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## Sentiment Analysis Based on Customer Reviews System on Restaurants

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**Abstract**—The services and products being provided in today's time are open to all users to have and post their opinions on various platforms. This project work provides an efficient restaurant review prediction model to predict the review for the restaurant based on a certain collection of client reviews. Restaurant reviews are labeled as True or False, with True denoting a positive review and False denoting a negative one. Based on the comments they receive, firms and businesses can use sentiment analysis to improve their services or goods. The goal of this effort is to develop a model that can accurately categorize Portuguese evaluations into categories that are neutral, favourable, or negative.

**Index Terms**—Sentimental Analysis, Natural Language Processing, SVM, Bi-LSTM.

### I. INTRODUCTION

In this day of globalisation, we are constantly on the lookout for new ideas that will save us time, simplify tasks, and eliminate the need for manual processing. Patrons of eateries assign ratings and write evaluations according to how satisfied they are. Other customers can use these ratings and reviews to assist them decide whether or not to visit those eateries. To improve their business, restaurant owners can also use these evaluations to guide modifications based on input from patrons.

Customers now rely heavily on rating and review systems as a source of information when making purchases. Customers utilize these platforms to investigate goods and services before making a purchase. They also use them to read reviews left by previous customers to get a sense of how they felt about the product or service. Customers can avoid buying goods or services that might not fulfil their requirements or expectations and make more informed purchases. However, because these systems produce a lot of data, it is challenging for users to quickly and simply obtain the information they require. Machine learning (ML) is one of the subset of artificial intelligence (AI). ML takes data as input and learns essential relationships from it in order to make judgments that meet the needs of the user. Natural language processing (NLP) skills are provided by machine learning for text processing.

Specifically, we use machine learning methods for review classification. Sentiment analysis can be used to automatically classify reviews as positive, negative, or neutral, which can be helpful for customers to quickly find the information they need. Additionally, sentiment analysis can be used to extract information such as the main topics discussed in the review, which can be used to improve search functionality and recommendation systems. Sentiment analysis can also be used to identify patterns and trends in customer feedback, which can be valuable for businesses and service providers. For example, if a company receives a high number of negative reviews about a specific product, it can use this information to improve the product and provide a better experience for customers [9]. Moreover, sentiment analysis can also be used to predict customer preferences and behaviour, by analysing their reviews and feedback. This can be used by companies to tailor their products and services to better suit customer needs, which can lead to increased customer satisfaction and loyalty. It can also be used to segment customers based on their preferences and behaviour, which can be used to improve targeted marketing campaigns. In addition, sentiment analysis can also be used to identify the reasons why customers are unhappy with a product or service. This can be used to make informed decisions about what needs to be improved, in order to provide better service and increase customer satisfaction. This can also help in identifying the key drivers of customer loyalty and retention. All things considered, rating and review platforms are essential to many different businesses, and sentiment analysis can help make these platforms easier for consumers and service providers to use. Sentiment analysis can help customers to quickly and easily find the information they need and can help businesses to improve their services and products based on customer feedback. It can also be used to gain insights and make data-driven decisions that can lead to increased customer satisfaction and loyalty, which can ultimately drive business growth.

### II. LITERATURE SURVEY

An overview of challenges in sentiment analysis:

It has been debated what happens when sentiment analysis faces difficulties. In the first distinction, sentiment review structure is contrasted with sentiment analysis issues. This distinction's impact demonstrates how crucial domain-dependence is to sentiment issues. Based on the obstacles, the accuracy of sentiment analysis algorithms is the subject of the second comparison. Three different kinds of review structures—structured, semi-structured, and unstructured—were employed in the first comparison. There are two kinds of obstacles in sentiment analysis: theoretical and technological. NLP overheads such as brief abbreviations, ambiguity, emotions, and sarcasm, as well as domain dependence, negation, bipolar words, entity feature/keyword extraction, spam, and bogus reviews are some of the issues. For theoretical tasks, parts-of-speech (POS) tagging results are highly accurate. Because of its phrases and expressions, n-gram has an advantage over all other solutions when it comes to technological challenges. The outcomes provided an explanation of how well sentiment analysis challenges worked to raise the model's accuracy.

Aspect based Sentiment Oriented Summarization of Hotel Reviews :

Due to the unstable size of review dimensions and customer produced content, different text analytic approaches like opinion mining, sentiment analysis, topic modelling, aspect classification, play a significant role in analysing the content. topic modelling is statistical in nature, it may identify a wide range of themes within a corpus of text. There is an opinion associated with each type of aspect, and the sentiment analysis approach may successfully elicit these feelings. Sentiment analysis is helpful in the majority of situations, regardless of whether it is a business intelligence issue or an instance of unstructured document classification. It is now seen as the most important step in the information retrieval process. Research on sentiment analysis can be advanced by text summarising methods. The Sent Word library is used to mine opinions from hotel reviews. The reviews were summarized on different aspects and sentiment analysis was performed .

Evaluating Online Hotel Reviews for Helpfulness:

A review is only really helpful for making decisions if it is well-thought-out and informative. Because of accessibility, the indicators of reviews' value vary for various study fields. Reviews with the highest number of votes on travel and hospitality websites are thought to be more insightful and helpful for customers. It can be helpful in optimizing the cost of the search for most of the consumers by using feature engineering

Emotional Dissection of Hotel Reviews:

It has been noted that semantic orientation can also be applied to sentiment analysis to categorize reviews into positive and negative categories, denoted by a 1 or a 0. A review that contains both adjectives and adverbs can be categorized based on the average semantic orientation of its phrases. When sentiments and semantic orientation are combined, an efficient value is anticipated. Only in cases where the mean is positive is the review advised; in other cases, it is not. In general, the Naive Bayes model outperforms SVM [2]. Text mining

classification is a fundamental text-mining job that classifies unstructured input with appropriate categories from a predetermined collection. Naive Bayes (NB), Support Vector Machine (SVM), K-Nearest Neighbours (KMN) and SVM with PCA are some of the most often utilised machinery learning approaches for classification and regression analysis. Because NB processes large amounts of data quickly, researchers favour it even though its prediction outputs are less reliable. Currently, SVM is one of the most effective methods for classifying unlabeled data. As a result, comparisons between different machine learning algorithms should be conducted in order to identify which data-mining method in the restaurant sector gives the most precision and accuracy.

The primary focus of this article is the use of predictive models to determine restaurant ratings[1]. The relevance of ratings for both customers and businesses is highlighted while discussing the use of ratings as the main criterion for evaluating a restaurant.

The company Zomato is mentioned as a major player in the field of food reviews and its impact on how people browse through restaurants is highlighted. Different machine learning algorithms such as Support Vector Machine (SVM), Linear Regression, Decision Tree, Random Forest, XGBoost, ADA Boost are discussed as potential tools for predicting restaurant ratings. It is stated that these models have the ability to analyse various features of existing restaurants in a city and predict their ratings, making it an important aspect to consider before making a dining decision. Out of all the algorithms used ADA Boost gave the best results. It is highlighted that a great deal of study has been done on the variables influencing market share and sales in the restaurant business, with an emphasis on analyzing "dine-scape" variables to raise customer satisfaction levels. The conclusion suggests that if data for other cities is also collected, accurate predictions could be made for those locations as well. Overall, the study highlights the value of restaurant ratings and the application of predictive models in the process of assigning ratings. The potential impact of these predictions on both customers and businesses is acknowledged, and the potential for further research in this area is suggested by using data from more cities. In order to forecast client attitudes in the food delivery services (FDS) domain, the focus is on the application of explainable artificial intelligence (XAI) techniques along with machine learning (ML) and deep learning (DL) models.

The paper begins by highlighting the increased demand for food delivery services during the COVID-19 pandemic, and the importance of customer reviews as a source of information about a company's performance. The goal of the study was to review the current state of research in the use of ML, DL and XAI for sentiment analysis in the FDS domain, with a focus on identifying areas for improvement and future research directions. It notes that while lexicon-based and ML techniques are widely used for predicting sentiments through customer reviews in the FDS domain, the use of DL techniques is more limited due to the lack of interpretability and understandability of the decisions made. It also finds that

77 percentage of the models used in the FDS domain are non- interpretable in nature, which can be a source of concern for organizations. The paper suggests that DL models in other domains have shown good performance in terms of accuracy, but lack understandability, which can be achieved through the implementation of XAI techniques such as LIME and SHAP. The survey concludes that future research should focus on incorporating DL models for sentiment analysis in the FDS domain and implementing XAI techniques to increase the interpretability and understandability of the models. It also advises using topic categorization techniques. Overall, the paper emphasizes the usage of XAI to improve the understand- ability of DL algorithm results making the model accurate and explainable. In [3] a study that focuses on analysing restaurant reviews to provide useful information that is not captured by traditional ratings is shown. The study uses two different datasets of restaurant reviews and employs machine learning algorithms such as Naive Bayes and Logistic Regression to classify the reviews and perform sentiment analysis. The study also utilizes the genism library for summarization and uses visualization techniques to display the results. The study found that the Multinomial NB model performed better than other algorithms in terms of accuracy, precision, recall, and F1 score. The study also found that taking online orders and table bookings increases the number of customers, and suggests that restaurants should collaborate with delivery sites like Zomato and Swiggy to grow their business. Additionally, the study suggests that restaurants should offer quick bites for areas where there are many MNCs and that the average cost for a person should not be high. In the future, a real-time application can be developed to help people analyse reviews more effec- tively to grow their businesses. Neural network architectures can be used to make text summarization more accurate and readable. The ability to gain insights from reviews can open up a new world in the field of analytics and how data is used in businesses. There is potential for future research in this area, and the study can be applied to various industries such as transportation, hospitality, healthcare, and education. The study comes to the conclusion that successful and wealthy restaurants depend on the efficient analysis of their evaluations, and that further research may be done to create an analytical system that fully utilises the potential of restaurant reviews. In

[4] an abstractive multi-text summary method for generating restaurant reviews is shown. The proposed system uses a combination of natural language processing techniques, including the Text Rank algorithm, to automatically extract the most informative and representative sentences from the reviews, based on predefined topics and sentiments. The method aims to provide users with a comprehensive and easily digestible summary of the restaurant, including basic information, key positive and negative aspects, and an overall sentiment ratio. The researchers used four predefined topics to classify the information, which is chosen based on the common choices that most users look for on review websites. The method was evaluated and compared to two other summary methods the Refresh and Genism systems, using various criteria, such as informativeness, clarity, helpfulness, and likes, and it was found to be superior in all aspects. The study comes to the conclusion that the suggested approach has the potential to be expanded to additional areas and characteristics in the future and can be a useful tool for rapidly assessing the general atmosphere and important elements of a restaurant. A machine learning-based approach for sentiment analysis of restaurant reviews is proposed in [5]. Sentiment analysis determines the emotional tone, attitude, and sentiment expressed in each text. A dataset of restaurant reviews is used and split into two parts: 70To balance the underlying factors of customer value in a restaurant setting, [6] applied machine learning- based natural language processing techniques to the analysis of a large number of online customer reviews explored. This allowed for additional refinement of the model through the use of techniques like data augmentation or over-sampling/under- sampling methods. It pinpoints 14 elements that, taken as a whole, represent earlier studies on customer value. The results imply that a more thorough understanding of the nature of customer value can be attained by combining cognitive and affective elements with the experiential viewpoint of value. Furthermore, the study discovers novel factors that have seldom been explored in previous studies. It proposes a methodological framework that enables researchers to test the quantitative measure of customer perceptions derived from unstructured online reviews. It finds that service providers need to fully understand specific factors that constitute customer value to receive customer preference. The 14 specific factors identified in the study contain customers' actual experiences, which service providers can use to improve their service operations. For example, service providers may be able to develop performance indices based on those identified factors. Additionally, the study also identifies many negative factors of customer value and suggests that practitioners need to not only improve the positive factors but also mitigate the negative fac- tors, given that they are related to customer satisfaction. It also suggests that hospitality and social media firms need to adopt a holistic view of customer value. When creating a marketing campaign or service design, managers frequently concentrate on the advantages

that consumers can understand. The results of this study, however, indicate that they shouldn't discount the importance of the cognitive or affective components of customer value.

Social media companies that post online reviews of restaurants will be able to reorganise rating systems and reviews to convey important details more broadly. They will also be able to create a recommendation system that aligns customer preferences with the attributes that specific restaurants meet. It does not define the type of restaurant to identify a difference and is restricted to the food service business 7555 Journal of Pharmaceutical Negative Results | Volume 13 | Special Issue 07 | 2022. To validate the findings and get a deeper understanding of value perception, more qualitative and quantitative research, as well as in-depth empirical research, should be carried out on the new value variables that the study has discovered.

The [7] delves into the recent studies and research done in the field of sentiment mining, specifically in the context of automating the sentiment analysis process. It would show the various methods that have been tested and propose a new hybrid classification method based on coupling classification methods using an arcing classifier. It also covers the different algorithms used in the proposed method, such as Naïve Bayes (NB), Support Vector Machine (SVM), and Genetic Algorithm (GA), and their performance in terms of accuracy. Additionally, it also shows the effectiveness of ensemble techniques for sentiment classification and the feasibility and benefits of the proposed approach using restaurant reviews as a case study. Studies on the extraction of classification information from reviews and its use to comprehend rating context and its significance in assisting users in making better selections are also included in this paper. The accuracy of the model using algorithms like Naïve Bayes, Support Vector Machine, genetic algorithm, and Proposed Hybrid Methodology is 85%

[8] the use of sentiment analysis in natural language processing to analyse reviews of restaurants on the Zomato application is shown. The researchers pre-processed the data by making all words lowercase, tokenization, removing numbers and punctuation, removing stop words, and lemmatization. They then used the term frequency-inverse document frequency (TF-IDF) to create word vectors. 150,000 reviews were used in the study. The data was then split into positive, negative, and neutral sentiments based on the rating of the review. The model used was a random forest classifier and the metrics used to evaluate the model were precision, recall, and accuracy. It was discovered that the model's accuracy was 92.43667 percentage. The precision of positive, negative, and neutral sentiments was 92percentage, 93percent



Fig. 1. Customer Reviews System

age, and 96percentage respectively. The recall of positive, negative, and neutral sentiments was 99percentage, 89percentage, and 73percentage respectively. The average precision and recall were 93percentage and 87percentage. The 10 words that had the most impact on the results were: "bad", "good", "average", "best", "place", "love", "order", "food", "try", and "nice". The study concludes that the model is effective in predicting the sentiment of restaurant reviews, but suggests that further research can be done to improve the results, such as using imbalanced dataset algorithms and using the word data of sentiments to find the sentiments rather than relying on ratings.

### III. PROBLEM STATEMENT AND SOLUTION

Giving clients access to a sentiment analysis system for review classification could be useful in analysing information where opinions are strongly polarized and very unstructured. Additionally, selecting a restaurant based on a particular recipe is challenging unless a recommendation system is in place to help with the process. Many patrons took additional time to look up the best eateries serving the cuisine they're craving. It is true that most patrons are aware of only a few number of eateries where they can get the meal they desire.

If people want to try a new recipe or eat their favourite in a new location, there should be a recommender system in place that

helps them decide which restaurant to go to and what to eat there.

Such a system will direct customers to the appropriate area whenever they wish to visit the restaurant for a particular kind of food. Additionally, the suggested method will save time and effort when determining which places have the best meals. In essence, hybrid filtering combines knowledge-based filtering with content-based filtering through a collaborative filtering method. In order to recommend food and restaurants to clients, this study employs the two filtering mechanisms—collaborative and context-based filtering approaches and algorithms—in an interchangeable manner.

#### IV. METHODOLOGY

A. Natural Language Processing (NLP) is a subfield of machine learning that deals with the understanding, interpretation, modification, and potential production of human language by a computer. Computers can comprehend human language thanks to a technique known as natural language processing, or NLP. Natural language processing (NLP) enables machines to comprehend spoken or written content and perform a variety of tasks, including topic categorization, keyword extraction, translation, and more.

B. Support Vector Machine (SVM) Algorithm - The research has presented a Machine Learning model that would aid in the categorization of restaurant evaluations. To categorise the reviews, this model was trained using the SVM (Support Vector Machine) Algorithm. SVM stands for Supervised Learning and is used to solve both classification and regression issues.

#### V. CONCLUSION

This study presents an efficient restaurant review prediction algorithm to predict the review for the restaurant based on many customer reviews. Natural Language Processing (NLP) combined with the SVM classification method yielded the greatest prediction accuracy-(77 percent). This tactic will help entrepreneurs anticipate client comments and enhance the customer experience. The online food delivery and restaurant review industry have been rapidly growing in recent years, and it has become crucial for businesses to understand customer sentiment towards their restaurants. Sentiment analysis is a technique that uses natural language processing and machine learning to understand customer emotions and opinions, and it can be used to make data-driven decisions and improve the overall customer experience. The main objective is to provide a comprehensive understanding of current research trends and advancements in this field and to serve as a starting point for future research. Despite the success of the bi-GRU approach, which is currently the most popular technique used, there is still room for improvement, and it is necessary to explore new techniques and methods for sentiment analysis with the increasing amount of data and the need for more accurate analysis. This survey will help researchers to understand the current trends and advancements in the field and to make better data-driven decisions. In the future, a real-time application can be made so that people can use it to analyze the reviews more effectively and grow their businesses. There is still a wide range of approaches to investigate, which might make this a much more fascinating field to research and develop.

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