VendorVision: A Cloud application for customer review analysis

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***Abstract*—** The purpose of this work is to assist retail store owners by transforming customer reviews/feedback into insights using NLP and Generative AI. The application enables different retail businesses to capture, store and visualize customer feedback from the online compendium of reviews- Google Maps. This way, it empowers the system on extracting sentiment analysis, key business topics, and trends related to customer sentiment, chronic issues, and tangible solutions via Natural Language API by Google Cloud and Gemini recommendations. Using real-time data feeds and historical feedback, the platform enables both the analysis of short-term tendencies and the overall trend analysis. The proposed solution aims to enhance customer satisfaction and by increasing sales figures.

This solution is characterized by having flexible and efficient cloud architecture, making it well suited for the diverse physical retail outlets in the current market. Besides providing the services of the data interpretation for the store owners, which will help them to make reasonable decisions for the store, this project promotes the customer-oriented, data-driven decision making. Customer concerns can be handled effectively and, therefore, enhance business performance significantly.

Keywords- Sentiment Analysis, NLP, Text Summarization, Generative AI, Insight generation, Cloud architecture, API access

I. INTRODUCTION

- The worldwide web and word of mouth have now increasingly turned into a vital wheel of the continuous business cycle where service providers have come to realize the importance of consumers' attitude and impressions that they can shape. Performing a review analysis with existing methods is an incredibly monotonous and time-consuming process. These are due to recent development in Natural Language Processing (NLP) and features of machine learning that allow an automated system sieve through masses of user content to come up with useful information.

- This project includes providing a complete system for online review analysis with an intent to extract maximum out of the above mentioned developments in sentiment analysis, text summarization and generative AI in order to deliver real world recommendations for the vendor to optimize customer experience and overall sales.

- The system harnesses the optimal sentiment analysis of qualitative reviews into positive, negative and neutral and generative AI to give recommendations for improvement from classified results. In addition, trends and epithets are derived to represent instances as seen frequently in customers' comments.

- It uses APIs including Google Places to retrieve reviews, and global support; Google Translation which enables it to provide support locally to different regions. They are conveyed in the form of analytical dashboards created using the Plotly tool with work trends of customer sentiment data.

- Another way the gap is closed is in the following manner: the same proposed solution brings in raw review data and the places it is in, in a form that store owners can use as insights immediately. The purpose of this project is to equip emerging businesses with the necessary tools that will allow them to address customers' feelings toward their services and products and use the received information to increase customer satisfaction rate and better their revenues.

- The subsequent sections outline the approach adopted by the system, the approach of integrating APIs, scoring techniques of sentiment analysis and the methods of review summarization. Experience is illustrated through case studies to real-life scenarios and then we consider future enhancements and possible ways the system might be further developed.

II. LITERATURE SURVEY

- The project is conceived after the analyzed studies of several research papers to help us in accumulating the requisite knowledge for this field, and to comprehend the present generation of Sentiment Analysis at hand and the improvements which are made in the current period of time. This procedure is of critical importance so that we can conceptualize the rationales behind each progression that has taken place and how they affect this field individually and collectively. Just like there is little logical connection between the two, the use of a particular algorithm, developed in a completely different environment and designed to accomplish an entirely different goal, can assist in making some of the stages of an advanced sentiment analysis algorithm a bit more efficient.

- *Summarizing Product Reviews Using NLP-Based Text Summarization*: This paper considers the shift from traditional physical shopping to the modern convenience of online shopping pointing to both the importance of review-based data and the means to effectively use the same towards the betterment of the store in question.

- This aided us in reaching two conclusions- the significance of online customer reviews, a recurring theme across all the papers enlisted, the use of NLP-based techniques (Sentiment Analysis and Text summarization) to extract the useful information from these reviews and find a mechanism to translate them into real-world goals which could lead to the betterment of the stores.

- *Sentiment analysis for E-commerce product reviews in Chinese based on sentiment lexicon and deep learning:* points to a new sentiment analysis model- SLCABG, which is based on the sentiment lexicon, combining Convolutional Neural Network (CNN) and attention-based Bidirectional Gated Recurrent Unit (BiGRU). The software involved here was extremely complex and required enterprise level hardware to run on smoothly. This drawback helped us realise, in order to get industry level results, we would have to use other means to achieve them, due to which Cloud-based models were considered.

- *Sentiment Analysis in E-Commerce Platforms: Current Techniques and Future Direction:* this paper acted as a model for finding and aiming to bridge academic gaps in any field. It helped us find an approach and gave an illuminating, detailed overview into the world of NLP models for each task in textual analyses. It pointed towards improvement of sarcasm detection and fine grained analyses techniques as grounds for future research

- *Sentiment Analysis in E-Commerce:* A Review on The Techniques and Algorithms: this particular paper strengthened our feeling that there is realistic potential for making a difference with this type of sentiment analysis. It provided evidence of better product approaches, client attention, and hence, sales. Even more, it strengthened an argument for the Sentiment analysis as a means to have common, enormous short term and long term benefits when coping with huge text corpora which can be immediately applied to a big heterogeneous class of applications. It also mentioned lexicon based analysis as an alternative, highlighting some of the limitations of the Sentiment Analysis techniques in context of sarcasm and other shaded text interpretations.

- *Natural Language Processing for Analysing Online Customer Reviews: A Survey:* helped us realise the real-world influence held by customer reviews in any large-scale popular application and its ability to sway people's belief, further strengthening our belief in its potential as a highly relevant dataset to be used for our project.

- *AI-Driven Predictive Analytics in Retail*: A Review of Emerging Trends and Customer Engagement Strategies: One of the few papers addressing privacy, fairness, and transparency in AI implementations in a topical manner revealed the sensitive nature of data and how carefully it must be used, nudging us in the direction of public datasets which would not impinge on any individual's privacy.

- *Predictive Analytics and Machine Learning for Real-Time Supply Chain Risk Mitigation and Agility:* A paper which played a crucial role in instilling our belief in the dynamism of systems, real-time support and monitoring and the significance of predictive analytics in the modern climate of AI boosted retail.

- *Customer Experience and Satisfaction:* Consumers' Perception of Product Quality and Customer Relationship Management on Consumers' Buying Intention: another important paper that established the review by customers and customers' value in the choice made by the masses when it came to store selection, product selection or service provision. It elaborated with empirical analysis regarding the unique status of these reviews and contributed a local approach to an application which we believe will benefit the people in our community.

II. PROPOSED METHODOLOGY

VendorVision, is an cloud application designed to analyse large sets of online reviews, in the service of store owners to fully utilise the data held within them. Using the developments in Sentiment Analysis, text summarization and Generative AI, it aims to provide actionable real-world insights and recommendations, tailored to enhance customer experiences and thereby, to improve sales.

The system realises the full potential of sentiment analysis, using it to classify reviews into positive, neutral, or negative categories, Generative AI to provide suggestions and improvements that can be incorporated in the physical stores based on analysed feedback. This helps the physical stores provide a unique customer service and experience which sets them apart from online platforms and thereby boost their sales.

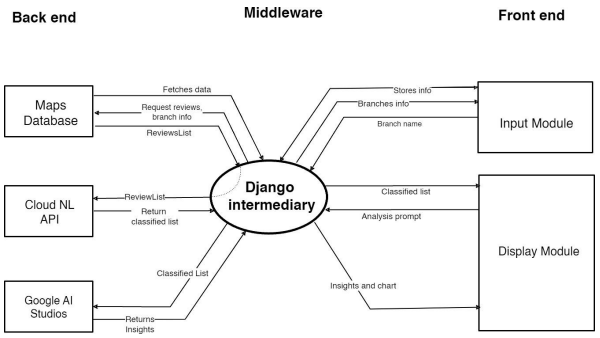

Fig 1. Architecture Diagram

A. *Datasets Used*

- Google Maps Database for review sourcing

A. *Personalized Recommendations and Conflict Resolution in Vendor Vision*

This methodology describes the method employed by Vendor Vision while offering suggestions to enhance store performance based on the users' feedback analysis. Through sentiment analysis the platform will be in a position to help store owners and managers warrant for the improvement of services and products.

Data Submissions and Sentiment Analysis

1. *User Input*:

   - The user gives inputs which are the name of the store and the location.
   - With this input, the system returns a list of stores, and the sentiment score from the analysis phase.

2. *Sentiment Scoring*:

   - The score given to each store depends on the opinion, the review and rating given by the customers.
   - The sentiment score reflects the overall perception of the store, categorized as:
     - Positive
     - Negative
     - Neutral
   - The sentiment magnitude helps establish the level of sentiment score and the extent to which sentiment towards the store has been embraced in the text aids in providing weights on the reviews.

3. *Review Analysis*:

   - For a clearer picture, the system admits and groups the reviews into positive, negative or neutral ones.

Review Analysis Functionality

1. *"Analyze" Button*:

   - The system automatically groups all reviews for displaying them when the user clicks the "Analyze" button based on the sentiment of the reviews.
   - This makes it easier to examine customer views where the plan can focus on specific strengths and issues.

2. *Recommendation Generation*

"Recommend" Button:

   - If there are negative reviews, then the system produces decision-making suggestions that are helpful to respond to customers' complaints and enhance store results.
   - Recommendations are made based on problems found in the negative feedback which makes them relevant and easy to implement.

User-Centric Insights

   - The platform provides intuitive insights to help store managers:

Understand Sentiment Trends:

- An option for breaking down into sentiment distribution such as pie charts or bar graphs for easy comparison.

Focus Areas:

- Ensure frequent themes on positive and negative feedbacks are brought out, for consideration of areas of improvement.

Scalability and real time updating

Vendor Vision adapts to various store types and scales to handle large volumes of reviews:

- *Real-Time Processing*: It guarantees the current sentiment analysis and recommendations.
- *Customizability*: It supports its integration with disparate store categories and user-specific settings.

Key Benefits

- *Enhanced Customer Satisfaction*: has a tangible, real-world impact on the sales of the store by providing insights based on the negative reviews of the store.
- *Data-Driven Decision Making*: Informs store owners with recommendations and or insights drawn from trends appearing across the reviews which have been processed and analysed.
- *Improved Store Reputation*: Grows trust continuously and actively addresses the issues raised by the customers for better services.

Store Recommendation and Segmentation

The following Vendor Vision model, the process of store information acquisition and analysis starts with the Google Map API that finds histories literal and recognized stores using a string search inquiry with the store name and location given by the user. The API then returns details of other related stores including their addresses, ratings and the comments made by customers. These retrieved data points are then processed using Sentiment Analysis to easily sort and filter customers' feedback.

The model operates in two primary modes:

1. *Segment Everything:*

This Google Maps API returns all the stores that are of the same name and location, listing stores/branches having the same name/brand. This affords the user to choose amongst the options to analyse reviews of a particular branch.

Sentiment Analysis is used in this research to sort customer reviews into positive, negative and neutral sentiments.

Each sentiment category is split and graphed, showing grouped totals (e.g., total positive, total negative, and total neutral) for each store.

The results allow the user to view an overall summary of the perceived image of the store and also evaluate and compare different stores.

2. *Detailed Analysis Mode:*

When the "Analyze" button is clicked the system then looks at the individual reviews for each store.

The Reviews page presents reviews grouped under sentiment analysis, positive, negative and neutral which provides information regarding customer experiences.

This segmentation allows store managers or the users to have a detailed picture of the different strengths and weaknesses in customer experience.

3. *Recommendation Generation:*

When negative comments are identified the "Recommend" button provides tangible advice on how to address concerns.

The system analyzes negative feedback and offers 10 specific improvement activities about store products, services, and satisfaction.

A. Image of the website

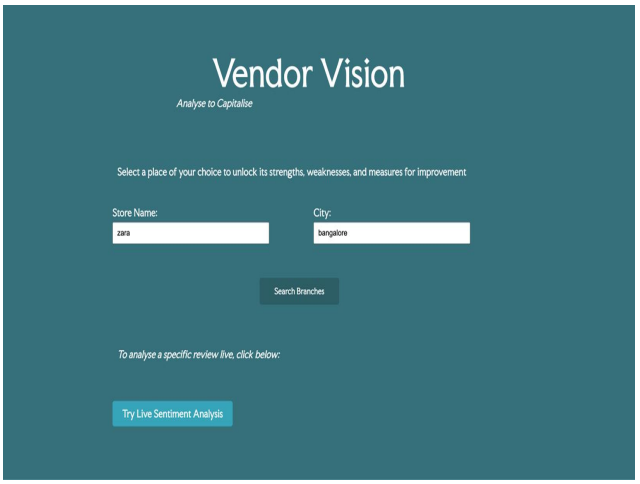

Fig. 2 Input Page - details of the store are entered here

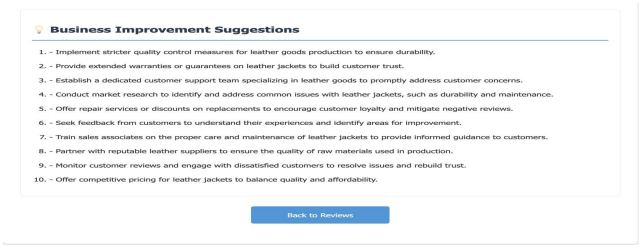

Fig. 3 Output image after selecting particular branch

The system then allows the user to select a particular store for focused analysis. Sentiment Analysis is applied to this selected instance, using the following methodology:

1. *Store Matching:*
   - The *Google Maps API* provides a list of potential matches for the user-specified store.
   - The system evaluates the relevance of each store using location proximity and name similarity.
   - The most relevant store is identified and selected for detailed analysis.
2. *Sentiment Segmentation:*
   - Customer reviews associated with the selected store are analyzed and categorized into positive, negative, and neutral sentiments using sentiment analysis techniques.
   - Reviews are segmented based on sentiment, creating a clear view of the store's feedback distribution.
3. *Intersection and Scoring Mechanism:*
   - If multiple reviews are linked to overlapping store instances (e.g., different branches or similar names), the system applies a scoring mechanism to determine the best match.
   - The score is calculated based on relevance metrics, such as customer review frequency and location proximity.
   - Higher scores confirm that the selected store aligns accurately with user intent.
4. *Focused Segmentation:*
   - Once the store is selected, the sentiment analysis results are segmented and visualized.
   - The output highlights the proportions of positive, negative, and neutral reviews, allowing users to focus on specific feedback categories.
5. *Detailed Feedback:*
   - Users can view detailed reviews within each sentiment category to understand customer experiences better.
   - This segmented analysis provides actionable insights to address specific issues raised in negative reviews or build on positive feedback.
6. *Recommendations:*
   - For stores with significant negative sentiment, the system generates tailored recommendations.
   - These recommendations aim to address customer concerns and enhance the store's overall reputation and performance.

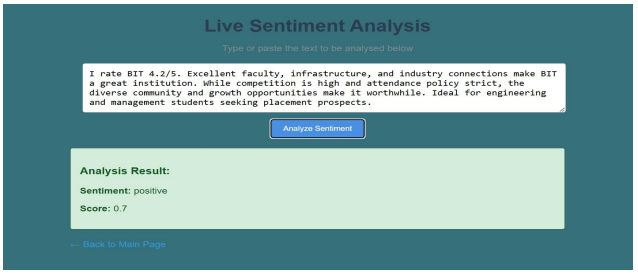

Fig. 5 Output image for live analysis

IV. RESULTS

Fig. 6 Review Dashboard

The end goal of this application is to aid users to in transforming their available reviews into usable, real-life insights and facilitates the complete understanding of what the store's strengths and weaknesses are. This aids the user in implicitly gaining knowledge on what the store's customer base desires. This enables store owners to build on their strengths and eliminate their weaknesses

V .CONCLUSION

The project effectively illustrates how sentiment analysis, data visualization, and natural language processing can be combined to examine customer evaluations in-depth. It gives businesses an effective and scalable way to comprehend client input and make data-driven decisions by utilizing Google Cloud APIs and AI models.

Through the use of user-friendly interactive dashboards, the system successfully retrieved reviews, identified sentiment, condensed insights, and produced practical improvement recommendations. Businesses may increase customer satisfaction, optimize services, and boost overall operational efficiency with the aid of these capabilities.

Notwithstanding its achievements, the project identifies some drawbacks that can be fixed in further rounds, such as language support and API rate restrictions. Additional

work, such expanding language capabilities and improving recommendation generation, could allow the project to serve.

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