VISVESVARAYA TECHNOLOGICAL UNIVERSITY

BELAGAVI – 590018,Karnataka

INTERNSHIP REPORT

ON

"Sentiment Analysis Of Lockdown In USA During Covid-19 A Case Study On Twitter using ML"

Submitted in partial fulfilment for the award of degree(18CSI85)

BACHELOR OF ENGINEERING IN COMPUTER SCIENCE AND ENGINEERING

Submitted by:

Nisarga M

4GW20CS064

Conducted at
Varcons Technologies Pvt Ltd

GSSS INSTITUTE OF ENGINEERING AND TECHNOLOGY FOR WOMEN

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

GSSS Institute of Engineering & Technology for Women KRS Road, Metagalli, Engineering Campus, Mysore- 570016

CERTIFICATE

This is to certify that the Internship titled **"Sentiment Analysis Of Lockdown In USA During Covid-19 A Case Study On Twitter using ML"** carried out by **Nisarga M,** a bonafide student of **GSSS Institute of Engineering and Technology for Women** in partial fulfillment for the award of **Bachelor of Engineering**, in **Computer Science and Engineering,** under Visvesvaraya Technological University, Belagavi, during the year 2023-2024. It is certified that all corrections/suggestions indicated have been incorporated in the report.

Signature of Guide   **Signature of HOD**   **Signature of Principal**

External Viva :

Name of the Examiner   Signature with Date

1) _____   2) _____

_____   _____

D E C L A R A T I O N

I, **Nisarga M(4GW20CS064)**, final year student of Computer Science and Engineering, **GSSS Institute of Engineering and Technology for Women**-570 016, declare that the Internship has been successfully completed, in **Varcons Technologies Pvt Ltd**. This report is submitted in partial fulfillment of the requirements for award of Bachelor Degree in Computer Science and Engineering, during academic year 2023-2024.

Date : September 21, 2023

Place : Bangalore.

USN: 4GW20CS064

NAME: Nisarga M

INTERNSHIP OFFER LETTER

Date: 11th August, 2023

Name: **Nisarga M**
USN: **4GW20CS064**

Dear Student,

We would like to congratulate you on being selected for the **Machine Learning With Python (Research Based)** Internship position with **Varcons Technologies**, effective Start Date **11th August, 2023**, All of us are excited about this opportunity provided to you!

This internship is viewed as being an educational opportunity for you, rather than a part-time job. As such, your internship will include training/orientation and focus primarily on learning and developing new skills and gaining a deeper understanding of concepts of **Machine Learning With Python (Research Based)** through hands-on application of the knowledge you learn while you train with the senior developers. You will be bound to follow the rules and regulations of the company during your internship duration.

Again, congratulations and we look forward to working with you!.

Sincerely,

Spoorthi H C
Director
VARCONS TECHNOLOGIES
213, 2st Floor,
18 M G Road, Ulsoor,
Bangalore-560001

A C K N O W L E D G E M E N T

This Internship is a result of accumulated guidance, direction and support of several important persons. We take this opportunity to express our gratitude to all who have helped us to complete the Internship.

I express our sincere thanks to our Principal Dr. Shivakumar M, for providing usadequate facilities to undertake this Internship.

I would like to thank our Head of Dept CSE Dr. Raviraj P, for providing us an opportunity to carry out Internship and for his valuable guidance and support.

I express our deep and profound gratitude to our guide, for her keen interest and encouragement at every step in completing the Internship.

I would like to thank all the faculty members of our department for the support extended during the course of Internship.

I would like to thank the non-teaching members of our dept, for helping us during the Internship.

Last but not the least, I would like to thank our parents and friends without whose constant help, the completion of Internship would have not been possible.

<div align="right">

Nisarga M
4GW20CS064

</div>

ABSTRACT

The COVID-19 pandemic of 2020 prompted governments worldwide to implement lockdown measures to curb the spread of the virus. This study focuses on analyzing public sentiment during the lockdown period in the United States, utilizing Twitter data and machine learning techniques. The objective is to gain insights into how people expressed their sentiments on the social media platform in response to these unprecedented circumstances.

The methodology involves a multi-step process, starting with the collection and preprocessing of a substantial corpus of tweets related to the COVID-19 lockdown. The text data is cleaned, tokenized, and transformed into numerical features, enabling the application of various machine learning models. These models are trained and evaluated on labeled sentiment data to accurately classify tweets into positive, negative, or neutral sentiment categories.

The results of this sentiment analysis provide a comprehensive view of how the public's emotions evolved throughout the lockdown period. By analyzing sentiment trends over time, geographical variations, and specific lockdown-related topics, this study sheds light on the emotional impact of the pandemic on the American population.

TABLE OF CONTENTS

CHAPTER 1

1. COMPANY PROFILE

A Brief History of Varcons Technologies Pvt Ltd

Varcons Technologies is a leading provider of cutting-edge technologies and services, offering scalable solutions for businesses of all sizes. Founded by a group of friends who started by scribbling their ideas on a piece of paper, today we offer smart, innovative services to dozens of clients. We develop SaaS products, provide Corporate Seminars, Industrial trainings and much more. At VCT, they make sure every product/service that they offer is built keeping in mind the practical usability of the product/Service, they are a startup focused on Creativity and Customizability, and they also provide subscription models for Software that they have already built, Since the application is already configured, the user has a ready-to-use application. This not only reduces installation and configuration time but also cuts down the time wasted on potential glitches linked to software deployment. Smart solutions are at the core of all that we do at VCT. Our main goal is to find smart ways of using technology that will help build a better tomorrow for everyone, everywhere. SaaS offers a variety of advantages over traditional software licensing models and We here at VCT tend to include the key features of SaaS in everything we build. They understand that the best desired output can be achieved only by understanding the clients demand better. Varcons Technologies work with their clients and help them to define their exact solution requirement. Sometimes even they wonder that they have completely redefined their solution or new application requirement during the brainstorming session, and here they position themselves as an IT solution consulting group comprising of high caliber consultants.

They believe that Technology when used properly can help any business to scale and achieve new heights of success. It helps Improve its efficiency, profitability, reliability; to put it in one sentence "Technology helps you to Delight your Customers" and that is what we want to achieve.

CHAPTER 2

2. ABOUT THE COMPANY

At Varcons Technologies Pvt Ltd, they make sure every product/service that they offer is built keeping in mind the practical usability of the product/Service, they are start-up focused on Creativity and Customizability, and They also provide subscription models for Software that they have already built, Since the application is already configured, the user has a ready-to-use application. This not only reduces installation and configuration time but also cuts down the time wasted on potential glitches linked to software deployment.

they create API's and tools that help you automate any process with a host of features pertaining to the Device. They believe that with the Right Software, Service and Analytics, Great Things Can Happen

Services of Varcons Technologies Pvt.Ltd

Website as Software

They develop websites that behave and interact similar to sophisticated software.

Branding as Design

We offer professional Graphic design, Brochure design & Logo design. We are experts in crafting visual content to convey the right message to the customers. They also design custom wraps for your products(also known as package designing).

Search Engine Optimization

We help you manage your SEO campaign more efficiently and effectively. We help you gain market share by leveraging our expertise. our holistic approach to identify anything that may be hurting your traffic or rankings and show you just how to outrank the competition

Analytics and Research

They analyze the way your users/customers interact with you/your business by gathering, studying and understanding the consumer voice and their perception of the product/service.

Comprehensive Customer Support

With a comprehensive range of services, we guarantee your technology needs are not just met, but exceeded. We shall work with your customers/users closely to understand the way your users/customers use/make use of products/services.

Embedded Systems and IOT

We work with Consumer Electronics, Lighting, Home Automation, Metering, Sensor-Technology, Home Appliance and Medical Device companies to help them create smart and connected products. Through its integrated Embedded and IoT services, VCA helps build intelligent & connected devices that can be remotely monitored and controlled while leveraging edge and cloud computing for a host of intelligent applications and analytics.

CHAPTER 3

3. INTRODUCTION

The outbreak of COVID-19 caused heavy disruption to the everyday lives of people across the globe. In a country like with a large, diverse population like India, there are bound to be instances of mass hysteria and panic which are further fueled by unreliable and sometimes inaccurate data. Gauging the feelings/emotions of the citizens would provide insights into the public mindset and would pave the way for the government and many organizations to address these situations by providing them with the right data and information, eradicating fake news, thereby helping in suppressing unnecessary panic among the people. Social media acts as the bridge between the people, the government, and such organizations. The scope of this project lies in the application of sentiment analysis to the views expressed by people on social media, twitter, in this case, to analyze the trends in the dynamic mood of the population. Usually, the terms "fight" and "positive" are used in a negative and positive context respectively, but we observe a role reversal in this situation. The identification of such terms and their usage according to the context would be an essential part of the project. Also, the scope of the project can be found in stopping the spread of fake news related to the pandemic, creating an interactive dashboard that delivers information about the current situation, real-time sentiment analysis of tweets, trend analysis of various COVID-19 related hashtags, engagement on Twitter, overall sector-wise polarity score of the tweets and the public emotion charts.

PROBLEM STATEMENT

Built a python application that asks for a keyword and you need to identify the sentiment of that keyword using an open source dataset.

CHAPTER 4

4. SYSTEM ANALYSIS

Initially, the IEEE Coronavirus (COVID-19) Tweets Data set was downloaded from their website. Upon inspection, it was found that many tweets did not have geo-locationtags, and also many were in different languages apart from English. Due to this challenge in obtaining proper data, a new data set named Geo-Tagged Coronavirus (COVID-19) Tweets Data set was obtained from the same website. These tweets were then hydrated using the "Hydrater" software and also a few python commands. Then, tweets in "English" and tweets from "India" were randomly chosen and a new dataset was created. Further, other data set containing COVID-19 related tweets from India were obtained from Kaggle. This data set was then cleaned and normalized to make it useful for further analysis.

This cleaned data were then subjected to further analysis by extracting bigrams, trigrams, and plotting frequency bar graphs, Word Clouds, Relationship Nexus, Boxplots, etc. This was done using both Python and R. Some Interactive Plots were also plotted. This complete process is termed as Exploratory Data Analysis.

After Exploratory Data Analysis is completed, the tweets are then Tokenized and are made in a format suitable for the Language Model. In this Step, two models were used:

> 1) Roberta Model: Transfer learning methods were implemented to carry out sentiment analysis. Sentiment Analysis of Tweets was carried out by integrating and using both the Hugging face Transformer Library and Fast AI. Further Slanted Triangular Learning Rates, Discriminate Learning Rate and even Gradual Unfreezing were used, as a result of which, state-of-the-art results were obtained rapidly without even tuning the parameters. The tokenized data was then passed through the RoBERT a model to perform Sentiment Analysis. This yielded a model with an accuracy of 97% over the data set. The Tweepy API was used to scrape tweets in real-time which were then passed through the model to obtain the sentiments.

> 2) RoBERTa-CNN Sentiment Extractor: After the completion of the sentiment analysis the data was further explored for the sentiment triggers in the tweets. Hugging Face transformers don't have a TFRoberta For Question Answering, for this purpose, a TFRobertaModel was created to convert trained data into arrays that the Roberta model can interpret. While training the Sentiment Extractor model, 5 stratified KFolds were used in such a way that, in each fold, the best model weights were saved and these weights were reloaded before carrying out testing and predictions. Roberta with CNN head was used for Twitter Sentiment Extraction.Thus after passing the data through this model we

obtained a new column of the extracted text for the sentiments which was also used to plot certain graphs.

3) Now the entire process pertaining to the data and Model building is completed. Now, the Flask APP is built for the purpose of Deployment. First, the application is deployed on the localhost and debugged and then we move on to deploying on the WebServers.

A flask app was used for setting up website routing. It is used to integrate the back end machine learning models with the dashboard. Then Socketio (web sockets) were used for dynamic implementations on the website, namely the Real-Time Plot Generators and Twitter live feed. The basic functionality of the Flask Socketio lies in running background threads when the client is not connected to the website thereby enabling dynamic plotting. The above built Dashboard was deployed on the Local Machine and debugged for any possible errors. The scraping rate and other parameters were monitored and corrected accordingly models with the dashboard. Then Socketio (web sockets) were used for dynamic implementations on the website, namely the Real-TimePlot Generators and Twitter live feed. The basic functionality of the Flask Socketio lies in running background threads when the client is not connected to the website thereby enabling dynamic plotting. The above built Dashboard was deployed on the LocalMachine and debugged for any possible errors. The scraping rate and other parameters were monitored and corrected accordingly.

REQUIREMENT ANALYSIS:

HARDWARE

- System   :   4Core Processors
- Hard Disk   :   142 GB
- Ram   :   4 GB

SOFTWARE

- Jupyter Notebook

- Visual Studio Code

- Python Version 3.11.0

CHAPTER 5

5. FLOW CHART

```
Data acquisition & Cleaning  →  Exploratory Data Analysis (EDA)  →  Deep Learning Model Selection and Development  →  Roberta and Roberta-CNN Model Validation and Real-Time Testing
                                                                                                                                              ↓
Flask Socket.IO API Design  ←  Website CSS and JavaScript Template Creation  ←  Sentiment triggers Trends Analysis and Layout Setup for Trends Display  ←  Analysis of Results and Visualization
        ↓
Dynamic Twitter Feed Development and Showcase  →  Local Machine Deployment Testing and Debugging  →  Docker Image Creation  →  Flask App Threads and Web Traffic Sanity Check
```

CHAPTER 6

6. CODE:

#import libraries

import numpy **as** np

import pandas **as** pd

import matplotlib.pyplot **as** plt

import seaborn **as** sns

import string

from wordcloud **import** WordCloud

import nltk

nltk**.**download('all',quiet**=True**)

from PIL **import** Image

#Model libraries

from sklearn.metrics **import** *

from sklearn.model_selection **import** train_test_split

from sklearn.linear_model **import** LogisticRegression

from sklearn.tree **import** DecisionTreeClassifier

from xgboost **import** XGBClassifier

from sklearn.model_selection **import** GridSearchCV

from sklearn.svm **import** SVC

from sklearn.neighbors **import** KNeighborsClassifier

from sklearn.metrics **import** confusion_matrix,classification_report

from sklearn.model_selection **import** cross_val_score

import warnings

warnings**.**filterwarnings('ignore')

#checking Head

df1**.**head()

import string

def remove_punctuations(text):

   for punctuation **in** string**.**punctuation:

```python
    text = text.replace(punctuation, '')
    return text
df["clean_tweets"] = df['OriginalTweet'].apply(remove_punctuations)
df['clean_tweets']
from nltk.stem.porter import *
stemmer = PorterStemmer()
#function for stemming
def stemming(text):
    text = [stemmer.stem(word) for word in text]
    return (" ".join(text))
df['stemmed'] = df['clean_tweets'].apply(lambda x: stemming(x))


#result
df.stemmed.head()



# replacing values
replace_values = {"Sentiment":{'Extremely Negative':'Negative', 'Extremely Positive':'Positive'}}
df = df.replace(replace_values)
sentiment_count1 = df['Sentiment'].value_counts().reset_index()
sentiment_count1.columns = ['Sentiment','count']
sentiment_count1
df['OriginalTweet'][0]
df['OriginalTweet'] = df['OriginalTweet'].str.replace('http\S+|www.\S+', '', case=False)
import string
def remove_punctuations(text):
    for punctuation in string.punctuation:
        text = text.replace(punctuation, '')
    return text
df["clean_tweets"] = df['OriginalTweet'].apply(remove_punctuations)
df['clean_tweets']
```
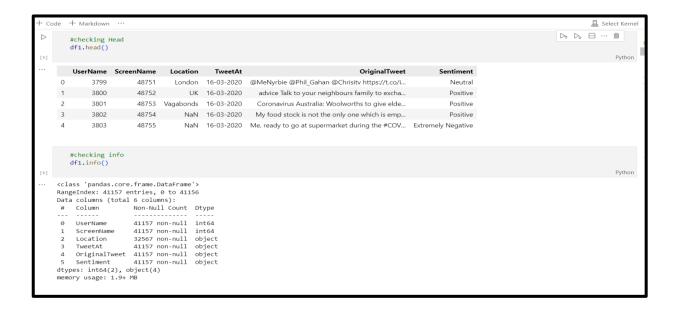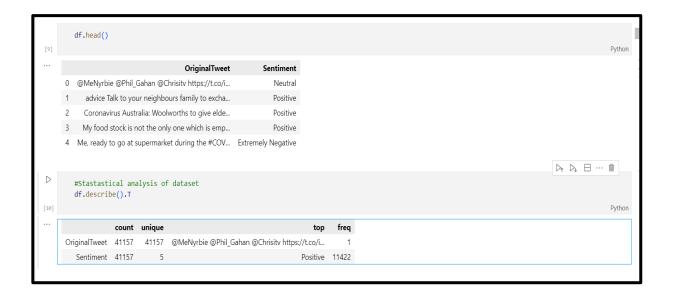
```python
# Plotting the piechart for Sentiments distribution
sentiment_count1 = df['Sentiment'].value_counts().to_list()
labels=['Positive','Negative','Netural']
plt.figure(figsize=(10,8))
plt.pie(x=sentiment_count1,explode=[0.04,0.04,0.1],shadow=
True,labels=labels,autopct="%.2f%%",radius=1.1)
plt.title("Proportion Of Sentiments", fontsize=20)
plt.legend(bbox_to_anchor=(1.05, 1), loc='upper left', borderaxespad=0)
plt.show()
#seperating the sentiments for word cloud
neutral = pd.DataFrame(df[['stemmed','lemmed']] [df['Sentiment'] == 'Neutral'])
positive = pd.DataFrame(df[['stemmed','lemmed']]  [df['Sentiment'] == 'Positive'])
negative = pd.DataFrame(df[['stemmed','lemmed']]  [df['Sentiment'] == 'Negative'])
In [40]:mask = np.array(Image.open("/content/drive/MyDrive/Colab Notebooks/Capstone Projects
/Twitter Sentiment Analysis/toppng.com-transparent-background-twitter-logo-943x800.png"))
wc = WordCloud(background_color='white',mask =
mask,contour_width=1,contour_color='steelblue')
wc.generate(str(neutral['lemmed']))
plt.figure(figsize=(20,20))
plt.imshow(wc,interpolation='bilinear')
plt.axis("off")
plt.show()


#Plotting Confussion matrix
cf1= (confusion_matrix(y_test,pred_lr_cv))
plt.figure(figsize=(8,5))
ax= plt.subplot()
sns.heatmap(cf1, annot=True, fmt=".0f",ax = ax)
# labels, title and ticks
ax.set_xlabel('Predicted labels', fontsize=15)
ax.set_ylabel('Actual labels', fontsize=15)
ax.set_title('Confusion Matrix (Logistic Regression with CV)', fontsize=20)
ax.xaxis.set_ticklabels(labels)
ax.yaxis.set_ticklabels(labels)
```

CHAPTER 7

7. SNAPSHOTS:

```
+ Code  + Markdown  ···                                                        Select Kernel
```

```python
#checking Head
df1.head()
```

	UserName	ScreenName	Location	TweetAt	OriginalTweet	Sentiment
0	3799	48751	London	16-03-2020	@MeNyrbie @Phil_Gahan @Chrisitv https://t.co/i...	Neutral
1	3800	48752	UK	16-03-2020	advice Talk to your neighbours family to excha...	Positive
2	3801	48753	Vagabonds	16-03-2020	Coronavirus Australia: Woolworths to give elde...	Positive
3	3802	48754	NaN	16-03-2020	My food stock is not the only one which is emp...	Positive
4	3803	48755	NaN	16-03-2020	Me, ready to go at supermarket during the #COV...	Extremely Negative

```python
#checking info
df1.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 41157 entries, 0 to 41156
Data columns (total 6 columns):
 #   Column         Non-Null Count  Dtype
---  ------         --------------  -----
 0   UserName       41157 non-null  int64
 1   ScreenName     41157 non-null  int64
 2   Location       32567 non-null  object
 3   TweetAt        41157 non-null  object
 4   OriginalTweet  41157 non-null  object
 5   Sentiment      41157 non-null  object
dtypes: int64(2), object(4)
memory usage: 1.9+ MB
```

```python
df.head()
```

	OriginalTweet	Sentiment
0	@MeNyrbie @Phil_Gahan @Chrisitv https://t.co/i...	Neutral
1	advice Talk to your neighbours family to excha...	Positive
2	Coronavirus Australia: Woolworths to give elde...	Positive
3	My food stock is not the only one which is emp...	Positive
4	Me, ready to go at supermarket during the #COV...	Extremely Negative

```python
#Stastastical analysis of dataset
df.describe().T
```

	count	unique	top	freq
OriginalTweet	41157	41157	@MeNyrbie @Phil_Gahan @Chrisitv https://t.co/i...	1
Sentiment	41157	5	Positive	11422

```python
df['clean_tweets']
```

```
0          menyrbie philgahan chrisitv  and  and
1          advice talk to your neighbours family to excha...
2          coronavirus australia woolworths to give elder...
3          my food stock is not the only one which is emp...
4          me ready to go at supermarket during the covid...
                              ...
41152      airline pilots offering to stock supermarket s...
41153      response to complaint not provided citing covi...
41154      you know itās getting tough when kameronwilds...
41155      is it wrong that the smell of hand sanitizer i...
41156      tartiicat well newused rift s are going for 70...
Name: clean_tweets, Length: 41157, dtype: object
```

```python
df['clean_tweets'] = df['clean_tweets'].str.replace("[^a-zA-Z#//]"," ")
df.head()
```

	OriginalTweet	Sentiment	clean_tweets
0	@menyrbie @phil_gahan @chrisitv and and	Neutral	menyrbie philgahan chrisitv and and
1	advice talk to your neighbours family to excha...	Positive	advice talk to your neighbours family to excha...
2	coronavirus australia: woolworths to give elde...	Positive	coronavirus australia woolworths to give elder...
3	my food stock is not the only one which is emp...	Positive	my food stock is not the only one which is emp...
4	me, ready to go at supermarket during the #cov...	Extremely Negative	me ready to go at supermarket during the covid...

```python
df.head()
```

	OriginalTweet	Sentiment	clean_tweets	stemmed	lemmed
0	@menyrbie @phil_gahan @chrisitv and and	Neutral	[menyrbie, philgahan, chrisitv]	menyrbi philgahan chrisitv	[menyrbie, philgahan, chrisitv]
1	advice talk to your neighbours family to excha...	Positive	[advice, talk, neighbours, family, exchange, p...	advic talk neighbour famili exchang phone numb...	[advice, talk, neighbour, family, exchange, ph...
2	coronavirus australia: woolworths to give elde...	Positive	[coronavirus, australia, woolworths, give, eld...	coronaviru australia woolworth give elderli di...	[coronavirus, australia, woolworth, give, elde...
3	my food stock is not the only one which is emp...	Positive	[food, stock, one, empty, please, dont, panic,...	food stock one empti pleas dont panic enough f...	[food, stock, one, empty, please, dont, panic,...
4	me, ready to go at supermarket during the #cov...	Extremely Negative	[ready, go, supermarket, covid, outbreak, im, ...	readi go supermarket covid outbreak im paranoi...	[ready, go, supermarket, covid, outbreak, im, ...

```python
sentiment_count = df['Sentiment'].value_counts().reset_index()
sentiment_count.columns = ['Sentiment','count']
sentiment_count
```
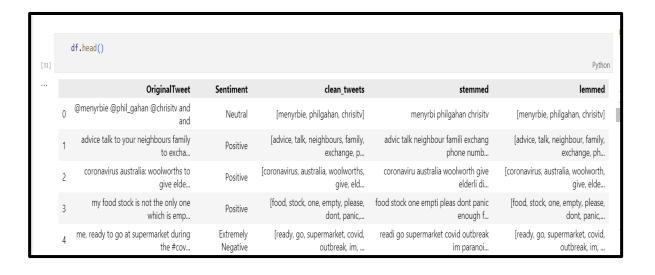[32]   Python

	Sentiment	count
0	Positive	11422
1	Negative	9917
2	Neutral	7713
3	Extremely Positive	6624
4	Extremely Negative	5481

```python
# Accuracy
cv_score_dt_cv= cross_val_score(dt_cv,cv_X_train,y_train, cv=5)
print("Accuracy: {}" .format(np.mean(cv_score_dt_cv)))
```
[60]   Python

Accuracy: 0.6914852657105394

```python
# Classification report of Performance metrics
label=['Neutral','Positive','Negative']
print(classification_report(y_test,pred_dt_cv))
```
[61]   Python

```
              precision    recall  f1-score   support

    Negative       0.69      0.68      0.68      4620
     Neutral       0.61      0.66      0.64      2314
    Positive       0.75      0.74      0.75      5414

    accuracy                           0.70     12348
   macro avg       0.69      0.69      0.69     12348
weighted avg       0.70      0.70      0.70     12348
```

CHAPTER 8

8. ADVANTAGES AND DISADVANTAGES:

ADVANTAGES:

- Real-time Insights: Twitter provides a vast amount of real-time data, allowing you to gauge public sentiment as events unfold, which can be crucial during a rapidly evolving situation like a pandemic.

- Large Dataset: Twitter has a massive user base, providing a large dataset for analysis, which can improve the accuracy of sentiment analysis models.

- Understanding Public Opinion: Sentiment analysis helps in understanding how people perceive and react to lockdown measures, which can inform policymakers and public health authorities.

- Monitoring Trends: You can track sentiment trends over time to see how opinions change in response to different phases of the lockdown or government policies.

- Targeted Response: Identifying negative sentiment can help authorities address concerns and improve communication to increase compliance with lockdown measures.

DISADVANTAGES:

- Noise in Data: Twitter data can be noisy due to spam, bots, or irrelevant content, which can negatively impact the accuracy of sentiment analysis.

- Bias and Sampling: Twitter users are not representative of the entire population, and there can be sampling bias, as not everyone uses the platform.

- Limited Context: Twitter's character limit constrains the depth of opinions shared, making it challenging to capture nuanced sentiment accurately.

- Ambiguity and Sarcasm: Sentiment analysis may struggle to interpret sarcasm, irony, or ambiguity in tweets, leading to misclassification.

- Lack of Demographic Information: Twitter data often lacks demographic information, making it difficult to understand sentiment variations among different groups.

- Ethical Concerns: Analyzing personal data on a public platform without consent raises privacy and ethical concerns, which must be carefully addressed.

- Model Dependence: The accuracy of sentiment analysis heavily depends on the quality of the machine learning model and training data, which can be challenging to optimize.

CHAPTER 9

9. CONCLUSION

Sentiment analysis or opinion mining is a hot topic in deep learning. There is still a long way to go before sentiments can be accurately detected from texts, because of the complexity involved in the English language, and even more when other languages like Hindi are considered. Though the Roberta model developed as a partof this project has predicted and classified the sentiments of the test data set into positive, negative and neutral categories with an accuracy of 97%, by making necessary modifications and additions to the model, sentiment analysis can be donewith greater accuracy by taking the language complexities into consideration.

CHAPTER 10

10. REFERENCE

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