SENTIMENTS ANALYSIS STUDY FOR THE ADAPTATION OF ONLINE MEDICAL FORUMS

ABSTRACT

Online medical forums allow users to research medical treatments or conditions and gain support from other users dealing with similar issues. These forums have become increasingly popular over the past decade, helping connect medical patients and professionals from various backgrounds and creating a supportive online community. This paper evaluates the adaptation of online medical forums in Nigeria, to analyse the opinions of Nigerian citizens in using the medical system. In this research, a Tweepy API (python library/ module that contains the required object and functions for managing the Twitter data), textblob (python library for processing textual data), and matplotlib modules (for creating statistical charts) were used to extract related tweets from the Twitter. The project involves steps like creating a Twitter developer account, which gives the privilege to create a Twitter application and has keys for accessing online resources. The analysis begins by searching for the data, storing it, filtering it and then returning the sentiment analysis to review the positive, neutral, and negative tweets. The output of this project returns a table and scatter graph that displays the Subjectivity and polarity of the opinions of Nigerians on the adaptation of online medical forums. Similarly, a bar chart is obtained that shows the positive tweets, the negative tweets and the neutral regarding online medical forums.

Keywords: Sentiment Analysis, Online Medical Forums, Tweepy, Textblob, Matplotlib

1. INTRODUCTION

As technology evolves, social media (Websites. Blogs, Online Systems, Interaction Platforms, etc.) keep dominating the interaction, business, entertainment, political, social and academic activities of people worldwide [1]. In the olden days, it had been challenging to accumulate the opinion of people due to the lack of centralised platforms that gather people and give them the privilege to divulge their beliefs liberally [2]. Obtaining people's points of view in those days requires manual processing, which is prone to errors and insufficient data [3]. However, social media platforms transform how people communicate by linking up the globe through an open environment (social media terminals) without obstacles to time, distance and space [4].

With the rapid growth of the internet, many users are participating in health communities, such as medical forums, to gather about health-related topics, discuss their opinion on medications, procedures and diagnoses and connect with others who share their conditions. For several reasons, which include the nature of the contents created by bloggers, which can be formed into threads, and the abundance of data allows the accumulation of opinions, sentiments and thoughts in a vast spectrum, this self-narrated text gives readers a window into bloggers' state of mind. Sentiment Analysis is the process of measuring automatically the type of opinion expressed in the text, either positive, negative or neutral. As a result, sentiment analysis (opinion pulling out) is now easy to undertake because people feel unrestricted to supply their points of view online. Sentiment analysis uses computing

technologies to extract, store, retrieve, modify and compare social media writers' opinions [5]. A review of the literature reveals that medical sentiment analysis is currently a subject of growing research interest. The phenomenal increase in blogging is seen in health communities, such as medical forums, which are flooded by millions of users (many of whom are patients) seeking health-related information, sharing medical problems or experiences, and choosing to get informational support or opinions from other users (patients, healthcare professionals, or doctors), these personal texts offer an opportunity to gain insight into a blogger's mindset. This project used Tweepy API, Textblob and Matplotlib to analyse sentiment on adapting Online Medical Forums in Nigeria. The Tweepy module evaluated two thousand (2000) tweets from Twitter and identified tweets that firmly adopted online medical forums (positive tweets), those that were neutral (neutral tweets) and those that physically opposed the adaptation of online medical systems (negative tweets). The analysed data will be displayed on the bar chart and scatter line graph [6].

Twitter Sentiment Analysis Research has been done that evaluates social media users' views, beliefs and opinions about a specific topic. This research uses Tweepy API (python Library) and Textblob as an interface to access and analyse Twitter tweets online. A machine learning algorithm is then used to evaluate the data and filter out various opinions on a topic of discussion [7].

The project uses the ontology of personal health information for Facts Extraction and applies Machine Learning approaches in computerising and recognising the expressed sentiments. Similarly, Sentiment Analysis of Medical Online Forums was conducted to ascertain the major subject matters regarding health issues and identify the government's appropriate decision. The significant gap of this study was that no graph was plotted to elucidate the foremost health subject matters [8].

Furthermore, A Sentiment Analysis Based on Social Media Data was done to build Artificial Intelligent Agent to detect polarity in a document and the author's sensation. This research uses the following algorithm; Naive Bayes (NB), Support vector machines (SVM) and Maximum entropy (ME) for classification and analysis of the data. The limitation of this research is that it cannot evaluate non-text content (images, sound and video) [9]. The project aimed to evaluate the status of covid-19 people worldwide to help mitigate the pandemic. Moreover, another research was taken on Analysing Twitter Data to Evaluate the People's Attitudes to Public Health Policies and Measures during COVID-19. This project proposes a strategy for using pre-trained, early-trained, and late-trained models in a surveillance system based on Twitter data. However, this study didn't deduct the Subjectivity and polarity of the data under each model used [10].

Similarly, A Sentiment analysis of Twitter data to analyse the Effect of Covid-19 was proposed [11]. The sentiment analysis aimed to help identify the area of concentration for the medical team to alleviate the Covid-19 pandemic. This analysis uses Tweepy API to access the tweeter tweet automatically. In addition, this research involves using the following technics; N-grams; are the combination of words used together, Word2vec; is a method to create word embedding efficiently, a bag of words; is a type of feature extraction or feature encoding used to extract features from the text, and Supervised Machine learning; is a kind of machine learning where a large portion of the data is unlabeled (input data) and a small portion of the data are labelled (output data).

In research [12], the author attempted to analyse Twitter data to extract valuable information or opinion on a particular topic of discussion. The author uses Sequential Minimal Optimization (SMO) machine learning algorithm to analyse the data. The project accesses Twitter tweets using Tweepy API (python module). However, this research fails to elucidate data filtration, which is the core of every sentiment analysis.

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2. MATERIAL AND METHODS / EXPERIMENTAL DETAILS / METHODOLOGY

The below figure shows the overall methods adopted to execute the sentiment analysis on Online Medical Forums in Nigeria.

2.1 Project Architecture

The figure below displays the step-by-step process and procedure to execute the sentiment analysis on adapting online medical forums in Nigeria.

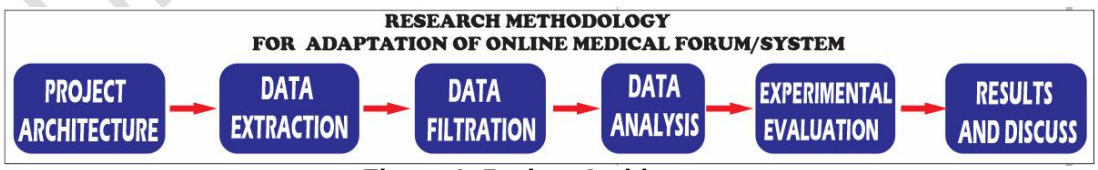

Figure 1: Project Architecture

2.2 Data Extraction

The social media platform used for data collection is Twitter. The process begins by creating a Twitter developer account that provides users login credentials for each Twitter project [14]. This project uses Jupyter Notebook as an Integrated Development Environment, an

open-source software that allows the creation and sharing of web applications, live codes, equations and texts. A prerequisite for accessing the data on Twitter is to install and import all the required libraries [15].

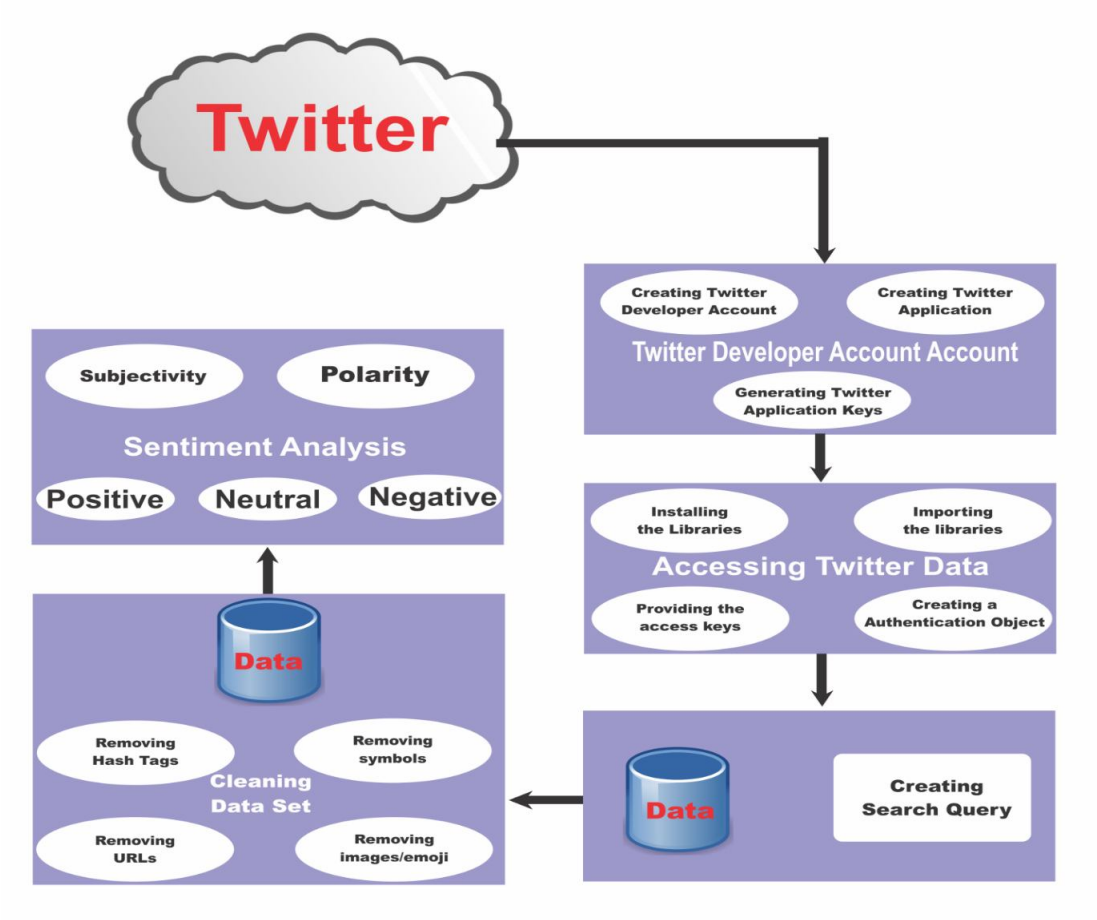

Figure 2: Data Extraction phase

The figure below shows the python codes that installed and imported the required libraries.

```
In [1]:     #Installing Tweepy Library
!pip install tweepy
    #Installing TextBlob Library
!pip install textblob
    #Installing Matplotlib Library
!pip install matplotlib

     #importing the required Libraries
import tweepy
import textblob
from textblob import TextBlob
import pandas as pd
import numpy as np
import re, string
import matplotlib.pyplot as plt
plt.style.use('fivethirtyeight')
```

Figure 3: Installing and Importing of Libraries

Furthermore, the provided keys from the Twitter developer account are used as login details. Then an authentication object is created using Tweepy API to access Twitter data [15] directly. The figure below displays the python codes that make Tweepy API objects for authentication to Twitter data.

```
In [2]:      #Authentication using twitter keys
auth = tweepy.OAuthHandler(consumer_key, consumer_secret)
auth.set_access_token(access_token, access_token_secret)
api=tweepy.API(auth, wait_on_rate_limit=True)
```

Figure 4: Creating Authentication Object

The search query extracted 2000+ tweets related to online medical forums in Nigeria. The search query includes the language, the range of data about the date and the mode of the data [16]. Moreover, the search query variable is declared to search for the related data using Tweepy cursor and search. The below figure displays the python codes that search for the data and store it in a variable all_tweets.

```
   #Creating Search Query
search_term='Online Medical Forum'
tweets=tweepy.Cursor(api.search, q=search_term, lang='en', geocode="6.465422,3.406448,769km",since_id='02/02/2021', tweet_mode='
    #Storing the Tweets in the Variable 'all_tweets'
all_tweets=[tweet.full_text for tweet in tweets]
     #printing the Tweets
df=pd.DataFrame(all_tweets, columns=['Tweets'])
df.head(10)
```

Figure 5: Search Query

2.3 Data Filtration

Data filtration is data percolation; to clean unwanted parts of the data, such as hashtags, symbols, images, etc [17]. In this research, a # symbol that begins any word, sentence, or number has been removed. Similarly, all @ signs that begin any later or number have been cleaned. All the URLs i.e. website address, have been eliminated, and all double and single underscore, newline tab, and backslash have been removed. This project used a cleanText() function to clean the unwanted data.

The below figure is the function that cleans the data.

```
#cleaning the data set
def cleanText(tweet):
    tweet=re.sub('#medical', 'Medical', tweet)
    tweet =re.sub('#Medical', 'Medical', tweet)
    tweet =re.sub('@Medical', 'Medical', tweet)
    tweet =re.sub('#[A-Za-z0-9]+', '', tweet)
    tweet =re.sub('@[A-Za-z0-9]+', '', tweet)
    tweet =re.sub('\\n', '', tweet)
    tweet =re.sub('https?:\/\/\S+', '', tweet)
    tweet=re.sub('RT', '', tweet)
    tweet =re.sub('\\:', '', tweet)
    tweet =re.sub('\\__', '', tweet)
    tweet =re.sub('\\_', '', tweet)
    tweet = re.sub('[()!?]', ' ', tweet)
    tweet = re.sub('\[.*?\]',' ', tweet)
    tweet = re.sub("["u"\U0001F600-\U0001F64F""]",'',tweet)
    tweet= re.sub("["u"\U0001F300-\U0001F5FF""]",'',tweet)
    tweet= re.sub("["u"\U0001F680-\U0001F6FF""]",'',tweet)
    tweet= re.sub("["u"\U0001F1E0-\U0001F1FF""]",'',tweet)
    tweet= re.sub("["u"\U00002500-\U00002BEF""]",'',tweet)
    tweet= re.sub("["u"\U00002702-\U000027B0""]",'',tweet)
    tweet= re.sub("["u"\U000024C2-\U0001F251""]",'',tweet)
    tweet= re.sub("["u"\U0001f926-\U0001f937""]",'',tweet)
    tweet= re.sub("["u"\U00010000-\U0010ffff""]",'',tweet)

    return tweet
```

Figure 6: Data filtering

The figure below displays the two columns of some parts of the data: before and after filtration.

	Tweets	Cleaned
0	If you want to develop or implement cutting-ed...	If you want to develop or implement cutting-ed...
1	@MyMedicalShopO1 My Medical Shop - Online Phar...	My Medical Shop - Online Pharmacy Answer 3 Gl...
2	@MyMedicalShopO1 Ans: 3). Glucometer.\n\n#myme...	Ans 3 . Glucometer. My M...
3	RT @AiredaleNHSFT: If you have an urgent but n...	If you have an urgent but not-life-threateni...
4	Operating pharmacies, hospitals, health & ...	Operating pharmacies, hospitals, health & ...
5	RT @bariweiss: 20. The committee justified her...	20. The committee justified her suspensions ...
6	Social Scientist - 20 Years of Experience - Ne...	Social Scientist - 20 Years of Experience - Ne...
7	Social Scientist - 20 Years of Experience - Ne...	Social Scientist - 20 Years of Experience - Ne...
8	Registered Nurse - 20 Years of Experience - Ne...	Registered Nurse - 20 Years of Experience - Ne...
9	Registered Nurse - 20 Years of Experience - Ne...	Registered Nurse - 20 Years of Experience - Ne...
10	#Nurseleaders should consider implementing the...	should consider implementing the RN/LPN care ...
11	#Technology plays a vital part in modernising ...	plays a vital part in modernising our . Telem...
12	Depression (major depressive disorder) is a co...	Depression major depressive disorder is a co...
13	Tired of switching between books and online re...	Tired of switching between books and online re...
14	100% quality medical equipment for healthcare ...	100% quality medical equipment for healthcare ...
15	Along with convenience and savings, choosing t...	Along with convenience and savings, choosing t...
16	Are you looking at the list of job opportuniti...	Are you looking at the list of job opportuniti...
17	RT @bariweiss: 20. The committee justified her...	20. The committee justified her suspensions ...
18	If you have an urgent but not-life-threatening...	If you have an urgent but not-life-threatening...
19	This 30-hour online course is for #radiography...	This 30-hour online course is for students wh...
20	Alteza Develops customized best-in-class onlin...	Alteza Develops customized best-in-class onlin...
21	RT @efuatawiahz: Launched my medical store web...	Launched my medical store website for studen...
22	AAMC Webinars and Online Courses: Language-App...	AAMC Webinars and Online Courses Language-Appr...

Figure 7: Data Filtration

2.4 Data Analysis

Data analysis is the evaluation of the data using some algorithm, statistics, method, functions, or logical technics to deduct some fact [18]. In this research, we use Tweepy, textblob and matplotlib to generate the Subjectivity and polarity of the data and then generate the sentiment analysis.

2.4.1 The Subjectivity of Data

The Subjectivity of the data defines the amount of personal opinion/interest and the fact of a particular subject matter. The higher Subjectivity, the higher the subjective opinion rather than the facts [19]. This project uses the function getSubjectivity() and returns the Subjectivity of the data. The TextBlob() returns the Subjectivity.

The below figure displays the codes for Subjectivity

```
def getSubjectivity(tweet):
    return TextBlob(tweet).sentiment.subjectivity
df['Subjectivity']=df['Cleaned'].apply(getSubjectivity)
df.head()
```

Figure 8: Python Codes that return the Subjectivity of data

2.4.2 Polarity of Data

The polarity of data defines the positive and negative status of the data; the contradiction lies between -1 and 1; the positive values stand for positive responses, while the negative values stand for negative posts. Similarly, a TextBlob has been used using the getPolarity() function and returns the polarity of the data generated.

```
def getPolarity(tweet):
     return TextBlob(tweet).sentiment.polarity
df['Polarity']=df['Cleaned'].apply(getPolarity)
df.head()
```

Figure 9: Python Codes that return the polarity of data

2.4.3 Sentiment Analysis

The sentiment analysis returns the opinion of people on a specific topic of discussion, evaluates the data and produces the positive view (any positive value), negative opinion (negative value) and neutral opinion (any value equal to zero) [20]. This research uses the getSentiment() function and if condition and returns negative analysis if the score is less than 0, returns neutral analysis if the score equals 0 and returns positive analysis if the score is greater than 1.

The below figure is the code that executes the sentiment analysis.

```
def getSentiment(score):
    if score < 0:
        return 'Negative'
    elif score == 0:
        return 'Neutarl'
    else:
        return 'Positive'

    df['Sentiment']=df['Polarity'].apply(getSentiment)
df.head(50)
```

Figure 10: Python Codes that return the sentiment analysis

2.5 Experimental Evaluation

The project is conducted through the following steps; creating a Twitter developer account and obtaining the project and the keys. Download Jupyter notebook as python IDE (Integrated Development Environment). The project keys are used in the Jupyter notebook to create a link between IDE and Twitter. The object is established for navigating to Twitter tweets online. Subsequently, a search query is created to search for the specific dataset (the location of the search data, the time frame, and the mode of the data) and finally store the data in the variable. The extracted data is displayed on a table; the clean function filters the unwanted part of the data, such as emojis, symbols, retweets, etc. The getSubjectivity and getPolarity functions are applied to return the extracted data's Subjectivity and Polarity. The matplotlib library is used to plot a scatter graph of Subjectivity and Polarity. The getSentiment class is applied to retrieve the sentiment analysis of the opinions (positive, negative and neutral). Finally, matplotlib is used to plot a bar chart graph of sentiments analysis obtained.

2.5.1 The Subjectivity and Polarity Sentiment Analysis Results

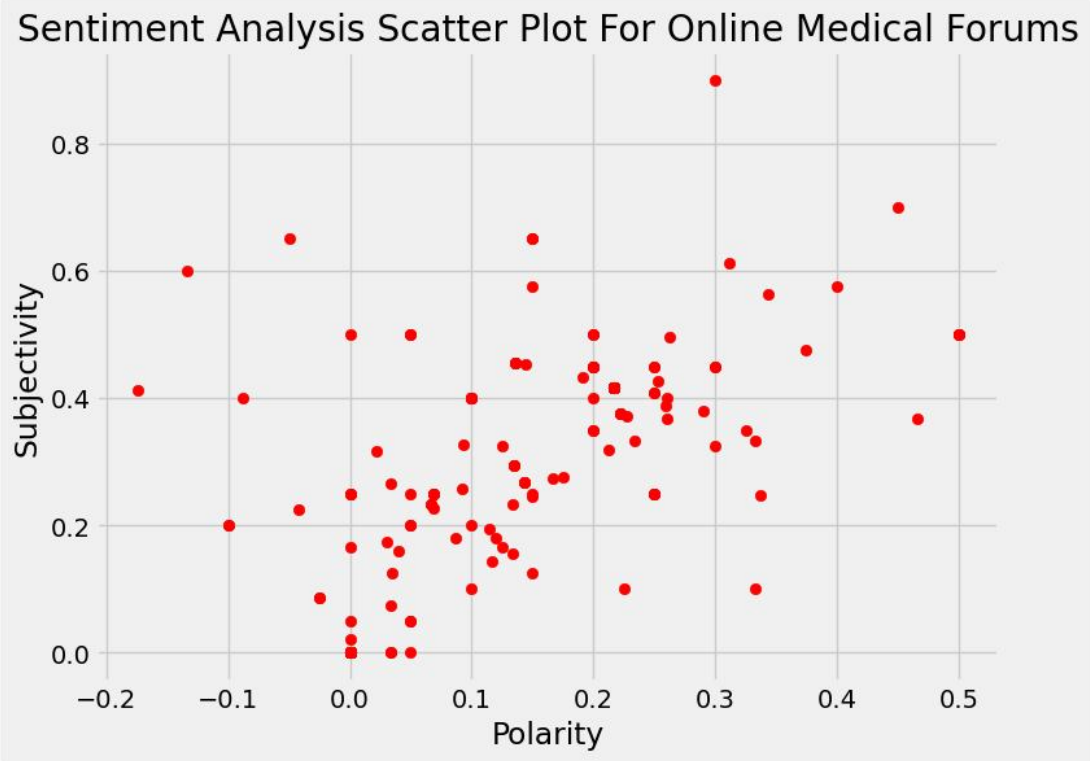

Figure 11: Scatter plot

The above figure displays the Subjectivity and the Polarity of the data. The Subjectivity is lower, meaning that factual information overwhelmed the personal opinion on adapting the online medical system. Similarly, it can be seen that only less than 5% felt negative values which implies a Negative view; less than 25% deemed under 0, which implies a Neutral opinion, while Positive opinion was up to 70%. The result obtained is relatively accurate as it has been directly deducted from Twitter. Most people who talk about online medical forums support it rather than criticise it. Furthermore, most of the existing sentiment analyses did not capture the Subjectivity and the Polarity of the opinion.

2.5.2 Sentiment Analysis Bar Chart Result

A bar cart displayed the sentiment analysis parameters, i.e. positive, negative, and neutral tweets. The chart was plotted using the matplotlib library.

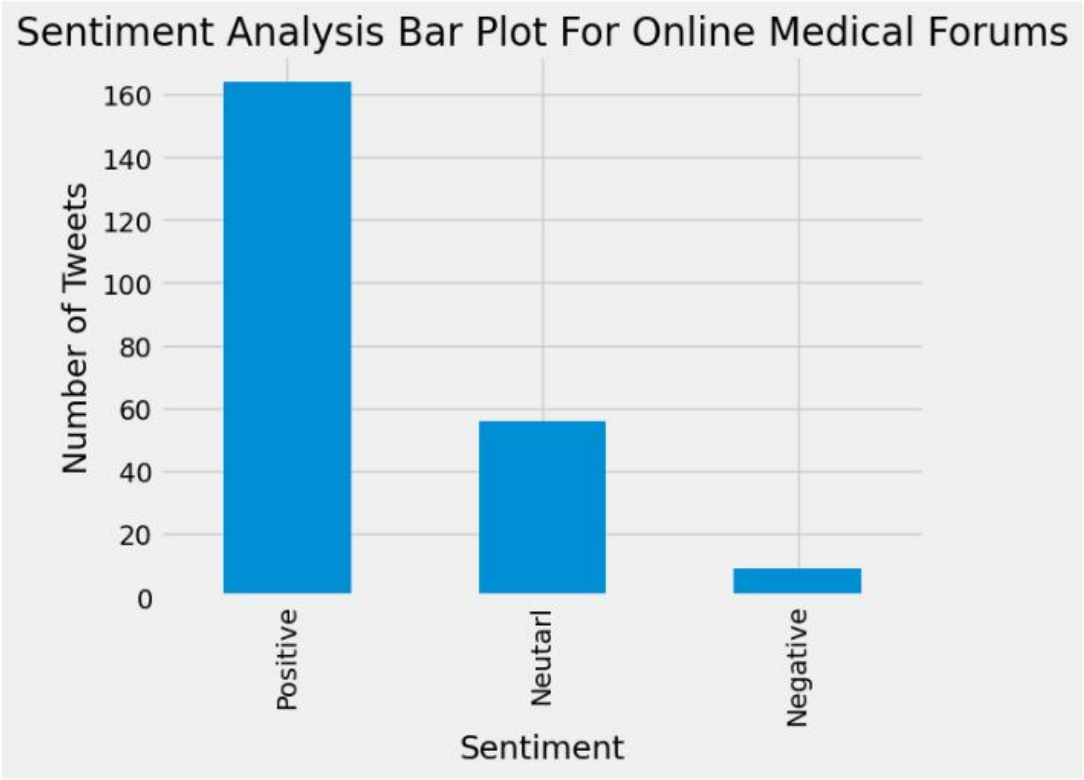

Figure 12: Bar chart displaying Positive, Neutral and Negative Tweets

The below figure calculated the percentage of positive, neutral and negative tweets. Most of the existing results return the sentiment analysis manually in a tabular form which is inefficient and tedious to comprehend. However, this result is efficient as the data quality is robust, and the charts and the data is deducted through programming technics.

```
In [317]: # Proportion of sentiment
          df["Sentiment"].value_counts(normalize=True)*100

Out[317]: Positive    71.615721
          Neutarl     24.454148
          Negative     3.930131
          Name: Sentiment, dtype: float64
```

Figure 13: Percentage of Positive, Neutral and Negative Tweets

From the above figures, Nigerian people are adopting Online Medical Forums for their healthcare activities.

3. RESULT AND DISCUSSION

This part reports the results obtained during the project. There are two (2) results to display, i.e., the Subjectivity and polarity, and then sentiment analysis (positive, neutral and negative). The matplotlib library was used to plot the bar chart and scatter line graphs of the result obtained.

The subjective result obtained; returns to the personal opinions of Nigerians on the adaptation of online medical forums. Subjectivity is focused on personal opinion rather than a fact about a particular subject matter.
Similarly, the project gets the polarity of the opinions of Nigerians. The contradiction is the direction of the opinion, whether the opinion is positive or negative and returns the polarity of the dataset, which lies between -1 to 1.
Finally, the sentiment analysis of the entire dataset is returned, which divide the opinions into three major part; the positive opinions (those opinions that support the online medical forums), negative opinions (those opinions that oppose the subject matter) and neutral opinions (those opinions that neither support nor opposed the system).

4. CONCLUSION

This paper provides the results of sentiments that are presented in a scatter graph and bar chart that displays the Subjectivity and polarity of the opinions in the posts. We have presented a corpus of data collected from the Twitter application regarding the posts with the search query “online medical forum” for the subject area. Though we couldn’t get many tweets of the search query, the result showed there would be more adaptation for such forums in the near future. In future research, we aim to develop medical sentiments using more lexicons, and we propose a method to capture more phrases.

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