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PDL Lab15: Text dataset creation and design of Simple RNN for Sentiment Analysis

1. Import libraries

In [1]:

```
import csv
import tensorflow as tf
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from tensorflow.keras.preprocessing.text import Tokenizer
from tensorflow.keras.preprocessing.sequence import pad_sequences
```

In [2]:

```
from keras.models import Sequential
from keras.layers import Dense, Embedding,SimpleRNN
```

In [4]:

```
from nltk.corpus import stopwords
STOPWORDS = set(stopwords.words('english'))
```

2. Creation of data

In [6]:

```
df = pd.read_csv("data.csv",encoding="ISO-8859-1")
```

In [7]:

```
df.head()
```

Out[7]:

	Labels	Quotes
0	0	Look deep into nature, and then you will under...
1	0	Colors are the smiles of nature
2	0	I believe in God, only I spell it Nature
3	0	Nature does not hurry, yet everything is accom...
4	0	If you truly love nature, you will find beauty...

3. Opening your CSV file

In [8]:

```
import csv
```

In [9]:

```
file = open('data.csv')
type(file)
```

Out[9]:

```
_io.TextIOWrapper
```

In [10]:

```
csvreader = csv.reader(file)
```

In [11]:

```
header = []
header = next(csvreader)
header
```

Out[11]:

```
['Labels', 'Quotes']
```

In [24]:

```
with open('data.csv', 'r') as file:
    csvreader = csv.reader(file)
    rows = []
    for row in csvreader:
        rows.append(row)
row
```

Out[24]:

```
['1',
 'Technology brings convenience but often disconnects us from the natural
world']
```

In [25]:

```
file.close()
```

In [26]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 12 entries, 0 to 11
Data columns (total 2 columns):
 #   Column   Non-Null Count  Dtype 
---  ------   --------------  ----- 
 0   Labels   12 non-null     int64 
 1   Quotes   12 non-null     object
dtypes: int64(1), object(1)
memory usage: 320.0+ bytes
```

4. Pre-processing the text

In [27]:

```
y = df['Labels']
X = df['Quotes']
```

5. Dataset Preparation

In [28]:

```
from sklearn.model_selection import train_test_split
X_train, X_val, y_train, y_val = train_test_split(X, y, test_size=0.3)
```

In [29]:

```
print(X_train.shape)
print(X_val.shape)
print(y_train.shape)
print(y_val.shape)
```

```
(8,)
(4,)
(8,)
(4,)
```

In [30]:

```
# 4th step to be continue
train_token = Tokenizer(num_words=100,oov_token='<oov>')
train_token.fit_on_texts(X_train)
word_index = train_token.word_index
train_sequence = train_token.texts_to_sequences(X_train)
dict(list(word_index.items())[0:10])
```

Out[30]:

```
{'<oov>': 1,
 'the': 2,
 'is': 3,
 'of': 4,
 'nature': 5,
 'you': 6,
 'but': 7,
 'into': 8,
 'a': 9,
 'will': 10}
```

In [31]:

```
vocab = len(train_token.word_index) + 1
vocab
```

Out[31]:

```
63
```

In [32]:

```
train_sequence[3]
```

Out[32]:

```
[28, 29, 8, 5, 30, 31, 6, 10, 32, 33, 34]
```

In [33]:

```
train_padded = pad_sequences(train_sequence,maxlen=100,padding='post')
train_padded[5]
```

Out[33]:

```
array([41,  3, 11, 42, 12, 43,  2, 44,  7, 12, 45, 46, 47,  2, 48,  0,
0,
        0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,
0,
        0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,
0,
        0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,
0,
        0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,
0,
        0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0])
```

In [34]:

```
train_padded.shape
```

Out[34]:

```
(8, 100)
```

In [35]:

```
val_token = Tokenizer(num_words=500,oov_token='<oov>')
val_token.fit_on_texts(X_val)
val_index = val_token.word_index
val_sequence = val_token.texts_to_sequences(X_val)
```

In [37]:

```
if len(val_sequence) > 4:
    # Access the element at index 4
    value = val_sequence[4]
else:
    # Handle the case where the list doesn't have enough elements
    print("The list doesn't have enough elements.")
```

```
The list doesn't have enough elements.
```

In [38]:

```
val_padded = pad_sequences(val_sequence,maxlen=100,padding='post')
```

6. Model Creation

In [40]:

```
model = Sequential()
# Embedding Layer
model.add(Embedding(300,70,input_length=100))
model.add(SimpleRNN(70,activation='relu'))
model.add(Dense('1',activation='sigmoid'))
```

In [41]:

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

In [42]:

```
model.summary()
```

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #   
=================================================================
 embedding (Embedding)       (None, 100, 70)           21000     
                                                                 
 simple_rnn (SimpleRNN)      (None, 70)                9870      
                                                                 
 dense (Dense)               (None, 1)                 71        
                                                                 
=================================================================
Total params: 30941 (120.86 KB)
Trainable params: 30941 (120.86 KB)
Non-trainable params: 0 (0.00 Byte)
_________________________________________________________________
```

In [43]:

```
history=model.fit(train_padded,y_train,epochs=10,verbose=2,batch_size=15)
```

```
Epoch 1/10
1/1 - 3s - loss: 0.6932 - accuracy: 0.5000 - 3s/epoch - 3s/step
Epoch 2/10
1/1 - 0s - loss: 0.6932 - accuracy: 0.5000 - 33ms/epoch - 33ms/step
Epoch 3/10
1/1 - 0s - loss: 0.6932 - accuracy: 0.5000 - 25ms/epoch - 25ms/step
Epoch 4/10
1/1 - 0s - loss: 0.6932 - accuracy: 0.5000 - 25ms/epoch - 25ms/step
Epoch 5/10
1/1 - 0s - loss: 0.6932 - accuracy: 0.5000 - 35ms/epoch - 35ms/step
Epoch 6/10
1/1 - 0s - loss: 0.6932 - accuracy: 0.5000 - 31ms/epoch - 31ms/step
Epoch 7/10
1/1 - 0s - loss: 0.6932 - accuracy: 0.5000 - 45ms/epoch - 45ms/step
Epoch 8/10
1/1 - 0s - loss: 0.6931 - accuracy: 0.5000 - 32ms/epoch - 32ms/step
Epoch 9/10
1/1 - 0s - loss: 0.6932 - accuracy: 0.5000 - 30ms/epoch - 30ms/step
Epoch 10/10
1/1 - 0s - loss: 0.6932 - accuracy: 0.5000 - 27ms/epoch - 27ms/step
```

In [44]:

```
model.evaluate(val_padded,y_val)
```

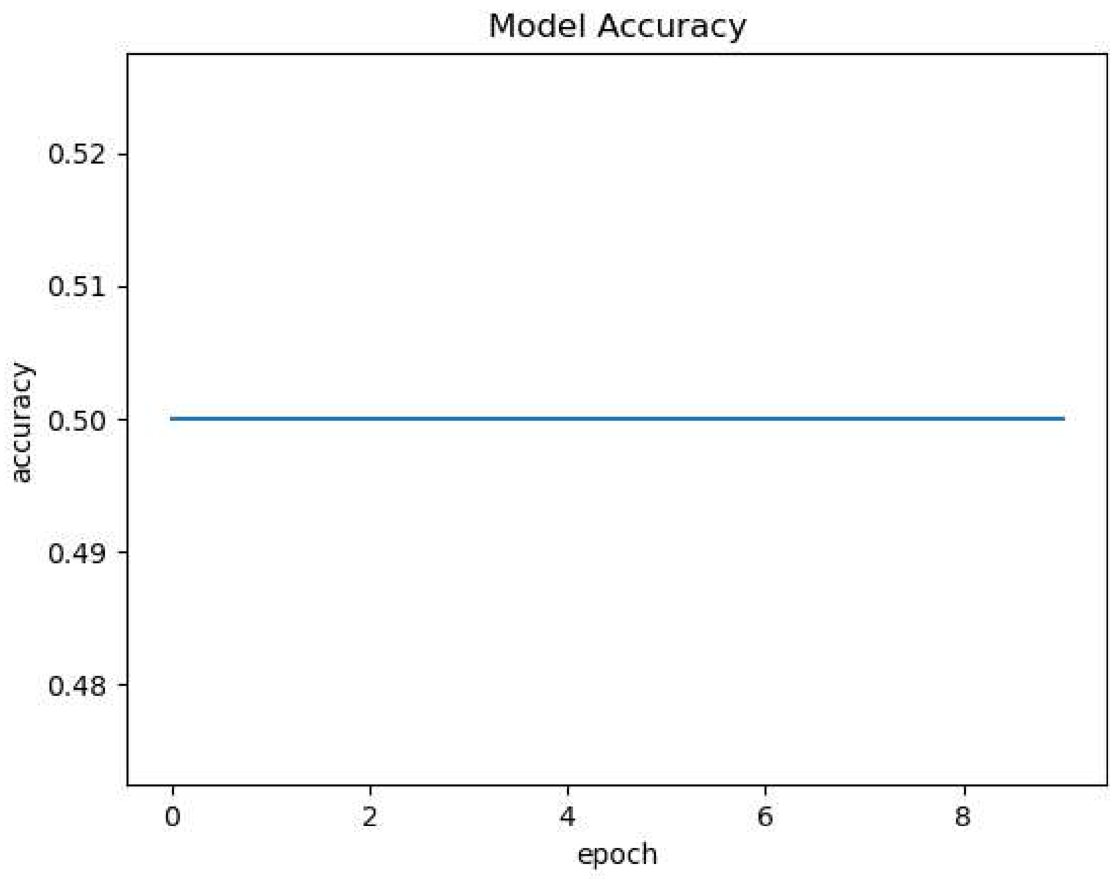
```
1/1 [==============================] - 0s 447ms/step - loss: 0.6931 - acc
uracy: 0.5000
```

Out[44]:

```
[0.693149745464325, 0.5]
```

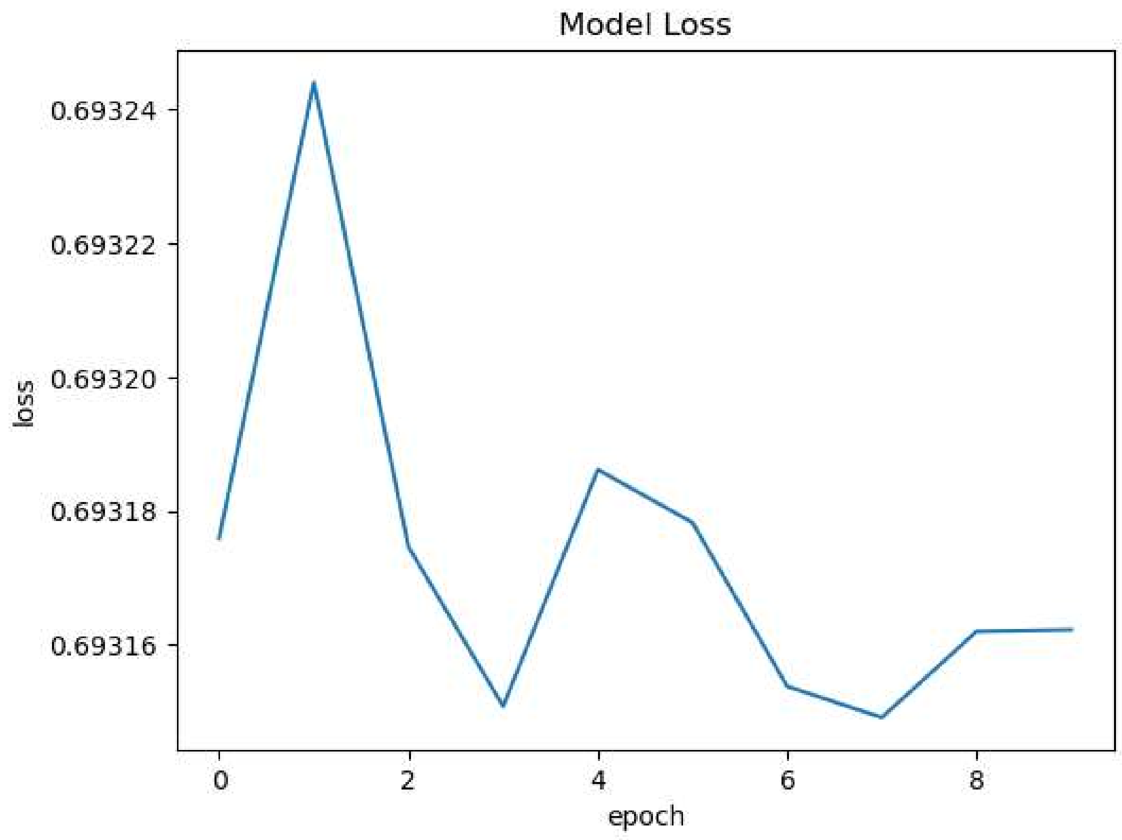
In [45]:

```
plt.plot(history.history['accuracy'])
plt.title('Model Accuracy')
plt.ylabel('accuracy')
plt.xlabel('epoch')
plt.show()
```



In [46]:

```
plt.plot(history.history['loss'])
plt.title('Model Loss')
plt.ylabel('loss')
plt.xlabel('epoch')
plt.show()
```



In [47]:

```
text = df["Quotes"]
```

In [48]:

```
#sent = [w.lower() for w in text.split() if not w in STOPWORDS]
trail_token = Tokenizer()
trail_token.fit_on_texts(text)
#word_index = trail_token.word_index
trail_seq = trail_token.texts_to_sequences(text)
#dict(list(word_index.items())[0:10])
trail_pad = pad_sequences(trail_seq,maxlen=100,padding='post')
```

In [49]:

```
trail_pad
```

Out[49]:

```
array([[20, 21, 10, ...,  0,  0,  0],
       [26, 27,  1, ...,  0,  0,  0],
       [13, 29, 30, ...,  0,  0,  0],
       ...,
       [ 1, 66, 18, ...,  0,  0,  0],
       [ 2,  4, 71, ...,  0,  0,  0],
       [77, 78, 79, ...,  0,  0,  0]])
```

Step-7 and 8 :

Step-8:

In [51]:

```
model1 = Sequential()
# Embedding Layer
model1.add(Embedding(5000,64,input_length=100))
model1.add(SimpleRNN(32,activation='tanh'))
model1.add(Embedding(5000,32,input_length=100))
model1.add(SimpleRNN(32,activation='tanh' ))
model1.add(Dense('1',activation='sigmoid'))
```

In [52]:

```
model1.summary()
```

```
Model: "sequential_1"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 embedding_1 (Embedding)     (None, 100, 64)           320000

 simple_rnn_1 (SimpleRNN)    (None, 32)                3104

 embedding_2 (Embedding)     (None, 32, 32)            160000

 simple_rnn_2 (SimpleRNN)    (None, 32)                2080

 dense_1 (Dense)             (None, 1)                 33

=================================================================
Total params: 485217 (1.85 MB)
Trainable params: 485217 (1.85 MB)
Non-trainable params: 0 (0.00 Byte)
_________________________________________________________________
```

In [53]:

```
model1.compile(optimizer='adam',loss='binary_crossentropy',metrics=['accuracy'])
```

In [54]:

```
history1=model1.fit(train_padded,y_train,epochs=10,verbose=2,batch_size=15)
```

```
Epoch 1/10
WARNING:tensorflow:Gradients do not exist for variables ['embedding_1/emb
eddings:0', 'simple_rnn_1/simple_rnn_cell/kernel:0', 'simple_rnn_1/simple
_rnn_cell/recurrent_kernel:0', 'simple_rnn_1/simple_rnn_cell/bias:0'] whe
n minimizing the loss. If you're using `model.compile()`, did you forget
to provide a `loss` argument?
WARNING:tensorflow:Gradients do not exist for variables ['embedding_1/emb
eddings:0', 'simple_rnn_1/simple_rnn_cell/kernel:0', 'simple_rnn_1/simple
_rnn_cell/recurrent_kernel:0', 'simple_rnn_1/simple_rnn_cell/bias:0'] whe
n minimizing the loss. If you're using `model.compile()`, did you forget
to provide a `loss` argument?
WARNING:tensorflow:Gradients do not exist for variables ['embedding_1/emb
eddings:0', 'simple_rnn_1/simple_rnn_cell/kernel:0', 'simple_rnn_1/simple
_rnn_cell/recurrent_kernel:0', 'simple_rnn_1/simple_rnn_cell/bias:0'] whe
n minimizing the loss. If you're using `model.compile()`, did you forget
to provide a `loss` argument?
WARNING:tensorflow:Gradients do not exist for variables ['embedding_1/emb
eddings:0', 'simple_rnn_1/simple_rnn_cell/kernel:0', 'simple_rnn_1/simple
_rnn_cell/recurrent_kernel:0', 'simple_rnn_1/simple_rnn_cell/bias:0'] whe
n minimizing the loss. If you're using `model.compile()`, did you forget
to provide a `loss` argument?
1/1 - 3s - loss: 0.6933 - accuracy: 0.5000 - 3s/epoch - 3s/step
Epoch 2/10
1/1 - 0s - loss: 0.6933 - accuracy: 0.5000 - 26ms/epoch - 26ms/step
Epoch 3/10
1/1 - 0s - loss: 0.6932 - accuracy: 0.5000 - 17ms/epoch - 17ms/step
Epoch 4/10
1/1 - 0s - loss: 0.6931 - accuracy: 0.5000 - 27ms/epoch - 27ms/step
Epoch 5/10
1/1 - 0s - loss: 0.6932 - accuracy: 0.5000 - 17ms/epoch - 17ms/step
Epoch 6/10
1/1 - 0s - loss: 0.6932 - accuracy: 0.5000 - 15ms/epoch - 15ms/step
Epoch 7/10
1/1 - 0s - loss: 0.6932 - accuracy: 0.5000 - 16ms/epoch - 16ms/step
Epoch 8/10
1/1 - 0s - loss: 0.6931 - accuracy: 0.5000 - 22ms/epoch - 22ms/step
Epoch 9/10
1/1 - 0s - loss: 0.6932 - accuracy: 0.5000 - 22ms/epoch - 22ms/step
Epoch 10/10
1/1 - 0s - loss: 0.6932 - accuracy: 0.5000 - 28ms/epoch - 28ms/step
```

In [55]:

```
model1.evaluate(val_padded,y_val)
```

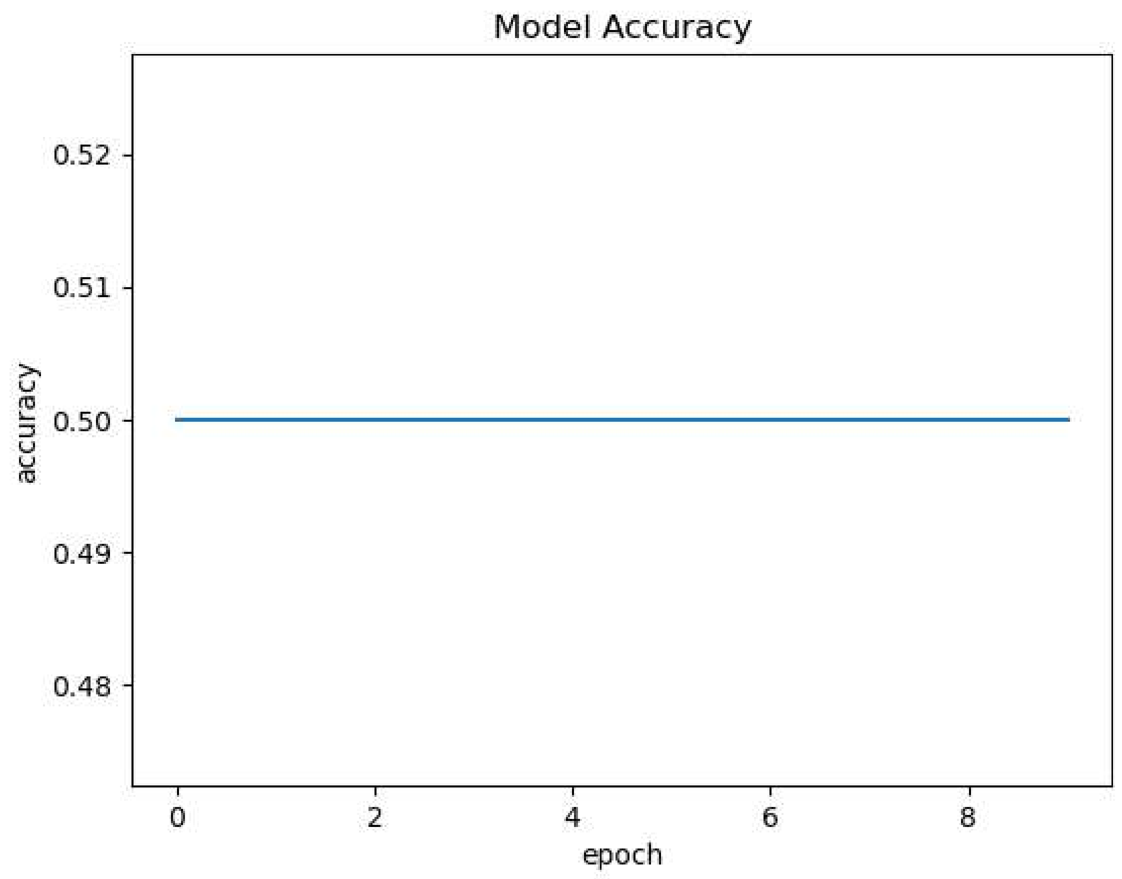
```
1/1 [==============================] - 1s 524ms/step - loss: 0.6932 - acc
uracy: 0.5000
```

Out[55]:

```
[0.6931710243225098, 0.5]
```

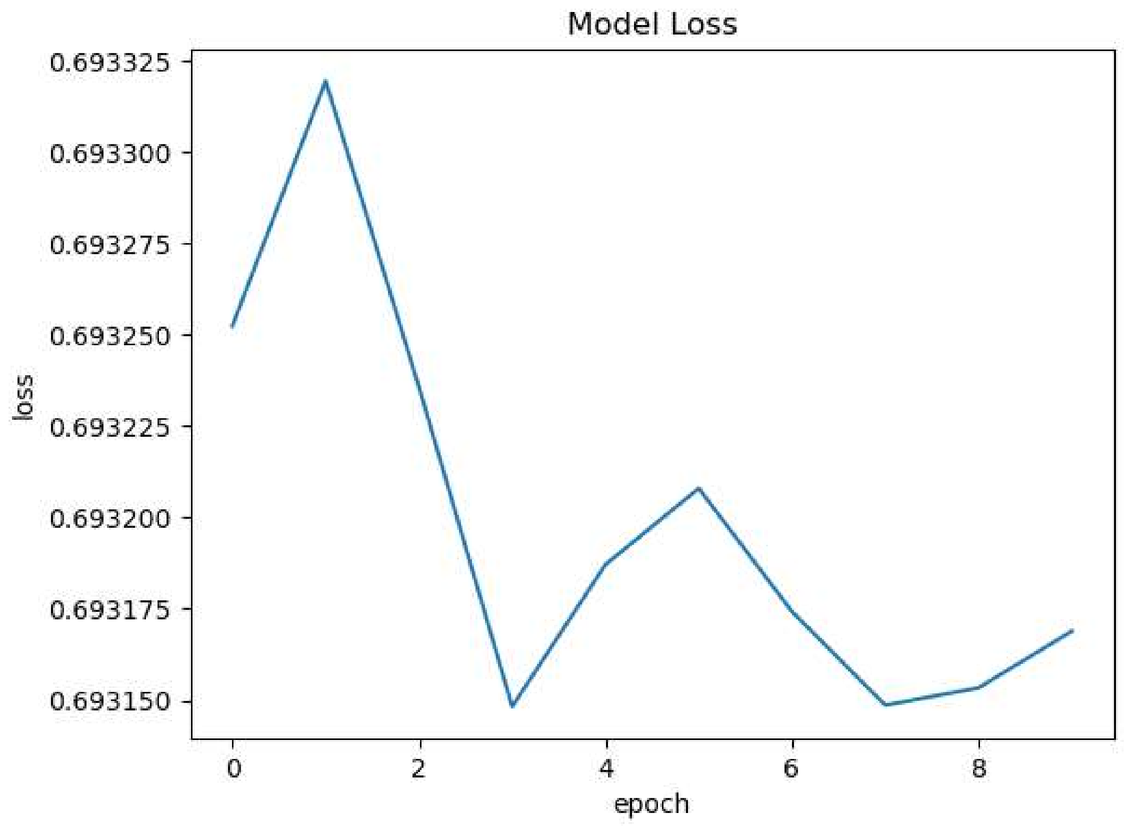
In [56]:

```
plt.plot(history1.history['accuracy'])
plt.title('Model Accuracy')
plt.ylabel('accuracy')
plt.xlabel('epoch')
plt.show()
```



In [57]:

```
plt.plot(history1.history['loss'])
plt.title('Model Loss')
plt.ylabel('loss')
plt.xlabel('epoch')
plt.show()
```



In [59]:

```
model2 = Sequential()
# Embedding Layer
model2.add(Embedding(4000,128,input_length=100))
model2.add(SimpleRNN(64,activation='tanh'))
model2.add(Embedding(4000,128,input_length=100))
model2.add(SimpleRNN(64,activation='relu' ))
model2.add(Embedding(4000,128,input_length=100))
model2.add(SimpleRNN(64,activation='tanh' ))
model2.add(Dense('1',activation='sigmoid'))
```

In [60]:

```
model2.summary()
```

```
Model: "sequential_2"
_________________________________________________________________
 Layer (type)                Output Shape              Param #   
=================================================================
 embedding_3 (Embedding)     (None, 100, 128)          512000    
                                                                 
 simple_rnn_3 (SimpleRNN)    (None, 64)                12352     
                                                                 
 embedding_4 (Embedding)     (None, 64, 128)           512000    
                                                                 
 simple_rnn_4 (SimpleRNN)    (None, 64)                12352     
                                                                 
 embedding_5 (Embedding)     (None, 64, 128)           512000    
                                                                 
 simple_rnn_5 (SimpleRNN)    (None, 64)                12352     
                                                                 
 dense_2 (Dense)             (None, 1)                 65        
                                                                 
=================================================================
Total params: 1573121 (6.00 MB)
Trainable params: 1573121 (6.00 MB)
Non-trainable params: 0 (0.00 Byte)
_________________________________________________________________
```

In [61]:

```
model2.compile(optimizer='adam',loss='binary_crossentropy',metrics=['accuracy'])
```

In [62]:

```
history2=model2.fit(train_padded,y_train,epochs=10,verbose=2,batch_size=15)
```

```
Epoch 1/10
WARNING:tensorflow:Gradients do not exist for variables ['embedding_3/emb
eddings:0', 'simple_rnn_3/simple_rnn_cell/kernel:0', 'simple_rnn_3/simple
_rnn_cell/recurrent_kernel:0', 'simple_rnn_3/simple_rnn_cell/bias:0', 'em
bedding_4/embeddings:0', 'simple_rnn_4/simple_rnn_cell/kernel:0', 'simple
_rnn_4/simple_rnn_cell/recurrent_kernel:0', 'simple_rnn_4/simple_rnn_cel
l/bias:0'] when minimizing the loss. If you're using `model.compile()`, d
id you forget to provide a `loss` argument?
WARNING:tensorflow:Gradients do not exist for variables ['embedding_3/emb
eddings:0', 'simple_rnn_3/simple_rnn_cell/kernel:0', 'simple_rnn_3/simple
_rnn_cell/recurrent_kernel:0', 'simple_rnn_3/simple_rnn_cell/bias:0', 'em
bedding_4/embeddings:0', 'simple_rnn_4/simple_rnn_cell/kernel:0', 'simple
_rnn_4/simple_rnn_cell/recurrent_kernel:0', 'simple_rnn_4/simple_rnn_cel
l/bias:0'] when minimizing the loss. If you're using `model.compile()`, d
id you forget to provide a `loss` argument?
WARNING:tensorflow:Gradients do not exist for variables ['embedding_3/emb
eddings:0', 'simple_rnn_3/simple_rnn_cell/kernel:0', 'simple_rnn_3/simple
_rnn_cell/recurrent_kernel:0', 'simple_rnn_3/simple_rnn_cell/bias:0', 'em
bedding_4/embeddings:0', 'simple_rnn_4/simple_rnn_cell/kernel:0', 'simple
_rnn_4/simple_rnn_cell/recurrent_kernel:0', 'simple_rnn_4/simple_rnn_cel
l/bias:0'] when minimizing the loss. If you're using `model.compile()`, d
id you forget to provide a `loss` argument?
WARNING:tensorflow:Gradients do not exist for variables ['embedding_3/emb
eddings:0', 'simple_rnn_3/simple_rnn_cell/kernel:0', 'simple_rnn_3/simple
_rnn_cell/recurrent_kernel:0', 'simple_rnn_3/simple_rnn_cell/bias:0', 'em
bedding_4/embeddings:0', 'simple_rnn_4/simple_rnn_cell/kernel:0', 'simple
_rnn_4/simple_rnn_cell/recurrent_kernel:0', 'simple_rnn_4/simple_rnn_cel
l/bias:0'] when minimizing the loss. If you're using `model.compile()`, d
id you forget to provide a `loss` argument?
1/1 - 3s - loss: 0.6957 - accuracy: 0.5000 - 3s/epoch - 3s/step
Epoch 2/10
1/1 - 0s - loss: 0.6996 - accuracy: 0.5000 - 42ms/epoch - 42ms/step
Epoch 3/10
1/1 - 0s - loss: 0.6949 - accuracy: 0.5000 - 31ms/epoch - 31ms/step
Epoch 4/10
1/1 - 0s - loss: 0.6932 - accuracy: 0.5000 - 50ms/epoch - 50ms/step
Epoch 5/10
1/1 - 0s - loss: 0.6944 - accuracy: 0.5000 - 37ms/epoch - 37ms/step
Epoch 6/10
1/1 - 0s - loss: 0.6947 - accuracy: 0.5000 - 37ms/epoch - 37ms/step
Epoch 7/10
1/1 - 0s - loss: 0.6938 - accuracy: 0.5000 - 47ms/epoch - 47ms/step
Epoch 8/10
1/1 - 0s - loss: 0.6932 - accuracy: 0.5000 - 45ms/epoch - 45ms/step
Epoch 9/10
1/1 - 0s - loss: 0.6935 - accuracy: 0.5000 - 52ms/epoch - 52ms/step
Epoch 10/10
1/1 - 0s - loss: 0.6940 - accuracy: 0.5000 - 49ms/epoch - 49ms/step
```

In [63]:

```
model2.evaluate(val_padded,y_val)
```

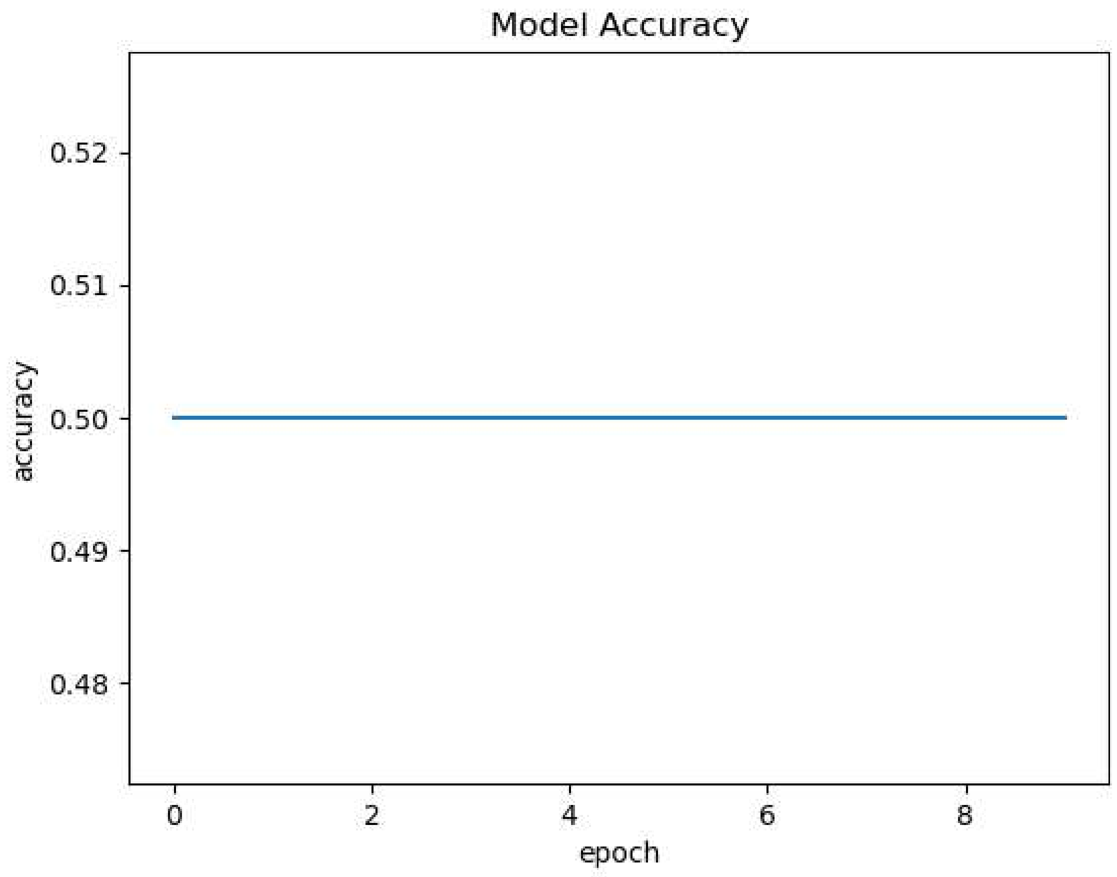
```
1/1 [==============================] - 1s 815ms/step - loss: 0.6939 - acc
uracy: 0.5000
```

Out[63]:

```
[0.6939154267311096, 0.5]
```

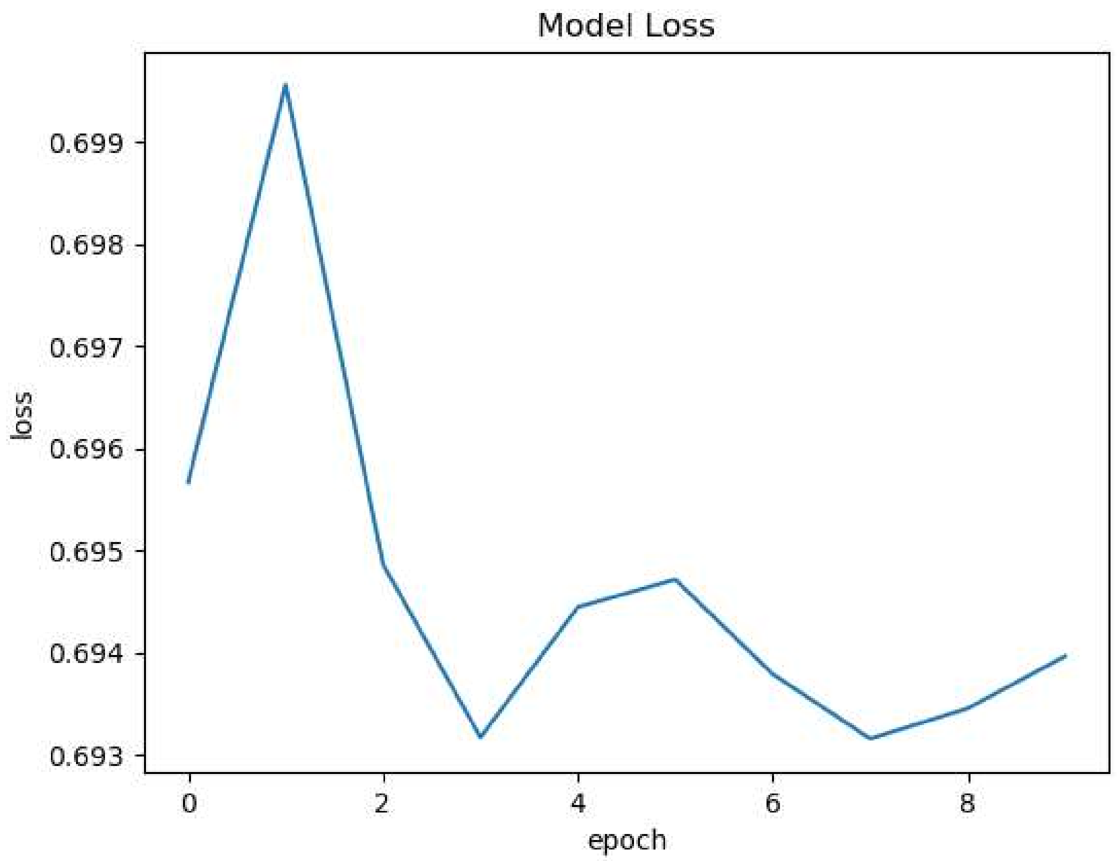
In [64]:

```
plt.plot(history2.history['accuracy'])
plt.title('Model Accuracy')
plt.ylabel('accuracy')
plt.xlabel('epoch')
plt.show()
```



In [65]:

```
plt.plot(history2.history['loss'])
plt.title('Model Loss')
plt.ylabel('loss')
plt.xlabel('epoch')
plt.show()
```


Model Loss
loss
epoch