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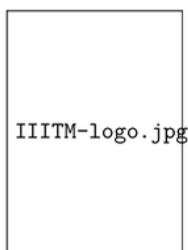
Detection of Emotion of Students using Text Mining and Machine Learning

Final project report submitted for B.Tech Project

B.Tech

by

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CANDIDATES DECLARATION

We hereby certify that the work, which is being presented in the report, entitled **Detection of Emotions of Students using Text Mining and Machine Learning**, Final project report submitted for B.Tech. Project for the award of the Degree of **Bachelor of Technology** and submitted to the institution is an authentic record of our own work carried out during the period *May 2019 to September 2019* under the supervision of **Dr. Ajay Kumar** and **Dr. Vinay Singh**. We also cited the reference about the text(s)/figure(s)/table(s) from where they have been taken.

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ABSTRACT modify krna hai esko

In today's world, most of the students are stressed/depressed. Stress is the feeling of pressure and strain and due to family's over expectation they never share their problems with their parents or relatives and stress affects their academic performance as well as Social performance, can increase the risk of heart attacks, ulcers and suicides and after sometime the stress can be change in depression. It can be external or internal and external factors can be their friend circle, girl friends and surroundings. While internal factors can be academic pressure, physical or economical problems. We have already seen the data of suicides in above section and the highest suicide rate is among the students who belongs to age group 15 to 25.

In our project we are going to perform text mining and machine learning algorithms over chats of the people who belongs to 15-25 age group to detect their temporary mental state. We have dataset in which students talk in different manner during different mental state, then we will use this method in chat application so that parents can understand the mental state of their children.
Keywords:

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(Nishant Kumar)

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ABBREVIATIONS

SVM	support-vector machine
NLTK	Natural Language Toolkit
NLP	Natural language processing
ML	machine learning
TF	term frequency
TF-IDF	term frequency-inverse document frequency
IDF	Inverse document frequency
UI	user interface
RIA	rich internet application
HTTP	HyperText Transfer Protocol
POS	parts of speech
TV	television

Chapter 1

INTRODUCTION AND LITERATURE SURVEY:

This chapter includes the details of Sentiment Analysis, Machine Learning techniques and literature review related to work done in this field.

1.1 INTRODUCTION

Emotions can be seen when people interact and communicate to each other. The exchange of emotions can be seen through text message, post of articles and blogs, facial expression and person's speech and it is known as text, facial and speech based emotion respectively. Recently, the work on facial and speech emotion detection has been done enough but attraction on text based emotion detection system is needed.

Emotions can be represented by a single word or a group of words. Word level emotions can be detected easily but on the sentence and document level emotion detection is not easy to find their emotions. Sentences have the main information of the documents, therefore on the document level emotion detection depends on the individual sentences on the document. Generally, the emotions is expressed in happy, sad, angry, love, fear, surprise, disgust and etc.

The motivation behind this work has come from the recent growing interest in emotion detection from the text, because the world wide web has facilitated due to online communication system, written content and blog post, and these open a new avenue to detect the emotions on the text data. By using Text Mining approach, the idea of this project is to determine the user's mood according to incoming messages in chat application from that particular user.

1.2 BACKGROUND

Text mining is a technique to extract high quality information from text. Thus, make the information accommodate in the text usable to the different algorithms. Information can excerpt to determine outline contained in the script. Hence, you can inspect words, clusters of words used in script. In the familiar terms, text mining will “turn text into numbers”. Such as guessing data mining projects, the application of unsupervised learning methods. After extracting high quality information using text mining, now researchers are doing sentiment analysis on the information to know people behaviour, mood and emotions. sentiment analysis is a process of determining the polarity of the text. now a days sentiment analysis became a very useful technique to know the behaviour of crowd during elections. most of the party uses this technique to know what public is thinking about their party, their leaders and their policies. they uses tweets, posts from the social media app. and then perform sentiment analysis on the data. e-commerce companies like (zomato, flipkart, amazon) uses sentiment analysis to know the opinion of products. they get their feedback and then sentiment analysis on their reviews and try to figure out what customers exactly wants. companies are able to know the likes and dislikes of the customers. they also develop a recommendation system after doing analysis on their reviews. it is also socially beneficial. because most of the student live away from their parents. they may be in good situation. but there may be a possibility that he is facing some issues, but not having much courage to tell their parents. in this situation text mining and sentiment analysis is very useful. parents can understand according to their messages.

1.3 LITERATURE REVIEW

In Natural Language Processing and Sentiment Analysis field, plenty of research has been done with different methods. We are going to look into the past research in this field for this project. In [YD17] this project, We come up a little bit different approach from the typical techniques. Examining a big dataset can give us large amount of convenient details about sentiment analysis. But in our project we use small dataset and try to find the exact details about it. In our project, We are executing real time analysis of text data of chat. We are given input from user chat to our machine learning model. That model will analyze it and produce the result with emoji. Moreover our dataset is not huge for processing it with machine learning model. and We will easily analyze it with real time and produce result to user during the chatting. This We will them to understand each other response quickly. And by this relationship between them can get better.

In this project [YD17] we examine the each user sentiment analysis and find the different category about people mindset and we can classify them in different section according to their characteristics. We use the data mining and NLP techniques to analyze the sentiment analysis of the user chat in real time.

In previous research, We has been done in the small dataset of twitter users. They use the Lexicon method for examining the sentiment analysis of user tweets on twitter. The dataset they picked for analysis are from different category of people and are more popular tweets, i.e. the dataset are very dynamic in nature. After that they find the different outcome from the large dataset of twitter dataset.

For analyzing the large dataset of user tweets on twitter, We need human assistance that can help to find the details of text very quickly and give results on the spot. The result of small data of tweet can be differentiate from predefined [sen] sentiment 140 dataset. And the author of the above method that we discussed gives the consistent result and are helpful for small dataset. The process that is used in this [YD17] method are quite similar to our project.

In the past research, the [YC17] researchers have examined the sentiment analysis with different machine learning models. Or We can say They used the variety of machine learning model the get the result for sentiment analysis. The most common methods of machine learning used are Naive Bayes and support vector machine. There are also two methods that are artificial neural networks and maximum entropy. There are three different methods for analyzing the sentiment analysis. The name of these machine learning methods are dictionary based , dictionary based method can describe that in this method we examine each word by word of our dataset to word available in the dictionary. After that we can get the result of text dataset i.e. we can say we can find the different emotions out of text. Another method for sentiment analysis is Hybrid and machine Learning. However the machine learning methods for sentiment analysis is most accurate the dictionary based methods. The accuracy of dictionary based methods are not up to the mark that can produce the correct emotions out of text dataset. The machine learning model outperform in the sentiment analysis and can provide with good accuracy of text for emotions. We can accurately predict the right emotions that can help to analyze the dataset and take decision according the emotions and provide the user the most efficient approach to make better decision among them about their various works. The accuracy of dictionary based methods is very huge. Because of this reacherse has produced the research in this field in the [YC17] past for analyzing the sentiment. In this past research has been done on only english language. So there is a good opportunity to analyze the sentiment of dataset in different language of text data set. So we can wind that the sentiment analysis is very challenging field and there are more issues in this field for analysing the sentiment out of text dataset. So we can say there is a huge opportunity for anyone to research in this field and get significant research and that will be helpful to real work. Sentiment analysis is a hot area to work on.

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1.4 OBJECTIVE

The major objective of the study is to determine the emotion (temporary mental state) of human. Machine learning model will be developed to achieve the

desired ¹²ults.

The following are the objectives of the study:

- To study the different emotions/temporary mental state of human and to represent them in a graphical format.
- To develop machine learning model while considering emotion in different duration of the day (morning , afternoon and evening and night as well).
- To depict the emotions using emoji/ emotional depiction chart.
- To calculate the results (in percentage) of different emotions of human using text and voice audio mining techniques.
- To measure the correctness of model by using appropriate statistical past data of emotions of human.
- To verify and validate the output with the help of current available data.
- Training the more the data about emotions/temporary mental state to machine learning model to improve performance of system.

Chapter 2

DESIGN DETAILS AND IMPLEMENTATION

2.1 Overview of Methodology

The methodology is divided into different steps:

- 2.1 - Chats dataset
- 2.2 - Preprocessing of the datasets
- 2.3 - Python Library for Sentiment Analysis
- 2.4 - Feature extraction of the datasets
- 2.5 - Feature selection of the datasets
- 2.6 - Training
- 2.7 - Classification
- 2.8 - Flowchart of methodology
- 2.9 -Building chat application
- 2.10 -Integrating sentiment analysis module and chat application

2.1.1 Chats dataset

This dataset is provided by kaggle. This chat dataset will consist of 95,000 sentences (over 6,30,000 words) and it is the conversation between boy to close friends, girlfriend, their family members, their relatives and company supervisors, and we are going to define four categories like happy, stressed, angry and others on this dataset. The purpose of the dataset is to find the mental status of the students on the basis of their conversations.

This dataset is unbalanced in which labels are happy(4243), stress(5463), angry(5506) and others(14948).

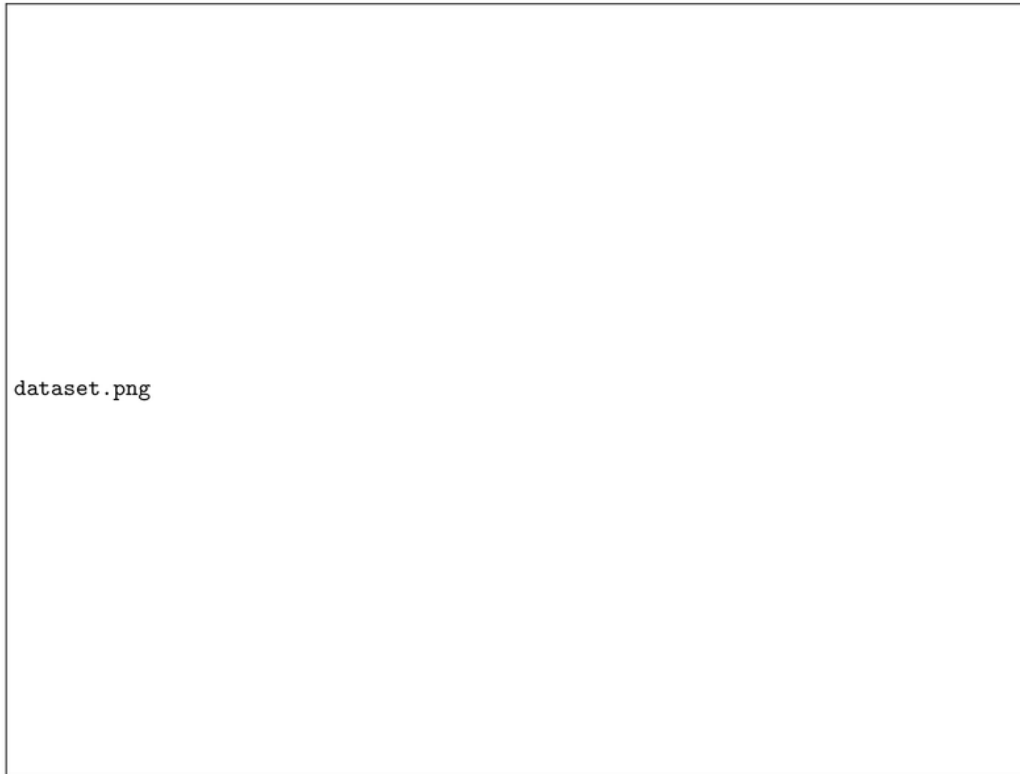


Figure 2.1: dataset.

2.1.2 Used Python Library

- scikit-learn
- nltk
- numpy
- pandas
- pickle
- joblib
- matplotlib and seaborn

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Scikit-learn

scikit-learn is a machine learning software which is a free software for data mining and data analysis and scipy, numpy and matplotlib is associated with this python library. It includes different machine learning library like svm, random forest, knn, k-means etc. It is examined as one of the finest libraries used for complex data. There are some modifications made in this library. One change is the cross-validation property, by which we can able to use more than one matrix. There some of training methods like nearest neighbors and logistics regression have obtained some little development.

Features Of Scikit-Learn

1. Cross-validation: There are a variety of methods which we can used for checking the accuracy of supervised models on unseen data.
2. Unsupervised learning algorithms: There are a wide range of this kind of algorithms like factor analysis, clustering, principal component analysis to unsupervised neural networks
3. Feature extraction: It can be used for extracting features from text and images.

2

Where is Scikit-Learn Used?

It includes a lot of algorithms for implementing standard data mining and machine learning tasks like model selection, clustering, regression, classification and reducing dimensionality.

NLTK(Natural Language Toolkit)

3

The [NLT] NLTK platform gives approachable interfaces to more than fifty lexical and corpora sources mapped to machine learning algorithms, as well as a strong option of utilities and parsers. Apart from its facilities for sentiment analysis, the NLTK algorithms include named topic segmentation, part-of-speech (POS), tokenizing, and entity recognition. NLTK also possess a fine selection of third-party add-on, as well as the most broad extending language support of any of the libraries explained here.

On the contrary, this versatility can also be immense. The utter diversity of some of its tool classification (it has nine stemming libraries as against to SpaCy's single stemmer, for example) can construct the framework look like an focused grab-bag of NLP archive material from the last one and half decade. This could attach a layer of complication to our logistical planning and project ideation.

The constructive side of this is that no contestant to NLTK can brag such a useful and comprehensive base of documentation, as well as subordinate online

resources and literature. At liberty in progress prop up is supplied by a lively Google Group.

Numpy

It is considered as most popular python library in machine learning. Numpy used internally by TensorFlow for executing multiple operations on Tensors. Numpy most important features is Array interface.

Features of Numpy

- 1.Mathematics: It convert complex mathematical implementations to simple.
2. Interactive: It is easy to use and very interactive.
- 3.Lot of Interaction: It have a lot of open source contributions due to widely used.
- 4.Intuitive: It makes the concepts easy and makes coding real easy.

2 Where is Numpy Used?

Numpy interface can be deployed for sound waves, expressing images and other binary raw streams as an array of real numbers in N-dimensional. For full stack developers having knowledge of this library is important.

2 Pandas

Pandas is a machine learning library in python that gives various tools for analysis and data structure of high-level. One of the best features of this library is the ability to interpret complex operations with data using one or two commands.

Pandas have various inbuilt techniques for filtering, combining data, grouping and time-series functionality.

Features Of Pandas

Pandas has the ability to make the whole process of manipulating data will be easier. Support for operations such as Visualizations, Concatenations, Aggregations, Sorting, Iteration and Re-indexing.

Where is Pandas Used?

At present, Pandas library have few releases which includes changes in API, enhancements, bug fixes and hundreds of new features. Despite being under

development it has ability to sort data and group, gives support for performing custom types operations and select best suited output for the apply method. Data Analyst often uses this library. When We use Pandas library with other libraries than that will produce a good amount of flexibility and high functionality.

pickle

For de-serializing and serializing python object structures, pickle module can be used. It is also called flattening and marshalling. Serialization is the process of transforming an object in memory to a byte stream and that byte stream can be kept on disk or forward over a network. After that, this character byte stream can then be get back and de-serialized back to a python object. Compression is other than Pickling. This is basically used for transforming of an object from one depiction(data in Random Access Memory(RAM)) to another (text on disk), than afterwards the process of encoding data with fewer bits, by which we can save the disk space.

Where is pickle Used?

Pickling is important for execution where you requirement some degree of perseverance in your data.State data of program can be stored to disk, so you can continue working afterwards. Pickle can be used to send data over a socket connection or Transmission Control Protocol(TCP), or to save python object in a database. Pickle is very important library of python for machine learning algorithms. Which you can use for making new prediction after some times, without writing again the same content or there is also no need of training of model again.

Matplotlib

For plotting 2 Dimensional graphics, We required matplotlib.pyplot library in python language. Matplotlib can be utilized in web application servers, python scripts, shell and user interface toolkits. It has a variety of toolkits for python matplotlib functionality. In which some of them are unconnected downloads and some of them have external dependencies.

- Basemap: Basemap is a map plotting toolkit and it has different map projections, political boundaries and coastlines.
- Cartopy: Cartopy is a mapping library featuring image transformation capabilities, polygon, line, arbitrary point and object map projection definitions.

- 5 • Excel tools: Matplotlib gives functionality for interchanging data with Microsoft Excel.
- Mplot3d: It can be used for 3-D plots.
- Natgrid: Natgrid is an interface to the natgrid library for irregular gridding of spaced data.

Joblib

7 It is a group of tools to give lightweight pipelining in Python. In specific:

1. Joblib is easy simple parallel computing and it is also robust and fast on huge data in specific and has particular optimizations for numpy arrays.
2. It has function like lazy re-evaluation (memoize pattern) and transparent disk-caching

Main features:

1. Embarrassingly parallel helper: It help 7 to write readable parallel code and debug it quickly.
2. Fast compressed Persistence: It is substitution for pickle to save efficiently on Python objects holding large data (joblib.dump joblib.load).
3. 7 Transparent and fast disk-caching of output value: It is functionality for Python functions that service well for arbitrary Python objects, including very large numpy arrays. It has different persistence and flow-execution logic from domain logic or algorithmic code by putting down the operations as a group of steps with well-defined inputs and outputs: Python functions. It can store their computation to disk and return it when it is needed.

2.1.3 Preprocessing of the dataset

Once the dataset is collected from the chats after that the next is pre-processing of dataset before implementation. During the pre-processing various steps are involved, they are,

1. Convert all uppercase letters to lowercase
2. Remove all stopwords
3. Spelling correction
4. Remove Non-English word
5. Tokenization
6. Stemming and Lemmatization

7. join the splited text

2.1.4 Feature extraction of the datasets

Selection of the useful words from the chat datasets is known feature extraction. In this feature extraction step we extract the aspects of the pre-processed chat dataset.

1. Features like unigram, bigram, ngram
2. POS (parts of speech tagging like nouns, verbs, adjectives, adverbs and organisations etc.)
3. Position of terms
4. Negation

2.1.5 Feature selection of the datasets

Selection of correct feature techniques take an important role in identifying attributes and improving classification accuracy. They are categorised as -

1. NLP (Natural Language Processing)
2. Statistical
3. Hybrid
4. Clustering

2.1.6 Training

Before training the datasets, we convert the raw text to feature vectors that can be used as input estimators using TfidfVectorizer. After that we trained the datasets(vectors) using different machine learning techniques and then we can predict the unknown data.

²⁰
TF-IDF: TF-IDF is a combination of two terms tf and idf and can be calculated as by product of tf and idf. TF-IDF is a weight that is used for information retrieval and data mining.

¹⁸
TF(Term frequency): It measures the frequency of words in the documents.

$$tf = (\text{number of time word } w \text{ in document} / \text{total number documents with word } w)$$

w in it)

IDF (Inverse document frequency): It measures the importance of word within document.
$$\text{idf} = \log(\text{total number of documents} / \text{number of documents with word } w \text{ in it})$$

$$\text{tf-idf} = \text{tf} * \text{idf}$$

2.1.7 Classification

After preprocessing, feature engineering and training the data, classification is done by using svm.

SVM : Support vector machine is the machine learning model used for classification, regression and outlier detection. SVM creates a hyperplane or a group of hyperplanes in a high or infinite dimensional space.

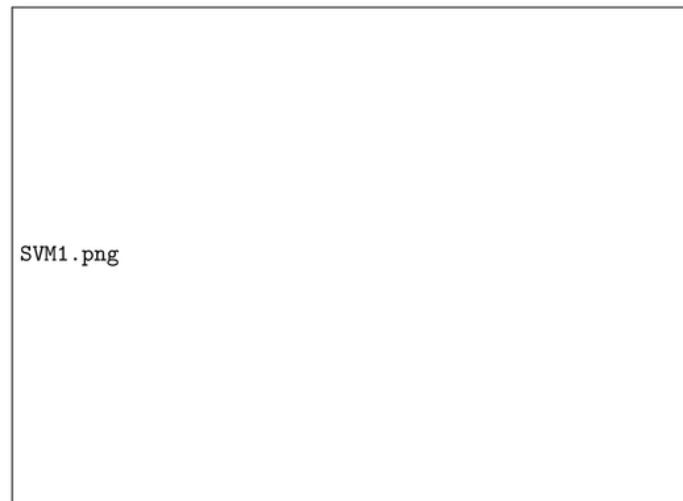


Figure 2.2: SVM figure 1

Margin: The distance between the nearest data point is called margin. In the above figure we can see that the three hyper-plane A, B and C in which hyper-plane C has the highest margin from support vectors because it has the highest distance from support vectors. Therefore, the hyper-plane C is the resultant hyper-plane which is used for classification.

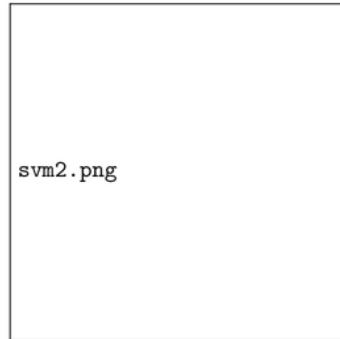


Figure 2.3: SVM figure 2

2.1.8 Flowchart of methodology

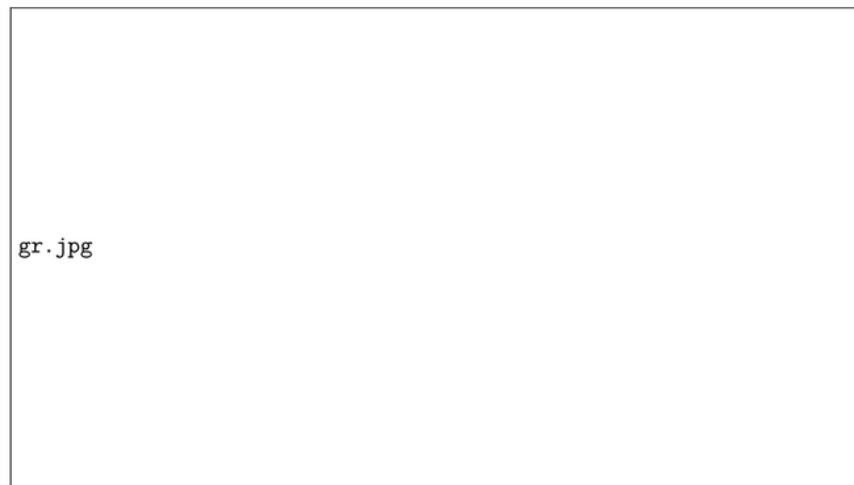


Figure 2.4: Graphical representation of used methodology.

2.1.9 chat application(frontend)

The chat application works in way that each user connects with each other via a single link.after accessing the link they registered their names and start sending messages to each other.whenever a user sends the message it is visible

to all users who are connected through this link. suppose there are two users and they are chatting with each other. when user A sends a message to user B. user B gets the message with the polarity of the message. we have defined our polarity of messages in happy, sad, angry, neutral and others. after seeing the message the user B is able to predict the mood of the user A. then the user B starts responding according to user A mood. we express the mood by using emojis in our chat application, which is running on the server. server sends the messages to machine learning module to check the polarity of the message and sends an emoji according to the message.

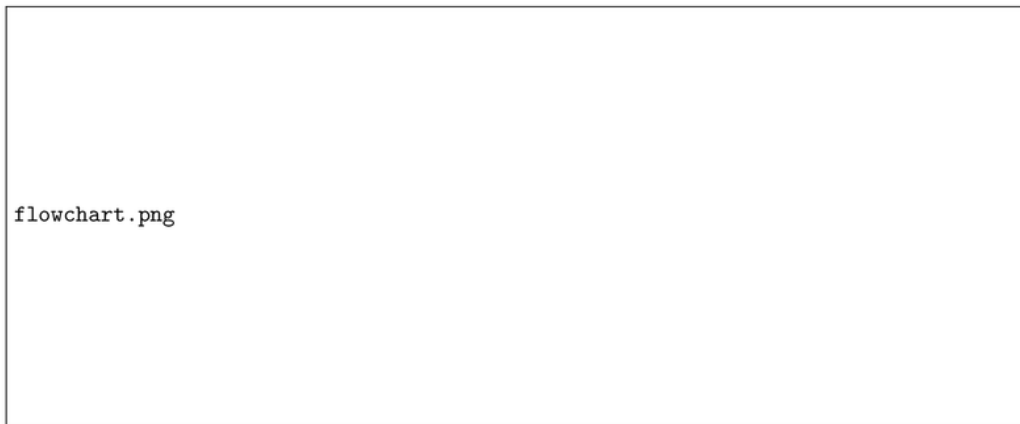


Figure 2.5: Nishant likhega.

14 Chat Application Module: First step approaching development of the entire project was to develop the chat application. To develop the chat application we are going to use node.js, react.js, socket.io (socket programming) and stylesheet to style the user interface. Socket.IO is a library that facilitates bidirectional, real-time and event-based connection between the browser and the server. The advantage of using socket.IO is that it can establish a connection in the presence of proxies, load balancers, personal firewall and antivirus software. node.js will handle the http request made by the client to the server. To build the user interface we are going to use react.js. React.js is a front end (UI) library that promotes the production of rich internet applications (RIA). React.js gives a way to create stateful, reusable interactive UI components. To make our user interface more attractive and easy to use we are going to use cascading style sheet to style the react components. The working of user interface is first of all user has to submit his/her name then he will be able to send the message. In the message field we will show the message with the name of user and the polarity of the message that means particular message is positive, negative or neutral. We can add as many users as we want.

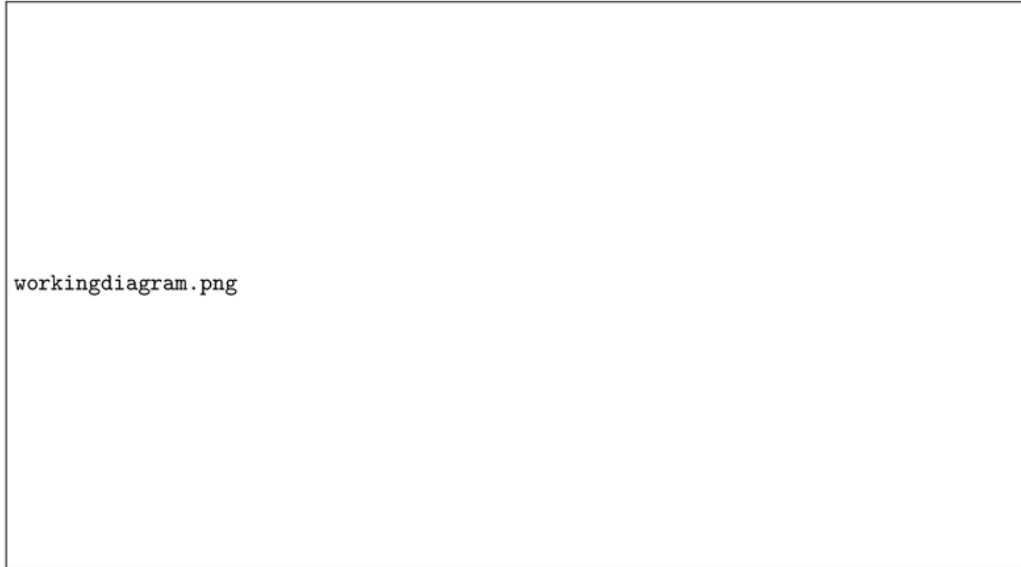


Figure 2.6: Nishant likhega.

Chapter ¹¹3

RESULTS AND DISCUSSION

3.1 RESULTS

Here the project methodology is completed into different steps such as collecting dataset, preprocessing on dataset, feature engineering, training and classification. For performing tasks on dataset, firstly it has been splitted into a training set(80 percentage) and test set(20 percentage). After that we trained the training set using SVM model and Naive Bayes and then We predict the unknown data or test set and get the different results, such as svm with 85.6 percentage accuracy and naive bayes with 77.8 percentage.

3.2 DISCUSSION

Nowadays, It has been seen that the text-based emotion detection plays an important role for human being to interact with computers on their chats but the emotion-based search engine does not give the very accurate result due to many reasons such as complexity of English language, unbalancing of labels, model and feature selection, word sense disambiguation and noises in the data, and the result can be improved by using deep learning models like fastai, neural networks, and word embedding.



Figure 3.1: Text Input.

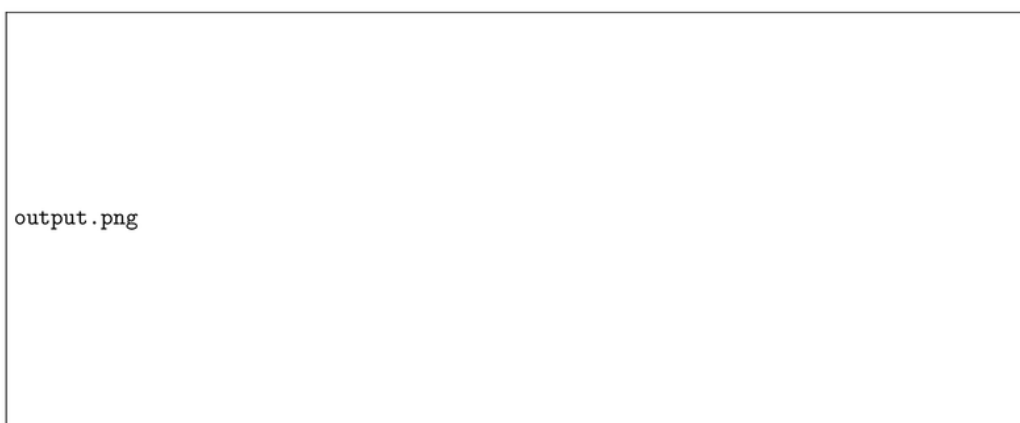


Figure 3.2: Output.

Chapter 4

CONCLUSION

Nowadays, the field of emotion detection is an exciting experiment of real-world applications where we discover the people's opinion which is important or not in better decision making. Here, We are still trying to detect the emotions of corpus texts accurately due to complexity in the English language. Currently, many people have started showing their emotions or opinions on the Web that enlarge the need for examining the opinionated online content for various real-world applications.

In this project, we are trying to show the basic way of classifying chats into happy, angry, stress and others category using support vector machine and how language models are related to the SVM and can produce the better results. We can further improve our classifier by using more features from the chats, tuning the parameters of SVM classifier or trying another classifier.

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