

Chapter 14

Applications of Pipelining With ML to Authenticate Emotions in Textual Contents

Yati Varshney

ABES Engineering College, India

Markandey Sharma

ABES Engineering College, India

Sonali Jaiswal

ABES Engineering College, India

Mayank K. Gupta

Eli Lilly and Company, USA

Rohit Rastogi

 <https://orcid.org/0000-0002-6402-7638>

ABES Engineering College, India

ABSTRACT

This research chapter aims to provide a smart approach for Human - Machine Interaction development using emotion detection on textual content. These texts can be anything like reviews, tweets, and any form of passage. As the machine is being advanced so that all the performance and commands are given in the text form. This is necessary to analyze the textual content for getting better performance and making the machines smarter. As the customers share their views on social media through the reviews, this mechanism is now spread across all the organization. Nowadays, the number of reviews and tweets are increasing and there is a necessity to analyze the data for further results. In this research, the team analyzes the tweets content in the forms of emotions in which there are multiple forms of the emotions. The machine learning approach is used with tf-idf vectorization for more accuracy. In the presented research, the team performs four machine learning algorithms for analysis; these include Naive Bayes and support vector machine.

DOI: 10.4018/979-8-3693-1082-3.ch014

MOTIVATION

Today's Emotions play a primary role in identifying the mood of a human being. There are generally five emotions: happy, sad, anger, fear, disgust. For identify and evaluate the emotions of the textual data, emotion detection is used. Emotion detection can also help the businessman to make a masterplan to know the customer's requirements based on the customer's emotions.

SCOPE OF THE STUDY

There is a growing interest in deep emotions detection of facial expression in different areas of application. Users would like to know which different topics are talked about in the gestures, which of them are Happy, Sad, Anger, Fear, and Disgust. One can improve and develop a business environment by social media gestures and developed business correlation. In the present time researchers used a machine learning approach (S. Zad, et al., 2021).

In the future, researchers will perform deep learning to detect emotion for more accuracy. Deep learning uses neural networks which build their own properties. Researchers think the most important bit for emotion analysis in the future has less to do with improving the accuracy of the algorithm (Nandwani, P. et al., 2021).

TOPIC ORGANIZATION

This study gives a smart city approach to our country. A country produces a large amount of textual content on social media i.e. reviews. All the content can be classified using this methodology. For the endorsement of the study, the author team did a survey and reviewed four research papers of concerned topics, etc. Survey provides us deep knowledge about the accuracy of the reviews in different companies and how many reviews are helpful for a quick suggestion.

The author team has described the methodology in which they have represented the methods used for the study. This study used the ML based analysis of the textual content. Further, the paper discusses the analysis techniques and how to analyze textual content, what will be the emotions of that data.

To overcome the topics and problems identified in the evaluation, different types of applications and suggestions have been given here. Emotion detection is one of the most important parts in the field of research, according to the recommendation section given in this research paper. The new features of this research is defined in the novelties and at the end the conclusion portion shows the brief detail of the research.

Ethical Committee and Funding

The research have no human related experiments. No violation of the ethics constraints. As the title says there is not any kind of damaging of the nature and humans. This research is not funded.

Role of Authors

Rohit Rastogi acted as team leader and coordinated among all co-authors. He got the topic declared and did a deep study about it and told the co-author about its background and has also helped a lot in emotion detection. He also prepared the structure of the manuscript and ensured the quality of the content along with all co-authors. Ms. Yati did the data analysis. The experimental analysis along with the concluding remarks has been done by Mr. Markandey and Ms. Sonali. All the co-authors have compiled the literature survey along with graphical Representations. Ms. Yati and Markandey contributed to the results and discussions along with concluding remarks.

INTRODUCTION

Emotion detection or opinion mining is the method to identify the emotion of the textual content. These textual content can be anything like reviews, comment, message or any phrase. Emotion detection is a part of sentiment analysis but with multiple classes which are the emotions like sadness, joy, happiness, neutral, love, surprise, etc. In this paper the team uses 9 emotions or classes.

Emotion Detection and Sentiment Analysis in Social Media

Social media is full of emotions, sentiments and feelings of the people. However analyzing, detecting the emotion or opinion is the big deal which can be solved by sentiment analysis. Emotion detection aims to detect the emotion and feeling of the text as like joy, anger, etc. Emotion detection has many applications like gauging the people how happy they are (Peng, s. et al., 2022).

There are six emotions: anger, disgust, joy, sadness, surprise, and fear, widely used to detect the human's emotion. Surprise is a little unobvious because it can be emotion in a positive and negative way.

Figure 1. Variety of emotions used in sentiment analysis and their levels

(<https://www.google.com/url?sa=i&url=https%3A%2F%2Fpowerslides.com%2Fpowerpoint-marketing%2Fanalytics-templates%2Fsentiment-analysis%2F&psig=AOvVaw167depQCgj848BJ3DNndOT&ust=1642264810001000&source=images&cd=vfe&ved=0CAsQjRxqFwoTCLDbuqvXsfUCFQAAAAAdAAAAABAJ>)



There are three approaches: first rule based, statistic based and hybrid approaches. These approaches are based on availability of the data. In sentiment analysis, this can be done by lexicon-based methods and machine learning or conceptual based learnings (as per Figure 1) (Chew Yean et al., 2015).

Social Media Gestures and Business Correlation

Social Media Gestures is a platform where people share their opinion, thoughts, emotions through emoji and facial expressions and gesture speech, it is a type of social network, and is a field where a lot of research is being done. Emotion detection is done to understand the feelings, attitudes and thoughts expressed and to know its original meaning. To take any business to the heights, it is most important to know the feelings of the customer and to listen and understand their opinion and opinion (Machova. K. et al., 2023).

And to know Customer's requirement of his emotion. Due to which the demand of the customer will increase and the business will also grow. That's why emotion detection and sentiment analysis is very important for business. Twitter is one of the main platforms of social media. There is a way through which people put their opinion in front of everyone. Twitter is an application that also represents microblogging. Discussion takes place on any topic of the country and abroad through Twitter, so that the opinion, feelings of the people can be known. A businessman can increase their business by providing people's required products, with the help of social media gestures (as per Figure 2) (Al-Kharusi, M.I.M., et al., 2015).

Knowledge Pyramid and Emotions Analysis

The relation between the knowledge of the data and the information of the data is done only through the knowledge pyramid. It is in the form of a hierarchy as seen in the image below. It helps in knowing and understanding any data well, it is known as the Knowledge Pyramid (Guo, Jia et al., 2022) [13].

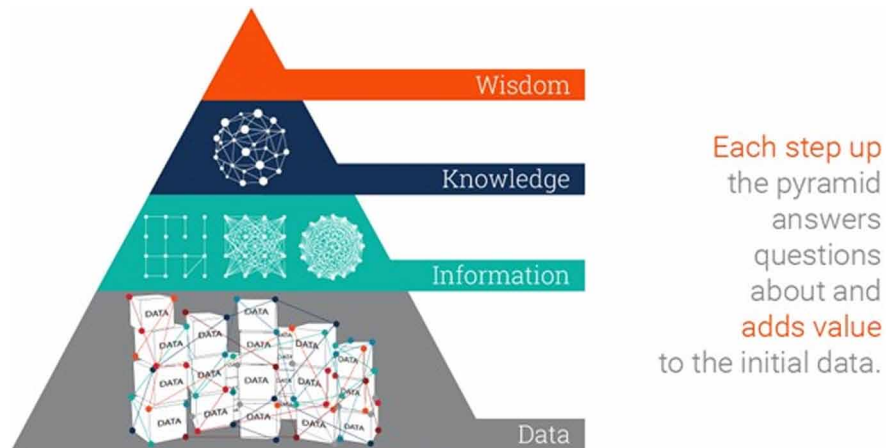
The collection of facts in a raw and unorganized way forms a data, which consists of numbers and words. And today in the field of this research DIKW is known as a knowledge pyramid. This data is formed after cleaning that is removing the errors and unused words for making the data easy to measure

*Figure 2. Social media gesture and having a variety of the sentiments of each person
(<https://community.servicenow.com/009ff117db5cbf085ed4a851ca961958.iix>)*



Application of Pipelining With ML to Authenticate Emotions

Figure 3. The DIKW model for data value extraction and knowledge management
(<https://bit.ly/3Kc6kQm>)



analysis and visualized purpose. In the top of the DIKW hierarchy, the wisdom can be achieved by knowing the two questions like “why do something “ and “what is best “. It means wisdom can be defined as the knowledge applied in action (as per Figure 3) (Fricke, M. et al., 2009); (Achaempong, F. A. et al., 2015).

LITERATURE REVIEW

There are many approaches to detect the emotion of the textual content to study about the relative work of emotion detection. The researcher team has studied 4 existing research papers. There are many papers in which the textual content is retrieved from twitter, Facebook or any other social media. There are various ways to preprocess the data like NLP, Pipeline, etc.

Panguila, K.F.M. (2019) emphasized that as social media is the only source where people can share their opinions. Nowadays, this social media produces a large amount of textual data. For the analysis of that data machine learning gives the approach i.e. sentiment analysis. The aim of this analysis is to extract the sentiments of the people. There are two machine learning approaches used to find the sentiment whether it is positive or negative. Nowadays the researchers used unsupervised learning using NLP to improve the accuracy. There are many machine learning classifiers – Data Extraction then second is preprocessing is used to normalize the dataset and minimize the size. Third is feature representation. Authors used sparse vector representation, dense vector representation, Naive Bayes, Maximum Entropy, Decision Tree, Random Forest, and Support Vector Machine. This research paper concluded to give the polarity of the textual content as positive, negative or neutral (Panguila, K.F.M. et al., 2019).

Shiv Naresh Shivhare (2012) W. Gerrod Parrat wrote A book named “Emotion in social Psychology, wrote by W. Gerrod Parrat, he explained that emotion hierarchy has six classes at primary level which are love, joy, Anger, Fear and surprise. In this research paper, the emotion of any person can also be known through his speech, face expression and his textual content or emotion given in the form of text. Which is called Speech Facial Detection and Text Emotion. Detecting emotion and analyzing sentiment is growing very fast by using the increasing technology in the field of computer science, emotion detection has become an important domain in the field of analysis. According to this research paper, it is a challenge to

detect the textual content given by a person and their emotions through their facial expressions. Detecting emotions is very important. For example, in order to grow a business, it is important to understand the emotions given by the customers. Keywords used in this research paper: Textual Emotion Detection, Emotion World Ontology, Human-computer Interaction. This paper used some different type techniques: Keyword spotting technique, Lexical Affinity Method, Learning-based Method, Hybrid Method. In this paper I used some algorithm: Emotion Detector Algorithm. Parameters used: Parent child relationship, Depth in Ontology, Frequency in Text Document (Shiv Naresh Shivhare., 2012).

Dey, R.K. et al., (2020) propounded in their work that sentiment analysis can be done into three categories which are machine learning, hybrid approaches and lexicon approaches. Firstly, it involves machine learning algorithms and linguistic features. Secondly, it involves the collection of the terms used as sentiment which are precompiled as lexicons used for analyses. Now it is further classified into dictionary and corpus based approaches. These are used as semantic methods for sentiment analysis. The combination of machine learning and lexicon based approaches is called hybrid approaches.

1. Machine Learning Approach: Machine learning approach uses the machine learning algorithms for statistical analysis. Machine learning algorithms are used for syntactic features.
2. Lexicon-based Approach: Lexicon based approach is used when the analysis is done according to the collection of the semantic words used in the text. Those words are compared with the sentiment dictionaries and the maximum number of times the sentiment repeats is found as the positive or negative.
3. Hybrid Method: Hybrid method as the name shows that it is the combination of the earlier approaches. This method gives more efficiency than the above ones. The improvement in the machine learning algorithms are frequently mentioned in this research.

Algorithms used in this research are Naive Bayes Classifier, K-Nearest Neighbor, XGBOOSTGBDT, Decision Tree. Socio-Economic standpoint uses sentiment analysis. Understanding of the statistical analysis and methods used for all the research can be beneficial for the good accuracy produced and for businesses, institutes, etc. This research paper surveyed the challenges lied in the sentiment classification and applications of the sentiment analysis.(Dey, R.K. et al., 2020).

(V. V. Ramalingam et al., 2018) found that emotion detection plays a major role in AI. As it is the best approach for knowing the textual content by using machines only. There are two types of methods used for emotion detection - Keyword based method, this method uses the WordNet for identifying the emotions based on some antonyms, synonyms and the second one is Vector Space Model, in which the words are formed in the matrix form and identify the relationship between the row and columns. Vector Space Models have two forms to implement - PMI and Learning based approach.

In PMI (Pointwise Mutual Information), the two words are compared with each other on the basis of the appearance. In a learning based approach the classifications are actually based on the training of the machine. The machine has to learn the textual content with their emotions to give the result for new textual content. This approach is used to enhance the development of the Human and machine interaction. There are two procedures to do emotion detection. First word based approach in which the NLP is used using the NLTK package. And second is the learning based approach in which the twitter API is used for extracting the tweets and then training the data and testing it according to the learning. This paper researches both the approaches with not only the single word but on multiple words in the sentence (V V Ramalingam et al 2018).

Application of Pipelining With ML to Authenticate Emotions

Table 1. Tabular summary for literature review based papers

S.No.	Paper, Author Name	Summary	Methodology, dataset, Algo	Concluding Remarks
1	Sentiment Analysis on Social Media Data using Intelligent Techniques, Panguila, K.F.M., Chandra J.	Social media is the only platform to express the thoughts of the people. There is a large amount of textual data full of sentiments on social media. Unsupervised techniques give the accurate result. First data collection, then preprocessing, then analysis and last visualizing.	Unsupervised techniques, sparse vector representation, dense vector representation, Naive bayes, Maximum entropy, Decision tree, Random Forest, Support Vector Machine. Uber rides reviews and famous personality data set	It results that multilayer perceptron and convolutional neural networks perform better than other classifiers in general.
2	Emotion Detection from text Shiv Naresh Shivhare.	In this paper the author totally works on Emotion Detection. Emotion is a way to express our feelings and thoughts, it is expressed by a person through facial expression and gesture speech.	There are used Spotting Technique for detecting the Emotions and proposed methodology are(Emotion Ontology) and(Emotion Detector Algorithm) and (Support Vector Machine)	This research paper concludes the good work done by the researchers to detect emotions from facial information.
3	On Sentiment Analysis Techniques Involving Social Media And Online Platforms, Dey. R.K., Sarddar, D., R., Sarkar, I., Bose, R.	The hybrid approach is the combination of the Machine learning and Lexicon based approach This can result in the most popular view by the user for sentiment classification.	Naive Bayes Classifier, K-NN (K-Nearest Neighbor), 7 XGBOOST GBDT, Decision Tree.	For sentiment analysis, the main challenges and applications that are based on sentiment classification are surveyed.
4	Emotion Detection from Text, Ramalingam V.V., Pandian A., Jaiswal A., Bhatia N.	The approaches used to identify the emotions of the textual content. Word based using NLP and Learning based using twitter API by training and testing the dataset and learning the machine accordingly.	Keyword based and learning based approaches, NLTK package, Machine learning approaches for training and testing.	This survey paper presents that there are many ways to approach emotions but they don't give good accuracy. If both the approaches get together they can give more accuracy than the individuals.
5	Anomaly Detection in Social Media Using Text-Mining and Emotion Classification with Emotion Detection, Bakkialakshmi, V.S., Sudalaimuthu, T.	The emotion detection anomaly is used to find the emotion from the textual content. This can be done by using data mining. Data mining is used to classify the textual content using some technologies.	Data mining is performed on the micro blog produced by the customers tweets.	This research paper concluded that the data mining gives the best results in regard of emotion detection as it have many classes.
6	Emotion Ontology Studies: A Framework for Expressing Feelings Digitally and its Application to Sentiment Analysis, Eun H.P. and Veda C.S.	Emotion ontology is used to find the customer's feedback nature regarding the company product. This research produced a framework for the companies to easily identify the product's review.	This research used the Human Computer Interface(HCI) for identify the emotion . This research also uses the artificial intelligence.	This research concluded by building a successful framework for the companies for their easily analysis of the product's reviews.

Figure 4. Tweet emotions dataset first few rows with their respective three attributes



(V. S. Bakkialakshmi et al., 2023) found that anomaly detection is used to identify the spam messages and also textual contents emotions. Most of the researchers uses the text mining for the opinion detection . In this research, authors perform the text mining using anomaly detection on the micro blogs. Micro blogs are the messages or tweets produced from the social media . In this authors will detect the emotion of the micro blog using text mining (V. S. Bakkialakshmi et al 2023).

(Eun H.P. et al.,2023) Emotion ontology is defined to find the discrete emotion of the textual content. This helps company to easily identify the customers reviews. In this research authors made a framework which help to identify the customers feedback in every context. This not only identify the emotions but also sentiments of the feedback. This ontology made a emotion analysis and sentiment analysis which help the companies to check the customer’s review (Eun H.P. et al.,2023).

Pl. Refer Table 1 for background works done.

METHODOLOGY AND SETUP: DESIGN OF EXPERIMENT

Name of Algorithms Used

Pipeline model is used to prepare, transform and model. In this research the researcher used the pipeline model for preprocessing and modeling. In which the vectorization is performed using count vectorization and the transformer which is mostly used is TF-IDF transformer. The cleaning is done using the neat text package. The algorithms used in this research paper are:

1. Multinomial NB
2. Support Vector Machine
3. Random Forest

Application of Pipelining With ML to Authenticate Emotions

4. Decision Tree
5. XGBoost Classifier

Dataset

Tweet emotion dataset

Need of Tweet Emotion Dataset

Tweet emotion dataset is the dataset in which there are many types of emotions for classifying the text. This is the only dataset which has 13 classification of the text for the textual content.

Selected Data Set Attributes

Basically there are many attributes in this dataset like tweet_id, sentiment and content but the analysis is done on this dataset uses only 2 attributes .These are: Content and sentiments

Metadata

Tweet emotion has the maximum number of classes for classifying the text. It provides most of the emotions for almost all types of text. It is easy to analyze for any kind of text. It is the best dataset for emotion detection on any kind of text. It gives more accuracy than others dataset.

Selected Dataset One Sample Image

tweet_emotions is actually having 40000 rows and 3 columns. It actually contains 40000 tweets with 13 classifications of the emotions (as per Figure 4).

Hardware Requirement

- Ram- 8GB (minimum)
- Processor- i3

Software Requirement

- 1) Libraries- Pipeline, seaborn, matplotlib, NumPy, pandas, Sklearn
- 2) Classifier-
 - MultinomialNB
 - DecisionTreeClassifier
 - RandomForestClassifier
 - XGBClassifier
 - Support Vector Machine
- 3) Google colab.
- 4) Pycharm Editor
- 5) TD-IDF transformer
- 6) Count Vectorization

It is used to look at customer satisfaction based on reviews, sentiment and reaction as an additional perspective, when doing analysis on text data. NLTK library is more suitable for sentiment analysis research.

OS Requirement

It can work even with windows, linux, mac OS. Because this research only needs ideas for running the code.

Storage Requirement

This research used a pycharm editor dataset which used a minimum 500 KB of storage.

Front End

- HTML
- CSS
- BOOTSTRAP
- jQuery
- JavaScript

HTML, CSS and JavaScript are the front-end programming languages used to design the website for making the site interactive. These front end languages Make the website more interactive and minimalist.

Back End

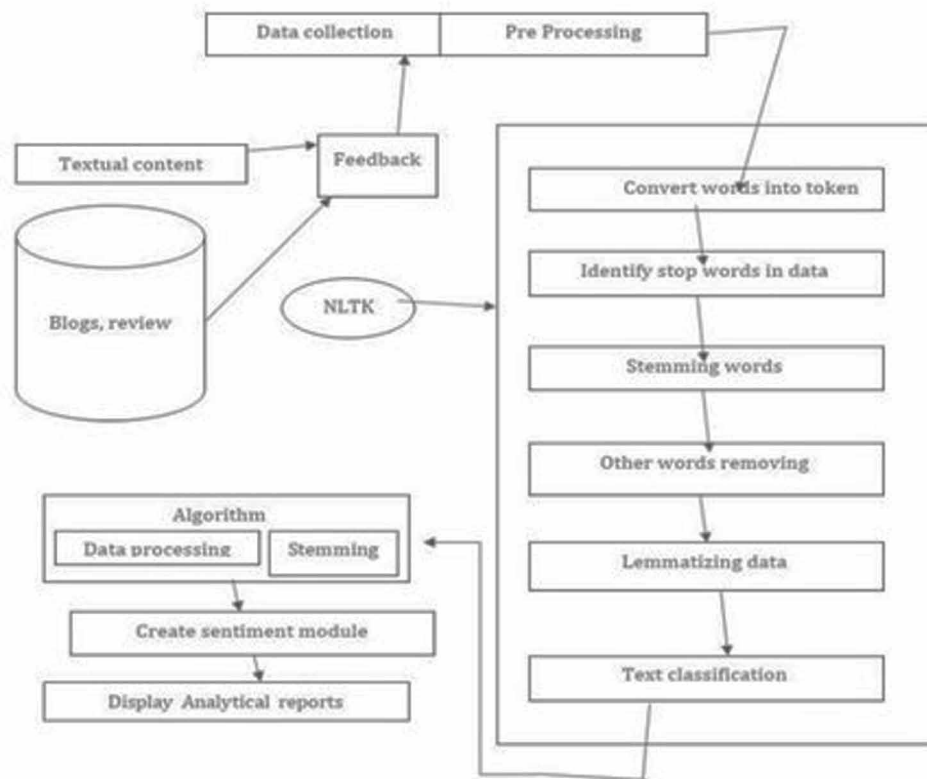
Python 3 Language is used in this research because it is simple and easy. In python language there are many inbuilt modules which are easily used in analysis. Natural Preprocessing Language is used in sentiment analysis. NLTK is the module used in the Python language. Unsupervised algorithms are used because they give more accuracy as compared to supervised algorithms. And also the Django framework is used in this research for better performance.

Steps of Execution

1. Select the choice between sentiment analysis and emotion analysis.
2. For emotions detection, there is the option of emotion detection. Just click on it.
3. After that click on real text and enter the tweet in it and search accordingly.
4. Results display the emotion of the text.

Application of Pipelining With ML to Authenticate Emotions

Figure 5. Flowchart for emotions detection and analysis



METHODOLOGY

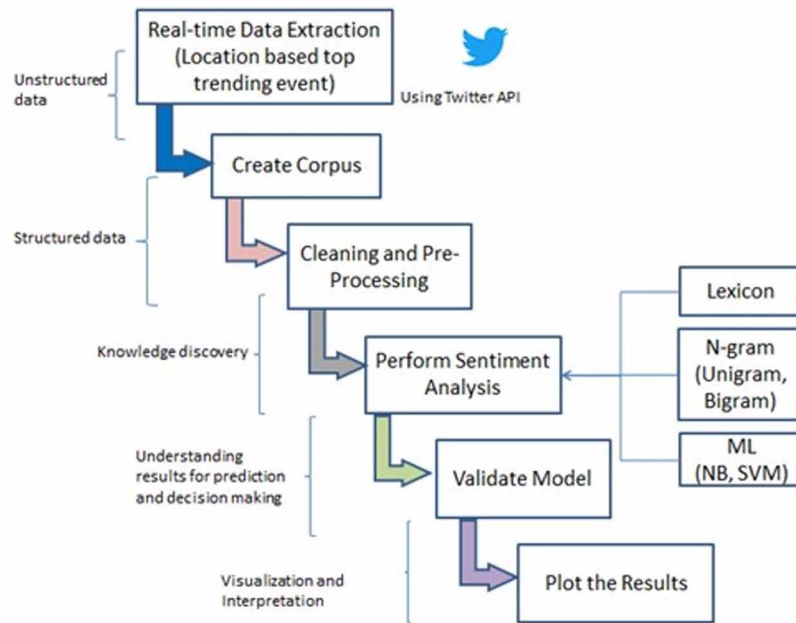
Flow Chart

This diagram shows the flowchart of emotion detection. In this diagram blog reviews and textual content like input it's given by users and then all input collection is called feedback in this diagram then it's pre-processing and then by the help of more than algorithm techniques it's given input analysis and gives results graph reviews (as per Figure 5).

Block Diagram

This Figure Shows the block diagram of emotion detection how it is performed from the starting to end. First the preprocessing process occurs and then feature extraction occurs. After that the modeling takes place for analysis (as per Figure 6).

Figure 6. Block diagram of real time emotions detection



Data Flow Diagram (Level Zero, Level One, Level Two)

This figure shows the data flow diagram of emotion detection level 0. In this the textual content given by the user is analyzed by the sentiment analysis system and gives results. That result can define the emotion of that textual content (as per Figure 7).

Figure 7. Data flow diagram (level zero)

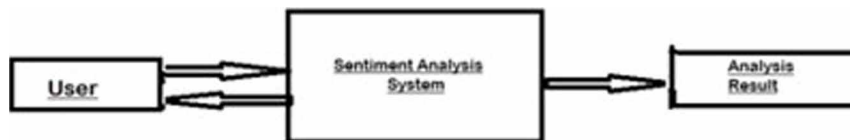
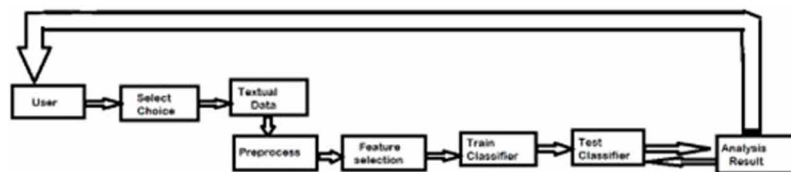
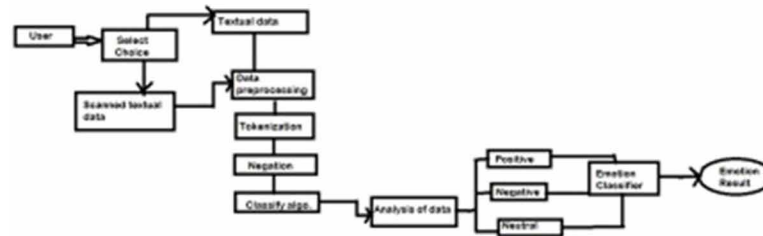


Figure 8. Data flow diagram (level one)



Application of Pipelining With ML to Authenticate Emotions

Figure 9. Data flow diagram (level two)



This figure shows the DFD level 1 of emotion detection. In this level, the team shows the process of the sentiment analysis for emotion detection. First the data is preprocessed and then sent to the splitting. The training dataset is trained according to the classifier. After that, the testing is performed according to the prediction. This results in the specified emotion for the textual content (as per Figure 8).

This figure shows the DFD level 2 of emotion detection in which it shows that the dataset is not used as it is. It is first preprocessed using different methods. In this research the neat text package is used for cleaning then the pipeline is used to vectorize and transform. Then the modeling is done and the predict provides the results in one of the 9 emotions (as per Figure 9).

RESULT AND DISCUSSIONS

There are many algorithms performed on the dataset Sentiment140 and all give the accuracy, precision, F1 score and recall of each classifier. The supports for all the classes are shown below with their emotions-

Supports for class 0 (sadness) = 3176
Supports for class 1 (anger) = 1331
Supports for class 2 (love) = 1357
Supports for class 3 (surprise) = 274
Supports for class 4 (fear) = 865
Supports for class 5 (joy) = 2487
Supports for class 6 (neutral) = 625
Supports for class 7 (worry) = 1780
Supports for class 8 (happiness) = 1634
Total number of texts are = 13529
The performance of each algorithm is as follows:

Random Forest Algorithm

For the Random Forest Classifier, the researcher used pipeline of the count vectorization, TF-IDF transformation and Random Forest Classifier function as-

```
Pipeline([('vect', CountVectorizer(lowercase=False)), ('tfidf', TfidfTransformer()), ('model', OneVsRestClassifier(RandomForestClassifier(n_estimators=200, random_state=100)))] (1)
```

Figure 10. Confusion matrix of random forest having multi class

		Confusion Matrix								
		0	1	2	3	4	5	6	7	8
Actuals	0	2367	44	57	1	7	24	9	319	292
	1	58	1026	18	0	10	11	4	71	93
	2	40	10	956	3	0	39	8	235	103
	3	6	0	0	265	6	4	0	0	2
	4	13	7	2	11	846	4	0	0	4
	5	21	0	21	2	6	2503	2	3	2
	6	50	4	50	1	1	5	19	292	156
	7	110	14	95	1	4	23	24	1140	357
	8	268	23	83	2	7	30	11	578	646
		Predictions								

After this the model is trained according to the classifier and done the prediction (as per the equation 1). Prediction results to the accuracy score of the classifier. Random forest classification gives the 72.2% accuracy which is the best and fittest accuracy from all the other classifiers. This classifier is fit for multiclass classifiers in ROC Curve, the true positive and false positive rate is shown according to the different thresholds for each class or emotion (as per Figure 10 and 11).

In the confusion matrix, there are 9 classes' means 9 emotions with their true positive and false positive rate. According to the confusion matrix-

Total number of texts are= 13529

Total True predictions are= 2367+1026+956+265+846+2503+19+1140+646 = 9768

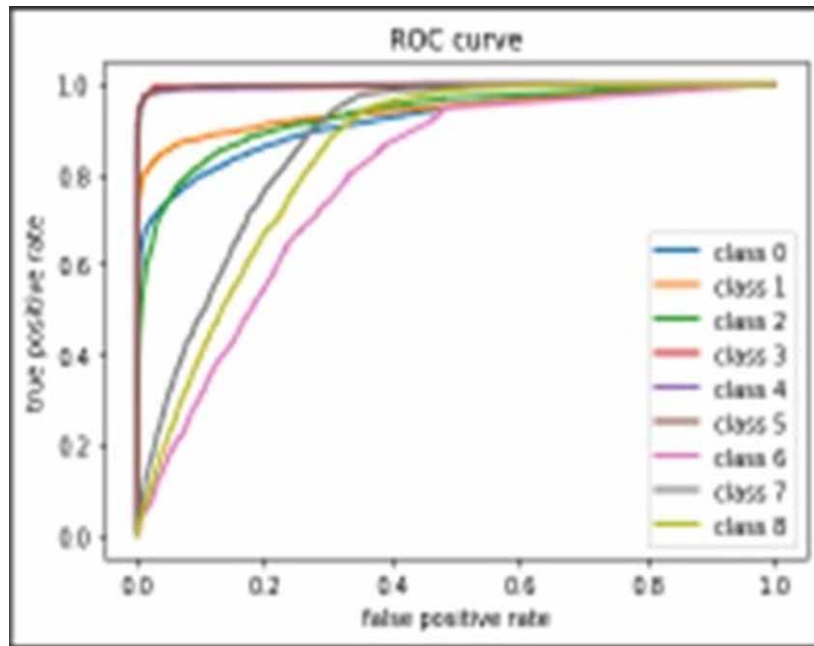
Accuracy= (9768/13529)*100 =72.2%

Multinomial Naive Bayes Algorithm

For the Multinomial NB classifier, the researcher used pipeline of the count vectorization, TF-IDF transformation and MultinomialNB classifier as-

Application of Pipelining With ML to Authenticate Emotions

Figure 11. ROC Curve for the Random Forest which shows the accuracy of 72.2%



```
Pipeline ([('vect', CountVectorizer(lowercase=False)),  
          ('tfidf', TfidfTransformer()), ('model', OneVsRestClassifier(M  
ultinomialNB()))]) (2)
```

After this the model is trained according to the classifier and done the prediction(as per the equation 2). Prediction results to the accuracy score of the classifier. Multinomial Naive Bayes gives the 53.3% accuracy which is the worst and low accuracy from all the other classifiers. This classifier is not fit for multiclass classifiers In ROC Curve, the true positive and false positive rate is shown according to the different thresholds for each class or emotion (as per Figure 12 and 13).

In the confusion matrix, there are 9 classes' means 9 emotions with their true positive and false positive rate. According to the confusion matrix-

Total number of texts are= 13529

Total True predictions are = 2825+469+424+3+280+2410+0+425+269 = 6681

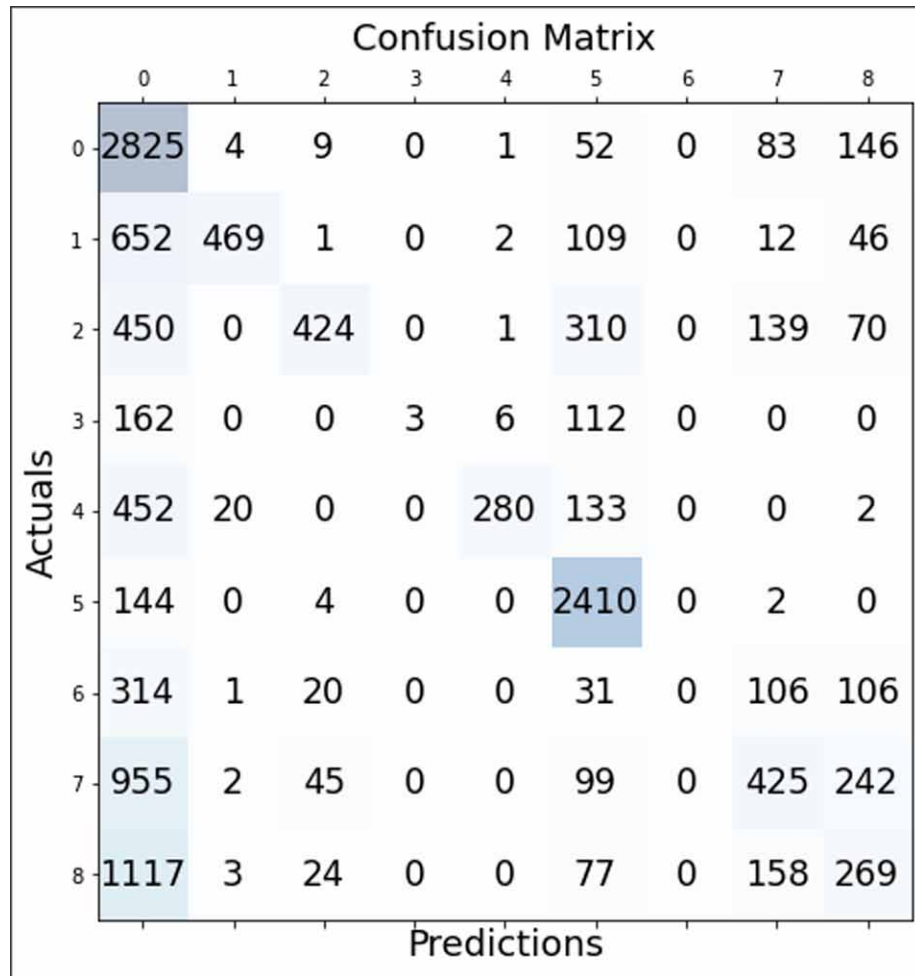
Accuracy= (6681/13529)*100 =753% (approx.)

Support Vector Machine

For the Decision Tree classifier, the researcher used pipeline of the count vectorization, TF-IDF transformation and Support Vector Machine classifier as-

```
pipe_svm = Pipeline([('vect', CountVectorizer()),  
                    ('tfidf', TfidfTransformer()),
```

Figure 12. Confusion matrix of multinomial Naive Bayes having multiclass



```
('model', OneVsRestClassifier(svm.SVC()))])
```

(3)

After this the model is trained according to the classifier and done the prediction (as per the equation 3). Prediction results to the accuracy score of the classifier. Support Vector Machine gives the 72.07% accuracy which is the best accuracy from all the other classifiers. In ROC Curve, the true positive and false positive rate is shown according to the different thresholds for each class or emotion (as per Figure 14 and 15).

In the confusion matrix, there are 9 classes' means 9 emotions with their true positive and false positive rate. According to the confusion matrix-

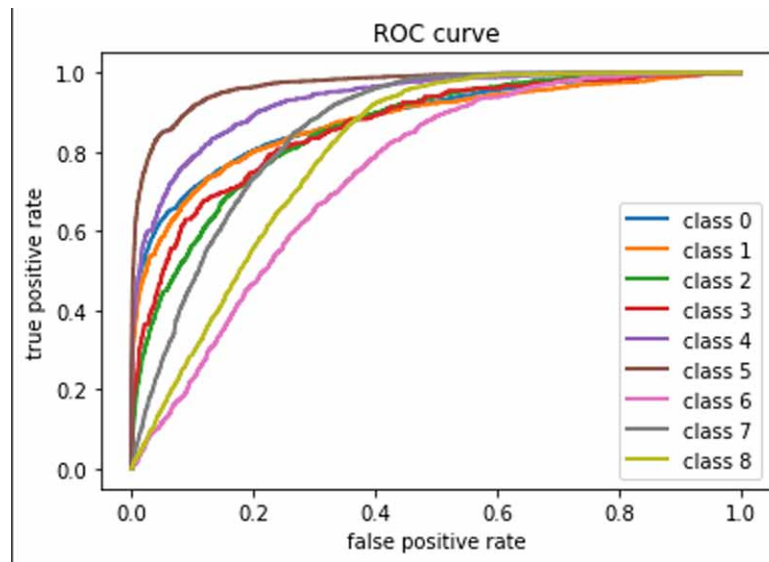
Total number of texts are= 13529

Total True predictions are = 2427+995+933+206+831+2497+15+1068+761 = 9733

Accuracy= (9733/13529)*100 =72.07% (approx.)

Application of Pipelining With ML to Authenticate Emotions

Figure 13. ROC curve for the multinomial Naive Bayes which shows the accuracy of 53.3%



Decision Tree Algorithm

For the Decision Tree classifier, the researcher used pipeline of the count vectorization, TF-IDF transformation and DecisionTreeClassifier with random state as a parameter -

```
pipe_dt = Pipeline([('vect', CountVectorizer(lowercase=False)),
                    ('tfidf', TfidfTransformer()),
                    ('model', OneVsRestClassifier(DecisionTreeClassifier(random_state=100)))]
(4)
```

After this the model is trained according to the classifier and done the prediction (as per the equation 4). Prediction results to the accuracy score of the classifier. Decision Tree gives the 69.5% accuracy. In ROC Curve, the true positive and false positive rate is shown according to the different thresholds for each class or emotion (as per Figure 16 and 17).

In the confusion matrix, there are 9 classes' means 9 emotions with their true positive and false positive rate. According to the confusion matrix-

Total number of texts are= 13529

Total True predictions are =2329+1032+903+248+873+2395+45+847+622 = 9294

Accuracy= (9294/13529)*100 =69.5%

XGBoost Classifier Algorithm

For the XGBoost classifier, the researcher used a pipeline of the count vectorization, TF-IDF transformation and XGBoost classifier with 300 n_estimators .

Figure 14. Confusion matrix of support vector machine having multiclass

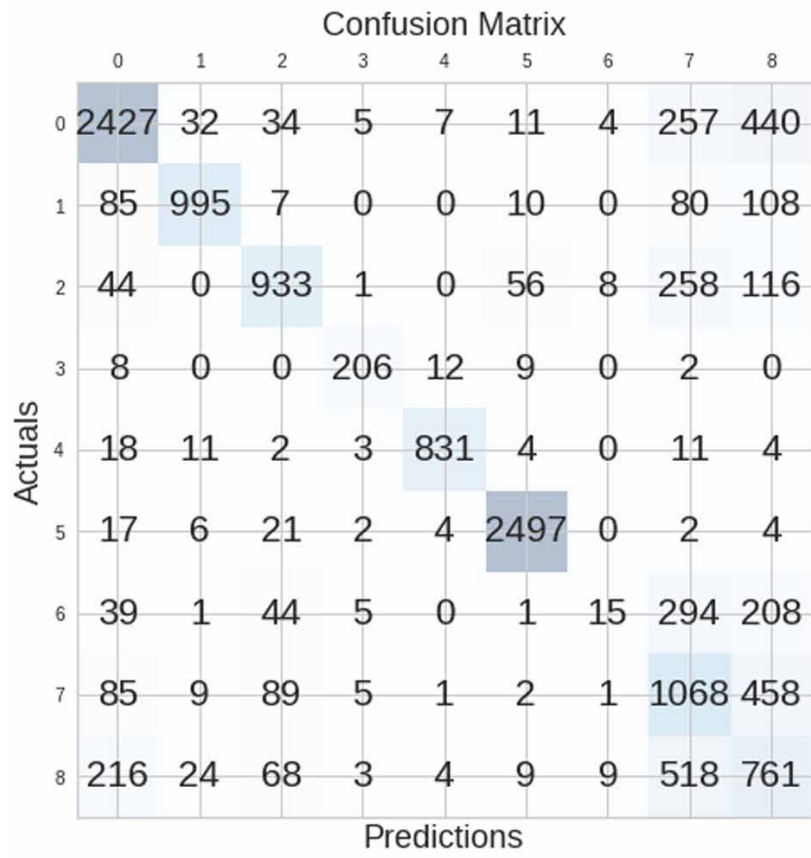
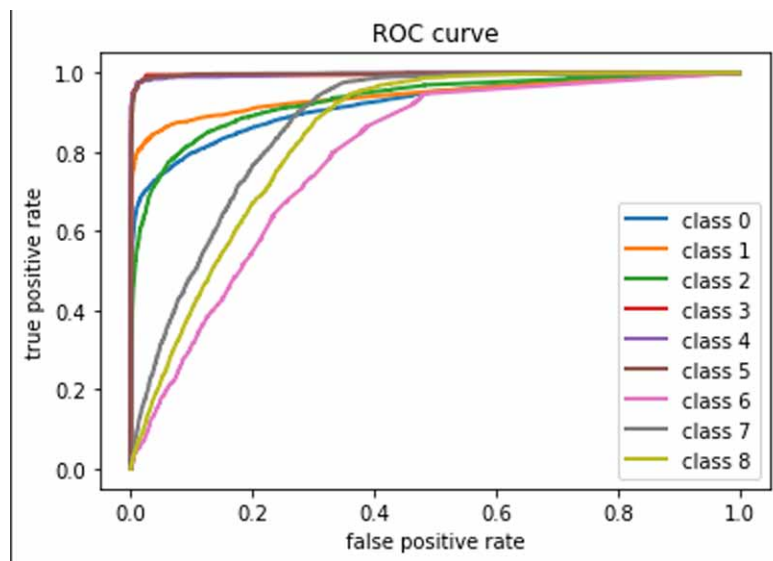


Figure 15. ROC curve for the support vector machine which shows the accuracy of 72.07%



Application of Pipelining With ML to Authenticate Emotions

```
pipe_xg = Pipeline([('vect', CountVectorizer()),  
('tfidf', TfidfTransformer()),  
('clf', OneVsRestClassifier(XGBClassifier(n_estimators=300, random_  
state=100))))] (5)
```

After this the model is trained according to the classifier and done the prediction(as per the equation 5) .Prediction results in the accuracy score of the classifier. XGBoost gives 67.07% accuracy. In ROC Curve, the true positive and false positive rate is shown according to the different thresholds for each class or emotion (as per Figure 18 and 19).

In the confusion matrix, there are 9 classes' means 9 emotions with their true positive and false positive rate. According to the confusion matrix-

Total number of texts are= 13529

Total True predictions are =2104+880+811+251+753+2319+16+1420+520 = 9074

Accuracy= (9074/13529)*100 =67.07%

Comparative Analysis

This figure shows the comparison between the different Machine learning algorithms. In this the dataset and preprocessed data both used the same for all classifiers. There is the pipeline for preparing the data then vectorizing the data and final is to modeling the dataset with different algorithms. According to the accuracies of different classifiers, it is concluded that the random forest and SVM gives more accuracy than the multinomial NB, XGBoost classifier and Decision Tree (as per Figure 20).

NOVELTIES

In this research, Emotion detection is the type of sentiment analysis but with multiple classes. The novelties for this research are.

1. Existing research gives less accuracy than this research.
2. This research performs the maximum number of classifiers as compared to existing research.
3. This research uses a pipeline for the preparation, vectorization and modeling.
4. One vs rest classifier for multiple classes for modeling.

RECOMMENDATIONS

There are various techniques to detect the emotion of the textual content given by the users of the social media. In this research, the team uses the pipeline model with label binarization using OneVsRestClassifier. In this research, there are 8 emotions used in this dataset for modeling. These are sadness, anger, joy, love, surprise, fear, neutral and worry. These emotions play an important role in the research. All the results are in the form of one emotion. The text can be predicted according to the training and gives

Figure 16. Confusion matrix of decision tree having multiclass

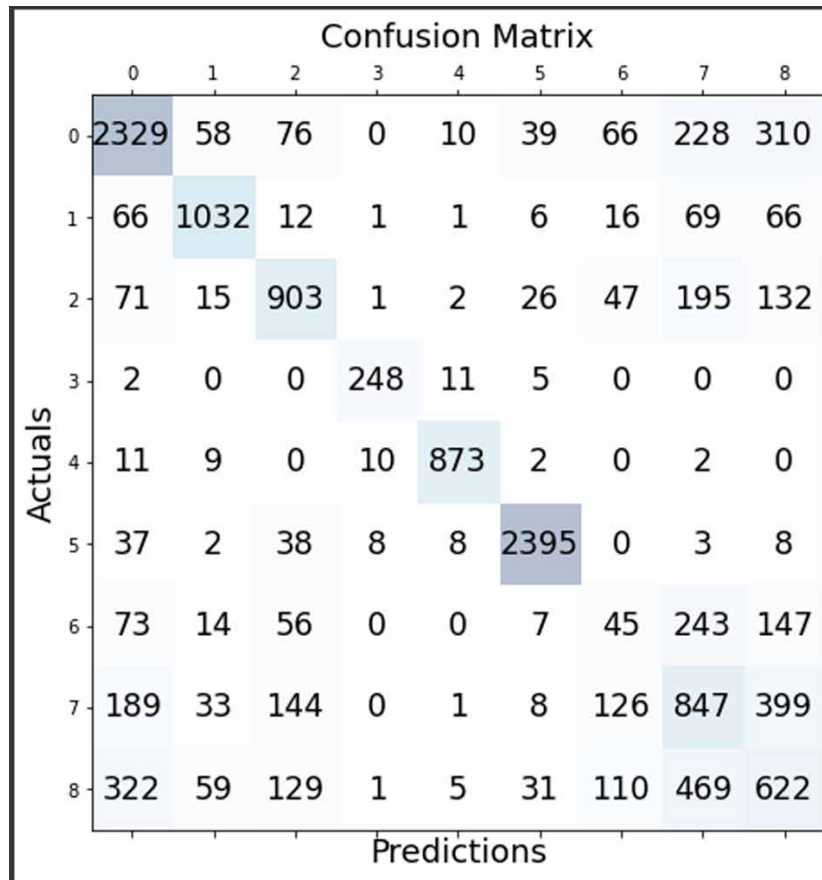
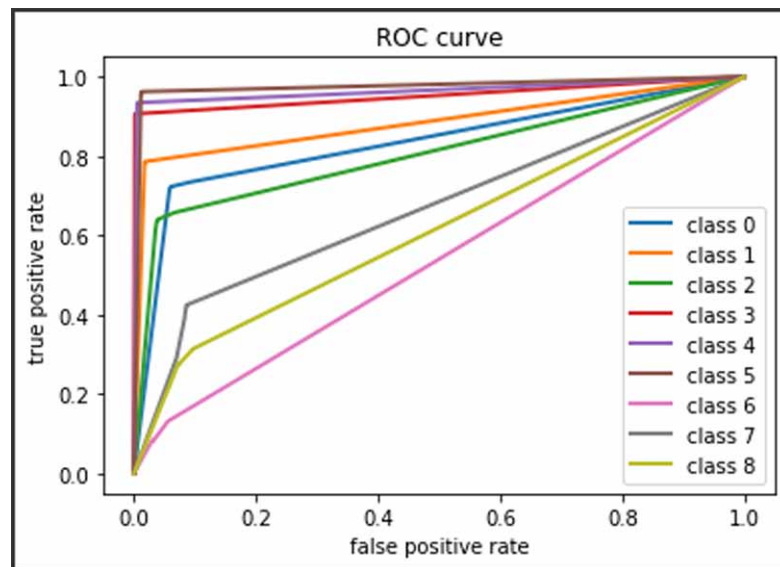
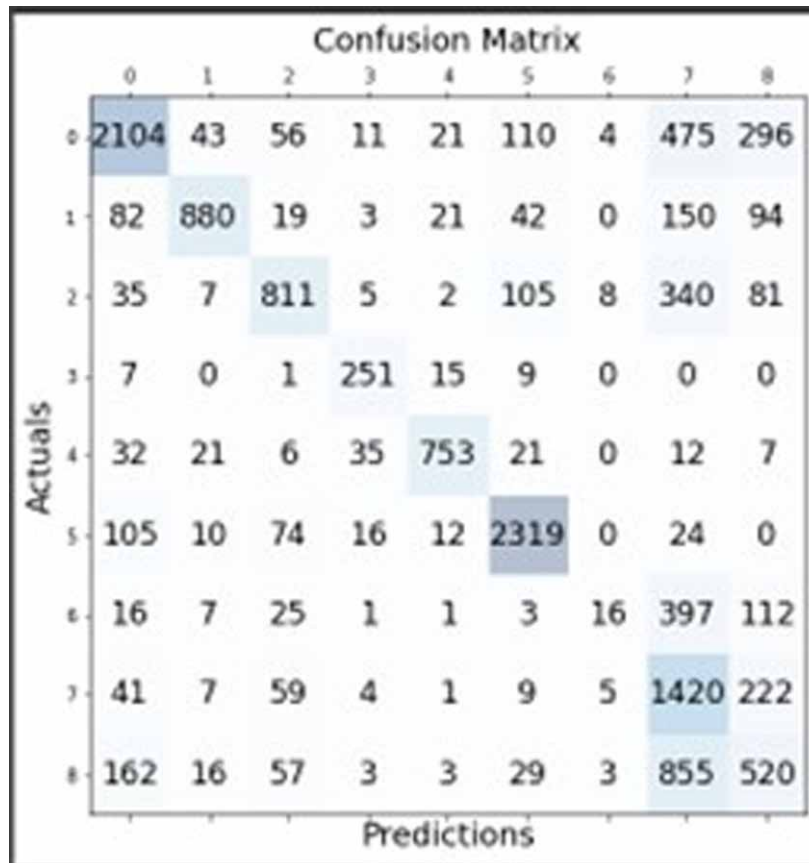


Figure 17. ROC curve for the decision tree which shows the accuracy of 69.5%



Application of Pipelining With ML to Authenticate Emotions

Figure 18. Confusion matrix of XGBoost classifier multiclass



A confusion matrix for a multiclass XGBoost classifier. The matrix is 9x9, with both axes labeled 0 through 8. The vertical axis is labeled 'Actuals' and the horizontal axis is labeled 'Predictions'. The diagonal elements, representing correct classifications, are: 2104 (0,0), 880 (1,1), 811 (2,2), 251 (3,3), 753 (4,4), 2319 (5,5), 397 (6,6), 1420 (7,7), and 855 (8,8). Other values represent misclassifications between classes.

	0	1	2	3	4	5	6	7	8
0	2104	43	56	11	21	110	4	475	296
1	82	880	19	3	21	42	0	150	94
2	35	7	811	5	2	105	8	340	81
3	7	0	1	251	15	9	0	0	0
4	32	21	6	35	753	21	0	12	7
5	105	10	74	16	12	2319	0	24	0
6	16	7	25	1	1	3	16	397	112
7	41	7	59	4	1	9	5	1420	222
8	162	16	57	3	3	29	3	855	520

the emotion of the text. There are various other ways also to detect emotion from different forms of data. These data can be images, speech and text. For images, OpenCV is used for detection of the image.

FUTURE RESEARCH DIRECTIONS AND LIMITATIONS

Limitations

1. This research provides less accuracy with the idioms and other phrases.
2. This research performs the multiclass classification which can be the cause of the less accuracies in few classifiers.
3. The limitation is that it can predict well in a few words like “crap”.

Figure 19. ROC curve for the XGBoost Classifier which shows the accuracy of 67.07%

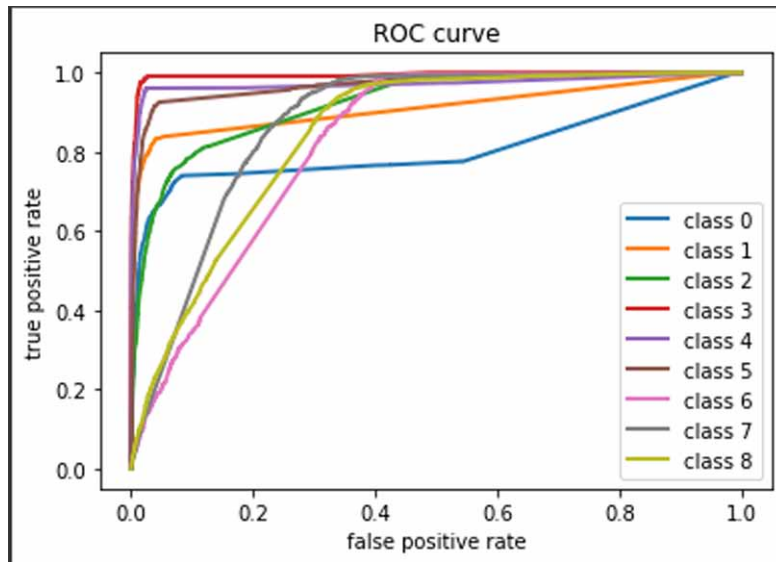
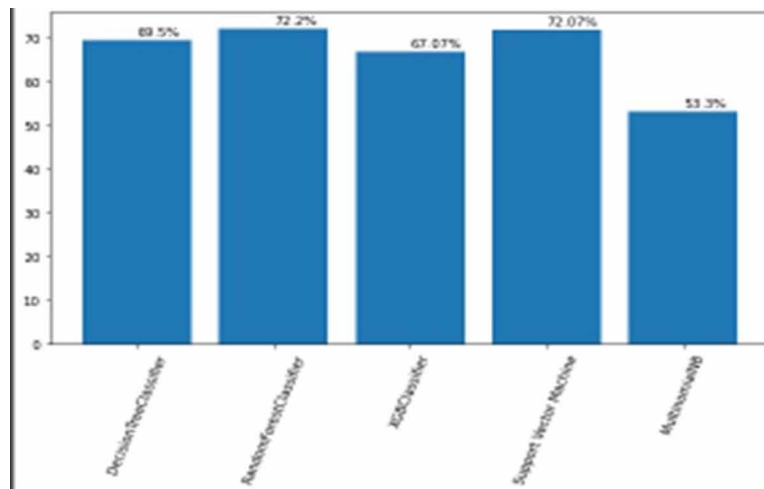


Figure 20. Representation of 5 machine learning algorithms performed on the dataset with their accuracies



Future Directions

1. The next research can be performed with more classifications.
2. Next research can be performed as with more accuracy.
3. This analysis can be performed on the real time reviews from any social media platform.

CONCLUSION

In this research paper, the team shows the smart approach for textual content provided on social media. There are millions of reviews given on social media in which they share their ideas about the products, items and about the feelings. In this research, the team uses the pipeline for preparation, vectorization and analyzing the model according to the classifier.

There are 5 classifiers used in this research. These are Random Forest, Decision Tree, Multinomial Naive Bayes, Support vector machine and XGBoost classifier. As there are 9 classes with 9 emotions, there is the need for multiclass classification with OneVsRestClassifier() mode. This mode signifies to split the multiclass into binary classifier problems per class. For binarization, the research uses label_binarize

After the modeling process with 5 classifiers, it is concluded that Random Forest and Support Vector Machine are the best for multiclass classification. Decision Tree is also good but as comparison to SVM and random forest it gives less accuracy.

REFERENCES

- Acheampong, F. A., Wenyu, C., & Mensah, H. N. (2020). *Text-based emotion detection: Advances, challenges, and opportunities*. Wiley. <https://onlinelibrary.wiley.com/doi/full/10.1002/eng2.12189> doi:10.1002/eng2.12189
- Al-Kharusi M. I. M., Usman I. A., & Awwalu A J. (2015). Application of Sentiment Analysis in Business Intelligence. *International Journal of Knowledge, Innovation and Entrepreneurship, Vol, (3)*, 51–60.
- Bakkialakshmi, V. S., & Sudalaimuthu, T. (2023), Anomaly Detection in Social Media Using Text-Mining and Emotion Classification with Emotion Detection, *International Conference on Cognition and Recongition*. Springer. 10.1007/978-3-031-22405-8_5
- Chew-Yean. (2015). Emotion Detection and Recognition from Text Using Deep Learning. *Machine Learning Blog*.
- Dey, R. K., Sarddar, D. R., Sarkar, I., & Bose, R. (2020). On Sentiment Analysis Techniques Involving Social Media And Online Platforms. *International Journal Of Scientific & Technology Research Volume, 9(5)*.
- Eun H.P. & Veda C.S. (2023). Emotion Ontology Studies: A Framework for Expressing Feelings Digitally and its Application to Sentiment Analysis. *ACM Comput. Surv. 55*. doi:10.1145/3555719
- Fricke, M. (2009). *Sentiment Analysis on Social Media* (Vol. 35). The University of Arizona. doi:10.1177/0165551508094050
- Guo, J. (2022). Deep learning Approach to Text Analysis for Human Emotion Detection from Big Data. *Journal of Intelligent Systems, 31(1)*, 113–126. doi:10.1515/jisys-2022-0001
- Machová, K., Szabóova, M., Paralič, J., & Mičko, J. (2023). Detection of emotion by text analysis using machine learning, *Front. Psychol. Frontiers in Psychology, 14*, 1190326. doi:10.3389/fpsyg.2023.1190326 PMID:37799520

- Nandwani, P., Verma, R. (2021). A review on sentiment analysis and emotion detection from text. *Soc. Netw. Anal. Min.*, 11, 81. doi:10.1007/s13278-021-00776-6
- Panguila, K. F. M., & Chandra, J. (2019). Sentiment Analysis on Social Media Data Using Intelligent Techniques. *International Journal of Engineering Research and Technology. International Research Publication House*, 12(3), 440-445. https://www.rpublication.com/irph/ijertv19/ijertv12n3_20.pdf
- Peng, S., Cao, L., Zhou, Y., Ouyang, Z., Yang, A., Li, X., & Yu, W.S. (2022). A survey on deep learning for textual emotion analysis in social networks, *Digital Communications and Networks*, 8(5), 745-762. doi:10.1016/j.dcan.2021.10.003
- Ramalingam, V. V., Pandian, A., Jaiswal, A., & Bhatia, N. (2018). Emotion Detection from text, *National Conference on Mathematical Techniques and its Applications (NCMTA 18) IOP Conf. Series: Journal of Physics: Conf. Series 1000 012027*. IOP Science. , <https://iopscience.iop.org/article/10.1088/1742-6596/1000/1/012027/pdf> doi:10.1088/1742-6596/1000/1/012027
- Shivhare. S. (2015). Emotion Detection from Text. *Conference: Data Mining and Knowledge Management Process (DKMP 2012)*. Research Gate. ,(PDF)https://www.researchgate.net/publication/225045375_Emotion_Detection_from_Text doi:10.5121/csit.2012.2237
- Zad, S., Heidari, M., Jones, J. H. J., & Uzuner, O. (2021). Emotion Detection of Textual Data: An Interdisciplinary Survey, *IEEE World AI IoT Congress (AIIoT)*. IEEE. 10.1109/AIIoT52608.2021.9454192

ADDITIONAL READING

- Alaoui, I., Youssef, G., Chaai, Y., & Messoussi, R. (2018). *A novel adaptable approach for sentiment analysis on big social data*. Research Gate. https://www.researchgate.net/publication/323642334_A_novel_adaptable_approach_for_sentiment_analysis_on_big_social_data
- Gupta, I. & Joshi, N. (2019). Enhanced Twitter Sentiment Analysis Using Hybrid Approach and by Accounting Local Contextual Semantic. *Journal of Intelligent Systems*. <https://www.degruyter.com/document/doi/10.1515/jisys-2019-0106/html?lang=en>
- Bakshi, R., Kaur, N., Kaur, R., & Kaur, G. (2016). *Opinion mining and sentiment analysis*. IEEE. (<https://ieeexplore.ieee.org/document/7724305>)
- MonkeyLearn. (n.d.). Sentiment Analysis and Machine Learning. *Monkey Learn*. https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjFzO-Wwt71AhW_wzgGHVU4C9gQFnoECAQQAQ&url=https%3A%2F%2Fmonkeylearn.com%2Fblog%2Fsentiment-analysis-machine-learning%2F&usg=AOvVaw2t8P5fCMYfZ1qRLrdOu_zh
- Data Flair. (n.d.). Sentiment Analysis in Python using Machine Learning. *DataFlair*. (https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjFzO-Wwt71AhW_wzgGHVU4C9gQFnoECCIQAQ&url=https%3A%2F%2Fdata-flair.training%2Fblogs%2Fpython-sentiment-analysis%2F&usg=AOvVaw2VKvvLeJq6MgGPKJfVTW80)

Application of Pipelining With ML to Authenticate Emotions

Sanchez-Rada, J. & Iglesias, C. (2019). *Social context in sentiment analysis: Formal definition, overview of current trends and framework for comparison*. Science Direct. (<https://www.sciencedirect.com/science/article/pii/S1566253518308704>)

Data Robot. (n.d.). Using machine learning for sentiment analysis: a deep dive. *Data Robot*. (<https://algorithmia.com/blog/using-machine-learning-for-sentiment-analysis-a-deep-dive>)

KEY TERMS AND DEFINITIONS

Naive Bayes: Naïve Bayes Classifier is one of the simple and most effective Classification algorithms which helps in building the fast machine learning models that can make quick predictions. It is a probabilistic classifier, which means it predicts on the basis of the probability of an object.

Unsupervised Algorithm: The goal of unsupervised algorithm is to find the underlying structure of the dataset, group that data according to similarities, and represent that dataset in a compressed format.

APPENDIX

Data Sets

Figure 21. Sample dataset one

tweet_id	sentiment	content
1956967341	empty	@tiffanylue I know I was listenin to bad habit earlier and I started freakin at his part =]
1956967656	sadness	Layin n bed with a headache ughhhh... watch on your cat...
1956967696	sadness	Funeral ceremony... gloomy friday...
1956967789	enthusiasm	wants to hang out with friends SOON!
1956968416	neutral	@dannycastro We want to trade with someone who has Houston tickets, but no one will.
1956968477	worry	Re-pinging @ghostinoh14: why didn't you go to prom? BC my bf didn't like my friends
1956968487	sadness	I should be sleep, but im not thinking about an old friend who I want, but he's married now. damn, & he wants me 2 scandalous!
1956968636	worry	Wmmmm. http://www.ghero.com/ is down
1956969035	sadness	@charvray Charlene my love, I miss you
1956969172	sadness	@ketcouch I'm sorry... at least it's Friday?
1956969456	neutral	can't fall asleep
1956969531	worry	Choked on her retainers
1956970047	sadness	Light I have to beat this stupid song to get to the next... nabe!
1956970424	sadness	@BrodyJenner if u watch the hills in london u will realise what torture it is because were weeks and weeks late. I just watch fortnite!
1956970650	surprise	Got the news
1956971077	sadness	The storm is here and the electricity is gone
1956971170	love	@burnsopeken signed
1956971206	sadness	So sleepy again and it's not even that late. I fall once again
1956971473	worry	@DenzHilton lady gaga tweeted about not being impressed by her video leaking just so you know
1956971585	sadness	How am YOU convinced that I have always wanted you? What signals did I give off... damn I think I just lost another friend
1956971981	worry	@raaaaaaah oh too bad! I hope it gets better. I've been having sleep issues lately too
1956972097	fun	Wondering why I'm awake at 7am writing a new song plotting my evil secret plots muahahaha... oh damn it, not secret anymore
1956972116	neutral	No Topic: Maps talks at the Baisage Markup Conference 2009. Program online at http://tr.im/mk62 (via @bobdc) #topictags
1956972270	worry	I ate Something I don't know what it is... Why do I keep Telling things about food
1956972359	sadness	so tired and I think I'm definitely going to get an ear infection... going to bed "
1956972444	worry	On my way home n having 2 deal w underage girls drinking gin on its bus while talking bout keggens... damn I feel old
1956972557	sadness	@isaacMascotte I'm sorry people are so rude to you, Isaac, they should get some manners and know better than to be so lewd!
1956972884	worry	Damn servers still down. I need to hit 80 before all the kopers pass me
1956973568	sadness	Fudge... Just BS'd that whole paper... So tired... Ugh I hate school... time to sleep!!!!!!!
1956973690	worry	I HATE CANCER. I HATE IT I HATE IT I HATE IT.
1956974706	hate	It is so annoying when she starts typing on her computer in the middle of the night!
1956975441	neutral	@cynthia_123 I can't sleep
1956975860	neutral	I missed the t'm'y bus!!!!!!!
1956975876	neutral	feels strong contractions but wants to go out. http://plurk.com/plurkdc
1956975927	neutral	SoCall: stoked, or maybe not... tomorrow

Figure 22. Sample dataset two

195698767	sadness	@antfuiddga I love those 'f'sakey' USB sticks. We only have the 4GB in Australia
1956987381	worry	fresh prince and sleepy sleeps my nightly routine... gotta go to Dmv early tmrw
1956987600	hate	dammit! hulu desktop has totally screwed up my ability to talk to a particular port on one of our dev servers, so I can't watch and code
1956987828	worry	@emmarie I am jealous of your mom talking to @taylorswt13. I want to see you all out twittering is making me miss you
1956987904	worry	I can't sleep... I keep thinking about the puppy I played with today
1956987950	worry	... I'm supposed to be sleep. But I got some much to do. &
1956988145	neutral	@lepetitagneau what's going on sweetheart?
1956988218	neutral	How can it be so freaking difficult to get a system-wide spellchecker? Shit, I'd settle for an office suite one. Stupid unhelpful Windows
1956988223	worry	Last one month due to summer, strawberry is not available in the Chermal markets!
1956988477	neutral	@willxomobb work at 6am. Gotta go to bed soon
1956989093	love	@RobertF3 correct! I ADORE Him. I just plucked him up and put him under my arm cuz he was cryin. All better now! Hahaha
1956989514	sadness	@sweetnspicy hii im on my pod... i can't fall asleep
1956989526	sadness	dont wanna work 11-830 tomorrow but I get paid
1956989560	sadness	feels sad coz I wasn't able to play with the guys!!! http://plurk.com/plurkdc
1956989561	neutral	PrinceCharming
1956989601	hate	@cayogal I wanted to come to BZ this summer / not so sure anymore... a teacher's life in the summer SUCKS
1956989814	worry	First ever dropped call on my mobile. On a call to @Telstra no less! (being charged for data even though I have a data pack)
1956990288	hate	@migenius23 You win... SiGH Rakeem
1956990413	neutral	Oh is that time for real?
1956990568	sadness	Dam these allergies! I don't like this time of year because of this! I never used to have this problem either
1956990729	worry	Oh no one minute too late! Oh well
1956991009	hate	@soviet_star Damn, that sucks
1956991673	sadness	@cayogal I wanted to come to BZ this summer / not so sure anymore... a teacher's life in the summer SUCKS
1956991704	hate	@mikycyrus THIS WEBSITE GAVE ME A VIRUS! When I opened it more windows kept PCOPPING up
1956991723	worry	shh! big scary bug flying around my room!!!!
1956992030	sadness	I wish she knew what she puts me through. She stole my heart, never gave it back... and occasionally she likes to be like look what I have!
1956992144	worry	is up with a nasty cough I can't be sick I have a huge weekend ahead of me
1956992349	neutral	@justamedicine That was stone cold. Crazy... ?
1956993007	boredom	im so tired
1956993080	neutral	shit time. bye brocham waaaaahhhhhh!!! http://plurk.com/plurkdc
1956993206	neutral	@melbournegirl I'm sure some1 will cum out and play. I'm workin through it! midnight.
1956994067	neutral	@necreativeone I second that. I wish it rained more where I am
1956995196	sadness	@neesabear early happy day of birth in case I don't make it! Very tired from therapy today n just taking my medicine! misshuf Love ya!
1956995505	neutral	damn it were is Eric or anyone else when you need your hair to be played with
1956995679	neutral	I'm feel deflated. Ugh. No more dog
1956995762	sadness	Allergies suck ducks nuts... <
1956995852	neutral	Well it almost was a good day... Guess I just retry tomorrow

Application of Pipelining With ML to Authenticate Emotions

Figure 23. Sample dataset three

1957006245	sadness	@heresmyhobo2 We hate change, so of course. Write fans for life. &E:3 Oh and if we havint met Rob by then something went horribly wrong.	
1957006307	worry	is feeling sad... for some reason. http://pkurk.com/p/waj3	
1957006547	sadness	well fuck. this new pain med has an odd warning that actually applies to me. i can't take this. <han is displeased.	
1957006674	sadness	just uploaded my new blog... a painful story about an 80s year old man who cried because he wanted to die... very sad	
1957006725	neutral	@juneyae i don't think so. I WANT DETAILS.	
1957006830	neutral	@jackgraynm Hi...!!! Who is Mary Poppins???	
1957006947	worry	@jaychuck its so addicting, but its kind of a curse to do them at night time. Everytime i do one, i feel like making music afterwards	
1957007167	neutral	my last tweet didn't send. bad phone	
1957007268	fun	@rely1 OMG Ur alive!!! LOL. 2day has gone sooo slow. i'm going insane Grrr You doing anything tonight?	
1957007357	empty	Have a headache. i'm going to bed. Goodnight!	
1957007394	neutral	@taidomi i was watching Parental Control	
1957007437	fun	@JessiJaeJoplin did you get them from california vintage? ahahah they have the BEST dresses. i want them but i dont have ebay	
1957007633	sadness	I just saw pics from this past Thanksgiving and am sad because Grandma was in them.	
1957007881	worry	@jetronic it wont let me	
1957008075	sadness	Took a shift tomorrow. I dont really feel like working right now.	
1957008193	sadness	but now i have no money for a phone	
1957008287	worry	Spent last night in A&amp;	E (ER), W
1957008292	worry	@TheLastDoctor 9 days. i'm about ready to visit Torchwood and see if they've heard anything	
1957008434	surprise	@Bam morley where are you? In Bris? i can't hear any thunder	
1957008478	surprise	bec vs fat food -- winner = fat food but not this weekend. i bear it!	
1957008498	sadness	Too bad the Red Devils... disappointing to say the least	
1957008766	surprise	I had a dream about a pretty pretty beach and there was no beach when I woke up	
1957008802	sadness	@xqjo Have a 3ware 9650SE, not fast enough for 3x X25-M SSD RAID5. 800Mhz IOP on the HPT. Might try an Adaptec 5405 (1.2Ghz).	
1957008887	surprise	when da heck will the garage man get here i ask you. WHEN.	
1957009454	worry	Ate Mandy, please forgive me. I really am sorry. I dont wanna lose my Bff	
1957009666	hate	@mefullsyew Umm yeah. That's probably a pretty good note to self because eeeeeewwwwwww.	
1957010072	worry	why are plane tickets so expensive	
1957010329	fun	@wendysastar @mefullsyew Umm yeah. That's probably a pretty good note to self because eeeeeewwwwwww.	
1957010415	worry	Needs a job BADLY!!!	
1957011291	sadness	@AlexanderWhite dsaammminnnn i do wish i was there.	
1957011738	worry	Went to Di Bolla coffee masters today and asked for a job... The person i needed to speak to is on holiday... :f0	
1957012476	sadness	@yuki_hime i played up until the latter parts of the voodoo village part co-op until i lost my usual partner	
1957012535	empty	@CymaDva23 Nite. Now i'm up n bored as opposed to almost sleep i'm b 4	
1957012769	sadness	is a bad friend	
1957013149	neutral	@ncpblatch happy birthdayy! hope you have an awesome day. didnt see you at next last night!	

Figure 24. Sample dataset four

1957002144	surprise	epq_san on no. "hugs"	
1957002127	neutral	@oxygen1705 bored now because i was talking to someone but now they're busy with something else. just kinda a bummer. idk	
1957002228	sadness	@rosnayzers i knowe. things won't be the samee &E	73
1957002539	worry	OMG-nees it's 11:18 pm and i need to beup early to set up my garage sale it starts a Bam. wish i said 9em. i'm beat.	
1957003043	happiness	@vinyfickian i kno i dooooo!!!!!! yaf party'n with out me	
1957003103	worry	Okay, so twitter suddenly changed, how do i respond to messages now	
1957003219	neutral	ugh... my dad just told me to read an article about Kavya Shivshankar the spelin bee girl, and be more like her.	
1957003308	worry	Decided that no matter how good my hair looks curly it doesn't justify the burn i get from the curler! My hands covered. I suck at it!	
1957003376	sadness	Going to sleep. Gonna fall asleep playing apps again. Timre is going to suck	
1957003385	neutral	@The@Collecte YEA I GOTTA BE UP AT 7:30	
1957003387	hate	I hate when my bf beats aa dogs. But i guess that the only way to teach these pits.	
1957003391	worry	spained my ankle. like really badly and tore some stuff. & hurt! and its my birthday weekend	
1957003420	sadness	I can't believe the Metal Gear Solid song was stolen. i'm so disappointed. http://bit.ly/YKK5u	
1957003489	hate	think i may have broke a toe at the bar tonight... thanks drunk girl for stepping all over me!!!!	
1957003484	neutral	Not one sale done today at work. Exploded balconies in the bag theater w coworkers. A fun day, but void of chll files and tips.	
1957003486	sadness	@MacZombieRaeer i wish i had Left 4 Dead. But first i'd need something to play it on.	
1957003480	neutral	@silybabyjule me too	
1957003483	neutral	@digenes that story reminds of living in Portugal	
1957003419	neutral	@hicks_yours diabetic? so is my dad. & i might be too, not sure. are you still allowed to eat sugar throughout the day?	
1957003564	happiness	I spilled my beer all over my leg. Wasted half my beer. Home now. I met a cute girl. Good conversation.	
1957003590	hate	my roommate @ness_sckie kxvas to ignore me	
1957003683	neutral	@SuperFiasco i'll make him nachos tomorrow. Better than if he would have made them himself.	
1957007465	neutral	@MyDailyRoutine yeahhh. &	dont judge my pillow
1957007860	retief	Scary lightning and thunder. i'm glad it's over now. Going to sleep. i hope i'm not late to school tomorrow again. Haha	
1957008324	sadness	my teeth and head hurts	
1957008399	sadness	I HATE rob zombie movies. &	the smell of weed. Yammmm

Coding Screenshot

Figure 25. ROC curve with different thresholds of the ML classifier



Figure 26. Calculating the precision and recall and plotting the ROC curve of them



Application of Pipelining With ML to Authenticate Emotions

Figure 27. Plotting confusion matrix for the ML classifier



Figure 28. Comparison of different classifiers according to their accuracies

