

Sentiment Analysis of Public Reaction towards Pakistan Democratic Movement

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Abstract- This paper performs the sentiment analysis on tweets and social media posts of general people of Pakistan about one of Pakistan's political party i.e. Pakistan Democratic Movement (PDM). PDM is a political movement comprised of 11 political parties of Pakistan founded against the current government of Pakistan. This paper focus on analyzing the sentiments of common Pakistanis towards PDM. Sentiment analysis is also called opinion mining or text mining. It is a way to find out public opinion and their reaction towards a particular entity or a topic. In the proposed system, data is extracted from Facebook using instant data scraper, and also tweets from twitter were extracted using twitter API. The data was extracted based on the query: current situations in Pakistan i.e. Pakistan Democratic Movement. This paper focuses on mining social media comments written in different languages and mostly in English. After pre-processing, data is labelled manually using 5 emotions which are agree, disagree, neutral, sarcastic and angry. After labeling the data several algorithms are used like support vector machines, Long Short Term Memory (LSTM) and Convolutional Neural Network (CNN) to classify the tweets/ posts.

Index Terms-- sentiment analysis, LSTM, CNN, reaction analysis, emotion detection

I. INTRODUCTION

The advancements in technology such as wireless networks [6], cloud computing [5], growth of big data [19] and development of novel algorithms in machine learning have enabled the use of computing technology to process, consume and understand the natural text. A natural language unlike a formal language is imprecise and highly context dependent. However, the emergence of models such as TF-IDF approaches, support vector machines and long short term memory (LSTM) have enabled the analysis and comprehension of text [4]. Sentiment analysis also called opinion mining or text mining, is a way to find out public opinion and their reaction towards a particular entity. The entity can be individual person, a product or any topic. Sentiment analysis is a sub topic of natural language processing that deals with the emotions which is expressed in text. Today the people around the world is interconnected through the internet, people use big platforms such as twitter, Facebook, YouTube to express their feeling towards particular entity, thus providing vast amount of data that will be used for analysis and quality information.

Sentiment analysis finds out some attributes when analyzing public opinion like: polarity (opinion expressed by a person is either positive or negative), subject (to which thing people are

expressing their opinions) and opinion holder (who is expressing the opinion?). The objective of this paper is to find out emotions / sentiments of general public about Pakistan democratic movement (PDM) [7]. PDM is a political movement comprised of 11 political parties against the Prime Minister of Pakistan Imran Khan led by Maulana Fazalur Rehman supported by two political parties the Pakistan Muslim League (N) and the Pakistan Peoples' Party. PDM's main agenda is based on the result of the general election 2018, in which Imran Khan led PTI was able to form a coalition government with other political parties like MQM, PMNL (Q) and other non PDM parties. PDM political movement however, is continually shifting from one agenda to another. It has been several months since the inception of this movement but all together 11 parties still didn't managed to acquire any substantial political success in any form.

In this paper, the authors have extracted social media tweets from social platforms and then analyzes it to determine the emotions of people. This paper focuses on mining social media comments primarily written in English. We are interested in seeing the behaviors and sentiments of people about the current situation of Pakistan Democratic Movement (PDM), analyzing people's opinions and what they thinking about the PDM in



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their tweets/comments on social media. The collected tweets will be subjected to preprocessing to bring the data in required format. After pre-processing, data is labelled manually using 5 emotions which are agree, disagree, neutral, sarcastic and angry. After labeling the data several algorithms are used like support vector machines, Long Short Term Memory (LSTM) and Convolutional Neural Network (CNN). The major contributions of this paper are multi-fold:

- To develop a novel data set for analysis of sentiments specifically for Pakistan's context
- To perform exploratory data analysis to understand people's emotions towards the political party
- To classify peoples' emotions using well-known machine learning algorithms

The rest of the sections of the paper has been organized as follows. The next section presents the related work. It is followed by methods and results. The paper concludes with discussions, findings of this research and future work.

II. LITERATURE REVIEW

In literature, there has been a significant amount of research on sentiment analysis [13,20]. A review on opinion mining and sentiment analysis can be seen in [18]. [21] worked on sentiment analysis of controversial topics on Pakistan's twitter user-base. The authors highlighted the hot topic running on in country and do sentiment analysis based on these topics. They collected data from twitter using these hashtags and analyzed community's influence score. They used retweets graph to perform the sentiment analysis and calculated score using klout influence score.

[8] worked on opinion and emotion mining for Pakistan general election 2018 on twitter data. They collected data against three main political parties. They used word cloud frequency histogram and word association graphs to show the public opinion. In the same way, they used cluster Dendrogram's graphs to show various types of analysis.

The authors in [16] analyzed the users' engagement of Gojek, Grab, and Uber in Indonesia. Sentiments analysis of twitter data was performed in [15] assuming that data primarily on these platforms are unstructured in nature. A model was proposed that can perform sentiment analysis of data scrapped from twitter platform. In another research, airport service quality was measure based on sentiment analysis for London Heathrow airport's Twitter account dataset. These analysis provide significant insights that can be used to improve airport service quality.

In various studies, machine learning has been used to perform sentiment analysis. For instance, [11] and [2] have used deep learning based convolutional neural network for analysis of sentiments. It is hypothesized that machine learning can outperform other techniques and three machine learning classifiers i.e. Naive Bayes, maximum entropy classification, and support vector machines have been used in [12]. Another innovation in recent years is the use of recurrent architecture

such as recurrent neural network (RNN) and long short term memory models (LSTM) for text data. In this direction, various researches have employed recurrent neural network for sentiment analysis [11]. A combination of supervised and unsupervised machine learning techniques have been used in [10] for sentiment analysis.

During elections that were held in 2016 in US, sentiment analysis was done to measure people opinions towards the policy announcements. Sentiment analysis was used to inquire sentiment of tweets by two presidential candidates of US named Donald Trump and Hillary Clinton with approximately 2.5 million tweets by users of Twitter during the elections. Short texts were examined to determine how accurately Twitter represents opinion of public related to elections. Behavior of twitter users were also examined to determine whether they used Twitter platform to give authentic and original opinion and to see whether tweets are repeated again and again. Sentiment of tweets of both candidates were observed and it was resulted that Donald Trump had more positive sentiment than Hillary Clinton as mentioned by users of Twitters and she won the US elections.

III. METHODS

Fig 1 shows the workflow of sentiment analysis. Listing 1 shows the details in pseudo code format. The public tweets are extracted via web scrapping, which are then processed, labelled manually and then machine learning is used for classification [14]. Following paragraphs discuss the details.

LISTING 1: Pseudo code describing the details of Proposed work

```

1. ScrapData()
2. Preprocessing()
3. ModelTraining()
4. Evaluation()

```

Procedure Preprocessing()

Begin

```

    Tokens = Tokenization()
    StopWrodRemoval(Tokens)
    RemovePunctuation(Tokens)

```

End

Procedure ModelTraining()

Begin

```

    BuildModel()
    CompileModel()
    Fit()

```

End

A. DATA PROCESSING

To collect data from Facebook, we used instant data scraper which is an extraction tool to extract data from any website. Data from Twitter is extracted using Twitter API's. Queries are used on backend to find out the related data. Following trends were extracted:

- PDM , the name of the alliance
- roPMLNro, PML is the name of the party in opposition
- WeRejectPDM, some one against PDM rejecting the alliance
- BanPTI, PTI is the party against whom PDM is formed
- PDM2020-21, the current year

These trends help to scrap related data. The Data from Facebook and Youtube are scrapped from posts. Any new channels' post related to PDM Jalsa are used to find out the related data. The extracted data is then saved into CSV files. The data collected from Facebook contains lot of stop words, punctuations so we need to convert data into required format.

The data is then manually labelled using 5 labels (agree, disagree, neutral, sarcastic and angry). Each comment is labelled after reading every single comment and then assigned a category. After extracting and labeling the data in CSV files, pre-processing is done in data. It includes tokenization, Urdu stop words removal, removing punctuations, stop words, hash tags. To remove stop words, punctuations NLTK libraries were use. Following are the major steps performed at this stage:

- Data processing – Remove Punctuation
- Tokenize - Encode the words and labels
- Training, Test Dataset Split

Word cloud of Facebook and Twitter extracted data is generated using python libraries Word Cloud which is a way to represent text data in a fancy way. In word cloud, size of each word shows significance and frequency in the document.

B. SENTIMENTS' CLASSIFICATION USING MACHINE LEARNING

The next step is the sentiments' classification using machine learning. Following algorithms were selected: support vector machine, long short term memory and convolutional neural network. Support vector machine (SVM) is a supervised machine learning algorithm which can be used for classification and regression. The objective is to find decision boundary as a hyper plane in high dimensional space. Kernel can be used to enable high dimension calculation on low dimension.

Long short-term memory (LSTM) is one of the modified architecture of Recurrent Neural Network (RNN) mostly used in the field of deep learning. Unlike standard feed forward neural networks, LSTM has feedback connections as well. To resolve vanishing gradient problem, an additional carry signal controlled through various gates is used to handle long term dependencies.

Convolutional neural network (CNN) is used primarily for image data. It comprises convolution and max-pooling layers. However, it has been used for sequence processing as well. The convolution layer is used to perform dot product of kernel and data over a sliding window. In this way, local features are extracted from data. Max pooling divides the data in to patches and extract maximum from each patch. As compared to LSTM, CNN is light-weight and is sometimes preferred over LSTM.

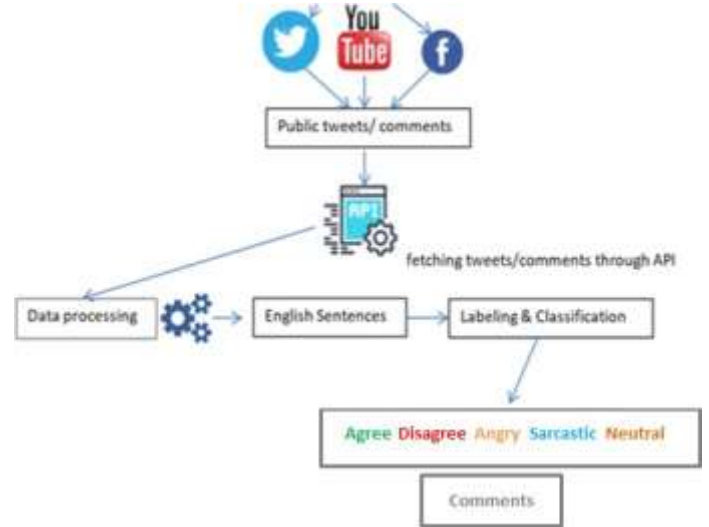


FIGURE 1: Workflow of Sentiment Analysis

IV. IMPLEMENTATION DETAILS

A range of machine/ deep learning models were used for sentiment analysis. For SVM, linear kernel is used to calculate the training and prediction time and then testing the trained model. For LSTM, Figure 2 shows the implementation. A combination of embedding and LSTM is first used to extract the features. Embedding helps in vectorization of text data. Then dense layer is used in the end to perform classification. Figure 3 shows the design of CNN model for this research. A combination of convolution and max-pooling is used for feature extraction which is followed by dense and softmax for classification.

Input (None,100)
Embedding (None,100,50)
LSTM (None,64)
Dense (None,256)
ReLu
Dropout
Dense
Softmax

FIGURE 2: Proposed design for LSTM

Input
Embedding
Convolution (20, 2)
Convolution (20, 3)
Convolution (20, 4)
GlobalMaxPooling()
Dense
ReLu
Dropout
Dense
Softmax

FIGURE 3: Proposed design for CNN

V RESULTS

This section presents the results of the various experiments conducted to evaluate the efficacy of proposed solution.

A. EXPLORATORY DATA ANALYSIS

As the first step, the data were explored using various analytical techniques. Figure 4 and 5 show the word cloud of Facebook and twitter extracted data. There are two types of opinions i.e. extremely positive and extremely negative. The negative sentiments are based on following popular words such as chor (i.e. thief), reject; while the positive sentiments are based on words such as nice, Masha Allah.



FIGURE 4: Word Cloud of Facebook extracted Data

Next, the demographics of the users (who are giving their opinion) are extracted. So, the locations of users were gathered. There were 941 distinct locations from where users are posting on social media. Figure 6 shows the top ten cities based on the posts. It can be seen that people of Lahore are most vibrant in positing about PDM. It is because the two largest parties of Pakistan i.e. PTI and PML (N) have strong basis in Lahore. Also, Karachi is one of the largest city and people of Karachi are also concerned about PDM. We also gathered number of views of different channels for PDM Jalsa (political show) coverage. It shows which channel has the highest number of views related to PDM. Fig. 7 shows the number of views of different channels.



FIGURE 5: Word Cloud of Twitter extracted Data

B. CLASSIFICATION

Different types of classifiers were used for predicting the sentiments of people. Table 1 shows the hyperparamter of the models. Figure 8 shows the count of the data labels. Most of the labels are for angry i.e. people are mostly not happy with the instable condition. Figure 9 shows the performance of SVM classifier in the form of confusion matrix used for predicting sentiments. It is found that an accuracy of 71.13% is obtained with SVM.

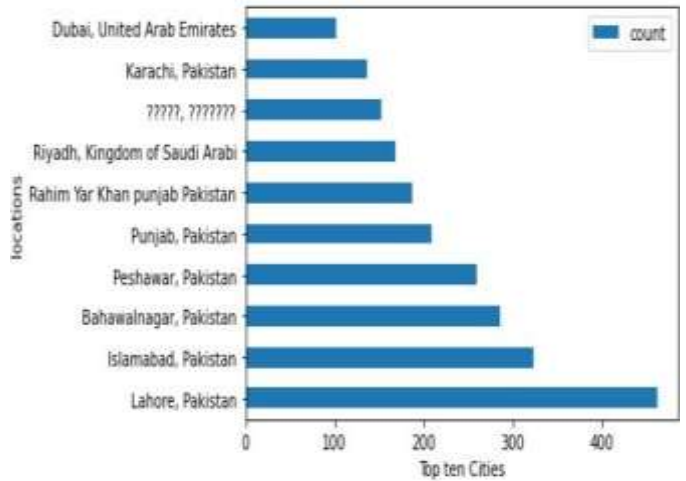


FIGURE 6: Demographics of users

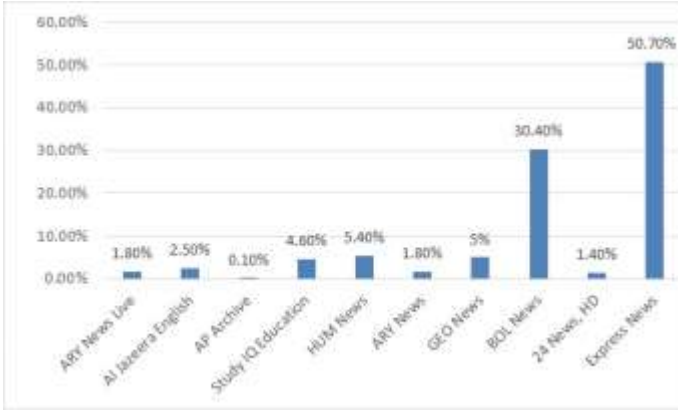


FIGURE 7: Total views on each channel, mentioned in legend

TABLE 1: Hyper-parameters of the model

Hyperparamter	Value
Optimizer	Adam
Loss	Categorical cross entropy
Epochs	10
Learning rate	0.01

We have then used LSTM and CNN both for classification of sentiments' data as the data is textual and termed as sequential data. So, LSTM and CNN are hypothesized to be useful for classification of sentiments data. Fig. 8 shows the accuracy and loss graph for LSTM. Using LSTM, a training accuracy of 78.56%, while the testing accuracy of 73.50% have been achieved. For CNN, our network was trained for 10 epochs and got the training accuracy of 81.77% while the validation accuracy on the same epoch is 71.01% which can be seen in Fig 9. Test accuracy of the model is 72.34%.

VI. DISCUSSION ON RESULTS

As seen in the graph that CNN is showing better results as compared to LSTM and SVM. As the data is limited data, LSTM model shows overfitting behavior. Although both models have same optimizer (Adam), same activation function (ReLU) and softmax function on the output layers, the network design effects methods of feature extraction and learning pattern. Both models were run for 10 epochs to see the difference and we can see that LSTM achieve 78.56% accuracy on training and 73.50% for testing; while CNN is achieving 81.77% on training, 71.01% validation and 72.34% testing accuracy.

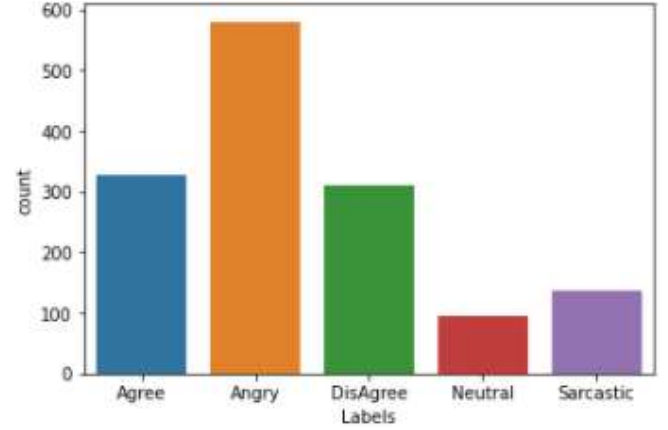


FIGURE 8: Category count for various sentiments in dataset

accuracy	71.1340206185567			
	precision	recall	f1-score	support
Angry	0.80	0.90	0.85	70
Agree	0.74	0.84	0.79	102
DisAgree	0.62	0.69	0.65	67
Sarcastic	0.75	0.14	0.23	22
Neutral	0.50	0.30	0.37	30
accuracy			0.71	291
macro avg	0.68	0.57	0.58	291
weighted avg	0.70	0.71	0.69	291

FIGURE 9: Confusion matrix of sentiment analysis based on SVM

VII. CONCLUSION

Sentiment analysis is a way to know the opinion of people about a particular entity or a subject. This paper is about the sentiment analysis of a Pakistan's political party i.e. PDM. The sentiment categorization of gathered data has been done by implementing the three machine learning models (SVM, LSTM and CNN). The model was trained using Adam optimizer with a learning rate of 0.01 for 10 epochs. The training took almost 1 hour. From the observations, it can concluded that LSTM model outperforms in accuracy on test dataset for multiclass classification. In particular, the accuracy score of LSTM% is 73.5, while for CNN it is 72.34%, whereas the accuracy score for SVM is 71.13 %.

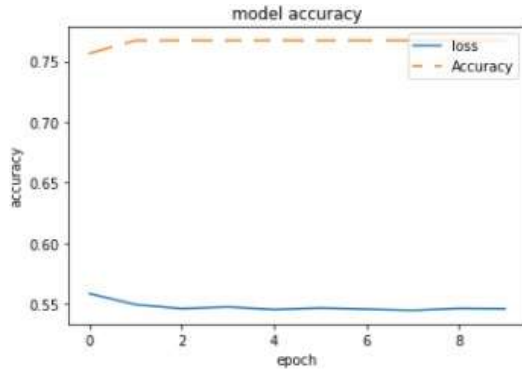


FIGURE 10: Accuracy and loss graph for LSTM

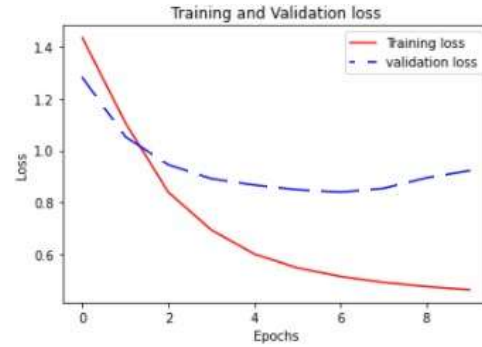


FIGURE 11: Training and validation loss graph for CNN Model

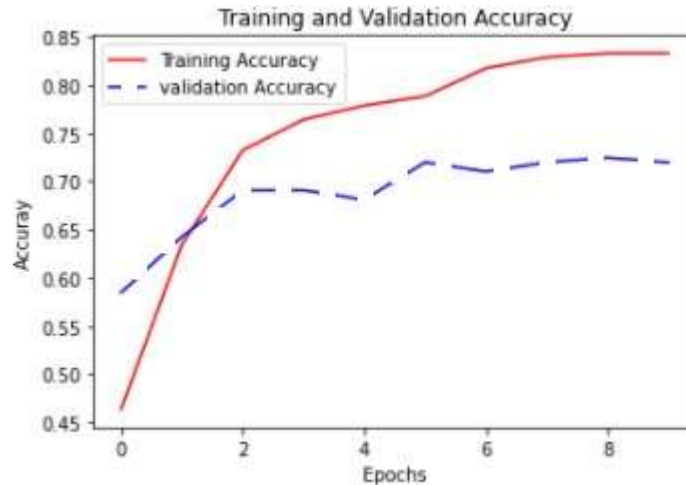


FIGURE 12: Training and validation accuracy graph for CNN Model

REFERENCES

- [1] Timmaraju, A., V. Khanna. "Sentiment Analysis on Movie Reviews using Recursive and Recurrent Neural Network Architectures". 2015. Department of Electrical Engineering, Stanford University, Stanford, CA
- [2] Dos Santos, C., Gatti, M. "Deep convolutional neural networks for sentiment analysis of short texts." In Proceedings of the COLING 2014, the 25th International Conference on Computational Linguistics: Technical Papers, Dublin, Ireland, 23–29 August 2014. pp. 69–78.
- [3] Miedema, F., S. Bhulai. "Sentiment Analysis with Long Short-Term Memory networks", Vrije Universiteit Amsterdam, August, 2018.
- [4] Islam, N., Shaikh, A., Qaiser, A., Asiri, Y., Almakdi, S., Sulaiman, A. and Babar, S. A. "Ternion: An Autonomous Model for Fake News Detection". *Applied Sciences*, 2021. vol 11, no. 19, p.9292.
- [5] Islam, N., & Rehman, A. "A comparative study of major service providers for cloud computing". In proceedings of 1st International Conference on Information and Communication Technology Trends, September 2013, Federal Urdu University, Karachi, Pakistan.
- [6] Islam, N., Shaikh, N. A., Ali, G., & Shaikh, Z. A. Aqeel-ur-Rehman, "A Network Layer Service Discovery Approach for Mobile Ad hoc Network Using Association Rules Mining. *Australian Journal of Basic and Applied Sciences*, 2010, pp. 1305-1315.
- [7] Jamali, Y., and S. Hussain. "Analyzing Negativity in Democratic Media Setup: Case Study of PDM." *Global Mass Communication Review*. 2021. vol. VI. pp. 149-160
- [8] Khan, S., Moqurrab, S.A., Sehar, R. and Ayub, U. . "Opinion and Emotion Mining for Pakistan General Election 2018 on Twitter Data." In Proceedings of International Conference on Intelligent Technologies and Applications. Springer, Singapore, 2018.
- [9] Domingo, M., J. Carlos Mart'in, and Glen Mandsberg. "Social media as a resource for sentiment analysis of Airport Service Quality (ASQ)." *Journal of Air Transport Management* 2019 vo. 78. pp. 106-115.
- [10] Maas, A. L., Daly, R. E., Pham, P. T., Huang, D., Ng, A.Y., and

- Potts, C. "Learning word vectors for sentiment analysis". In Proceedings of the 49th Annual Meeting of the Association for Computational Linguistics: Human Language Technologies, June 2011
- [11] Nogueira dos Santos, C., Gatti, M. "Deep Convolutional Neural Networks for Sentiment Analysis of Short Texts". In Proceedings of International Conference on Computational Linguistics August 2014, Ireland. pp. 69-78.
 - [12] Pang, B., Lee, L., Vaithyanathan, S.. "Thumbs up! Sentiment classification using machine learning techniques". In Proceedings of the 2002 Conference on Empirical Methods in Natural Language Processing, July 2002 pp. 79–86, USA
 - [13] Patel, A.P., Patel, A.V., Butani, S.G. and Sawant, P.B.. "Literature Survey on Sentiment Analysis of Twitter Data using Machine Learning Approaches". *IJIRST-International journal for Innovative Research in Science & Technology*, 2017, vol. 3, no. 10, pp. 19-21
 - [14] Srivastava, P.. "Essentials of Deep Learning: Introduction to Long Short Term Memory", December 10, 2017.
 - [15] Sahar A.El Rehman, Feddah Alhumaidi AlOtaibi, Wejdan Abdullah Al-Shehri "Sentiment Analysis of Twitter Data" In Proceedings of International Conference on Computer and Information Sciences, April 2019 IEEE , Saudia Arabia
 - [16] Saragih, M. H., and A. S. Girsang. "Sentiment analysis of customer engagement on social media in transport online." In Proceedings of 2017 International Conference on Sustainable Information Engineering and Technology (SIET). IEEE, Nove 2017., Baltu
 - [17] Mullen, T., & Collier, N. Sentiment analysis using support vector machines with diverse information sources. In Proceedings of the 2004 conference on empirical methods in natural language processing 2004. pp. 412-418
 - [18] T. Shaikh and D. Deshpande "A review on opinion mining and sentiment analysis," in IJCA Proceedings on National Conference on Recent Trends in Computer Science and Information Technology, no. 2, 2016, pp. 6-9.
 - [19] Usmani, Shan, Kamran, S., Zeeshan, M, Islam, N. Khan, Z. "A comparative analysis of apriori and FP-growth algorithms for frequent pattern mining using apache spark", In Proceedings of International Scientific Research Conference. 2021. Azerbaijan
 - [20] Yujiao, L.; Fleyeh, H. "Twitter Sentiment Analysis of New IKEA Stores Using Machine Learning". In Proceedings of the International Conference on Computer and Applications, Beirut, Lebanon, 25–26 July 2018.
 - [21] Zafar, Sarim, Usman Sarwar, Zafar Gilani, and Junaid Qadir. "Sentiment analysis of controversial topics on pakistan's twitter user-base." In Proceedings of the 7th Annual Symposium on Computing for Development, 2016. pp. 1-4. 2016.