18DCO301J – DATA X – APPLIED DATA SCIENCE WITH VENTURE APPLICATION

CUSTOMER SENTIMENT ANALYSIS

Submitted by

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(Under Section 3 of UGC Act, 1956)

BONAFIDE CERTIFICATE

Certified that this project report "Customer Sentiment Analysis" is the bonafide work of ARYAMAN ADIVYA SINGH (RA2011003011266),S P Jagrit,Routhu Manoj Sitaram,Rajarshi Agarwal,Janhvi Agrawal and Phate Viraj Vijay who carried out the project work under my supervision.

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INTRODUCTION

Business environments change frequently and require consideration when planning and conducting operations. It's also important to monitor any external environmental factors that can affect how the business functions as well as develop methods for overcoming these challenges. Choosing to monitor the dynamic nature
external environment factors allow businesses to protect themselves against predictable events and mitigate the effects of unexpected changes.

One of the external factors is the customer's sentiments. Customer sentiment analysis is an automated process of discovering customer emotions when they interact with your service, product, or brand. It is when the algorithms can detect
whether the customer is happy, sad, or neutral. It helps businesses get effective insights that can be used to improve targeting.

NEED OF THE PROJECT

Most of the buying process is an unconscious one, which is governed by emotions.Marketers achieve emotional branding by creating content that appeals to the consumer emotions. It proves difficult to read customer emotions using current methods.

Sorting Review Data at Large Scale

In today's world, data is being generated at an alarming rate be it from the users of Facebook or any other social networking site or the data which is being generated from different organizations. Because of this huge amount of data the value of the field of Data Science has a number of advantages in sorting them out.

Real - Time Analysis

Real-time Sentiment Analysis is a machine learning (ML) technique that automatically recognizes and extracts the sentiment in a text whenever it occurs. It is most commonly used to analyze brand and product mentions in live social comments and posts.

No Actionable Insight

Conclusions drawn from data that can be turned directly into an action or a response.

Missing the Mark in understanding Customer Needs

A company's digital presence is one of the main factors directly influencing its business
results. Therefore, it's essential to secure a positive user experience for our website visitors

High Prices for Automated Sentiment Analysis on E-Platforms

There exist many solutions that indeed charge more money but are not cost effective for startups.

Approach

Emotional branding is the process of forming a relationship between a consumer and a product or brand by provoking their emotions.

- Analyzing customer sentiment can be helpful in improving customer experience strategy

- Target customers who feel negatively and improve their service.

- Track customer sentiment or PRS(Product Review and Sentiment) over time effectively.

- Understand demographic and customer segment-based data quantitatively and qualitatively.

- Providing a Real-Time Analysis of Ratings

- Using data analytics to analyze emotions from various sources such as Visuals in seminars Personalized Interactions in surveys.

- Customer Reviews

- Using skills from AI/ML, sentimental analysis, other data analysis techniques and visualization methods.

BENEFITS

One of the benefits of sentiment analysis is being able to track the key messages from customers' opinions and thoughts about a brand.This helps the customer service department to be aware of any related issues or problems.As the method allows the organizations to understand their customers better, sentiment analysis provides a clear picture of the problems and persuades the organization to look for a solution.Making the customers happy and remain loyal to a brand is a taxing job. Hence another of the benefits of sentiment analysis make the whole process easier and at the same time provides opportunities for improvement.

Listed below are some of the benefits of sentiment analysis and a short explanation of how sentiment analysis helps your company.

- **Clients (other businesses)get an accurate analysis of their customers' emotions and build better content.**

- **Large scale customer emotion analysis made possible.**

- **Visual & user-friendly UI.**

- **Give a fight to the competition using emotional rebranding**

COMPETITION/CHALLENGES

Already Existing Online Solutions

These are businesses offering similar (or identical) products or services in the same market. They also vye for the same customer base. Some famous examples of direct competitors include
- Brand Watch
- Brand24
- MonkeyLearn
- Talkwalker

Fast Emerging AI Solutions

A high-profile emerging AI company provides the experienced data scientist with a platform for building and deploying machine learning models. This can although not direct but create an Indirect competition by deploying and providing a more tactful solution to this problem of Customer Data Management and Sentiment Analysis.

New Induction in this market Segment

Due to new Entry in this particular market segment our business may be affected from these challenges also known as the "new-entry effect"
- Financial Challenges
- Customer Preference Challenge
- Political Environment Challenge
- Human Resources Challenges

Customer Reachability

Due to new entry in the market segment, it may be an initial problem to gain customer reachability and therefore provide a trust factor to the new subscribers to our services and finance models.

CUSTOMER VALIDATION

Customer validation is an essential step in the process of developing a product. It helps you ensure you build something people will buy. The steps/questions needed to take a product from concept to market availability tests assumptions and hypotheses about the customer problem, target market, and product have been discussed below.

1. Can you tell me more about the last time you did Customer Multi-Platform Review Analysis?

The customer's(business owner) answered that since the product launch he has been performing a manual review checking department wherein they heavily rely on the portal's support of showing the keywords and how many negative/positive reviews they gained for their product.

2. What are the reasons you do Reviews Analysis?

The customer(business owner) provided the following reasons for review analysis:-
Better Understand your Customers & Improve Customer Service Credibility & Social Proof Fight with experience to save margins Improve Rankings Reviews,Generate More Reviews

3. How often do you Analyze the Review-Data collected?

The customer(business owner) provided a history of records where his Review-Data Analysis most probably relied on how the e-portal on which they provide their customers with their products sent them data. To be clear, it was a haphazard manner on a simple excel sheet with little to no data Analysis.

4. What are you trying to achieve/get done by doing Sentiment Analysis of the reviews?

In brief the customer((business owner)) provided with the following reasons to get a detailed sentiment analysis:-
Understand what your customers like and dislike about your product.Compare your product reviews with those of your competitors.Get the latest product insights in real-time, 24/7.Save hundreds of hours of manual data processing.

5. Could you describe step by step how you analyze the Data?

It is estimated that 80% of the world's data is unstructured. The business owner provided with his technique that he used was to manual data analysis by studying the review-data to find out the answers to how and why things happened in the past, which can be said as a tedious task

6. Which step is the most time-consuming/most difficult/most expensive?

The collection of reviews in a proper manner for a particular product is said to be a tedious task with a hectic amount of work due to manual entry of data in excel sheets.

7. Can you quantify this?

The customer provided Quantification which involves data, statistics, survey / research results from a relevant source, awards, expert research or evaluations, or improvements / reductions in attributes like revenue or costs.

8. Why is that?

The options for quantification can be briefly stated as :
- Data from customer results ($ or % values)
- Aggregated data from a group of customers ($ or % values)
- Statistics from an industry expert that support the intent of the Value Driver
- Survey or research results with attribution from an industry relevant source
- Industry or expertise award or mention for that particular value point
- Documented improvements / reductions in attributes like revenue / costs

9. If you could take out/avoid 1 step, which would you pick?

The customer presented his pain point as the step he would avoid from manual Data collection.

10. Why did you decide to go for this solution/process?

Regarding our solution, the business owner presented that the primary reason for this solution was the ease of the use of achieving the review-data analysis.

11. Did you ever compare alternative solutions to solve the customer non-satisfaction problem?

The business owner provided with the answer that all the other options were either too pricey or unavailable for his business.

12. How often do you experience problems in analyzing the customer sentiments through reviews ?

Customer sentiment analysis is used to gauge customer emotions expressed via online/social communication. It will give you an idea of how your customers perceive your brand, products, and services. This data can help you take adequate measures to improve customer satisfaction.

13. What happens before/after you experience the problem?

Before:- The customer presented the problems of collecting meaningful Data and selection of the right tool for analysis.

After:- The customer had to consolidate data from multiple sources and anticipate his quality of data collected over time.

14. What don't you like about the available resources?

Grammatical mistakes, spelling errors, and the use of shorthand are unavoidable. Sentiment analysis tools don't work as it may not be able to map the words to correct emotions or sometimes fail to identify the word itself. Also, algorithms and programs may not be able to decipher abbreviations.

15. How would you compare this (negative) experience to the Analysis you get ?

Negative case analysis helps with recognizing alternative viewpoints, the source of the contradicting data, and how they can contribute to your research to make it more robust. Furthermore, analyzing Negative cases gives you a better understanding of the strengths and limits of your data.

16. Can you show me how you do Data Sentiment Analysis?

The business owner provided with the insights on how he did the sentiment analysis:
- Collecting data: web scraping news articles
- Preprocessing text data
- Text vectorizations
- Sentiment analysis with logistic regressions

17. Have you ever tried to improve the original Traditional methods?

The business owner provided with the knowledge that currently no improvement was being done on the improvement of the traditional methods of data analysis methods.

18. Can you describe your solution?

To keep the explanation in the brief the following main steps would be carried out in our solution:
- A basic web app for sentiment analysis
- Login Tool to keep Data Safe
- Automatic Link-Web Scraping
- Visualization of Sentiments
- Key Points on what customers mention about product

19. Would you change anything today?

The customer provided with an idea of keeping it budget friendly with preferable for all kinds of every customer and covering most platforms.

20. What is the maximum you would pay (to invest) to tackle the problem of non-availability of such platforms?

The customer provided the maximum to pay according to the months of service he would use and the amount of features he would like to use.

21. Are you paying for a solution today?

He stated free websites and the annual subscription he gave for the microsoft Documenting services.

PROJECT DESCRIPTION

Sentiment Analysis to perform a fine-grained analysis as required for a specific use case. Sentiment Analysis can be used to track sentiment of new product launches, social media effects, people's sentiments in news articles, and perform market research.

Any company can apply sentiment analysis to social media, user reviews, or customer service enquiries to learn more about brand, feature and product perception, or successes and shortcomings within the company and product. This versatility has led to sentiment analysis receiving significant attention in recent years.

A DETAILED PROCESS HAS BEEN STATED BELOW

1. In the training process (a), our model learns to associate a particular input (i.e. a text) to the corresponding output (tag) based on the test samples used for training. The feature extractor transfers the text input into a feature vector.

2. Pairs of feature vectors and tags (e.g. positive, negative, or neutral) are fed into the machine learning algorithm to generate a model.

3. In the prediction process (b), the feature extractor is used to transform unseen text inputs into feature vectors. These feature vectors are then fed into the model, which generates predicted tags (again, positive, negative, or neutral)

UI ILLUSTRATION
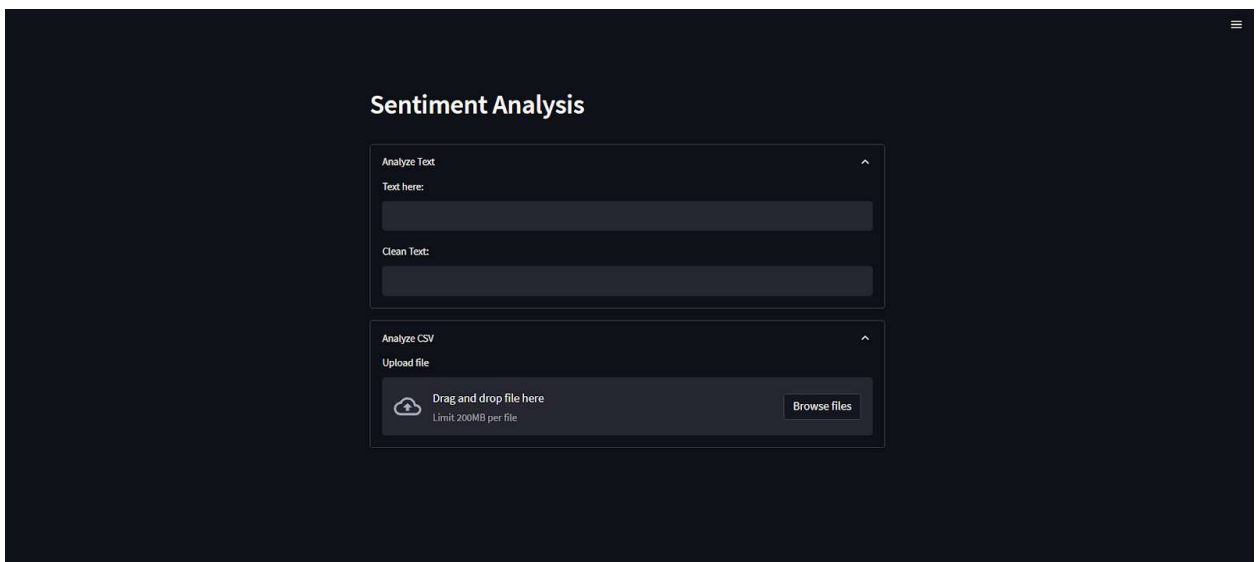
Main Screen
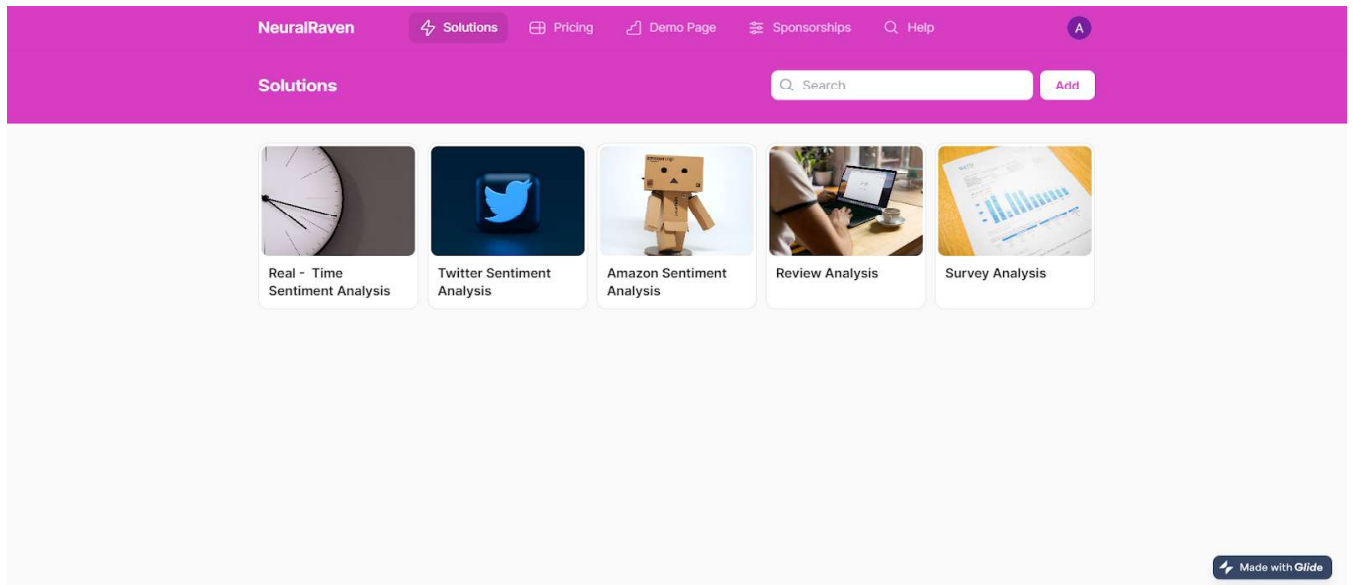
Pricing Plans Screen
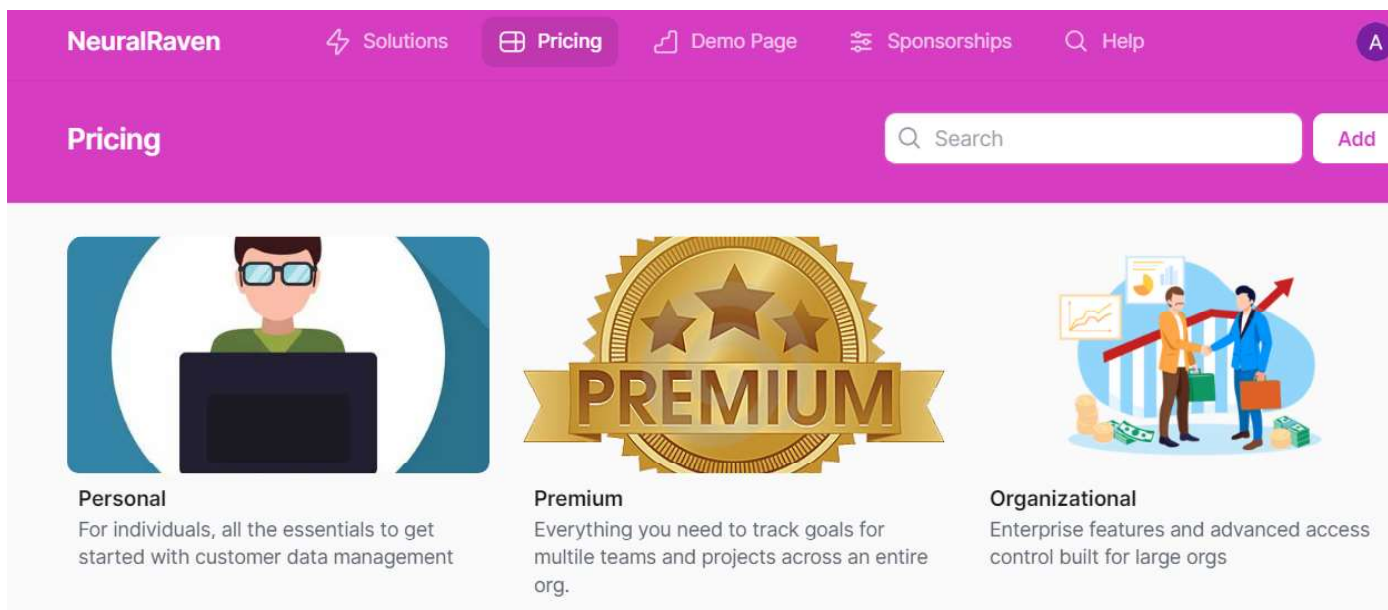
INPUT/OUTPUT DEMO

REAL TIME SENTIMENT ANALYSIS

The model uses streamlit library to provide a real time sentiment analysis of the input sentence by providing its polarity and its subjectivity.

It can also be used to quickly scan the CSV files and output the polarity of each statement in every cell,quite useful in Customer Review Analysis.
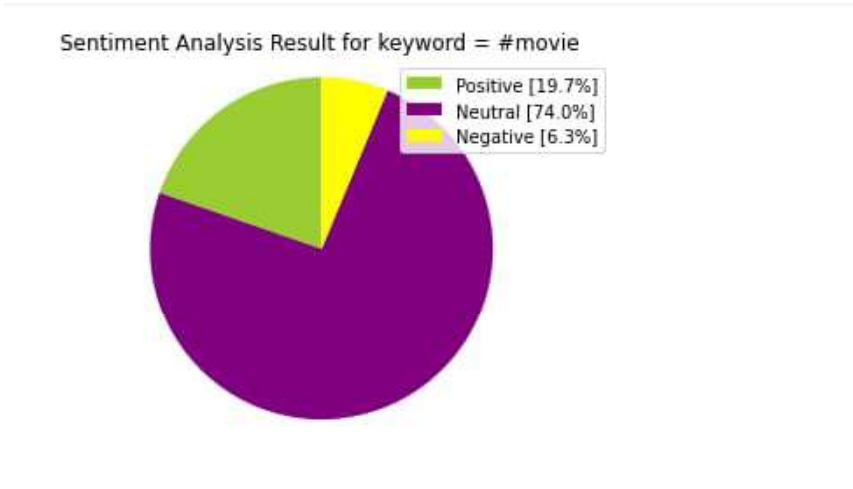
Twitter DataBase Sentiment Analysis

The Machine Learning model uses a text classification model using LSTM structure. And obtained Data from twitter API .The Accuracy of the model is 85.60%. The results show that Validation accuracy is more than the training accuracy. We have used sentiment intensity analyser to analyze the sentiment.

```
[13] positive = percentage(positive, noOfTweet)
     negative = percentage(negative, noOfTweet)
     neutral = percentage(neutral, noOfTweet)
     polarity = percentage(polarity, noOfTweet)
     positive = format(positive, '.1f')
     negative = format(negative, '.1f')
     neutral = format(neutral, '.1f')
```

Please enter keyword or hashtag to search: #movie
Please enter how many tweets to analyze: 2500

	0	text	polarity	subjectivity	sentiment	neg	neu	pos	compound	text_len	text_word_count	punct	tokenized	nonstop	stemmed
0	RT @RadioChinarFM: Our Evening Jock @rjsahilmu...	# ...	0.0	0.0	neutral	0.0	0.0	0.0	0.0	107	7	...	[.]	[.]	[.]
1	#affiliate #socialmedia #business #deals #link...	# # # # # ...	0.0	0.0	neutral	0.0	1.0	0.0	0.0	139	15	...	[.]	[.]	[.]
2	RT @NiziU__official: NiziU OFFICIAL FANCLUB\n 「...	\n「 」「 」...	0.0	0.0	neutral	0.0	1.0	0.0	0.0	120	13	\n「」「」...	[, 会員限定コンテンツを更新,]	[, 会員限定コンテンツを更新,]	[, 会員限定コンテンツを更新,]
3	@fantagiogroup @offcIASTRO So proud of our Act...	😍\n ...	0.0	0.0	neutral	0.0	1.0	0.0	0.0	112	8	😍\n ...	[, 차은우,]	[, 차은우,]	[, 차은우,]
5	RT @ChaEunwooINTL: 📷 daon_jjj IG post\n\nLike,...	📷 _\n\n, & ; ...	0.0	0.0	neutral	0.0	1.0	0.0	0.0	126	12	📷\n\n ...	[, 차은우,]	[, 차은우,]	[, 차은우,]

Sentiment Analysis Result for keyword = #movie

Positive [19.7%]
Neutral [74.0%]
Negative [6.3%]

Sentimental Analysis using Web Scraper

This model performs by web scraping on Wikipedia and performing sentimental analysis on the acquired data to generate few conclusions like polarity of the statements of Wikipedia towards the topic and finding the frequency of different words used in the data. This project can further be extended by generalizing the web scraping and generating a more conclusive sentimental analysis report on the given topic.
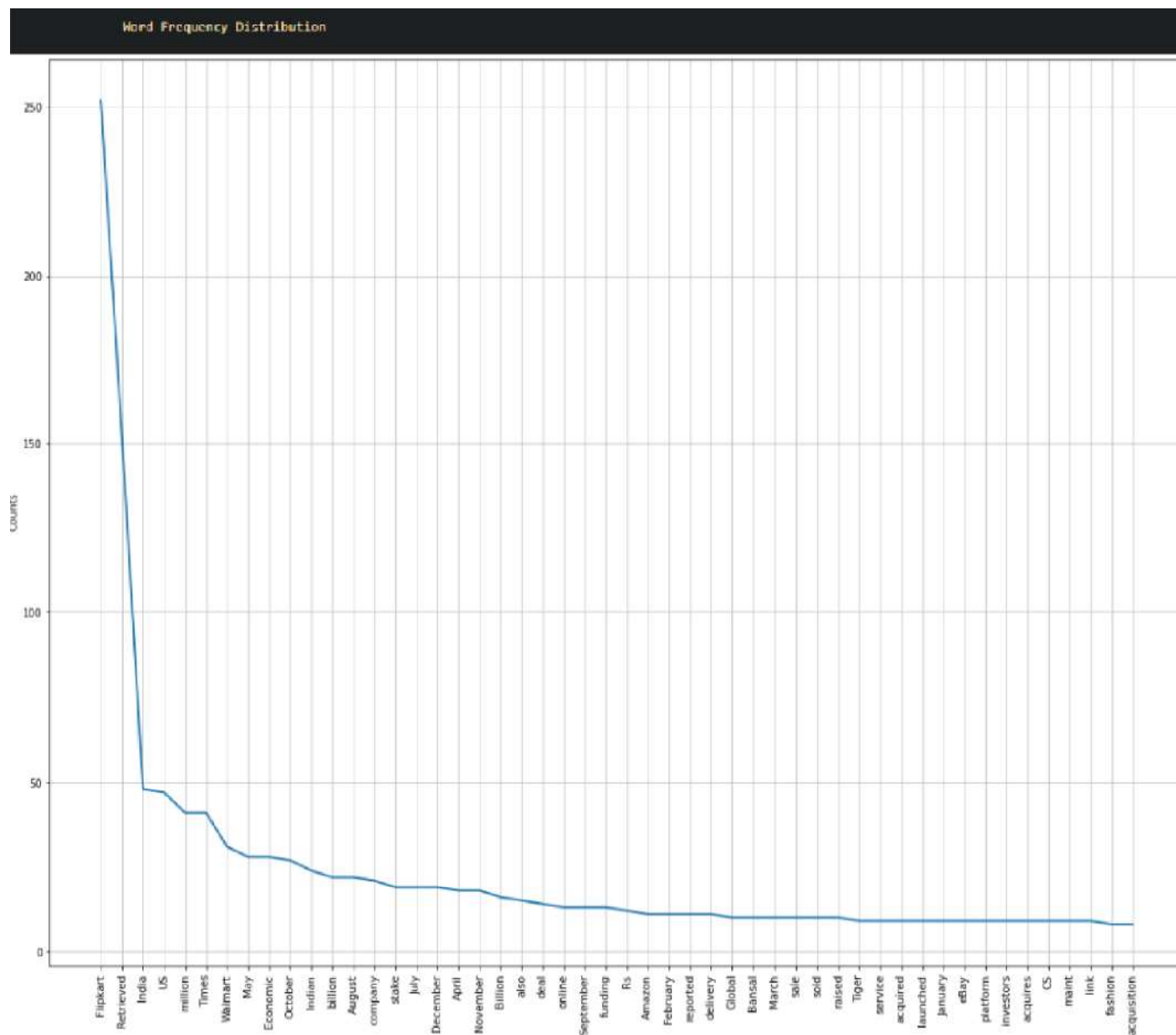
Input

```
        Enter Search Query:
        Flipkart
```

Output

```
        Analysis on sentences :

        Neutral    290
        Positive    85
        Negative    29
        Name: sentiment, dtype: int64
```

The graph below represents the amount and frequency of words used in the given data that can be very useful in getting the insights of the text pieces extractors.

Word Frequency Distribution

TECHNICAL COMPONENTS OF THE PROJECT

Common use cases of sentiment analysis include monitoring customers' feedback on social media, brand and campaign monitoring. Below we observe the tech stack required to create such a software.

Technology Used for the Proposed Solution:

- Data Science & Web Scraping

- Natural Language Processing(NLP)

- Machine Learning/Deep Learning

- Backend Technology like Flask

- FrontEnd UI using HTML,CSS, JS/React

- Deployment through a Cloud Based Server

SYSTEM ARCHITECTURE

THEORY

ML model training:

- Loading the Data from a Data Set
- Load an opinion lexicon listing the polarity of words.
- Splitting the Data Set into a Training Set and a Test Set
- Train a sentiment classifier using the word vectors according to polarity levels.
- Evaluate the Model
- Calculate the mean sentiment scores of the words in a piece of text.

Back-End Engineering

- Extract the ML model as pickle file
- Connect using Flask Implementation
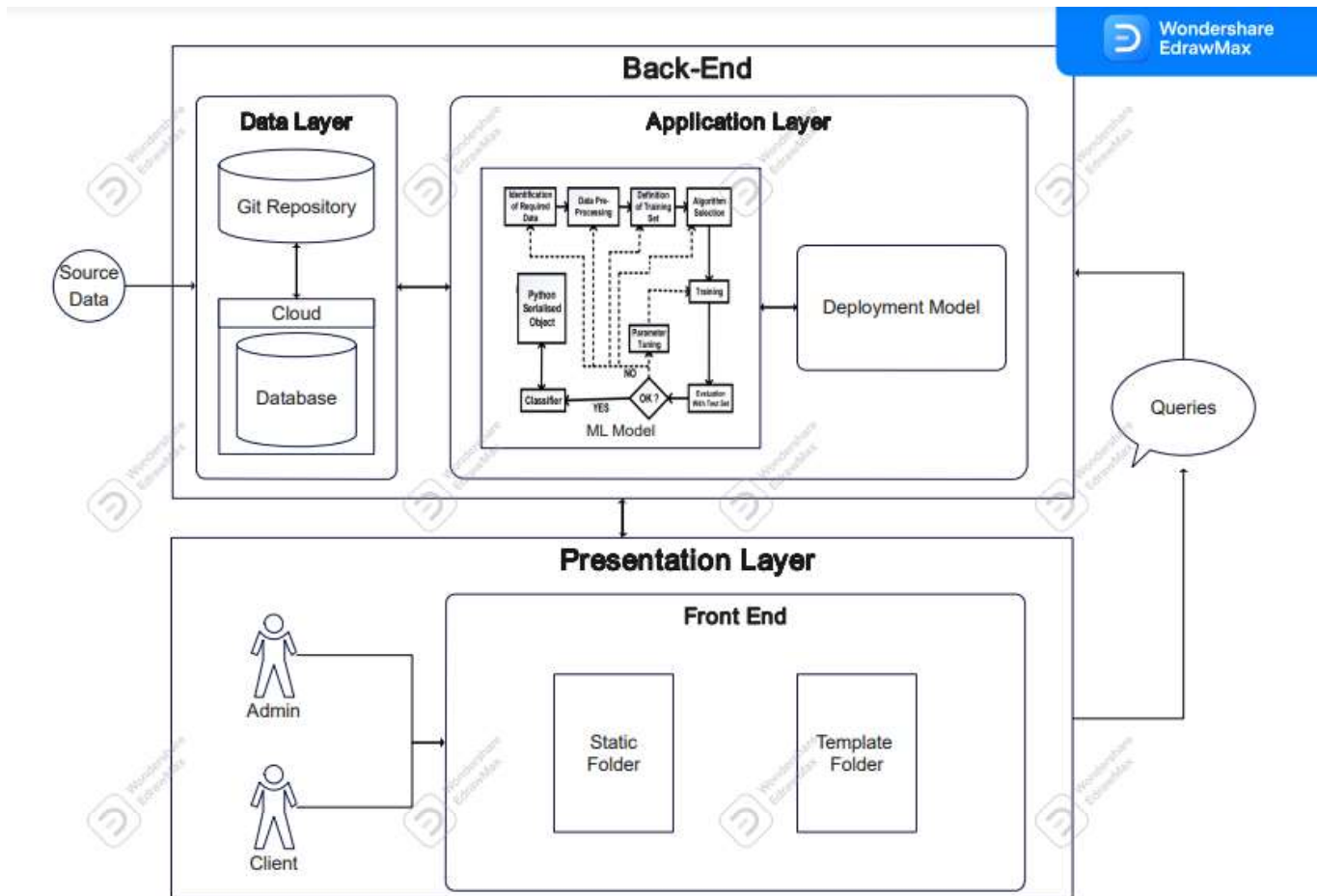
Front-End Engineering

Create a User Friendly interface for End-to-End Product

Deployment

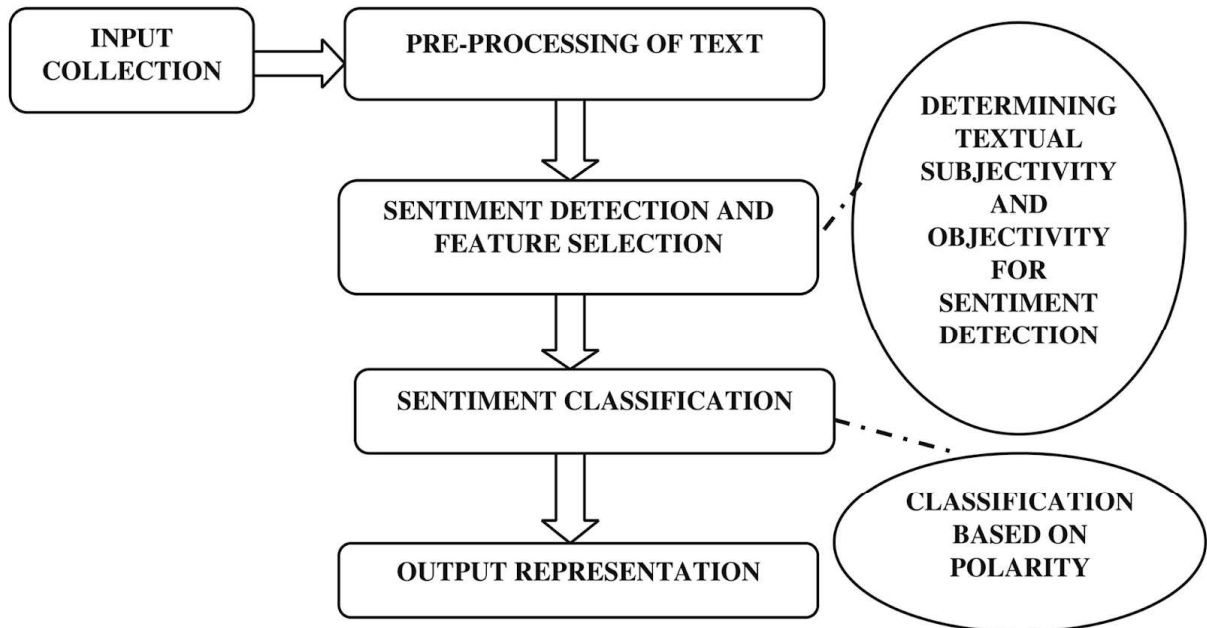Deploy the model on a cloud server(Eg : Heroku,Netlify,etc)
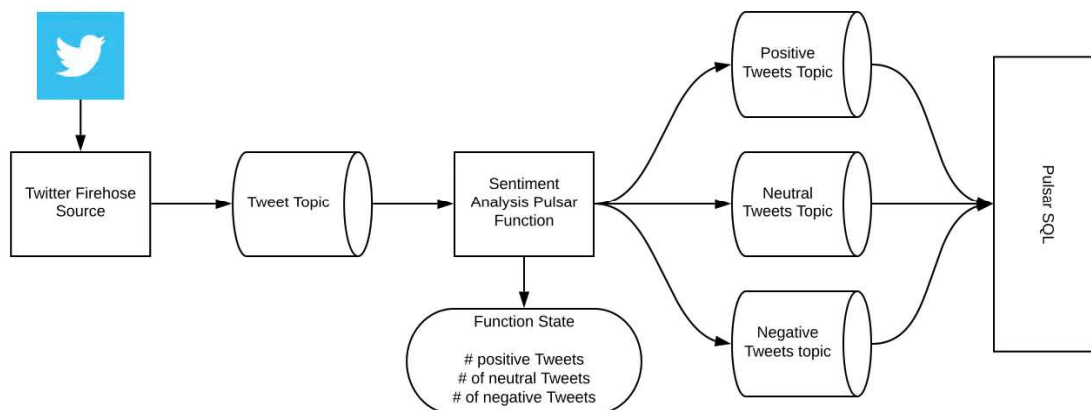
SYSTEM ARCHITECTURE

Diagram

DATA FLOW IN THE SYSTEM

Main Data Flow Architecture

For Twitter Sentiment Analysis

BUSINESS PLAN

A business plan is a document that defines in detail a company's objectives and how it plans to achieve its goals. A business plan lays out a written road map for the firm from marketing, financial, and operational standpoints. Both startups and established companies use business plans.

Key activities:

Marketing
➤ Marketing refers to activities a company undertakes to promote the buying or selling of a product or service. Marketing includes advertising, selling, and delivering products to consumers or other businesses.

Platform Development
➤ Platform development refers to the development of the fundamental software that makes hardware work and that provides a platform for application development.
➤ This includes the development of firmware, boot loaders, and BIOS, as well as operating system kernels and BSPs.

Communication with Clients and Partners
➤ Client communication is any communication between a business and its clients. This can include written communication, like emails and invoices; verbal communication, like phone calls; and physical communication, like smiling.
➤ A communication partner is just what the term implies: one who is on the opposite end of the sender-receiver connection.

Application Enhancement
➢ Application enhancement is a change in a product or an upgrade that raises the capacity of software or hardware beyond its unique specifications.
➢ It allows software and hardware performance capability. In a technology product, an enhancement is a remarkable development to the product.

Key Resources:

Brand Image
➢ Brand image is the perception of the brand in the mind of the customer. It is an aggregate of beliefs, ideas, and impressions that a customer holds regarding the brand.

Platform
➢ A marketing platform is a tool that links marketers and consumers and builds awareness, engagement and community.
➢ The first goal of an effective marketing platform is to enable companies to build relationships with consumers.

Tech knowledge
➢ Tech Knowledge means technical knowledge consisting of the processes, know-how, documentation, ideas, concepts, methodology, internally developed and licensed software, and algorithms for the development

Improving its algorithms and data analysis
➢ Algorithms should be error free and produce exact results as required by the user.Powerful insights should be given based on historical data with the help of data analytic skills.

Key Partners:

Investors
➢ An investor is any person or other entity (such as a firm or mutual fund) who commits capital with the expectation of receiving financial returns. Investors rely on different financial instruments to earn a rate of return.

Skilled Professionals
➢ proficient, adept, skilled, skillful, expert means having great knowledge and experience in a trade or profession. proficient implies a thorough competence derived from training and practice.

A customer

➢ A customer is an individual or business that purchases another company's goods or services
➢ Customers are important because they drive revenues; without them, businesses cannot continue to exist.

A complementary vendor

➢ A vendor is a general term for anyone who buys and sells goods or services. A vendor purchases products and services and then sells them to another company or individual. Large retailers, like Target, rely on many different vendors to supply products, which it buys at wholesale prices and sells at higher retail prices.

A supplier

➢ A supplier is a person, company, or organization that sells or supplies something such as goods or equipment to customers.

An intermediary (such as a reseller or an agent)

➢ An intermediary is a person who passes messages or proposals between two people or groups.

VALUE PROPOSITIONS

For the Company:

Better understanding with their employees and their needs.

Reduce customer churn

Boost business performance and strategy.

For the Employees:

Enhance their working environment

Improve training and employee recognition programs.

Foster a more humanized work culture.

COST STRUCTURE

- Development Cost

- Platform Maintenance

- Legal & Settlement cost

- Customer Support

- Research & Development

- Cost per Review(CPR)

- Revenue Streams

Revenue Model
- Advertising Revenue
- Subscription Revenue - Personal, Business, Premium
- Featured Listing
- Transaction Fee Revenue
- Affiliate Revenue
- Update and Enhancement Costs
- Subscription tenure cost
- Advertising
- User Data Access for Market Research

Customer Segment

Company(Clients)

People(Customers)

Customer Relationship

Company is the main Component

Same is the case with their Employees and the general public

Channels
Social Media

Twitter

Digital ads

Vouchers

FINANCIAL PLAN

GROWTH STRATEGY

Strategy Analysis:

- Market Penetration
- Market Expansion
- Product Expansion
- Diversification
- Acquisition

Strategy Formulation:

- BCG Matrix
- Stars – Premium Subscriptions, Sponsorships
- Cash Cows – Premium Subscriptions
- Question Marks – Invest Heavily
- Dogs – Click per Ads Revenue

Strategy Implementation:

- Discovery and Planning
- Designing
- Development and Deployment
- Marketing
- Customer Expectation Alignment
- Investor Satisfaction

TRACTION

Key Metrics Progress Chart

Time-Line	Clients	Subscriptions	Affiliations	Sponsorships
Monthly	10	10	1000	20
Quarterly	40	400	800	100
Half-Yearly	50	600	1500	150
Full Year	120	1500	2000	300
5 Years	600	5000	5000	300
10 Years	1000	10000	15000	500

Clients, Subscriptions, Affiliations and Sponsorships
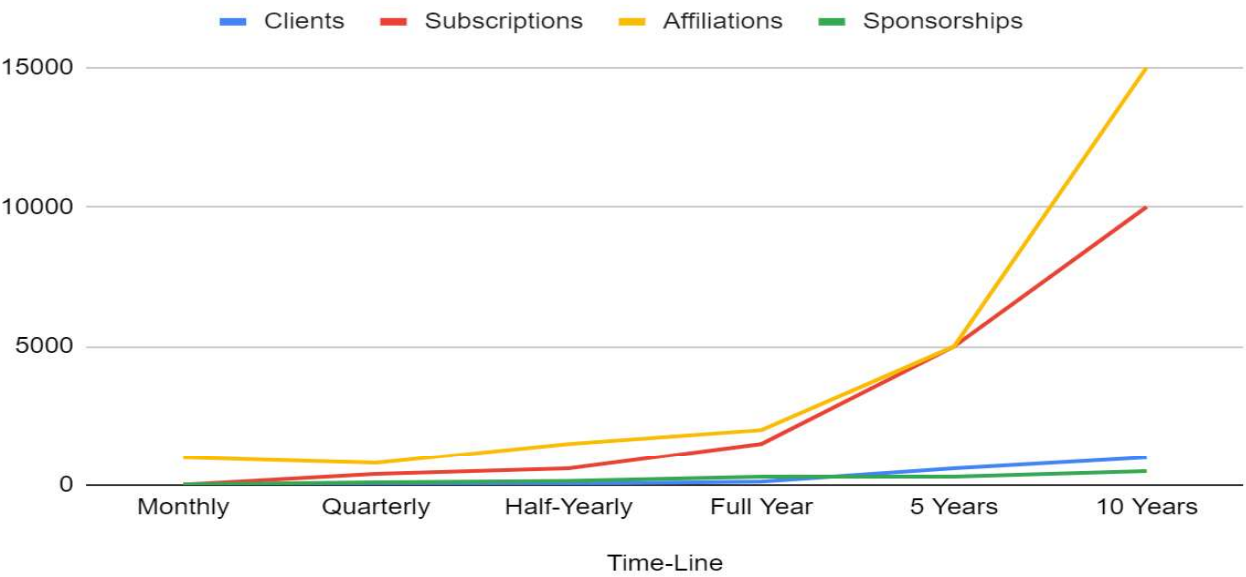
FINANCIAL CHART(EXPENDITURE AND GROSS PROFIT)

	2023	2025	2030	
Users	750	1200	2000	
Jobs	25	100	250	
Average price per job(Annual)	$900	$960	$1,080	
COMPANY REVENUE	$90,000	$204,000	$400,000	
- Cost of Revenue	0	0	0	
Gross Profit	$90,000	$204,000	$400,000	
OPEX				
- Sales & Marketing	$74,600	$142,800	$280,000	70%
- Customer Service	$12,500	$20,400	$40,000	10%
- Product Development	$7,200	$10,200	$20,000	5%
- Misc.	$3,700	$4,080	$8,000	2%
TOTAL OPEX	$98,000	$177,480	$348,000	
EBIT	$-8,000	$26,520	52,000	13%

2023, 2025 and 2030
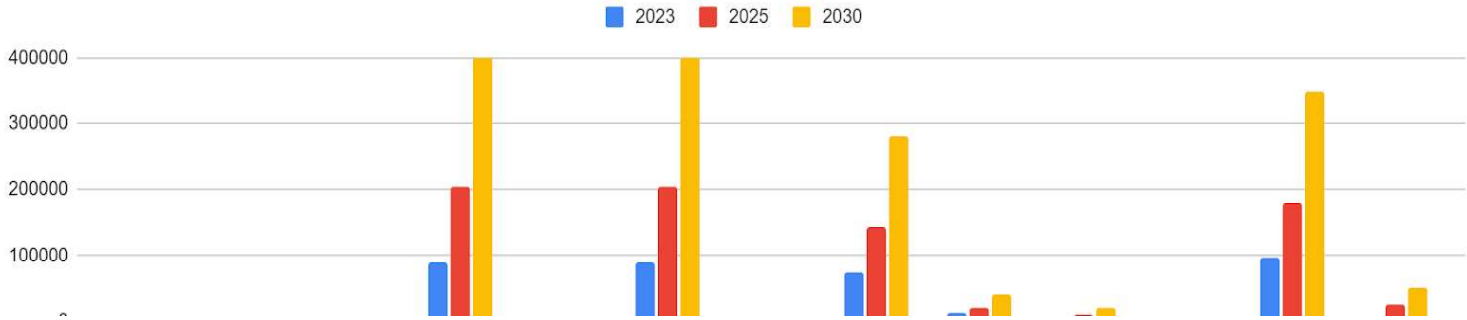
CONCLUSION

After concluding the live hands-on project, we get to understand more about Sentiment Analysis and how it majorly affects Business operations and affect their coming future. With sentiment analysis, you can predict your customers' response to new products or services before they hit the market.

Most of these algorithms can help detect a customer's emotional state in emails, live chat, and more. This enables businesses to prioritize specific messages and notify customer support when a disgruntled customer needs an immediate solution.

Whether you run a business, NGO, political party, or otherwise, we bet you can find a use for it. Bear in mind that sentiment analysis has near-limitless applications and it can bring significant benefits to a business like yours.