they were done there was a crow sat on a stone when he was

gone then there was none there was a horse going to the mill when he went on he stood not

still there was a lackey ran a race when he ran fast he ran apace there was a monkey climbed

a tree when he fell down then down fell he there was a navy went into spain when it returnd

it came again there was an old woman lived under a hill and if shes not gone she lives there

still winter has come cold and raw the north wind doth blow bleak in a morning early all the hills

are covered with snow and winters now come fairly mondays child mondays child is fair of face tuesdays child is

full of grace wednesdays child is full of woe thursdays child has far to go fridays child is loving and

giving saturdays child works hard for its living but the child that is born on the sabbath day is bonny

and blithe and good and gay jack and jill jack and jill went up the hill to fetch a pail

of water jack fell down and broke his crown and jill came tumbling after then up jack got up and

off did trot as fast as he could caper to old dame dob who patched his nob with vinegar and

brown paper charley charley charley charley stole the barley out of the bakers shop the baker came out and gave

him a clout which made poor charley hop the pipers cow there was a piper had a cow and he
```

While some of the rhymes dont make any sense, I was actually surprised that there was some rhymeing scheme in parts of it considering this was not written by a human