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Analyzing App Reviews Using AdaBoost SVM

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ABSTRACT: In the digital era, app reviews serve as invaluable feedback sources for developers striving to enhance user experiences and remain competitive. However, traditional sentiment analysis methods often struggle to keep pace with the dynamic nature of user opinions. This study proposes a machine learning-based sentiment analysis approach, leveraging Natural Language Processing (NLP) techniques and AdaBoost Support Vector Machines (SVM) for app reviews. Continuously updating sentiment analysis models in response to new user feedback, our methodology offers developers timely and accurate insights into user sentiments. By harnessing AdaBoost SVM algorithms and NLP, we aim to improve sentiment analysis accuracy and efficiency, enabling developers to make data-driven decisions and prioritize improvements based on real-time feedback. Additionally, our methodology incorporates aspect rate ranking, facilitating systematic identification and prioritization of areas for improvement within app reviews. Through empirical evaluation and comparison with existing approaches, we demonstrate the effectiveness and utility of our sentiment analysis framework for app reviews, thereby fostering continuous improvement in application development.

KEY WORDS: App Reviews, Machine Learning, NLP, Sentiment Analysis, Adaboost Support Vector Machines, Aspect Rate Ranking.

I. INTRODUCTION

Sentiment analysis, a fundamental aspect of natural language processing, has emerged as a critical tool for comprehending customer feedback and mining opinions in the huge terrain of application reviews. With the exponential rise of apps and social media, the number of user-generated material has surged, creating both possibilities and problems for businesses looking to accurately evaluate user sentiment. Machine learning algorithms play an important role in automating this process, using techniques like text categorization and sentiment score to filter through massive volumes of textual data and extract relevant insights. In this context, sentiment research not only acts as a measure of consumer happiness, but also influences critical business choices such as app enhancements and focused marketing initiatives. This study investigates the use of machine learning and NLP techniques in ranking of application evaluations, emphasizing its importance in the current environment of consumer-driven businesses.

A. Information Extraction

Information extraction from app reviews involves systematically analyzing user feedback to identify key insights and trends. This process typically begins with the collection of app reviews from various platforms such as app stores or review websites. Natural Language Processing (NLP) techniques are then applied to the reviews to extract relevant information, including sentiments, topics, features, and issues mentioned by users. Aggregating and analyzing this extracted data enables developers and product managers to understand user preferences and address issues to improve the overall app experience.

B. App Reviews

Machine learning (ML) is the study of computer algorithms that automatically get better over time. It is speculated to be a subset of artificial intelligence. Sample data, or "training data," is used to build a model by machine learning algorithms to make predictions or judgments without being explicitly programmed to do so. A lot of applications, like email filtering and computer vision, use machine learning algorithms when it would be difficult or impossible to develop traditional algorithms that can do the job. However, machine learning is not limited to statistical learning. A subset of machine learning is closely related to computational statistics, which focuses on predictions made by computers; However, there are other types of machine learning

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as well as statistical learning. The theory, method, and application areas of machine learning are provided by the study of mathematical optimization. A similar field of study is data mining, which focuses on exploratory data analysis through unsupervised learning. The interaction by which PCs figure out how to finish jobs without being explicitly trained is known as AI.

C. Opinion Mining

Opinion mining, also known as sentiment analysis, is an important area in the science of natural language processing that seeks to extract subjective information from textual data. With the rise of internet platforms and social media channels, people are increasingly sharing their thoughts, feelings, and views on a wide variety of topics, from products and services to social and political concerns. Opinion mining techniques enable the automatic analysis of this massive amount of unstructured data, providing companies, scholars, and politicians with important insights into public opinion, sentiment patterns, and new issues of interest. Opinion mining uses machine learning algorithms and language analysis to classify text as good, negative, or neutral, allowing decision-makers to make educated choices, modify marketing plans, and respond effectively to consumer input.

II. RELATED WORK

The previous research highlights a novel framework that enables software companies to drive their technology value stream based on the feedback (or reviews) provided by the end-users of an application. The proposed end-to-end framework exploits different Natural Language Processing (NLP) tasks to best understand the needs and goals of the end users. An analysis of reviews with sixteen popular Android Play Store applications from various genres over a long period provides encouraging evidence of the effectiveness of the proposed approach.

1. **Driving the technology value stream by analyzing the app reviews.**

An emerging feature of mobile application software is the need to quickly produce new versions to solve problems that emerged in previous versions. This helps adapt to changing user needs and preferences. In a continuous software development process, the user reviews collected by the apps themselves can play a crucial role *in detecting* which components need to be reworked. This paper proposes a novel framework that enables software companies to drive their technology value stream based on the feedback (or reviews) provided by the end-users of an application. The proposed end-to-end framework exploits different Natural Language Processing (NLP) tasks to best understand the needs and goals of the end users. We also provide *a thorough* analysis of the framework, the performance of each of the modules, and the overall contribution in driving the technology value stream.

2. **Mining Public Opinion on Hybrid Collaboration with RoBERTa. Empirical Quests for Management Essences.**

It has been hypothesized under this system that, when companies recover from the COVID-19 outbreak, a new working paradigm emerges: hybrid work arrangements. A hybrid work technique is a working strategy that allows employees to work from many locations, such as at home, on the go, or at work. People are sharing their views on the new work model through various social media platforms. Organizations and corporations value public feedback. Because public opinions enable decision-makers to respond quickly to rapidly changing cultural, economic, and social situations. Opinion mining has typically been used to summarize the number of positive and negative comments in a given text using sentiment analysis. Opinionated content from social media sites is utilized to determine people's enthusiasm or dissatisfaction with a certain subject under discussion. This study examines public attitudes (positive, negative, and neutral) on a hybrid work model that employs Twitter API and the Robustly Optimized BERT Pre-Training Approach (RoBERTa). 37 (4.2%), 305 (33.3%), and 658 (62.5%) tweets containing the word "hybrid work" were rated as unfavorable, neutral, and positive, respectively. We also compared public opinion regarding hybrid work to that of remote work.

3. **A study of concept-level sentiment analysis algorithms for textual data.**

As described in this system, text mining is one of the branches of data mining and refers to the computational process of discovering new patterns and relationships across datasets that appear to be unrelated. Data mining is an interdisciplinary field that combines statistics, artificial intelligence, and database systems to provide new methods for detecting patterns in information. Similarly, while working with textual data, we must employ methods from many disciplines of computer science (e.g., linguistics) and statistics. This paper examines the text-based sentiment analysis pipeline methodologies employed by scholars recently, such as preprocessing, aspect extraction, feature selection, and

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classification. It also looks at diverse uses of semantic analysis in social media, marketing, and product evaluations. Sentiment analysis (SA) is an ongoing study subject in text mining. It detects, extracts, measures, and treats emotive states and subjectivity in text computationally and methodically. Among the various applications of SA, gaining insight into public opinion on various socio-political issues through the analysis of tweets and other social media textual public materials, automated analysis of historical corpus, and the study of product reviews to obtain true customer feedback and predict customer sales are critical.

4. **Sentiment analysis of multilingual tweets about halal tourism. Tourism Management Perspectives.**

As indicated in this system, Halal tourism is a rapidly expanding section of the tourism business, hence a study of its patterns is necessary. This article investigates halal tourism trends by examining messages (known as 'tweets') on the social networking site Twitter. A total of 85,259 tweets were analyzed. The extraction procedure involved nineteen keywords (English and Bahasa Malaysia). The study used the extracted tweets to (1) investigate the origins of tweets related to halal tourism among the global population, (2) identify the major populations around the world that are engaged in halal tourism tweets, (3) analyze sentiment valence about halal tourism, and (4) identify popular destinations that appear in tweets. The study found that Japan is the most-tweeted-about halal tourism destination, followed by Malaysia and Indonesia. The findings can help the different halal tourism stakeholders plan their future halal tourism strategy. Halal tourism has recently gained substantial attention from academics and practitioners. This study examined tweets linked to halal tourism. The conclusions of this study can benefit a variety of stakeholders, including marketers looking to target the halal tourist industry.

5. **Aspect-based sentiment analysis and intelligent categorization in an unpredictable feedback pool.**

This study proposes using Aspect-based Sentiment Analysis (ABSA) to understand the public's attitude on the recent demonetization program imposed in India. The primary goal is to find the appropriate situations for specific features. Most traditional algorithms use attention processes and deep learning ideas, which reduce prediction accuracy and produce a lot of noise. Another key problem of attention processes is that the sentiment associated with a few context words changes depending on many factors, thus it cannot be deduced alone from itself. This work uses the optimal deep learning technique to execute the ABSA on demonetization tweets. The proposed model contains several steps, including pre-processing, aspect extraction, polarity feature extraction, and sentiment classification. Initially, the various demonetization tweets gathered from the Kaggle dataset are used. Pre-processing consists of four phases: stop word removal, punctuation removal, lowercase conversion, and data minimization to a reduced format. This pre-processed data is subsequently processed using aspect extraction to extract opinion terms. The retrieved aspect words are turned into features using polarity score calculation and Word2vec. The weight of the polarity scores is adjusted using the hybridization of two meta-heuristic algorithms, Firefly method (FF) and Multi-Verse Optimization (MVO), and the resultant method is known as Fire Fly-oriented Multi-Verse Optimizer (FF-MVO).

III. PROPOSED SYSTEM

The suggested method intends to revolutionize sentiment analysis in the realm of applications by offering a dynamic approach that constantly changes sentiment analysis models in response to new user reviews. Using machine learning techniques such as AdaBoost SVM algorithms, the system recognizes application features mentioned in online and offline reviews, classifies feelings as positive, negative, both, or undefined, and assigns aspect weights for further analysis. By evaluating reviews based on sentiment analysis results and aspect weights, the approach allows app developers to refine recommendation systems, boosting highly rated apps while addressing areas for improvement identified by user input. This iterative method assures accuracy and flexibility, allowing developers to respond to evolving user sentiments over time.

A. Online Review

- Identifies particular product features from internet reviews.
- Collected and extracted reviews from online sources.
- Identifies characteristics highlighted in evaluations, including doors, fingerprints, etc.
- Sentiment Classification: Uses AdaBoost SVM to categorize reviews as positive, negative, both, or undefined.

B. Offline review

- Extracted Reviews: Gathers and evaluates feedback from offline sources.
- Identifies elements from offline reviews, comparable to the online procedure.
- Classifies feelings in offline reviews as good, negative, both, or undefined using many approaches.

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• Assigns weights to various factors depending on their value and relevance.
• Reviews are ranked based on sentiment analysis and aspect weights.

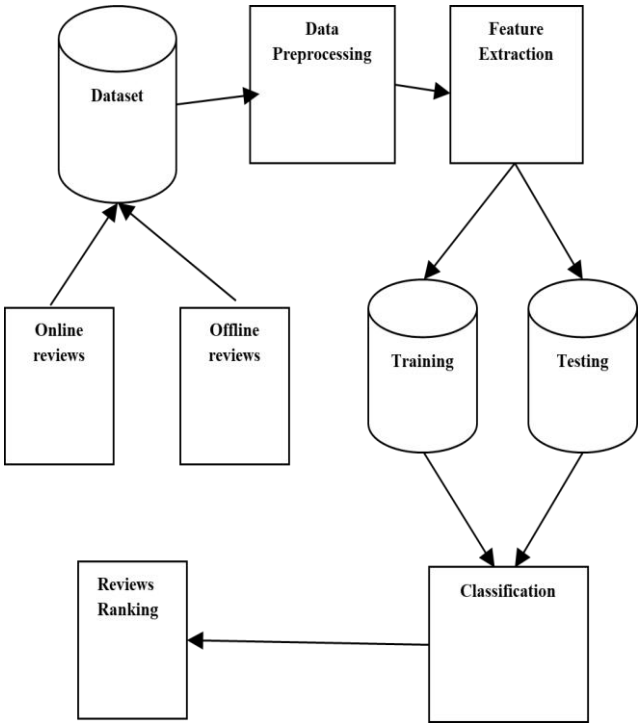

Figure 1. Block Diagram

C. Pre-processing

Pre-processing is an important stage in data analysis. It entails cleaning, converting, and organizing data to prepare it for machine learning or statistical analysis. Pre-processing for datasets may include handling missing values, removing duplicate records, normalizing or scaling numerical attributes, and encoding categorical variables. This step is critical for ensuring the quality and integrity of the data before using it to train machine learning models.

D. Feature Extraction

Feature extraction from app reviews is a critical aspect of sentiment analysis in the realm of application development. This process involves identifying and extracting key features or attributes mentioned in user reviews that contribute to the overall sentiment expressed toward the application. One approach to feature extraction involves utilizing natural language processing techniques to parse through user reviews and identify recurring themes or topics. This could include extracting mentions of specific functionalities, user interface elements, performance metrics, or any other relevant aspect of the application. Additionally, sentiment lexicons or dictionaries can be used to associate sentiment scores with extracted features, allowing for a more granular analysis of user sentiment toward each aspect of the application. Moreover, advanced machine learning algorithms such as support vector machines can be employed to automatically learn and extract features from text data, thereby improving the efficiency and accuracy of feature extraction in app reviews. Overall, effective feature extraction from app reviews enables developers to gain valuable insights into user preferences, identify areas for improvement, and make informed decisions to enhance the overall user experience of their applications.

E. Classification

In the sentiment context of analysis for app reviews, classification refers to the process of categorizing user sentiments as positive, negative, neutral, or any other predefined sentiment categories. This classification task is crucial for understanding the overall sentiment towards an application and can help app developers make informed decisions to improve their products.

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F. Reviews Ranking

Review ranking based on aspect weights involves assigning importance to different aspects or features of an application mentioned in user reviews and using these weights to rank and prioritize reviews. This approach allows developers to focus on the most relevant and impactful feedback when making decisions to enhance their applications. aspect weights are typically determined through a combination of automated techniques and domain expertise. Machine learning algorithms can be used to analyze large volumes of user reviews and extract key aspects or features mentioned by users. These aspects can then be assigned weights based on their importance to overall user satisfaction or other predefined criteria. Once aspect weights are assigned, reviews can be ranked by considering both the sentiment expressed in the review and the importance of the aspects mentioned. Reviews that discuss aspects with higher weights and express strong sentiments are given higher rankings, indicating their greater relevance and influence on user perception of the application. By prioritizing reviews based on aspect weights, developers can focus their attention on addressing the most critical aspects of their applications and making targeted improvements that are likely to have the greatest impact on user satisfaction and retention. This approach enables developers to make more informed decisions and allocate their resources more effectively to drive continuous improvement in their applications.

IV. ALGORITHM DETAILS

Inputs:

- Training data: X_train, y_train
- Number of base SVM classifiers: T
- Learning rate: α

Initialize:

- Initialize weights for samples: w[i] = 1/N, where N is the number of samples
- Initialize a list of SVM classifiers: svm_classifiers = []

For t = 1 to T:

1. Train an SVM classifier on the training data with weights w[i]
- Use weighted samples (X_train, y_train, w) to train the SVM classifier
- Obtain the decision function f_t(x) for the current SVM classifier
2. Compute the weighted error of the current SVM classifier:
- error_t = sum(w[i] * indicator(y[i] != f_t(x[i]))) / sum(w)
3. Compute the weight of the current SVM classifier:
- alpha_t = α * ln((1 - error_t) / error_t)
4. Update the weights of the samples:
- w[i] = w[i] * exp(alpha_t * indicator(y[i] != f_t(x[i])))
5. Normalize the weights:
- w = w / sum(w)
6. Add the current SVM classifier and its weight to the list:
- svm_classifiers.append((alpha_t, f_t(x)))

V. RESULT ANALYSIS

The sentiment classification algorithm's results show that it is successful at properly detecting the sentiment of app reviews and ranking of reviews based on their aspect value. Using a keyword-based method, the program correctly recognizes positive and negative attitudes based on the presence of important phrases in the review text. However, it is important to highlight that this technique may have limits in capturing complex thoughts or dealing with misspellings and linguistic differences. Thus, while the algorithm gives a basic comprehension of client input, further improvement and the addition of advanced approaches such as machine learning models like AdaBoost SVM might improve its accuracy and flexibility, especially in the fast-paced environment of applications.

Algorithm	Precision	Recall	F score	Accuracy
Existing	0.73	0.7	0.74	0.71

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Proposed	0.8	0.81	0.84	0.8

Table 1. Comparison Table

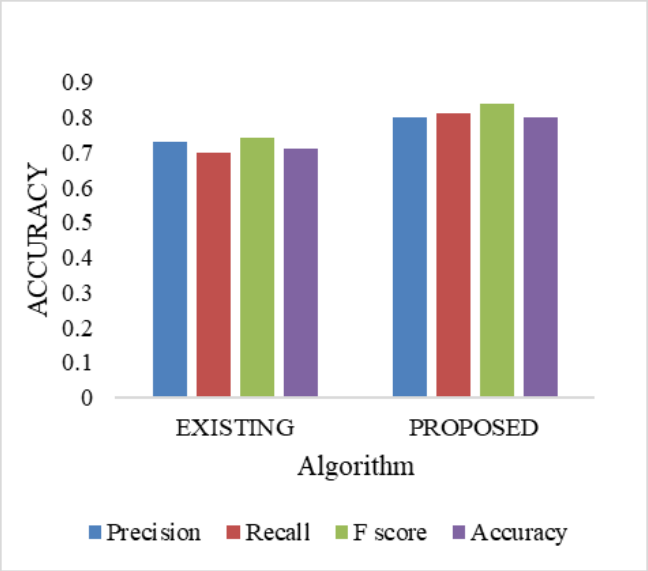

Figure 2. Comparison Graph

VI. CONCLUSION

To summarize, the creation and deployment of the review ranking system described in this work constitute a big step forward in comprehending user feedback in the changing environment of Applications. Using machine learning techniques such as AdaBoost SVM approaches, the system provides a complete approach to sentiment classification, allowing for reliable detection of product characteristics and feelings expressed in both online and offline evaluations. Through rigorous testing and iterative development, the system displays resilience, flexibility, and scalability, allowing the developers to enhance user satisfaction and reach the demands of users.

VII. FUTURE WORK

In the future, upgrading the review ranking system to include more advanced natural language processing techniques, such as deep learning models, may increase sentiment categorization accuracy and granularity. Furthermore, combining sentiment analysis with additional data sources, such as social media or customer service interactions, may offer a more complete picture of user attitudes and preferences. Furthermore, experimenting with real-time analytic capabilities and introducing proactive tactics like sentiment-based notifications or tailored suggestions might boost customer engagement and happiness on applications.

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