In [1]:
```
# Importing required libraries
import nltk
import pandas as pd
from nltk.corpus import stopwords
from textblob import Word
from sklearn.preprocessing import LabelEncoder
from collections import Counter
import wordcloud
from sklearn.metrics import classification_report,confusion_matrix,accuracy_score
from keras.models import Sequential
from keras.preprocessing.text import Tokenizer
from keras.preprocessing.sequence import pad_sequences
from keras.layers import Dense, Embedding, LSTM, SpatialDropout1D
from sklearn.model_selection import train_test_split
import matplotlib.pyplot as plt
import numpy as np
```

In [4]:
```
#Loading the dataset
data = pd.read_csv('amazon_alexa.tsv',sep='\t')
# Creating a new column sentiment based on overall ratings
def sentiments(df):
  if df['rating'] > 3.0:
    return 'Positive'
  elif df['rating'] <= 3.0:
    return 'Negative'
data['sentiment'] = data.apply(sentiments, axis=1)
```

In [5]:
```
data.head()
```

Out[5]:

	rating	date	variation	verified_reviews	feedback	sentiment
0	5	31-Jul-18	Charcoal Fabric	Love my Echo!	1	Positive
1	5	31-Jul-18	Charcoal Fabric	Loved it!	1	Positive
2	4	31-Jul-18	Walnut Finish	Sometimes while playing a game, you can answer...	1	Positive
3	5	31-Jul-18	Charcoal Fabric	I have had a lot of fun with this thing. My 4 ...	1	Positive
4	5	31-Jul-18	Charcoal Fabric	Music	1	Positive

In [6]:
```
#Check if there are any null values
data_v1 = data[['verified_reviews','sentiment']]
data_v1.isnull().sum()
```

Out[6]:
```
verified_reviews    0
sentiment           0
dtype: int64
```

In [7]:
```
def cleaning(df, stop_words):

    #converting to lowercase
    df['verified_reviews'] = df['verified_reviews'].apply(lambda x:

            ' '.join(x.lower() for x in x.split()))


    # Replacing the digits/numbers

    df['verified_reviews'] = df['verified_reviews'].str.replace('d', ''

            )

    # Removing stop words

    df['verified_reviews'] = df['verified_reviews'].apply(lambda x:

            ' '.join(x for x in x.split() if x not in stop_words))

    # Lemmatization

    df['verified_reviews'] = df['verified_reviews'].apply(lambda x:

            ' '.join([Word(x).lemmatize() for x in x.split()]))

    return df

stop_words = stopwords.words('english')

data_v1 = cleaning(data_v1, stop_words)
```

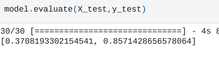
```
<ipython-input-7-7cbed1ab81c5>:4: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  df['verified_reviews'] = df['verified_reviews'].apply(lambda x:
<ipython-input-7-7cbed1ab81c5>:11: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  df['verified_reviews'] = df['verified_reviews'].str.replace('d', ''
<ipython-input-7-7cbed1ab81c5>:17: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  df['verified_reviews'] = df['verified_reviews'].apply(lambda x:
<ipython-input-7-7cbed1ab81c5>:23: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  df['verified_reviews'] = df['verified_reviews'].apply(lambda x:
```

In [8]:
```
data_v1.head()
```

Out[8]:

	verified_reviews	sentiment
0	love echo!	Positive
1	love it!	Positive
2	sometimes playing game, answer question correc...	Positive
3	ha lot fun thing. 4 yr ol learns inosaurs, con...	Positive
4	music	Positive

In [9]:
```
common_words=''
for i in data_v1.verified_reviews:
    i = str(i)
    tokens = i.split()
    common_words += " ".join(tokens)+" "
wordcloud = wordcloud.WordCloud().generate(common_words)
plt.imshow(wordcloud, interpolation='bilinear')
plt.axis("off")
plt.show()
```



In [10]:
```
# Encoded the target column
lb=LabelEncoder()
data_v1['sentiment'] = lb.fit_transform(data_v1['sentiment'])
```

```
<ipython-input-10-3c303bced4a2>:3: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  data_v1['sentiment'] = lb.fit_transform(data_v1['sentiment'])
```

In [12]:
```
data_v1.head(10)
```

Out[12]:

	verified_reviews	sentiment
0	love echo!	1
1	love it!	1
2	sometimes playing game, answer question correc...	1
3	ha lot fun thing. 4 yr ol learns inosaurs, con...	1
4	music	1
5	receive echo gift. neee another bluetooth some...	1
6	without cellphone, cannot use many features. i...	0
7	think 5th one i've purchase. i'm working getti...	1
8	look great	1
9	love it! i've listene song haven't hear since ...	1

In [14]:
```
tokenizer = Tokenizer(num_words=500, split=' ')
tokenizer.fit_on_texts(data_v1['verified_reviews'].values)
X = tokenizer.texts_to_sequences(data['verified_reviews'].values)
X = pad_sequences(X)
X
```

Out[14]:
```
array([[  0,   0,   0, ...,   0,   1,   2],
       [  0,   0,   0, ...,   0,   0,   5],
       [  0,   0,   0, ..., 263, 276,  24],
       ...,
       [  0,   0,   0, ...,  89, 326,  32],
       [  0,   0,   0, ..., 217,  58, 290],
       [  0,   0,   0, ...,   0,   0,   0]], dtype=int32)
```

In [15]:
```
model = Sequential()
model.add(Embedding(500, 120, input_length = X.shape[1]))
model.add(SpatialDropout1D(0.4))
model.add(LSTM(176, dropout=0.2, recurrent_dropout=0.2))
model.add(Dense(2,activation='softmax'))
model.compile(loss = 'categorical_crossentropy', optimizer='adam', metrics = ['accuracy'])
print(model.summary())
```

```
Model: "sequential"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
embedding (Embedding)        (None, 319, 120)          60000
_________________________________________________________________
spatial_dropout1d (SpatialDr (None, 319, 120)          0
_________________________________________________________________
lstm (LSTM)                  (None, 176)               209088
_________________________________________________________________
dense (Dense)                (None, 2)                 354
=================================================================
Total params: 269,442
Trainable params: 269,442
Non-trainable params: 0
_________________________________________________________________
None
```

In [17]:
```
#Splitting the data into training and testing
y=pd.get_dummies(data_v1['sentiment'])
X_train, X_test, y_train, y_test = train_test_split(X,y, test_size = 0.3, random_state = 42)
```

In [18]:
```
X_train = np.array(X_train)
X_test = np.array(X_test)
y_train = np.array(y_train)
y_test = np.array(y_test)
```

In [19]:
```
batch_size=32
model.fit(X_train, y_train, epochs = 1, batch_size=batch_size, verbose = 1)
```

```
69/69 [==============================] - 73s 707ms/step - loss: 0.4680 - accuracy: 0.8418
```
Out[19]:
```
<keras.callbacks.History at 0x7f5d91808430>
```

In [20]:
```
model.evaluate(X_test,y_test)
```

```
30/30 [==============================] - 4s 86ms/step - loss: 0.3708 - accuracy: 0.8571
```
Out[20]:
```
[0.3708193302154541, 0.8571428656578064]
```