Name:Anushka R

INTRODUCTION

1.1 Overview

Mobile phones have revolutionized the way we purchase products online, making all the information available at our fingertips. Reviews and ratings submitted by consumers became an integral part of the customer's buying decision process. The review and rating platform provided by eCommerce players creates a transparent system for consumers to take decisions and feel confident about it.

However, it is difficult to read all the feedback for a particular item especially for the popular items with many comments. In this project, we will attempt to understand the factors that contribute to classifying reviews as positive or negative

1.2 Purpose

The main objective of this project is to understand the factors that contribute to classifying reviews as positive or negative.Natural language processing is used to analyze the sentiment (positive or a negative) of the given review. A sample web application is integrated to the model built

key objectives are:

- Know fundamental concepts and techniques of natural language processing (NLP).
- Gain a broad understanding of text data.
- Know how to pre-process/clean the data using different data preprocessing techniques.
- know how to build a web application using Flask framework.

2. LITERATURE SURVEY

Existing Solution:

A Comparison of Sentiment Analysis Methods on Amazon Reviews of Mobile Phones
Sara Ashour Aljuhani1, Norah Saleh Alghamdi 2 School of Computing, Dublin City University (DCU)1Dublin, Ireland Department of Computer Science1,2 Princess Nourah bint Abdulrahman University (PNU) Riyadh,
KSA

Existing approaches to solve the problem:

In this research they have studied sentiment analysis of mobile phone reviews using different types of machine learning classifiers, such as Logis-

tic Regression (LR), Naive Bayes (NB), Stochastic Gradient Decent (SGD) and deep learning algorithms such as Convolutional Neural Networks (CNN). These algorithms are applied using different feature extraction approaches. For example, Bag-of-words with (Bigram, Trigram), TF-IDF with (Unigram,Bigram, Trigram), word2vec, word2vec with Bigram, and glove. We evaluated them with different classification methods

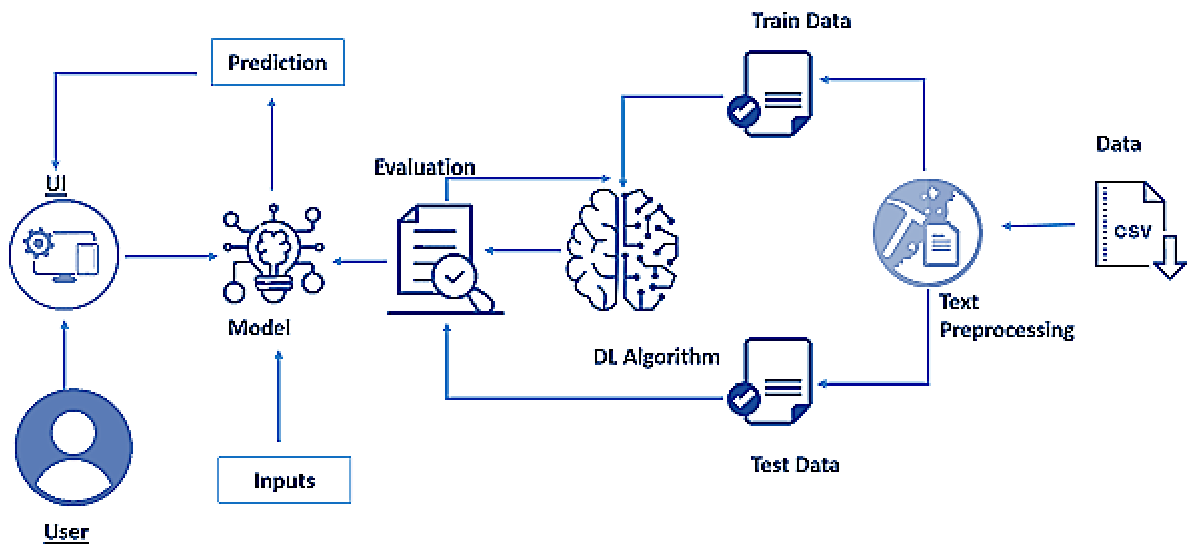
such as bag-of-words revealing that when the size of 'n' in n-gram increases, the accuracy will also increase, and Log loss value will decrease. On the other hand, our Bigram approach provided best results with TF-IDF in unbalanced data, and Trigram in balanced data.

3.Propose Solution:

The proposed solution is to understand the factors that contribute to classifying reviews as positive or negative.Natural language processing is used to analyze the sentiment (positive or a negative) of the given review.

4.THEORETICAL ANALYSIS

Block diagram



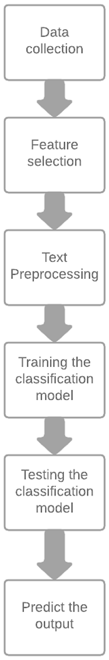
Hardware Requirements

- minimum of 8GB RAM
- Intel Core i7 processor) is recommended
- Windows 10 or above
- NVIDIA GPU is preferable

Software Requirements

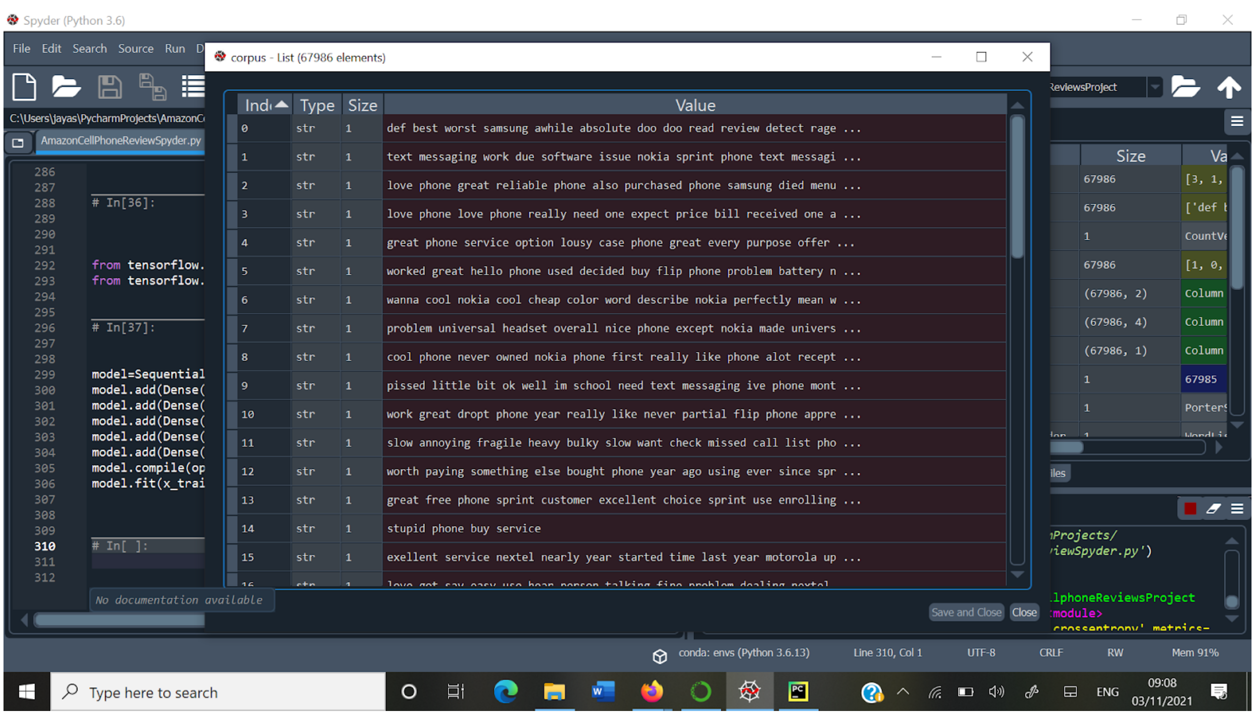
- Python
- Python Web Frame Works NLP

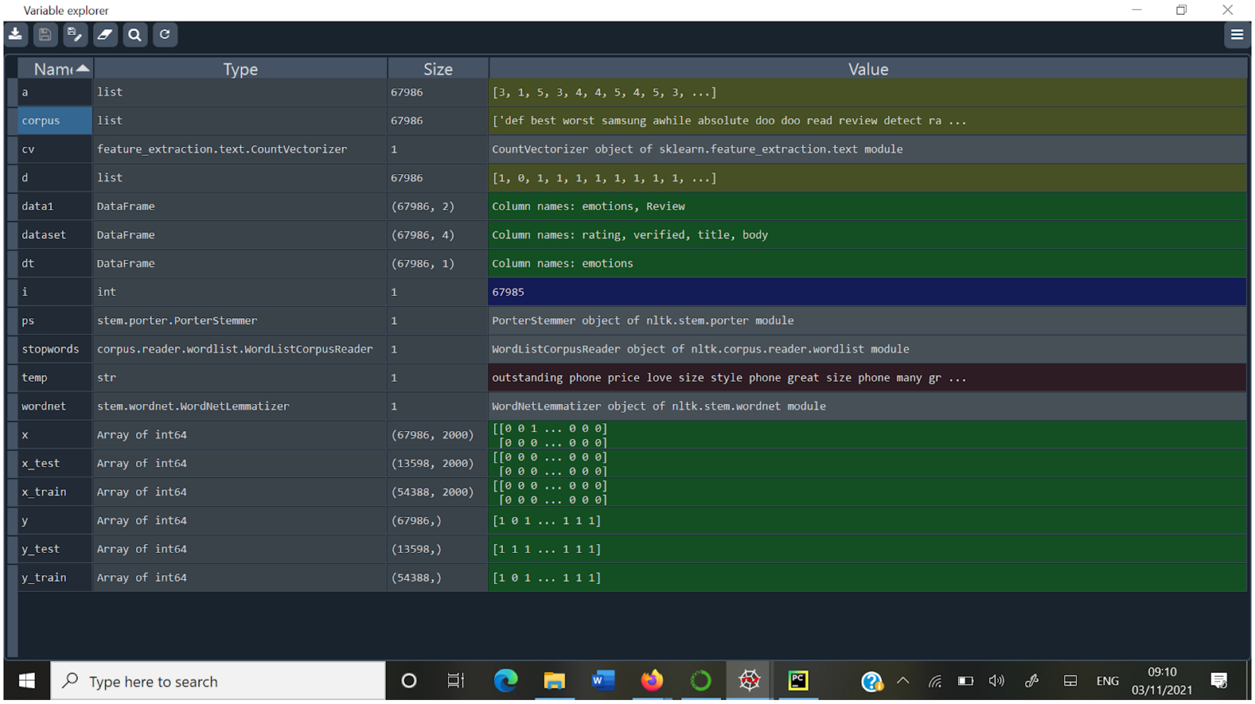
5.FLOWCHART



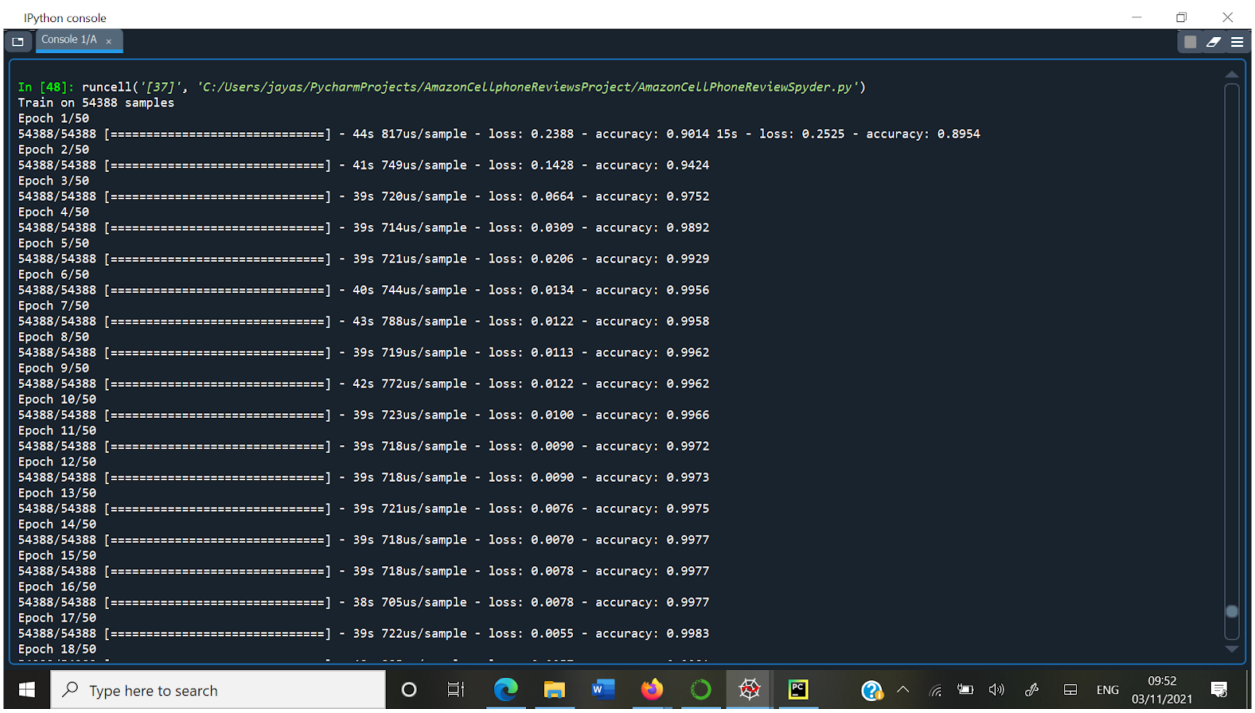
6. RESULT

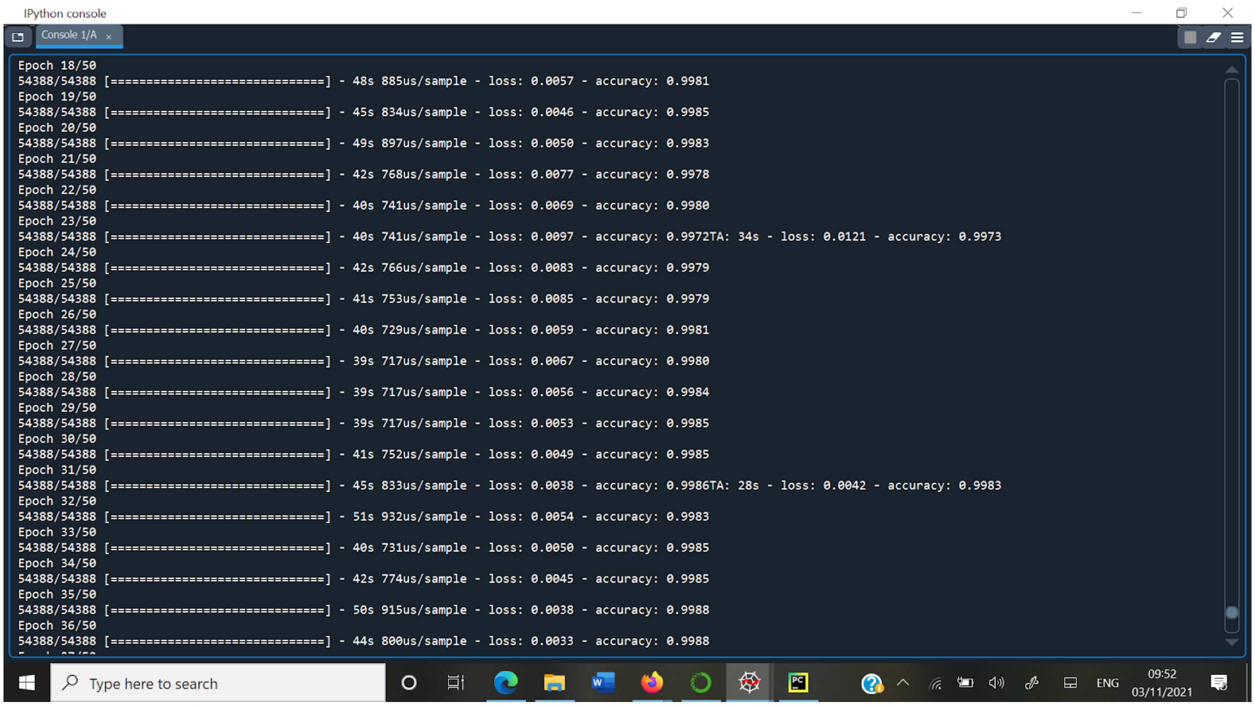
Text Preprocessing

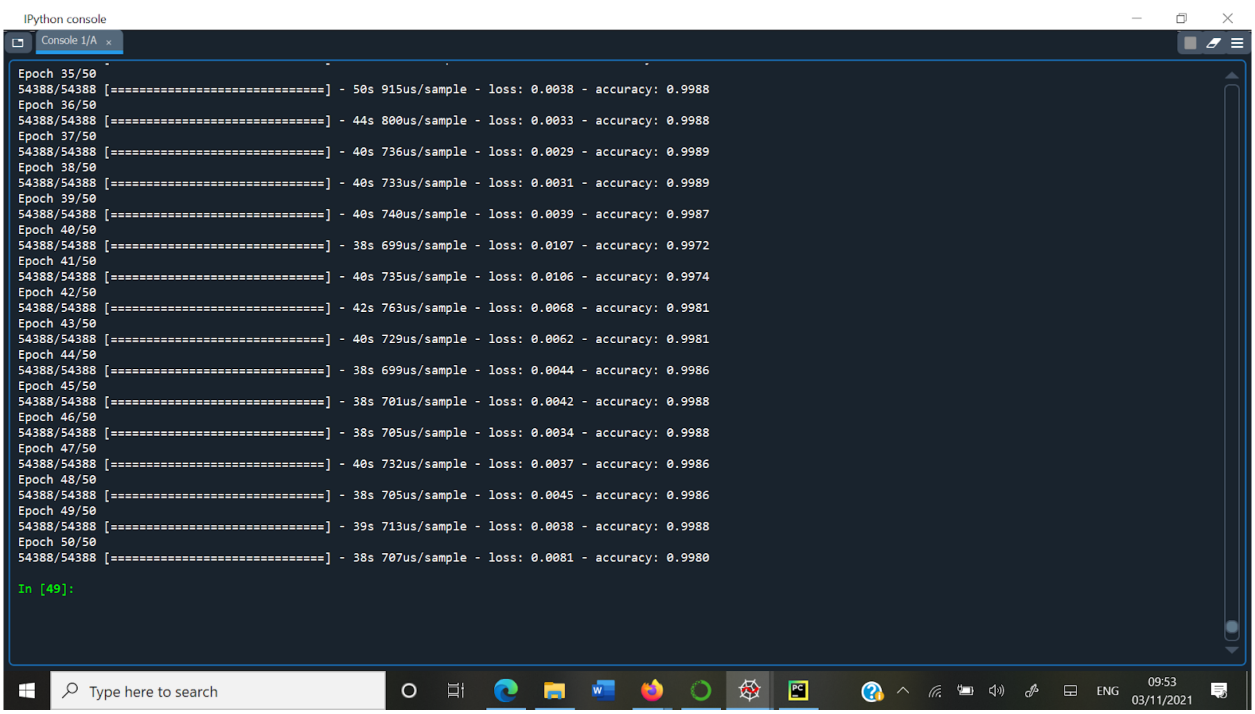




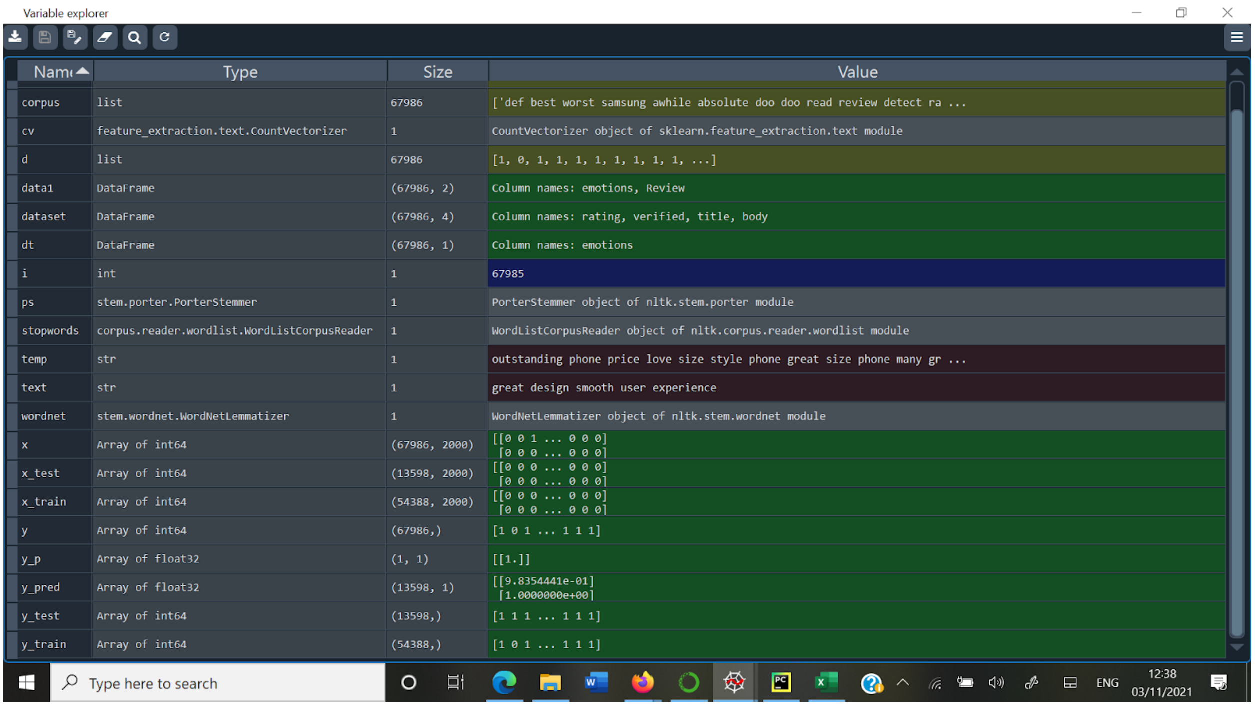
Model building



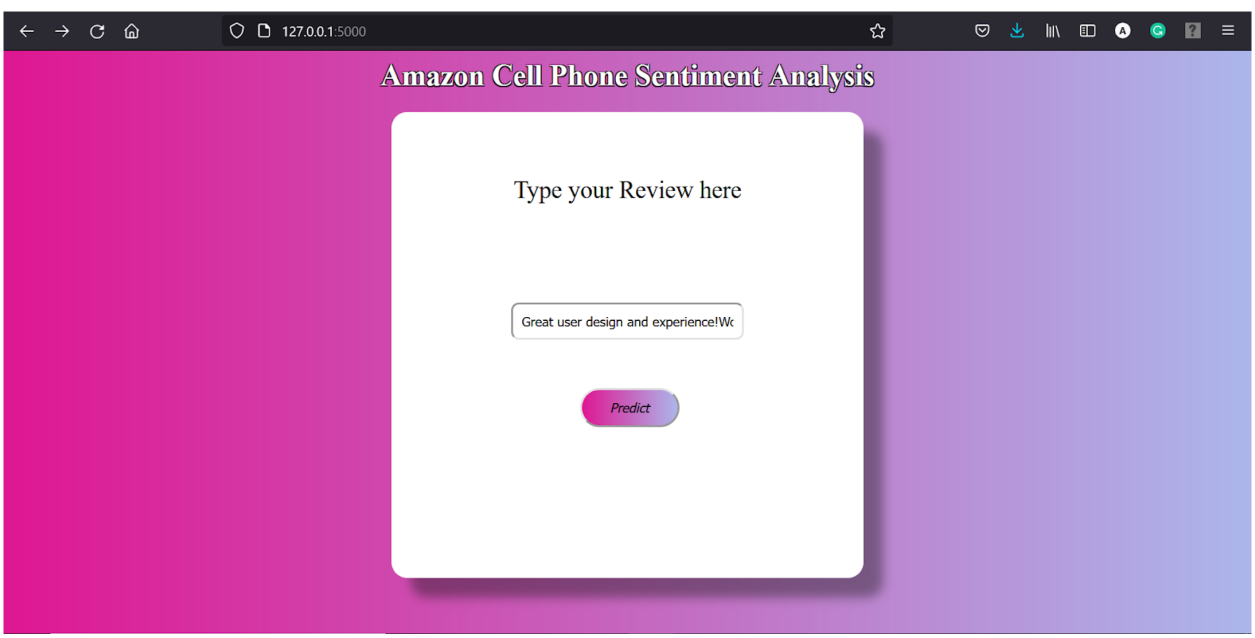

IPython console
Console 1/A
Epoch 18/50
54388/54388 [==============================] - 48s 885us/sample - loss: 0.0057 - accuracy: 0.9981
Epoch 19/50
54388/54388 [==============================] - 45s 834us/sample - loss: 0.0046 - accuracy: 0.9985
Epoch 20/50
54388/54388 [==============================] - 49s 897us/sample - loss: 0.0050 - accuracy: 0.9983
Epoch 21/50
54388/54388 [==============================] - 42s 768us/sample - loss: 0.0077 - accuracy: 0.9978
Epoch 22/50
54388/54388 [==============================] - 40s 741us/sample - loss: 0.0069 - accuracy: 0.9980
Epoch 23/50
54388/54388 [==============================] - 40s 741us/sample - loss: 0.0097 - accuracy: 0.9972TA: 34s - loss: 0.0121 - accuracy: 0.9973
Epoch 24/50
54388/54388 [==============================] - 42s 766us/sample - loss: 0.0083 - accuracy: 0.9979
Epoch 25/50
54388/54388 [==============================] - 41s 753us/sample - loss: 0.0085 - accuracy: 0.9979
Epoch 26/50
54388/54388 [==============================] - 40s 729us/sample - loss: 0.0059 - accuracy: 0.9981
Epoch 27/50
54388/54388 [==============================] - 39s 717us/sample - loss: 0.0067 - accuracy: 0.9980
Epoch 28/50
54388/54388 [==============================] - 39s 717us/sample - loss: 0.0056 - accuracy: 0.9984
Epoch 29/50
54388/54388 [==============================] - 39s 717us/sample - loss: 0.0053 - accuracy: 0.9985
Epoch 30/50
54388/54388 [==============================] - 41s 752us/sample - loss: 0.0049 - accuracy: 0.9985
Epoch 31/50
54388/54388 [==============================] - 45s 833us/sample - loss: 0.0038 - accuracy: 0.9986TA: 28s - loss: 0.0042 - accuracy: 0.9983
Epoch 32/50
54388/54388 [==============================] - 51s 932us/sample - loss: 0.0054 - accuracy: 0.9983
Epoch 33/50
54388/54388 [==============================] - 40s 731us/sample - loss: 0.0050 - accuracy: 0.9985
Epoch 34/50
54388/54388 [==============================] - 42s 774us/sample - loss: 0.0045 - accuracy: 0.9985
Epoch 35/50
54388/54388 [==============================] - 50s 915us/sample - loss: 0.0038 - accuracy: 0.9988
Epoch 36/50
54388/54388 [==============================] - 44s 800us/sample - loss: 0.0033 - accuracy: 0.9988
Type here to search
ENG
09:52
03/11/2021

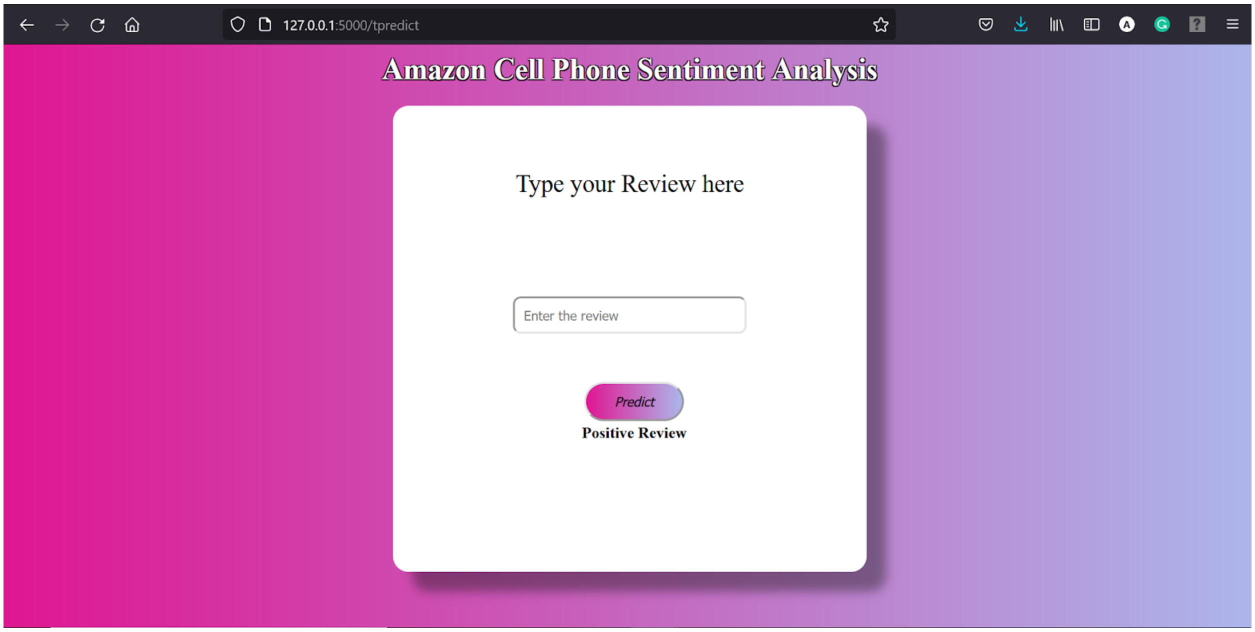

IPython console
Console 1/A
Epoch 35/50
54388/54388 [==============================] - 50s 915us/sample - loss: 0.0038 - accuracy: 0.9988
Epoch 36/50
54388/54388 [==============================] - 44s 800us/sample - loss: 0.0033 - accuracy: 0.9988
Epoch 37/50
54388/54388 [==============================] - 40s 736us/sample - loss: 0.0029 - accuracy: 0.9989
Epoch 38/50
54388/54388 [==============================] - 40s 733us/sample - loss: 0.0031 - accuracy: 0.9989
Epoch 39/50
54388/54388 [==============================] - 40s 740us/sample - loss: 0.0039 - accuracy: 0.9987
Epoch 40/50
54388/54388 [==============================] - 38s 699us/sample - loss: 0.0107 - accuracy: 0.9972
Epoch 41/50
54388/54388 [==============================] - 40s 735us/sample - loss: 0.0106 - accuracy: 0.9974
Epoch 42/50
54388/54388 [==============================] - 42s 763us/sample - loss: 0.0068 - accuracy: 0.9981
Epoch 43/50
54388/54388 [==============================] - 40s 729us/sample - loss: 0.0062 - accuracy: 0.9981
Epoch 44/50
54388/54388 [==============================] - 38s 699us/sample - loss: 0.0044 - accuracy: 0.9986
Epoch 45/50
54388/54388 [==============================] - 38s 701us/sample - loss: 0.0042 - accuracy: 0.9988
Epoch 46/50
54388/54388 [==============================] - 38s 705us/sample - loss: 0.0034 - accuracy: 0.9988
Epoch 47/50
54388/54388 [==============================] - 40s 732us/sample - loss: 0.0037 - accuracy: 0.9986
Epoch 48/50
54388/54388 [==============================] - 38s 705us/sample - loss: 0.0045 - accuracy: 0.9986
Epoch 49/50
54388/54388 [==============================] - 39s 713us/sample - loss: 0.0038 - accuracy: 0.9988
Epoch 50/50
54388/54388 [==============================] - 38s 707us/sample - loss: 0.0081 - accuracy: 0.9980
In [49]:
Type here to search
ENG
09:53
03/11/2021

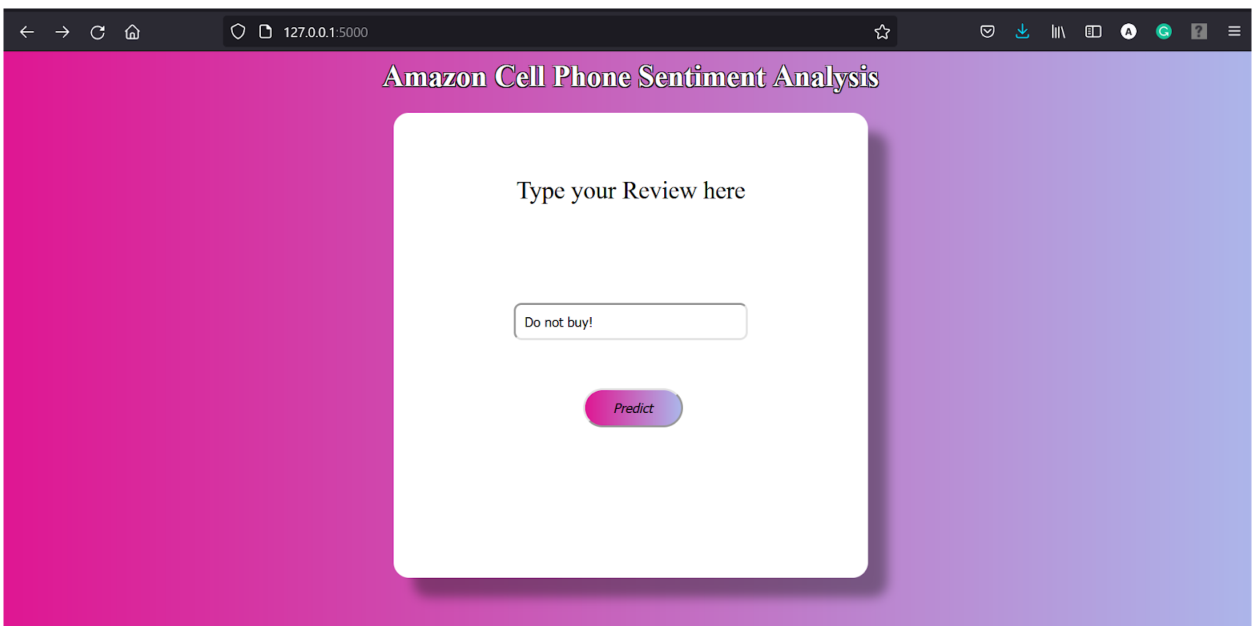
Testing

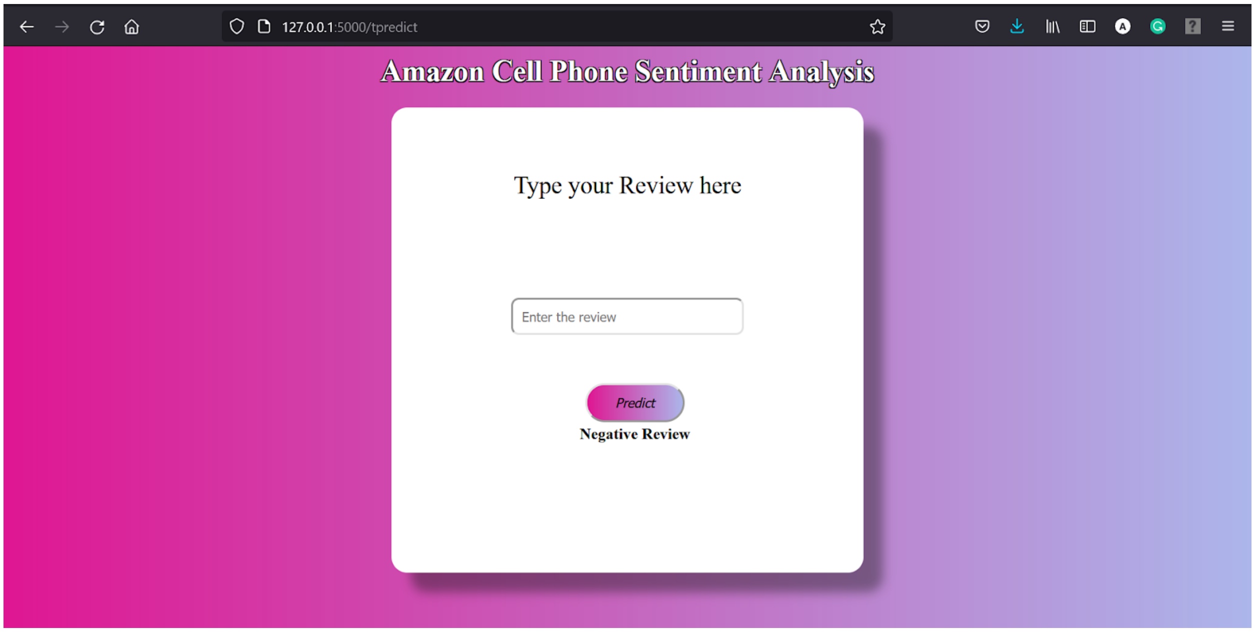

Variable explorer
Name Type Size Value
corpus list 67986 ['def best worst samsung awhile absolute doo doo read review detect ra ...
cv feature_extraction.text.CountVectorizer 1 CountVectorizer object of sklearn.feature_extraction.text module
d list 67986 [1, 0, 1, 1, 1, 1, 1, 1, 1, 1, ...]
data1 DataFrame (67986, 2) Column names: emotions, Review
dataset DataFrame (67986, 4) Column names: rating, verified, title, body
dt DataFrame (67986, 1) Column names: emotions
i int 1 67985
ps stem.porter.PorterStemmer 1 PorterStemmer object of nltk.stem.porter module
stopwords corpus.reader.wordlist.WordListCorpusReader 1 WordListCorpusReader object of nltk.corpus.reader.wordlist module
temp str 1 outstanding phone price love size style phone great size phone many gr ...
text str 1 great design smooth user experience
wordnet stem.wordnet.WordNetLemmatizer 1 WordNetLemmatizer object of nltk.stem.wordnet module
x Array of int64 (67986, 2000) [[0 0 1 ... 0 0 0] [0 0 0 ... 0 0 0]
x_test Array of int64 (13598, 2000) [[0 0 0 ... 0 0 0] [0 0 0 ... 0 0 0]
x_train Array of int64 (54388, 2000) [[0 0 0 ... 0 0 0] [0 0 0 ... 0 0 0]
y Array of int64 (67986,) [1 0 1 ... 1 1 1]
y_p Array of float32 (1, 1) [[1.]]
y_pred Array of float32 (13598, 1) [[9.8354441e-01] [1.0000000e+00]
y_test Array of int64 (13598,) [1 1 1 ... 1 1 1]
y_train Array of int64 (54388,) [1 0 1 ... 1 1 1]
Type here to search
ENG
12:38
03/11/2021

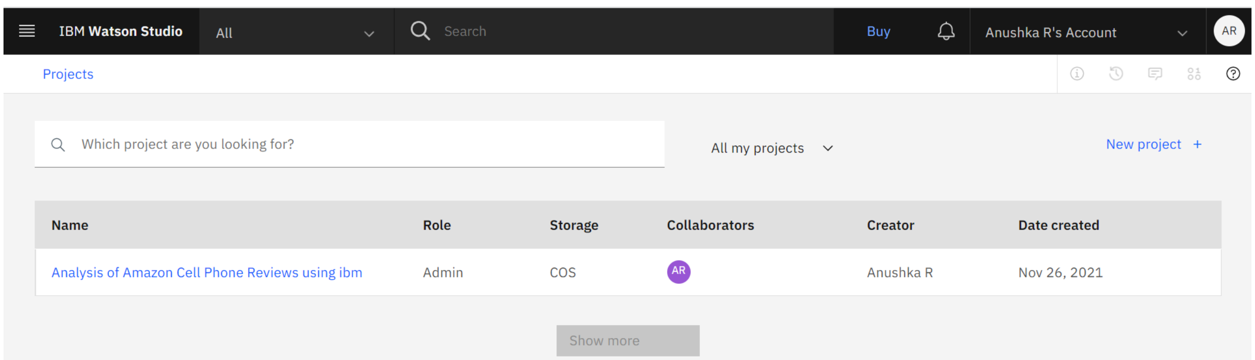
App

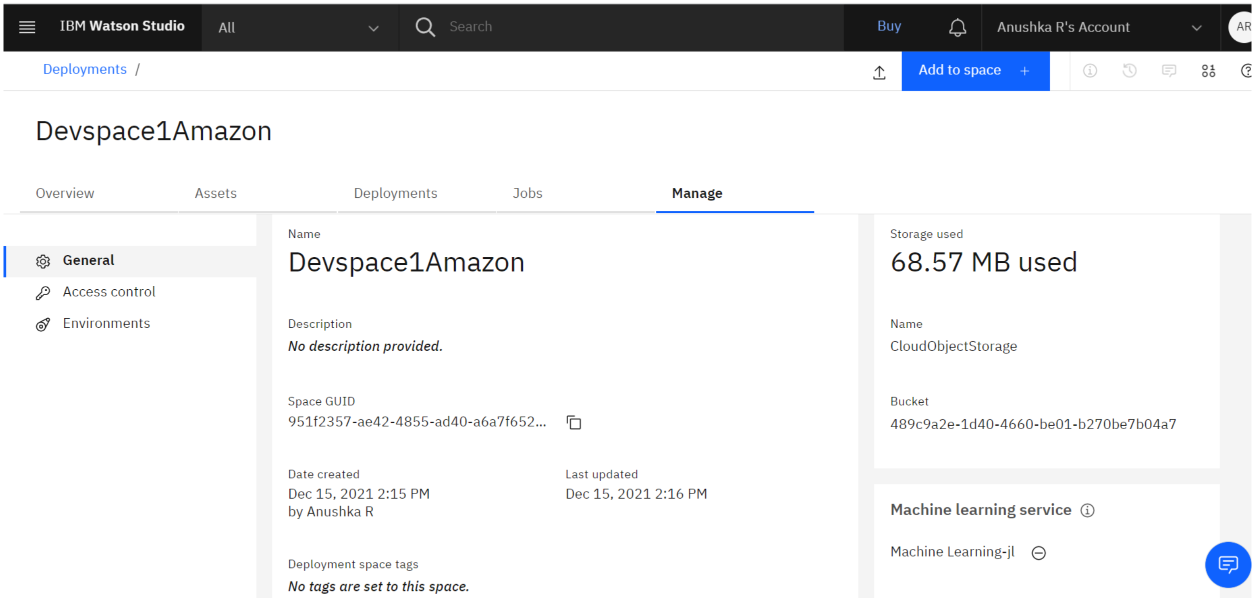

127.0.0.1:5000
Amazon Cell Phone Sentiment Analysis
Type your Review here
Great user design and experience!We
Predict

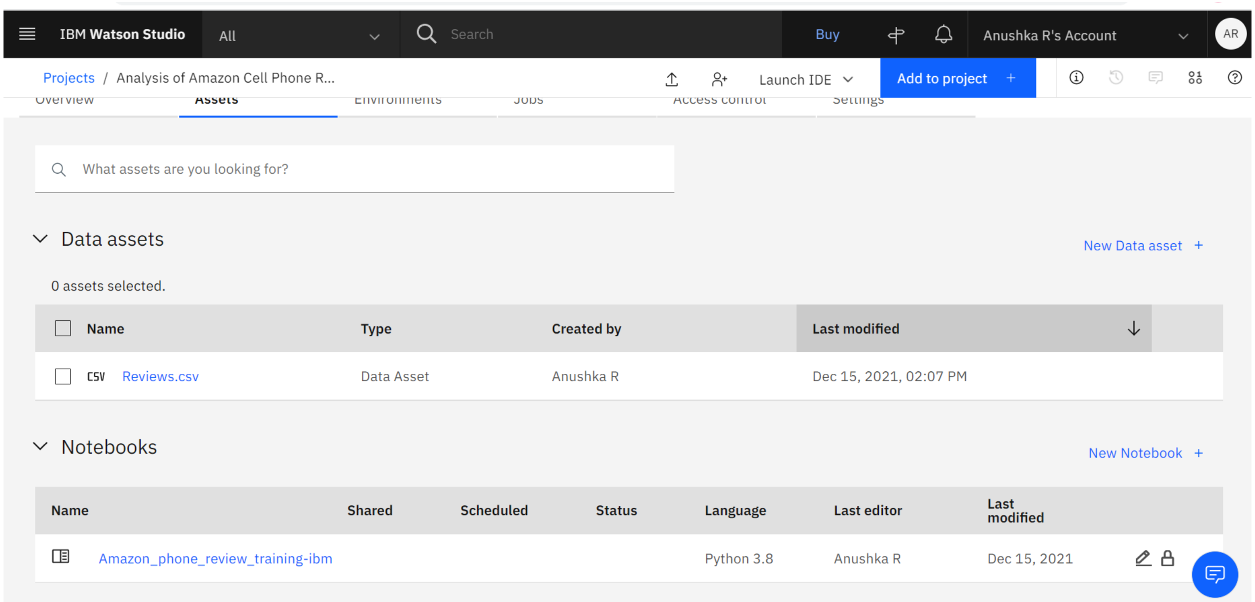

127.0.0.1:5000/tpredict
Amazon Cell Phone Sentiment Analysis
Type your Review here
Enter the review
Predict
Positive Review

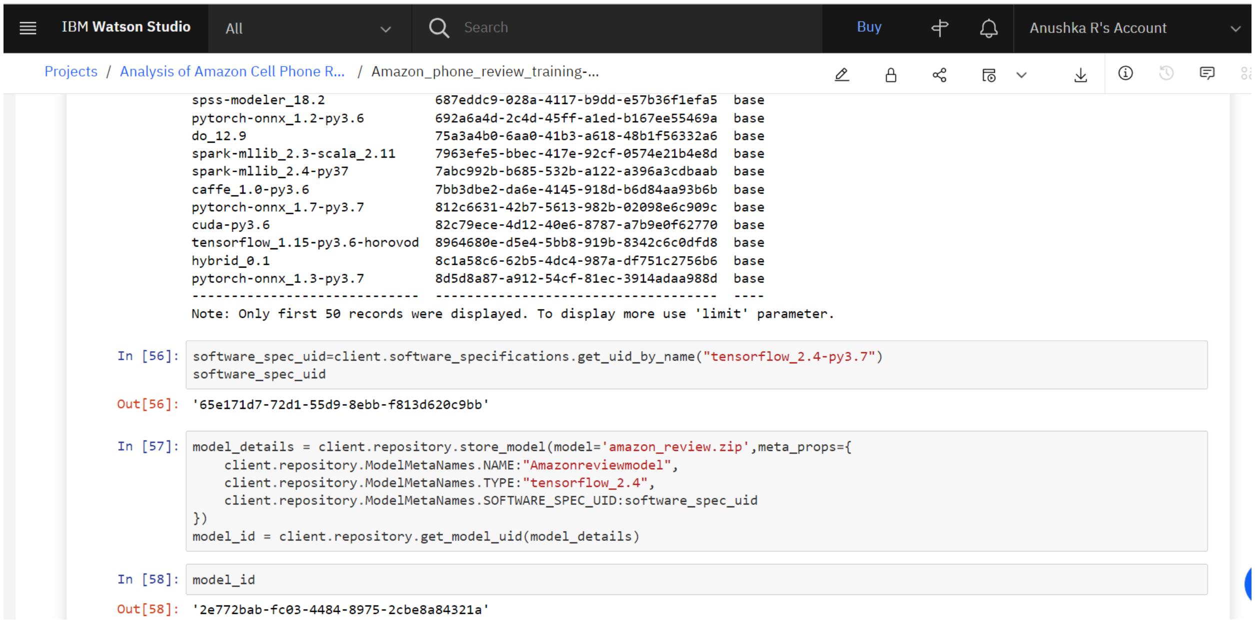

127.0.0.1:5000
Amazon Cell Phone Sentiment Analysis
Type your Review here
Do not buy!
Predict


127.0.0.1:5000/tpredict
Amazon Cell Phone Sentiment Analysis
Type your Review here
Enter the review
Predict
Negative Review


IBM Watson Studio
All
Search
Buy
Anushka R's Account
AR
Projects
Which project are you looking for?
All my projects
New project +
Name
Role
Storage
Collaborators
Creator
Date created
Analysis of Amazon Cell Phone Reviews using ibm
Admin
COS
AR
Anushka R
Nov 26, 2021
Show more


IBM Watson Studio
All
Search
Buy
Anushka R's Account
AR
Deployments /
Add to space +
Devspace1Amazon
Overview
Assets
Deployments
Jobs
Manage
General
Access control
Environments
Name
Devspace1Amazon
Description
No description provided.
Space GUID
951f2357-ae42-4855-ad40-a6a7f652...
Date created
Dec 15, 2021 2:15 PM
by Anushka R
Last updated
Dec 15, 2021 2:16 PM
Deployment space tags
No tags are set to this space.
Storage used
68.57 MB used
Name
CloudObjectStorage
Bucket
489c9a2e-1d40-4660-be01-b270be7b04a7
Machine learning service
Machine Learning-jl


IBM Watson Studio
All
Search
Buy
Anushka R's Account
AR
Projects / Analysis of Amazon Cell Phone R...
Launch IDE
Add to project +
What assets are you looking for?
Data assets
New Data asset +
0 assets selected.
Name
Type
Created by
Last modified
CSV
Reviews.csv
Data Asset
Anushka R
Dec 15, 2021, 02:07 PM
Notebooks
New Notebook +
Name
Shared
Scheduled
Status
Language
Last editor
Last modified
Amazon_phone_review_training-ibm
Python 3.8
Anushka R
Dec 15, 2021



7. ADVANTAGES

The proposed system does not restrict its scope over polarity or sentiment prediction, it digs into the polarity intensity such as whether the review is just positive or very positive and same for negative reviews. The proposed system results also show that the different aspects of the product about which positive is being said or negative is being said are also identified. The efficiency of the model is based on performance evaluation; it is seen that it outperforms Machine Learning model performance parameters.

DISADVANTAGES

Some of the limitations are low performance and highly time consuming. The proposed model fails to give accurate results sometimes and hence is inefficient.

8 .APPLICATIONS

- Social media monitoring
- Customer support

- Customer feedback
- Brand monitoring and reputation management
- Voice of customer (VoC)
- Voice of employee
- Product analysis
- Market and competitor research

9. CONCLUSION

Product review platform, provided by Amazon, describes that a major number of reviewers have set 4-star and 3-star ratings to the unlocked phones. The average length of the reviews comes close to 230 characters. It can be seen that review with more lengthy text tends to be more useful and there is a direct correlation between rating and price. Sentiment analysis shows that positive sentiment is established among the reviews and in terms of emotions, ‘trust’, ‘anticipation’ and ‘joy’ have highest scores.Hence it is observed that the proposed model gives more accurate and elaborative details about the reviews which is helpful in terms of analyzing the aspects of the products whose polarity is also identified. So because of this, consumers and service providers will get better clarification on products' market value and help them make important business decisions.

10. FUTURE SCOPE

Some algorithms that remain to be applied in future work include LSTM, KNN, and Maximum entropy. Then, we will compare the result to the result we performed in this current study. Our research has some limitations: NLP is relatively a new topic, and highly advanced; hence, it needs a lot of research to understand the field and how it works. Furthermore, we faced some problems with computer memory causing experiments to be highly time consuming.

APPENDIX

1. **source code**

index.html

```
<!DOCTYPE html>
<html>
<title >Amazon Cellphone Sentimental Review Analysis</title>
 <head>
<link href="https://cdn.jsdelivr.net/npm/bootstrap@5.1.3/dist/css/bootstrap.min.css" rel="stylesheet"
integrity="sha384-1BmE4kWBq78iYhFldvKuhfTAU6auU8tT94WrHftjDbrCEXSU1oBoqyl2QvZ6jIW3"
crossorigin="anonymous">
   <link rel="stylesheet" type="text/css" href="[url_for("static", filename="style/index12.css") }}">

   <style>

   body {

   /* background: #acb6e5;

   background: -webkit-linear-gradient (to right, #86fde8, #acb6e5);
   background: 1inear-gradient(to right, #86fde8, #acb6e5); */
   background: rgb(172,182,229);
background: linear-gradient(90deg, rgba(172,182,229,1) 35%, rgba(134,253,232,1) 100%);
   }
   </style>

   </head>

   <body class="body1">

   <form method="POST">

   <div class="container-fluid">

   <h1 style="color:black; font-size:50px;text-align:center" >Amazon Cellphone Sentiment Analysis</h1>

   <p align="center" style="font-size:25px">Enter your Review here</p>
```

```
<form action="/tpredict" method="POST">
<p align="center">
<input type="text" align="Center" placeholder="Enter the review" name="tweet" id="rcorners1"
required>
</p>
<table align='center' style='padding:0.5px; border-spacing: 10px; font-size:20 px'>
<tr>
<td colspan="2" align="center"><button class="btn btn-dark" type="submit" nane="predict"
align="center">PREDICT</button>
</tr>
<tr>
<td colspan="2" align="center"><b>{{ypred}}</b></td>
</tr>
</table>
</form>
<p>
{% if ypred == "Positive Review" %}
<p>Positive</p>

{% else %}

{% if ypred == "Negative Review" %}
<p>Negative</p>

{% endif %}
{% endif %}
</p>
</div>
</form>
</body>
</html>
```

Temp.py

```
import re
import nltk
import pandas as pd
import numpy as np
dataset=pd.read_csv("20191226-reviews.csv")
print(dataset.head())
print(dataset.isnull().sum())
dataset['body']=dataset ['body'].fillna('').apply(str)

dataset['name'] = dataset ['name'].fillna('').apply(str)
dataset['title'] = dataset ['title'].fillna('').apply(str)
dataset['helpfulVotes'] = dataset [ 'helpfulVotes' ].fillna('').apply(str)
print(dataset.isnull().sum())
dataset=dataset.drop(columns=['asin','name','helpfulVotes','date'],axis=1)
a=dataset['rating'].tolist()
d=[]
for i in range(len(a)):
    if a[i]>=3:
        d.append(1)
    else:
        d.append(0)
print(d)
dt=pd.DataFrame(d,columns=['emotion'])
print(dt)
data1=pd.concat([dataset,dt],axis=1)
data1.head()
data1.drop(['verified'],axis=1,inplace=True)
data1['Review'] = data1['title'].str.cat(data1['body'],sep=" ")
data1.drop(['title','body','rating'],axis=1,inplace=True)
print(data1.head())
print(data1.shape)
y=data1.iloc[:,0].values
x=data1.iloc[:,1].values
print(y)
```

```
from nltk.corpus import stopwords
from nltk.stem.porter import PorterStemmer #create an object for stemming
ps=PorterStemmer()
#library used for stem the words
from nltk. stem import WordNetLemmatizer #create an object for wordnet Lemmatizer
wordnet=WordNetLemmatizer()
data=[]
for i in range(len(x)):
   review=data1['Review'][i]
   review=re.sub('[^a-zA-Z]',' ',str(review))
   review=review.lower()
   review=review.split()
   review=[ps.stem(word) for word in review if not word in stopwords.words('english')]
   review=[wordnet.lemmatize(word) for word in review if not word in set(stopwords.words('english'))]
   review=' '.join(review)
   data.append(review)
from sklearn.feature_extraction.text import CountVectorizer
cv=CountVectorizer(max_features=2000)
x=cv.fit_transform(data).toarray()
print(x)
import pickle
pickle.dump(cv,open('count_vec.pkl','wb'))
from sklearn.model_selection import train_test_split
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.2,random_state=0)
print(x_train.shape)
print(x_test.shape)
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense
model = Sequential()
model.add(Dense(units=13264,activation ='relu'))
model.add(Dense(units= 2000,activation ='relu'))
model.add(Dense(units= 2000,activation ='relu'))
model.add(Dense(units= 2000,activation ='relu'))
model.add(Dense(units=1,activation ='sigmoid'))
```

```
model.compile(optimizer='adam',loss='binary_crossentropy', metrics = ['accuracy'])
model.fit(x_train,y_train,batch_size=128,epochs=50)
y_pred = model.predict(x_test)
text = "The phone is okay. average "
text = re.sub ('[^a-zA-Z]', ' ',text)
text = text.lower()
text = text.split()
text = [ps.stem(word) for word in text if not word in set(stopwords.words('english'))]
text = ' '.join(text)
y_p = model.predict(cv.transform( [text]))
# saving the model
model.save("review_analysis.h5")
```

App.py

```
from flask import render_template, Flask, request,url_for
from tensorflow.keras.models import load_model
import pickle
import tensorflow as tf
graph =tf.compat.v1.get_default_graph()
with open(r'count_vec.pkl','rb') as file:
   cv=pickle.load(file)
app=Flask(__name__)
@app.route('/')
def home():
   return render_template('index.html')
@app.route('/tpredict')

@app.route('/', methods=['GET', 'POST'])

def page2():
   if request.method == 'GET':

     return render_template('index.html')

   if request.method == 'POST' :
```

```
        topic= request.form['tweet']
        print("Hey " +topic)
        topic=cv.transform([topic])
        print("\n"+str(topic.shape)+"\n")
        with graph.as_default():
            cla = load_model('review_analysis.h5')
            cla.compile(optimizer='adam',loss='binary_crossentropy')
            y_pred = cla.predict(topic)
            print("pred is "+str(y_pred))

        if(y_pred > 0.7):
            topic="Positive Review"

        else:
          topic = "Negative Review"
        return render_template('index.html', ypred = topic)

if __name__=="__main__":
    app.run(debug=False)
```