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An Application Of Advanced Sentiment Analysis On X (Twitter) Utilising Large Language Models For The Precise Prediction Of Election Outcomes

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Abstract

In order to predict election outcomes, we are using the power of large language models, particularly GPT, to conduct sentiment analysis on Twitter. The extensive use of digital technology has led to a significant increase in the production of user-generated material, which has in turn sparked a radical change in the dynamics of communication across various platforms. In particular, social media platforms have become treasure troves of behavioral data that provide deep insights into a variety of fields, such as politics, e-commerce, medicine, and education. Predictive analytics pertaining to political tweet mining poses significant challenges, chief among them being the accurate assessment of sentiment accuracy and the detection of propagandistic narratives. Due to LLMs' proficiency in natural language processing (NLP) tasks, we suggest using them as a solution, especially GPT. Due to their thorough training, LLMs are able to comprehend sentiment and context, among other complex linguistic nuances. Their ability to generate cohesive text is essential for sentiment analysis. By utilizing these benefits, our goal is to use sentiment analysis with GPT models to forecast the results of the Indian Lok Sabha Elections in 2024. This study leverages the capabilities of LLMs and NLP approaches to solve the urgent demand for credible methodologies in election outcome prediction.

Keywords: Sentiment analysis, Large Language Models (LLMs), Social media, Twitter, Election forecasting, Natural Language Processing (NLP),

I. Introduction

The eventual goal of this research endeavor is to estimate election results by utilizing LLMs' potential for sentiment analysis on Twitter. This research aims to improve election prediction algorithms by examining the vast space of popular emotion reflected on social media. With the dawn of the digital age, user-generated content has expanded dramatically due to the widespread adoption and quick development of online technology. The public can now freely express their views and opinions on any issue of interest in a multiplicity of venues thanks to the ever-expanding digital environment, which has revolutionized traditional communication methods. The goal of this research effort is to fully use. An important source of behavioral insights for a variety of industries, including politics, education, market research, cyber security, healthcare, and urban planning, is this social media-dominated, content-rich environment. It has become increasingly crucial to use these insights when creating strategies and activities in these diverse domains.

The goal of this research effort is to fully use. An important source of behavioral insights for a variety of industries, including politics, education, market research, cyber security, healthcare, and urban planning, is this social media-dominated, content-rich environment. It has become increasingly crucial to use these insights when creating strategies and activities in these diverse domains. The main areas of work concerning the data extraction of electoral tweets for predictions are humour and sarcasm detection, trustworthiness verification, automatic propagandist and disinformation detection, user participation fundamentals, and individual biases. Precise sentiment analysis involves all of these aspects.

In this context, we suggest that Large Language Models (LLMs), especially GPT, can offer a solution to these problems and help construct an accurate sentiment prediction model. Lately, LLMs have demonstrated significant potential in addressing several natural language processing problems, such as adversarial training, paraphrasing, machine translation, and watermarking. Their ability to generate content allows them to produce material that is coherent and relevant over extended periods of time, which is essential for jobs like sentiment analysis. These characteristics make LLMs seem like a viable answer to the problems with sentiment analysis that exist now. Moreover, due to their unmatched depth and range, LLMs can understand and analyze a broad variety of linguistic contexts and constructions. They have extensive training on a wide range of text corpora, which enables them to comprehend the nuances of language, including mood, context, slang, and idioms. Thus, the goal of this research is to use GPT models to apply sentiment analysis on tweets in order to forecast the results of the upcoming Indian Lok Sabha Elections in 2024.

II. Literature Review

Sentiment analysis, pivotal in Natural Language Processing (NLP), involves extracting and interpreting subjective information from various sources to discern individuals' sentiments or stances on specific topics. Its progression unfolds in three phases: lexicon-based approaches, machine learning (ML) techniques, and the current era marked by Transformer models. Initially, sentiment analysis relied on lexicon-based methods, computing sentiment scores based on positive and negative words within texts. While simple and interpretable, these methods struggled with contextual understanding and linguistic complexity. Naive Bayes and Support Vector Machines, two supervised learning algorithms that improved adaptation to textual subtleties, were introduced with the proliferation of machine learning. Despite ML advancements, traditional techniques grappled with linguistic intricacies, prompting the rise of Transformer models like BERT and GPT-3. These deep learning frameworks excel in context comprehension, effectively handling negations, intensifiers, and implicit sentiments. Transformer models, renowned for their large parameter size, signify a pivotal shift in NLP research, offering unparalleled capabilities in text generation and understanding complex linguistic structures. In essence, large language models have become central in NLP, leveraging vast knowledge bases and sophisticated learning mechanisms to achieve human-like comprehension of textual data. Their

prominence underscores a transformative phase in sentiment analysis, promising further advancements in understanding and interpreting human sentiment across diverse domains.

- **On Using Twitter to Monitor Political Sentiment and Predict Election Results Bermingham, A., and Smeaton, A.F. 2011. In Proceedings of the Workshop on Sentiment Analysis where AI meets Psychology (SAAIP).**

  In this study, the possibility of modeling political mood and forecasting vote intents during an election cycle using Twitter material is discussed. The recent Irish General Election serves as a case study for the writers' investigation of this possibility. The writers also note a few things about keeping an eye on public opinion throughout an election campaign. They look at several approaches to qualitatively examining the underlying material as well as different sample sizes and time periods. The paragraph poses the concern of whether tweets accurately reflect the opinions of their followers and accurately reflect the intentions of voters in a country.

- **Gayo-Avello, Daniel. "A balanced survey on election prediction using twitter data." Department of Computer Science-University of Oviedo, Spain (2012).**

  This paper is a bibliography of all major researches related to the topic of predicting elections through use of twitter data. It highlights the major flaws and disadvantages of popular approaches. The author has presented a balanced view on the topic. Electoral prediction using social media is commented on.

- **Chauhan, Priyavrat, Nonita Sharma, and Geeta Sikka. "The emergence of social media data and sentiment analysis in election prediction." Journal of Ambient Intelligence and Humanized Computing 12 (2021): 2601-2627.**

  This study evaluates the efficacy of various sentiment and social network methodologies in predicting significant decisions using online social media platforms. This technique is employed to predict election results by assessing public sentiment through social media. The study examines sentiment analysis methods, emphasises the difficulties in forecasting election results, and makes recommendations for future lines of inquiry into the use of social media material in election prediction.

- **Suraworachet, Wannapon, Jennifer Seon, and Mutlu Cukurova. "Predicting challenge moments from students' discourse: A comparison of GPT-4 to two traditional natural language processing approaches." arXiv preprint arXiv:2401.01692 (2024).**

  The article claims that supervised machine learning and LLM techniques outperform the rule-based model, which primarily relies on expert-engineered features. Despite their advantages, LLMs are not a perfect solution due to confabulation, privacy concerns, and validity and reliability limitations. In order to identify difficulties and their bounds in groups, this study investigates the usage of three distinct NLP models: a Large Language Model (LLM), a supervised machine learning model, and a rule-based expert model. A discussion of model transparency and its implications for meaningful analytical feedback is included in the paper's conclusion.

- **Chumakov, Stanislav, Anton Kovantsev, and Anatoliy Surikov. "Generative approach to Aspect Based Sentiment Analysis with GPT Language Models." Procedia Computer Science 229 (2023): 284-293.**

This paper highlights the use of a sophisticated sentiment analysis method called Aspect Sentiment Triplet Extraction to identify important characteristics in textual material. Existing approaches suffer from data drifts and have trouble handling complex concepts since they rely on vast manual datasets and BERT models. This paper presents the ASTE approach that makes use of few-shot and fine-tuning methods in a GPT Model. The approach has worked well for term simplification, output triplet structuring, and data analysis in unfamiliar domains. The models, tested on Russian and English data, demonstrated the benefits of few-shot learning and achieved results comparable to enterprise solutions.

- **Barberá, P., & Rivero, G. Twitter users and their Understanding of political representativeness. Social Science Computer Review, 32(2), 153-163.**

  This research evaluates Twitter users' political awareness through demographic comparisons with the general population. It illuminates biases and constraints inherent in employing Twitter data for political analysis, emphasising the necessity of acknowledging user population characteristics. Understanding these factors is crucial for accurate interpretation and contextualization of political sentiments derived from social media platforms, contributing to more nuanced and representative insights into public opinion and political dynamics

- **Conover, M. D., Ratkiewicz, J., & Menczer, F. (2011). Political polarisation on Twitter. In the Proceedings of the Fifth International AAAI Conference on Weblogs and Social Media (pp. 89-96).**

  This study looks at the divide between parties on Twitter by analysing users' opinions and interactions. It emphasises polarisation's influence and discusses its ramifications for election forecasting using Twitter data. Understanding the extent and dynamics of polarisation on social media platforms is essential for accurate interpretation of political discourse and prediction of electoral outcomes, shedding light on the role of digital communication in shaping public opinion and political landscapes.

III. Problem Statement

Accurate sentiment analysis of political tweets is very difficult, particularly when it comes to sarcasm and humor detection. Errors in analysis can arise from linguistic complexities, such as idiomatic idioms and context-specific nuances. Propaganda, disinformation, and sock puppet detection become more difficult to identify due to self-selection bias and credibility verification issues. These difficulties could have far-reaching effects, including incorrect predictions and a reduction in the trustworthiness of research. To tackle this, precise sentiment prediction models that can recognize linguistic subtleties, sense humor and sarcasm, and recognize false information automatically must be developed. In light of the abundance of user-generated material on social media sites, processing enormous volumes of data efficiently is imperative.

IV. Objectives of Study

- The study project seeks to perform sentiment analysis on social media data using advanced GPT LLM.
- Important areas of focus include automatic propaganda identification, humor and sarcasm detection, and exact sentiment prediction of tweets.
- The project also includes demographic research, individual bias correction, and credibility testing
- The study also includes demographic research, individual bias correction, and credibility testing.
- Demographic research, individual bias correction, and credibility assessment are all part of the study.

- The research aims to create an accurate sentiment prediction model for predicting the results of the Indian Lok-Sabha Elections in 2024 by utilizing LLMs.
- In addition to advancing sentiment analysis, the Endeavour seeks to investigate how well LLMs can comprehend and forecast public opinion.

V. Proposed Methodology

- **Data Collection**

- For scientific research, data collecting is essential since it makes it easier to examine hypotheses and evaluate results. Our study collects tweets related to the impending election in an effort to create an extensive dataset. We retrieve tweets containing election-related hashtags or keywords by using web scraping APIs. Relevance and diversity of data provide challenges. A comprehensive dataset is ensured by diversity, necessitating tweets from a range of demographic, linguistic, and geographic origins. This adds depth to analysis by integrating several viewpoints. A total of 2000 tweets spanning from 01/01/2024 to 01/03/2024 were gathered in the collection process. The small number of tweets is in part due to the increased restrictions applied by Twitter in its access. Some hashtags and keywords used were as follows: #IndianGeneralElection, #indianelections, #narendramodi, #electioncampaign, #rahulgandhi, #congress, etc. The tweets were collected related to BJP and Congress Parties only.

Total Tweets	Non-English Tweets	Longest Tweet Character count	Shortest Tweet Character count	Average Tweet Character count
2000	500	917	20	156.03

Table 1: Dataset Characteristics after Cleaning

- **Data Preprocessing**

Preprocessing, which includes data cleaning and the management of noise and outliers, comes after data gathering in data science. Analysis is impacted by the heterogeneity of real-world data, which frequently contains inconsistent, noisy, or missing parts. LLMs are able to offer remedies for these issues. Transfer learning, contextual understanding, end-to-end learning, and automatic feature extraction are all possible with GPT models. It can work on data without requiring a lot of preprocessing thanks to all of this. The text column was exclusively utilized for sentiment analysis. Since stemming, stop-word removal, and other cleaning chores would only be applicable to English tweets, we decided against employing them. We rely on the model's capacity to comprehend various contexts and languages. We purge the gathered data of urls, duplicates, and retweets, among other things.

- **LLM Model Selection**

Because GPT models can reliably understand and interpret human language in a variety of languages, they have been chosen for multilingual sentiment analysis. Especially useful for sentiment analysis jobs, they can manage complex and nuanced textual nuances. In terms of performance, ChatGPT has outperformed other sentiment analysis technologies. Furthermore, ChatGPT has performed better than OPT, with a 6% increase in accuracy and a 4%–7% increase in F-measure. These results demonstrate the considerable predictive performance advantage of GPT methods, outperforming the state-of-the-art by more than 22% in F1-score. GPT models have demonstrated their suitability for the task through the implementation of few-shot and fine-tuning procedures. They have demonstrated the ability to structure output triplets consistently, simplify terms without sacrificing their meaning, and analyze data

from uncharted domains. As a result, the GPT-2 model was chosen due to its open source nature.

- **LLM Model Fine Tuning**

  After preprocessing the data, the next stage is to train large language models (LLMs) with an emphasis on multilingualism, given the global reach of social media sites such as Twitter. LLMs should be proficient at producing and comprehending text in a variety of languages, tackling issues like sarcasm and the subtleties of context that are common in social media text. LLMs are being used more and more for zero-shot and few-shot learning, which enables learners to absorb and apply new ideas from sparse instances. While GPT excels at English tasks, we trained the model for multilingual competency in Indic languages using the ai4bharat/IndicSentiment dataset. It was trained in the Google Colab T4 Python environment with default parameters.It obtained an accuracy score of 0.9302, which is comparable to that of conventional models.

- **Model Implementation**

  Adaptable models are necessary for dynamic scenario modeling, which includes sentiment analysis during elections, in order to handle sudden changes in public opinion. GPT works well in this area because of its ability to comprehend human language. Sentiment analysis is applied to the gathered tweets using the fine-tuned GPT-2 model.

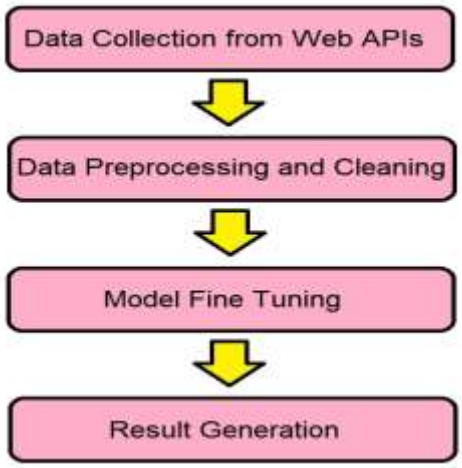

Figure 1: Flow Chart of the System

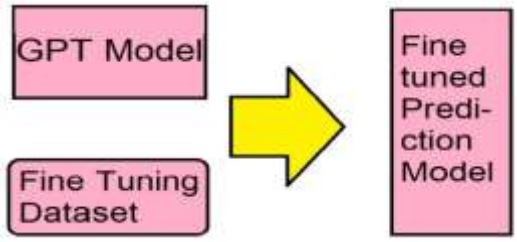

Figure 2: Model Tuning

VI. Benefits of Proposed System

- **Addressing Challenges in Social Media Data Gathering:-** Accurate sentiment analysis in a variety of linguistic contexts is made possible by LLMs' skillful interpretation of emojis, slang interpretation, hashtag analysis, handling of negation and sarcasm, and consideration of cultural context. Organizations are able to extract insights from social media data thanks to their flexibility and sophisticated comprehension.
- **Benefits in Data Processing: -** Text tasks like entity recognition, summarization, and categorization can be effectively automated with LLMs. Large data quantities may be processed thanks to their scalability, and its multimodal capabilities include audio, video, and pictures. By means of transfer learning, LLMs improve productivity.
- **Advantages in Sentiment Analysis: -** Because of their linguistic support, scalability, adaptability, and contextual comprehension, LLMs are excellent in sentiment analysis. They manage complicated language structures and reliably detect emotion polarity, increasing efficacy on various platforms and in various industries. Moreover, LLMs support cross-cultural insight production and sentiment analysis in a variety of linguistic contexts.

VII. Results and Discussions

- **Results**

This study employs Large Language Models (LLMs), notably GPT, for sentiment analysis on Twitter, revealing their effectiveness in predicting election outcomes by analysing political tweets. Results offer insights into public sentiment's correlation with elections, identifying patterns crucial for accurate predictions. Machine learning algorithms, including those integrated with GPT, play a pivotal role in processing extensive Twitter data. Sentiment analysis indicates that tweets related to the Congress party had a positivity rate of around 31%, while those related to the BJP party had a rate of around 34%. These results provide insights into election and political dynamics.

- **Discussions**

The results reveal distinct sentiment patterns on Twitter, with BJP-related tweets exhibiting marginally higher positivity rates compared to Congress. This indicates that BJP has a higher chance of winning the upcoming 2024 Indian Lok Sabha Elections. Neutral tweets accounted for 9%, while negativity predominated at 52%. Implementing social media data with traditional methods enhances election prediction accuracy. This research study highlights the role of celebrities and viral content in forming public interest. However, limitations such as diversity and the task of finding correct sentiment in social media should not be overlooked.. Continued refinement of sentiment analysis tools and techniques, particularly leveraging advanced language models like GPT, is crucial for enhancing Twitter-based election predictions.

Figure 3: Word Cloud of BJP and Congress Party Tweets

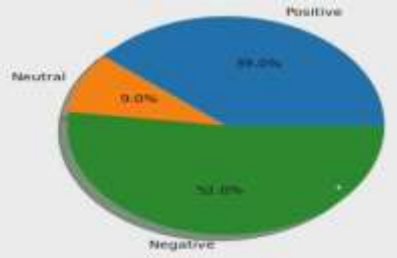

Figure 4: Sentiment Distribution of Tweets

Tweet	GPT Model Output
□Celebrating BJP's Rajya Sabha win, he highlights the 'historic' Ram Mandir 'Pran Pratishtha' in Ayodhya. Adityanath vows continued service if BJP secures a third term. #YogiAdityanath… □□□	Positive
Gujarat : The State ruled by BJP 2017 - Porbandar Port- 1500 kg Heroin 2022 - Mundra Port - 3000 kg Heroin 2022 - Porbandar-Jamnagar - 750kg Contraband 2023 - Gandhidham - 80 kg Cocaine 2024 - Veraval Port - 50 kg Heroin 2024 - Porbandar Port - 3300 kg Heroin #BJPHataoDeshBachao□□	Negative
BJP should translate all the talk to real time in Tamil for all the people here locally to understand. More for the DMK and its supporters to understand.	Neutral

Table 2: Sample Output of the Sentiment Analysis

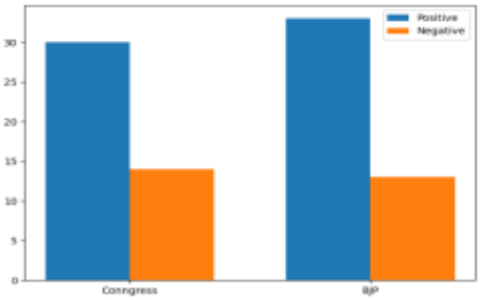

Figure 5: Polarity classification

VIII. Conclusion and Future scope

This study underscores the efficacy of Large Language Models (LLMs), notably GPT, in enhancing sentiment analysis for electoral forecasting on social media, focusing on the 2024 Indian Lok-Sabha Elections. Leveraging LLMs, we correlated sentiment trends on Twitter with election outcomes, emphasising the importance of advanced natural language processing. LLMs mitigate challenges like emoji interpretation and slang comprehension, facilitating accurate predictions. Our research extends to political analysis, public opinion monitoring, and policymaking, guiding decision-making and citizen engagement. Despite limitations like platform biases and data representativeness issues, refining sentiment analysis models and mitigating biases through sampling strategies are crucial for reliable results. Future work may include integrating multimodal data sources for enriched sentiment analysis, while ethical considerations ensure transparency in model deployment. Multiple sources of social media data can be implemented. Real time analysis may be attempted to gauge shifts in public opinion. Dynamic public sentiment can be modelled for more accurate election prediction.

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