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# Exploring the Safety of Women in Indian Cities via the Use of Machine Learning on Twitter

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**Abstract:** In public places across cities, women and girls have been victims of assault, harassment, abuse, and stalking. This research paper explores the ways in which Instagram, Facebook, and Twitter contribute to the empowerment of women in urban India. Also covered in this research is the possibility that Indian culture teaches its people to feel obligated to look out for women. It is possible to educate the young of India about the need of protecting women from harassment in urban areas through the use of Twitter posts that include images, text, and phrases. Hashtag messages on Twitter and other accounts allow women to voice their opinions on topics such as how they feel about going to work or taking public transit, and whether or not they feel comfortable with males they don't know.

***Index terms*** **-** *Women Safety, Machine Learning, Sentiment Analysis, Twitter Data, Social Media, Indian Cities, Harassment Detection, Public Safety, Text Classification, Hashtag Analysis, Online Activism, Urban Security, Data Mining, Natural Language Processing (NLP)..*

## 1. INTRODUCTION

Staring and insults are forms of unacceptable harassment and aggression that are unfortunately common in metropolitan areas. Women in urban areas of India have spoken out against sexual harassment and the passing off of comments made by strangers. Sixty percent of women reported feeling uneasy when using public transit for work or commuting in renowned Indian metropolitan areas like Delhi, Mumbai, and Pune.

Women are not restricted in their movement about the city, even to their places of employment or school. On their route to work, women may experience fear in places like shopping centres and malls as a result of harassment and body shaming.

Girls are harassed because there is a lack of protection for them or because there are no consequences for it. Some girls experienced lifelong trauma as a result of their neighbours' harassment or hazardous living circumstances when they were on their route to school.

The elimination of sexual harassment and violence against women is a top priority in safer communities. Instead of trying to restrict women and girls, society should make it a top priority to ensure their safety in urban areas.

The individuals and women whose names are included in the Twitter text collection are those who have spoken out against sexual harassment and unethical behaviour in Indian cities, which has made them feel uncomfortable. To prepare the data set for analysis, we used machine learning methods to eliminate zero values, smooth the data, and apply Laplace and Porter's theory to the data set on women's safety in Indian society. The outcome was a novel and distinct perspective on the security of women in Indian culture.

## 2. LITERATURE SURVEY

### 2.1 Sentiment analysis of top colleges in India using Twitter data

https://ieeexplore.ieee.org/document/7514636

In today's world, opinions and reviews accessible to us are one of the most critical factors in formulating our views and influencing the success of a brand, product or service. With the advent and growth of social media in the world, stakeholders often take to expressing their opinions on popular social media, namely Twitter. While Twitter data is extremely informative, it presents a challenge for analysis because of its humongous and disorganized nature. This paper is a thorough effort to dive into the novel domain of performing sentiment analysis of people's opinions regarding top colleges in India. Besides taking additional preprocessing measures like the expansion of net lingo and removal of duplicate tweets, a probabilistic model based on Bayes' theorem was used for spelling correction, which is overlooked in other research studies. This paper also highlights a comparison between the results obtained by exploiting the following machine learning algorithms: Naïve Bayes and Support Vector Machine and an Artificial Neural Network model: Multilayer Perceptron. Furthermore, a contrast has been presented between four different kernels of SVM: RBF, linear, polynomial and sigmoid.

### 2.2 Sentiment Analysis on Twitter Data using R

https://www.researchgate.net/publication/334754287_Sentiment_Analysis_on_Twitter_Data_using_R

Nowadays social networking sites are at the blast from where huge amount of information is produced or retrieved. 90% people of the world are sharing their perspectives every day on micro blogging sites, since it contains short and simple expressions. The various devices, mobiles, laptops, tabs and other IoT data gadgets generate huge volume of data and Microservices based web applications running on these have made it simpler for us to get any kind of data at any time and from any place. Social media is also used for expressing our opinions for the products and services. The feedbacks and ratings of millions of the social site users can be collated to extract their attitudes and sentiment towards any products or services and use that information for future market and business improvement or domain analysis. Mining user's opinion from social media is a difficult task; it can be refined into numerous ways. In this paper, an open source approach is presented which we have collected tweets from Twitter API and then pre-processed, analyzed and visualized these tweets using R. To analyze sentiments of tweets we are utilizing a statistical tool, R programming. This

sentiment analysis is based on text data retrieval from streamed web and then classifying people perspectives in eight distinct classifications of feeling (disgust, fear, anger, anticipation, sadness, trust, surprise) and two unique sentiments (positive and negative).

**2.3 Study of Twitter Sentiment Analysis using Machine Learning Algorithms on Python**

https://www.ijcaonline.org/archives/volume165/number9/gupta-2017-ijca-914022.pdf

Twitter is a platform widely used by people to express their opinions and display sentiments on different occasions. Sentiment analysis is an approach to analyze data and retrieve sentiment that it embodies. Twitter sentiment analysis is an application of sentiment analysis on data from Twitter (tweets), in order to extract sentiments conveyed by the user. In the past decades, the research in this field has consistently grown. The reason behind this is the challenging format of the tweets which makes the processing difficult. The tweet format is very small which generates a whole new dimension of problems like use of slang, abbreviations etc. In this paper, we aim to review some papers regarding research in sentiment analysis on Twitter, describing the methodologies adopted and models applied, along with describing a generalized Python based approach.

**2.4 Coarse-to-Fine n-Best Parsing and MaxEnt Discriminative Reranking.**

[PDF] Coarse-to-Fine n-Best Parsing and MaxEnt Discriminative Reranking | Semantic Scholar

Discriminative reranking is one method for constructing high-performance statistical parsers (Collins, 2000). A discriminative reranker requires a source of candidate parses for each sentence. This paper describes a simple yet novel method for constructing sets of 50-best parses based on a coarse-to-fine generative parser (Charniak, 2000). This method generates 50-best lists that are of substantially higher quality than previously obtainable. We used these parses as the input to a MaxEnt reranker (Johnson et al., 1999; Riezler et al., 2002) that selects the best parse from the set of parses for each sentence, obtaining an f-score of 91.0% on sentences of length 100 or less.

**2.5 Determining the Sentiment of Opinions.**

https://aclanthology.org/C04-1200.pdf

Identifying sentiments (the affective parts of opinions) is a challenging problem. We present a system that, given a topic, automatically finds the people who hold opinions about that topic and the sentiment of each opinion. The system contains a module for determining word sentiment and another for combining sentiments within a sentence. We experiment with various models of classifying and combining sentiment at word and sentence levels, with promising results.

## 3. METHODOLOGY

**i) Proposed Work:**

The proposed system analyzes women's safety in Indian cities by leveraging social media messages, particularly tweets, and applying machine learning techniques to detect unsafe locations. Using the TWEEPY package in Python, tweets related to women's safety are fetched; however, due to possible internet unavailability, a pre-downloaded dataset of MEETOO tweets and the Safe Inside dataset is utilized. The NLTK (Natural Language Toolkit) is employed for preprocessing, removing special characters and stopwords to clean the tweets. Sentiment analysis is performed using the TEXTBLOB library, where tweets with polarity values less than 0 are classified as negative (indicating unsafe areas), those between 0 and 0.5 are considered neutral, and those greater than 0.5 are classified as positive. Based on this sentiment classification, the system identifies areas with frequent negative sentiments, helping in mapping unsafe regions and promoting women's safety awareness through social media data analytics.

**ii) System Architecture:**

Using machine learning on tweets, the safety of women is analysed using many layers. In the event that the internet goes down, the Data Collection Layer can still get real-time tweets and a dataset that has already been downloaded (the Safe Inside dataset and MEETOO tweets). Using NLTK, the Preprocessing Layer filters tweets for stopwords, special characters, and unnecessary symbols. The Sentiment Analysis Layer sorts tweets into positive, neutral, and negative categories according to their polarity values using the TEXTBLOB library. Zero indicates unsafe areas, zero to half indicates neutrality, and more than half indicates positivity. The Classification and Prediction Layer analyses the frequency of negative tweets to identify potentially hazardous regions using machine learning. To conclude, the Visualisation and Reporting Layer aids individuals and authorities in making women safer by providing heatmaps and reports. This method is organised and uses data from social media to efficiently pinpoint potentially dangerous areas.

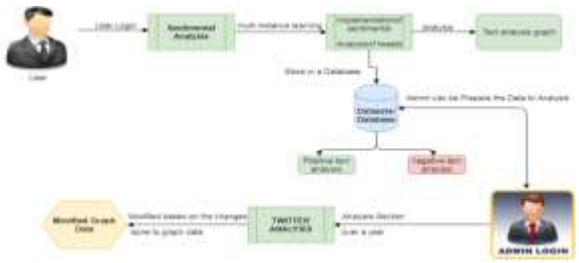

Fig 1 Proposed architecture

**iii) Modules:**

1. **Data Collection Module:** Retrieves real-time tweets using the TWEEPY package and uses a pre-downloaded dataset (MEETOO tweets and Safe Inside dataset) when the internet is unavailable.
2. **Preprocessing Module:** Uses NLTK to clean tweets by removing special characters, stopwords, and unnecessary symbols to ensure accurate analysis.
3. **Sentiment Analysis Module:** Utilizes the TEXTBLOB library to classify tweets into positive, neutral, or negative based on polarity values, helping identify unsafe areas.

- < 0 are classified as negative (unsafe areas).
- 0 to 0.5 are considered neutral.
- 0.5 are classified as positive.

4. **Classification Module:** Analyzes the frequency of negative tweets and applies machine learning techniques to improve the accuracy of location-based safety predictions.
5. **Visualization and Reporting Module:** Generates heatmaps, charts, and reports to highlight high-risk zones, providing insights for authorities and the public to enhance women's safety.

This modular approach ensures efficient data processing, analysis, and visualization for identifying unsafe areas.

**vi) Algorithms:**

a) **Naïve Bayes Classifier**: The Naïve Bayes Classifier is used for text classification. It categorizes tweets based on their sentiment, helping in the detection of areas with frequent negative tweets. This probabilistic classifier is effective for sentiment-based text classification tasks.

b) **K-Means Clustering algorithm:** The K-Means Clustering algorithm is applied for location-based analysis. It groups tweets based on their geographic coordinates, helping to identify clusters of unsafe areas. This technique enables better visualization of high-risk zones in different cities.

c) **Decision Tree algorithm:** The Decision Tree algorithm is used as a prediction model to analyze past trends and predict future unsafe locations. By learning from historical data, it helps in forecasting areas that might become unsafe based on sentiment patterns in tweets.

## 4. EXPERIMENTAL RESULTS

To run this project install python software and then run below command to install packages

Pip install numpy

Pip install pandas==0.25.3

After installing above packages double click on 'download_nltk.bat' file and then a window will appear and then click on 'download' button from that window and wait for 10 minutes to allow application to download all TEXTBLOB corpora packages. Internet must be there in your system to download this package. Once all packages download then that window turn to green colour to indicate download process complete and then you can close that window.

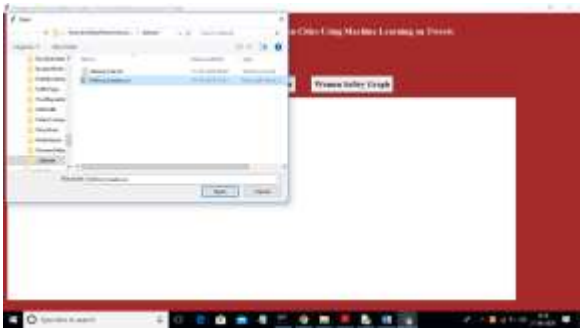

Fig 2: upload file

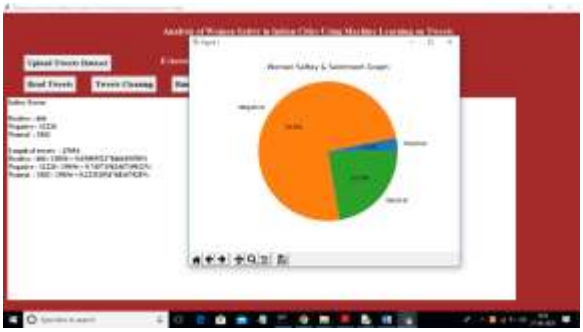

Fig 3Accuracy results

## 5. CONCLUSION

This study highlights the importance of social media data in analyzing women's safety in Indian cities using machine learning techniques. By collecting and analyzing tweets through sentiment analysis, the system effectively identifies unsafe locations based on public perceptions. The use of NLP and machine learning algorithms, such as Naïve Bayes for classification and K-Means for clustering, enhances the accuracy of identifying high-risk zones. This approach helps create awareness, supports law enforcement in taking preventive actions, and contributes to a safer environment for women.

## 6. FUTURE SCOPE

Future work can focus on integrating real-time location tracking to provide instant safety alerts and recommendations for safer routes. Enhancing the model with deep learning techniques, such as LSTMs or transformers, can improve sentiment accuracy. Additionally, incorporating data from multiple social media platforms and government crime records can enhance the reliability of safety predictions. A mobile application with an interactive dashboard can also be developed to provide users with live safety updates and allow authorities to take timely action.

## REFERENCES

[1]. Agarwal, Apoorv, FadiBiadsy, and Kathleen R. Mckeown. "Contextual phrase-level polarity analysis using lexical affect scoring and syntactic n-grams."Proceedings of the 12th Conference of the European Chapter of the Association for Computational Linguistics.Association for Computational Linguistics, 2009.

[2]. Barbosa, Luciano, and JunlanFeng. "Robust sentiment detection on twitter from biased and noisy data." Proceedings of the 23rd international conference on computational linguistics: posters. Association for Computational Linguistics, 2010.

[3]. Bermingham, Adam, and Alan F. Smeaton. "Classifying sentiment in microblogs: is brevity an advantage?."Proceedings of the 19th ACM international conference on Information and knowledge management.ACM, 2010.

[4]. Gamon, Michael. "Sentiment classification on customer feedback data: noisy data, large feature vectors, and the role of linguistic analysis." Proceedings of the 20th international conference on Computational Linguistics.Association for Computational Linguistics, 2004.

[5]. Kim, Soo-Min, and Eduard Hovy. "Determining the sentiment of opinions."Proceedings of the 20th international conference on Computational

Linguistics.Association for Computational Linguistics, 2004.

[6] Klein, Dan, and Christopher D. Manning. "Accurate unlexicalized parsing." Proceedings of the 41st Annual Meeting on Association for Computational Linguistics-Volume 1. Association for Computational Linguistics, 2003..

[7] Charniak, Eugene, and Mark Johnson. "Coarse-to-fine n-best parsing and MaxEnt discriminative reranking." Proceedings of the 43rd annual meeting on association for computational linguistics. Association for Computational Linguistics, 2005.

[8] Gupta, B., Negi, M., Vishwakarma, K., Rawat, G., & Badhani, P. (2017). Study of Twitter sentiment analysis using machine learning algorithms on Python. International Journal of Computer Applications, 165(9), 0975-8887.

[9] Sahayak, V., Shete, V., & Pathan, A. (2015). Sentiment analysis on twitter data. International Journal of Innovative Research in Advanced Engineering (IJIRAE), 2(1), 178-183.

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