

Exploring the Impact of Natural Language Processing:  
A use-case of Chat GPT using Sentiment Analysis.

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Exploring the Impact of Natural Language Processing:  
A use-case of Chat GPT using Sentiment Analysis

BY

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requirement for the degree of

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Lastly, we would like to express our appreciation to our families for their unwavering support and understanding throughout this project. Thank you all for your valuable contributions.

## DEDICATION

I would like to dedicate this Final Year Project to my respected supervisor, Dr Seah Choon Sen, who gave me valuable feedback, guidance, insight and encouragement throughout my Final Year Project Journey. I would like to express my gratitude to my beloved family members, friends, lecturers, seniors, and each respondent who assisted me a lot in my Final Year Project. Without all of your supports, encouragements and assistances, it would be challenging for me to accomplish this Final Year Project.

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## PREFACE

Every student must complete the Universiti Tunku Abdul Rahman (UTAR) Final Year Project 'UKMZ3016' Research Project' in order to receive a degree for Bachelor of International Business (Honours). As a student concentrating in International Business, the knowledge and good awareness of global concerns is a significant source of competitive advantage. However, international business is a complicated and broad topic with numerous dimensions. Among the numerous global concerns, public acceptance towards chatgpt, a contemporary issue that every organisation faces, has been identified as one important trend that everyone should grasp the opportunity in utilizing it. Through the analysis on the relationship between reviews and ratings, brief conclusion could be made to provide researchers, academics, industries a clear insight of future opportunity and indicating them actions should be taken. Therefore, the author is inspired to explore the Impact of Natural Language Processing (NLP) through the use-case of ChatGPT using Sentiment Analysis.

## ABSTRACT

Artificial Intelligence (AI) has been widely used among the industry leaders. Its burgeoning increase of popularity has become a controversial topic among the public. In addition, AI has garnered public attention since the debut of generative AI, ChatGPT from OpenAI. ChatGPT has become viral since it was launched and available to the public. The rating and review of the app are being used as a reference and they are persuasive to the potential users. However, does rating and review has a positive relationship? This study will analyse how does review affecting ratings. Sentiment Analysis will be used in this research. This research has collected a sample of 2293 reviews towards ChatGPT to examine the variables towards ratings. Data collected started from the introduction of ChatGPT Application on the IOS App Store until 26<sup>th</sup> July 2023. The outcome indicates that review have positive relationship towards rating. License was granted by creative commons.

## **Chapter 1: RESEARCH OVERVIEW**

### **1.0 Introduction**

This research is designed to explore public acceptance towards Chat Generative Pre-Trained Transformer (GPT) and how would reviews affect the ratings of Chat GPT using sentiment analysis. Chapter 1 consists of background, problem statement, research questions, research problems, research objectives, and research significant.

### **1.1 Background of study**

Artificial Intelligence (AI) is a terminology to describe the system that imitate cognitive ability commonly associated with humanity's characteristics, for instance complex problem solving, quick learning, and comprehensive speech (Russell, S. J., & Norvig, P. ,2010). Since the applications of AI in various field, leading companies created a new paradigm named Generative AI (Aydın & Karaarslan, 2023). Generative AI is a pre-trained model on extensive data to create new and unique content. This pre-trained model is capable of creating video, music, images, literature and even human-like conversation (Aydın & Karaarslan, 2023). It has the capabilities to understand and construct a great number of words as it has been through training on substantial of text data (Gill, S. S., & Kaur, R. ,2023). Since the debut of ChatGPT, it has garnered great amount of attention of the public (Aydın & Karaarslan, 2023). ChatGPT is a highly efficient Natural Language Processing (NLP) system that can understand the context of human conversations and provides immediate response in multiple languages. It utilizes deep learning function and comprehensive algorithms to complete a great deal of language-related tasks, for instance, translation, generation, question answering, while understanding the context to construct human-like responses (Lund et al., 2023).

There has been extensive discussion about ChatGPT on several platforms, showing both positive and negative expressions about the chatbot. During May 2023, ChatGPT app was being released on Iphone Operating System and can be downloaded from App Store (Nelson, 2023). This was a smart move from OpenAI to counter all the fakes and copycats that have inundated the market since the first release of ChatGPT in 2022. The mobile version of Chat GPT has garnered high attention of the public. Users has been providing feedback and app ratings in the app store.

## **1.2 Problem Statement**

ChatGPT has garnered a great deal of public awareness and speculations since its debut in the world of AI. Since then, there are at least two camps exist- one highly concerned about the abilities ChatGPT seems to have, and another excited about the possibilities of fundamental changes to human tasks to what extent (Speed, A. 2023). Extant literature reviews noted a significant nonhuman-like variability in ChatGPT due to lack of capabilities to build a continuous long-term memory of experiences (Speed, A. 2023). This variability of ChatGPT has certain similarities to the reliability of emergent cognitive abilities others studied in larger Large Language Models (Kosinski, 2023; Wei, et al; Webb, et al). Although ChatGPT has remarkable capability, researchers took a stance against the development of any form of sentience in ChatGPT (Speed, A. 2023). Additionally, ChatGPT appears to have a notable underlying bias towards mental unhealth that wrapped in feed-good responses, although OpenAI intentionally added constraints on ChatGPT to make it behave positively and friendly. Therefore, researchers advocate caution in relying on ChatGPT too solely, specifically in decision-making tasks, critical reasoning, or analysis (Speed, A. 2023). Organization is avoiding the application of generative AI for essentials tasks, specifically tasks requiring human well-being to ensure review the results of a Generative AI before officially being published (Haleem, A, 2022). AI is merely capable of partially resolving some of humanity's issues. Besides, AI is heavily relying on the quality of data trained. Therefore, AI models are limited to making predictions on the back of data they have



been trained on. Moreover, current AI models need more empathy, creativity, and other humanity abilities. They could not think creatively or understand nuanced humanity affections and emotions, given the limited capabilities of carrying out certain jobs (Haleem, A, 2022). Users of ChatGPT must ensure information given is from reliable sources before relying on its responses. It has a certain difficulty to verify the response from ChatGPT when it is compared to Google, as it produces raw text without any citations (Haleem, A, 2022). As it is still being a new model, there are many aspects that need improvements. The bias and limitation in the data trained may pose a serious impact on the generated results. The outstanding capabilities of ChatGPT to complete complex tasks in the of world education have caused different feelings among educators as this development is changing the educational praxis. ChatGPT has become a controversial topic in the education sector, while some reckon it as beneficial tool of teaching and learning. Another side holds an opinion in which it poses a threat to education institutions, and causes teachers and students become lazy with zero analytical abilities (Baidoo-Anu & Owusu Ansah, 2023). Researchers have provided tips for teachers to bar students from the application of ChatGPT in the school assignments. According to Elsen Rooney (2023), New York City Journal of AI 59 Education Department has banned ChatGPT on school applications and network, hence teachers and students no longer have access to ChatGPT. Today, people rely on product ratings and reviews heavily to decide if the product is widely accepted by the public. It can be easy for computer to read and analyse quantitative data rather than qualitative data. Unlike human, computer does not have the capabilities to perform critical thinking. It is based on trained data set to perform actions. Mere rating system could not represent the actual user experience comprehensively. Therefore, review system allows users to state their actual experience with precise word expressions. These two systems are often congregated to enhance the quality of feedback. However, are user rating and review indicating the same meaning concurrently? Does high rating denote highly satisfied comments with positives words used? Or does a comment with substantial positive words represent a full star rating? In this paper, sentiment analysis will be used to examine whether ratings and comments are symmetric or asymmetric.

### **1.3 Research Question**

This research aims to provide answers for the research question below:

1. What is the public acceptance rate towards ChatGPT?
2. How would user's review affect the rating of ChatGPT?

### **1.4 Research Objectives**

In addition to the research question, this research carries 2 objectives.

1. To investigate public acceptance towards ChatGPT
2. To examine the relationship between user's review and rating of ChatGPT using sentiment analysis.

### **1.5 Research Scope**

The information was gathered from App Store to provide insights on this research. The conduct of the research will be specifically based on the subject of ChatGPT, from OpenAI. Besides, the analysis is limited the period of time after the introduction of ChatGPT app on the App Store. The precision of the information from the dataset captured is one significant assumption. Therefore, making inferences and conclusion about the research is contingent upon the accuracy of dataset.

## **1.6 Research Significance**

This research paper provides thorough insight of ChatGPT to academic researchers, policy makers, and industries.

ChatGPT will benefit academic researchers by handling and analyse substantial amounts of data that is significant to research. ChatGPT has shown its significance in revolutionizing existing praxis in the world of science. Researchers could not progress without the capacity of analysing huge amounts of data. Therefore, ChatGPT is extensively used for data analysis. Moreover, this study brings educators and students a better understanding of ChatGPT. In this research, we will discuss on several aspects of ChatGPT. While it is crucial for learners constantly exploring and investigating new knowledge (Piaget,1980; Schunk, 2012), this paper will show how ChatGPT can facilitate this process. ChatGPT enhances learners' prior knowledge and experiences and assists them in constructing new knowledge. Moreover, individualized feedback of ChatGPT supports this process by generating tailored suggestions for future learning (Ippolito et al., 2022; Vygotsky, 1962).

Besides, this paper introduces and advocate the use of ChatGPT to policy maker. With the analysis on the public acceptance of ChatGPT, it provides a useful insight for policy makers. High public acceptance indicates the future extensive use of ChatGPT by the public. Policy maker will have a rough insight on the necessity to develop laws and regulations. Relevant regulations will govern the healthy AI environment and avoid any misuse and inappropriate behaviour.

Apart from that, an insight will be given to the industry. The business world will be benefiting from this research with the analysis given. Entrepreneurs will gain insights on the public acceptance of ChatGPT and create relevant competitive strategies. This study provides information on the emerging AI trends and potential business opportunities through the understanding of extensive use of ChatGPT.

## **1.7 Chapter Summary**

As a summary, this chapter provides an in-depth insight into the world of AI and the potential challenges that needed to be addressed. Besides, objectives of the study are listed out in this chapter. Also, this chapter provides useful insights for researchers, policy makers and industries.

## **Chapter 2: LITERATURE REVIEW**

### **2.0 Introduction**

This chapter will provide an insight into several aspect of AI and variables that affect ratings.

### **2.1 Underlying Theory**

The underlying theory for this research is Consumer Decision Making Theory.

#### **2.1.1 Consumer Decision Making Theory**

The relationship between review and rating is crucial in providing an insight for researchers, marketers, academics, and industries. The theory that supports this named ‘Consumer Decision Making Theory’. Consumer decision process embarks on a journey starts from the recognition of need to information search, evaluation of alternative, purchase decision and lastly post-purchase evaluation. Customer review and rating stimulate a significant difference. Since reviews and ratings are comments that showing genuine experience of users after the use of products, thus it could be an utmost important factor in affecting the entire consumer decision making process. The research from Lackermair shows the importance of reviews and ratings create a critical source of information for consumers (Lackermair et al., 2013). Similarly, the research on the effects of review source and product type from Bae and Lee (2011) indicate that reviews from an online community form a credible source for consumers to understand an established product. According to Dixia, 93% of customers will go through

online reviews and ratings before their purchase (Loiselle, 2023). People tend to share negative experience in product reviews more aggressively rather than a good experience. Consumers are extra sensitive towards product reviews and ratings where they learn about the experiences and problems that past customers have had. Besides, there were 97% of participants indicate customer reviews would affect their buying decisions, and 92% of consumers would hesitate to make a purchase if there were no customer reviews (Loiselle, 2023).

## **2.2 Artificial Intelligence**

Artificial Intelligence (AI) is a topic that has been widely discussed among the public for decades and it is often being portrayed within science fiction movies on how AI robots or machines will take control of the world demoting the humanity to a mundane servile in providing assistance to the newly developed AI (Yogesh et al., 2019). While this story seems like an overexaggerated depiction of AI, the truth is that AI has been extensively apply to our daily lives without much awareness. AI technology is no longer the realm of futurologists; however, it has become an inseparable part of the business model of many industries and a crucial strategic component in the plan of numerous sectors such as medicine, business and governments on a worldwide scale (Yogesh K. Dwivedi a et al., 2019). A more comprehensive and complete characterisation was introduced in (Kaplan & Haenlein, 2019), where the research describes AI on the basis of its capability to perform interpretation independently and gain knowledge from external data to produce particular results through flexible adaptation (Brown, N. 2019). The capabilities of AI being used to extensively resolve computationally intensives and creative limitations of humans provided new application domains within a wide array of industries, such as manufacturing, finance, healthcare, marketing, and education with considerable impacts on productivity and performance efficiency. The revolution of AI has reached to a certain level where a large number of tasks can be done by machine intelligence, such as medical diagnosis,

translation, autonomous planning and scheduling, gaming, autonomous vehicle and even spam fighting (Brown, N. 2019).

### **2.2.1 Generative Artificial Intelligence**

Generative Artificial Intelligence (AI) is one of the functional areas that focuses on generating new and original instances through machine learning on a great deal of databases of experiences (Aydın & Karaarslan, 2023). The application of Generative AI in fields are diverse such as creating unseen pictures, music, and text. Recent advancement in machine learning has brought to humanity a top-notch digital content creation like Generative AI (Hu, 2022). Generative AI creates artificial instances according to extant digital content for instance video, text, audio, videos, and images by studying training cases, applying their patterns and distribution through deep learning (Abukmeil, et al., 2021; Hu, 2022; Jovanović, 2022; Gui, et al., 2021). This can be achieved through a pre-trained model on massive dataset of examples and generating new instances that are almost identical to the training dataset (Aydın & Karaarslan, 2023). Example of the most well-known Generative AI are Transformer-based models, Generative Adversarial Network (GAN) , and Variational Autoencoders (VAE). The most popular Generative AI among them is Generative Adversarial Network. Another well-known branch of Generative AI is Variational Autoencoders (VAE). Variational Autoencoder is a branch of neural network that learns to generate unseen instances by the process of learning to compress and decompress input. After massive trainings on datasets of examples, a Variational Autoencoders will be able to compress given cases into tiny representation which is known as latent code. Based on the latent code, Variational Autoencoder is able to decompress the latent code and construct a new example that is analogous to training dataset. Moreover, generative models like Transformer-based models can be trained to generate human-like text, realistic pictures, and sounds (Aydın & Karaarslan, 2023). Technology experts

reckon the potential applications of Generative AI in different areas are endless. Conversation production, linguistic transformation, summarization of text is merely a minor part of ChatGPT application to create natural-sounding content. Chatbot is part of the functional areas of Generative with the capabilities to create human-like conversation when it engages with humanity (Aydın & Karaarslan, 2023). Chatbots have become the attention of the public as the question of ‘Can computer think?’ remains in doubt.

### **2.2.1.1 Chat Generative Pre-Trained Transformer (GPT)**

ChatGPT is founded by OpenAI, a US-based organization established in 2015. Chat GPT is a sophisticated natural language processing model, which was pre-trained on massive dataset that enables it to generate human-like language that is contextually appropriate and almost identical to human-written stuff (Aydın & Karaarslan, 2023). Since the debut of ChatGPT in the world of AI on November 2023, it has gained more than a million within a week (Baidoo-Anu & Owusu Ansah, 2023). ChatGPT as a leading generative tool has surprised the world with its top-notch capacity to accomplish exceptionally complex tasks. Chat GPT utilizes self-attention mechanism to create natural and human-like language, and this mechanism enables it to learn human conversations and provide replies in a more precise way. Moreover, ChatGPT is capable of text production in any language and subject for any specific needs. ChatGPT modular architecture enables it to complete a wide array of tasks for instance language modelling, machine translation, question-answering etc. Currently, ChatGPT is being extensively used to develop virtual assistants and chatbots that can generate human-like conversation. With huge potential, ChatGPT is now being widely implemented in various industries. This model can construct complex applications in diverse fields, for instance finance, education, medicine,



and others (Aydın & Karaarslan, 2023). The remarkable capabilities of ChatGPT in completing complicated tasks within the industry of education stimulated different opinions among educators, as this significant development in the world of AI is revolutionizing existing educational praxis (Baidoo-Anu & Owusu Ansah, 2023). Responses from ChatGPT can be in many forms, such as humorous, formal, or informal (Borji, 2023). It is capable of solving complex exam questions, write poetry and performing coding. These overwhelming functions are being achieved on the back of a thorough pre-trained language model which allows ChatGPT to agilely understand any contexts and construct respective answers that sound authentic. The public can sign up an account for the access of ChatGPT (GPT-3.5) without any charges or subscribe to GPT-4 for a price of \$20 per month (OpenAI, 2023).

## **2.3 Natural Language Processing (NLP)**

Natural Language Processing (NLP) is one of the significant implementation areas of computer science (Aydın & Karaarslan, 2023). The ultimate objective to accomplish with Natural Language Processing is to invent a computer system which will be capable in understanding human conversation and create human-like text response to users (Aydın & Karaarslan, 2023). In order to achieve the goal, Natural Language Processing incorporates various technologies, models, and algorithms. To be more specific, NLP utilizes computational linguistics, AI application, deep learning models, etc. (Aydın & Karaarslan, 2023). As a combination, these functions enable computers to understand the full meaning of natural language in the format of voice data or text. Besides translating languages from different countries, NLP generates responses or process commands in accordance with the data trained. It would be difficult for people to acquire new natural languages and even more challenging to master the entire language. However, NLP has the capability to achieve this with significant outcome.

### **2.3.1 Types of Natural Language Processing**

#### **A. Speech-To-Text**

Speech-to-text also known as speech recognition, is the process of accurately translating voice. Speed-to-text is imperative for any scenarios that requires answers spoken questions or voice commands. The extremely challenging issue of speech-to-text function is the way people talk, when they have different accent, or speaking quickly and slurring words together, with different intonation, and use incorrect grammar (IBM, 2023).

#### **B. Part of Speech Tagging**

Another terminology of part of speech tagging is grammatical tagging. This function determines particular word or piece of text in a speech based on its use and context. For example, grammatical tagging determines ‘make’ as a verb in ‘He can make a plane blueprint’ and identifies as a noun in ‘What make of shirt do you wear?’ (IBM, 2023).

#### **C. Word Sense Disambiguation**

This function provides a set of word with meanings through a procedure of semantic analysis that analyses and selects the most appropriate meaning that makes the most sense in the given context. For instance, word sense disambiguation differentiates the original meaning of the verb ‘make’ in ‘make a plan’ (decide) and ‘make a bet’ (place) (IBM, 2023).

#### **D. Co-reference Resolution**

This specifically detects words that are referring to the same entity. The simplest example is identifying the person or object to which a

particular pronoun is referring to, such as the word ‘She’ is referring to ‘Jessica’ (IBM, 2023).

### **E. Named Entity Recognition**

Named entity recognition or an abbreviation of NEM determines words or phrases as useful entities. For instance, Named Entity Recognition identifies ‘McDonald’s’ as a location, or ‘Jason’ as a male’s name (IBM, 2023).

### **F. Natural Language Generation**

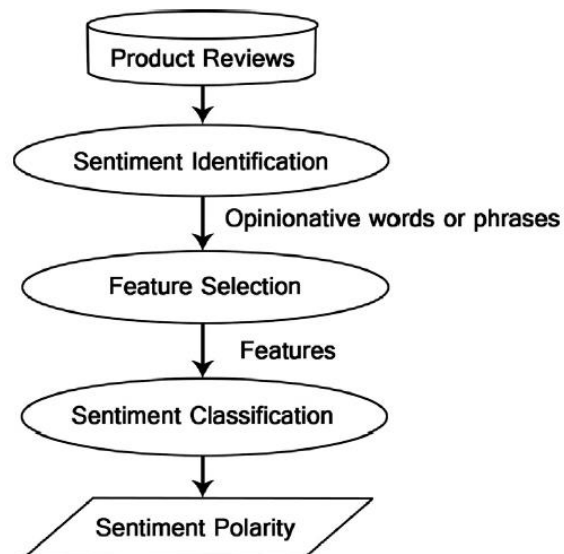
Natural Language Generation is having a completely opposite function of speech-to-text. The general function of Natural Language Generation is to incorporate structured information into the system and convert them into human language (IBM, 2023).

## **2.3.2 Sentiment Analysis**

Sentiment Analysis is a critical function of AI, specifically Chatbots that are constantly engaging with humanity. In today’s world, there are two functions of AI that share similar characteristic, which are Opinion Mining and Sentiment Analysis. Extant literatures have differentiated them with their specific function (Medhat et al., 2014). Sentiment Analysis determines the feeling and attitude expressed in a context and process it while Opinion Mining merely extracts and identifies people’s point of view towards an entity (Medhat et al., 2014). With that being said, the ultimate goal of Sentiment Analysis is to search for opinions, determines the attitude in the context, and categorize to respective polarities. Referring to Figure 1, Sentiment Analysis is also known as a classification process. As being show below in Figure 1, according to Medhat, there are three steps in Sentiment Analysis: document-level, sentence-level, and aspect-level of Sentiment Analysis (Medhat et al., 2014). The process targets to identify an

opinion document as showing a negative or positive opinion is being called as Document-level Sentiment Analysis. It examines the entire document as a basic information unit. Besides, the second step of the process is Sentence-level Sentiment Analysis. Its obligation is to identify sentiment showed in every sentence. Before classifying opinions into positive or negative, this step determines if the sentence is objective or subjective. Aspect-level Sentiment Analysis intends to group the sentiment to respective aspects of entities. Opinion holders may give distinct opinions for two or more aspects of the same entity. For instance, this level identifies the sentiments and classify them respectively like this sentence ‘The battery life of this speaker is not good, but the voice quality is superb.’ Figure 2.1 is indicating the process of sentiment analysis on product review.

*Figure 2. 1 Sentiment Analysis process on product review*

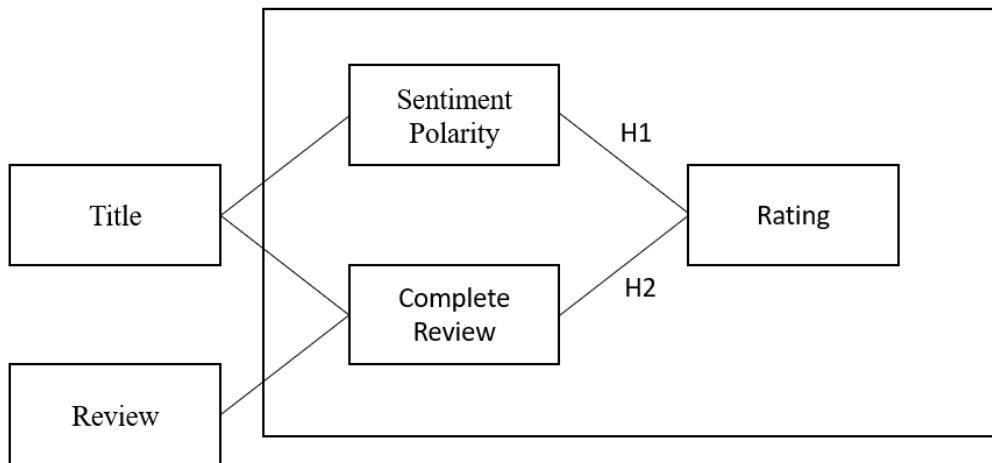


Source: Niaz, 2014

## 2.4 Conceptual Framework

Figure 2.2 shows the conceptual framework of this study.

Figure 2. 2: Conceptual Framework



## 2.5 Reviews of Variables

### Complete Review

A complete review is a terminology where researchers combine review and title of review into an entity. Review is a critical assessment of something. People share their experience and thoughts through written paragraphs in the app review. App reviews are crucial as it will affect potential user decision to download the app. We have collected 2,293 app reviews that contained of ChatGPT reviews and opinion. This data was not being categorized into any specific groups yet. These reviews were collected on twitter, and they contained of users' real feedback after the use of ChatGPT. Title is a short description of a review encompassing the essence of context. Besides

collecting content of app review, we have also gathered title of each app review. Title is a brief description of the context posted by the users. This is the very first step where user's sentiment or expression can be observed. Generally, users would put 'Amazing' 'Good App' as the title when they were having good experience with the app. On the other hand, title like 'Disappointed' 'Garbage' will be seen when users were having bad experience while using the app.

### **Sentiment Polarity**

Numerical values range from -1 to 1 are called Polarity scores. The value '-1' indicates a strongly negative sentiment, '0' shows a neutral sentiment, '1' depicts a very positive sentiment. Polarity scores allow researchers to have a clear insight to identify the overall mood of a various content such as product review, customer feedback, or a social media post.

### **Rating**

App rating is a numerical score to mobile application. Scores are given by users based on their overall satisfaction of using the app. In app store, users can rate downloaded application on a scale of one to five stars. The average of individuals' rating will display on product page and search result (Inc., n.d.). Bad reviews and ratings of a product or service discourage potential users from downloading the app and will directly affect the business. Therefore, app performance is often valued by marketers (Anderson & Simester, 2014). Marketers usually develop relevant strategies to address problems that are reflected in user's review. This data contains of users' ratings for ChatGPT. Data was collected on an ordinal scale where users can rate ChatGPT from the scale 1 to 5. Indicating from extremely unsatisfactory, unsatisfactory, neutral, satisfactory, to extremely satisfactory.

## **2.6 Hypothesis Development**

H1: There is a relationship between Complete Review and Rating

Unstructured reviews from user occasionally do not provide a clear classification. Therefore, complete review is being used in this research. Complete review is compounded by review and title. The main challenge of sentiment analysis process is to categorize keywords in complete review into respective sentiment polarity. This classification identifies the sentiment of specific context of review and categorize them into neutral, negative, or positive. In this research, tests will be conducted to analyse the relationship between complete review and rating. (IEEE,2020)

H2: There is a relationship between Sentiment Polarity and Ratings

The basic issue in sentiment analysis is categorization of sentiment polarity. With a context given, the task is to classify the text into the particular sentiment polarity, negative or positive, or neutral. However, when the text is being classified into different polarity, to what certain extent would the sentiment polarity affect ratings of reviews. In this research, examination will be conducted to analyse the relationship between sentiment polarity and ratings.

## **2.7 Conclusion**

In short, this chapter discusses on Consumer Decision Making Theory, provides an in-depth insight into the importance of the relationship between reviews and ratings. Besides, comprehensible definitions of variables and specific terminologies are given in this chapter. Lastly, a clear and understandable conceptual framework is shown in this chapter, giving a clear picture of the relationship between variables in this study.



## **Chapter 3 : METHODOLOGY**

### **3.1 Introduction**

This chapter will provide thorough insight into the methodology used for this research. This research will be conducted by using secondary data to examine relationship between the independent and dependent variable. The access of the secondary data has been made available to the general public on Kaggle by the author, Saloni Jhalani (Saloni Jhalani, 2023). The preliminary requirements for the selection of data was based on the minimum sample size of at least 2,000 units, and a recent upload date of within 12 months.

#### **3.1.1 Accessing Secondary Data**

This research will be conducted using secondary data. Secondary data is used in secondary research, where the data itself is collected by someone else (George, 2023). Raw data that was gathered and processed by the others is known as secondary data. The secondary data used in this research was being obtained on Kaggle, a data science platform where everyone has access to it. Since it was a raw data, data preprocessing is necessary. The existence of secondary data provided people with greater flexibility and convenience in their research as it saves a great deal of redundant time in collecting data independently.

### **3.1.2 Sources of Secondary Data**

The secondary data used for this research was sourced from Kaggle, an online platform consisting of machine learning engineers. The platform was founded in the year of 2010, being well-known for various datasets in different fields. The datasets were utilized by data scientists and machine learning engineers to work coherently in creating AI models and publishing dataset. The contributor of this dataset is Saloni Jhalani, a Software Engineer from India (Saloni Jhalani, 2015).

## **3.2 Sampling design**

Sampling design comprises of sampling techniques, sampling framework, and target population. Target population of this research is users of ChatGPT, including both app and website users. The sampling frame of this study was focused on the users of ChatGPT App from the IOS. However, the sampling technique could not be determined due to the processed data. The size of sample of this secondary data is 2,293 units.

### 3.3 Data processing

The data used in this research has gone through normalization process by the author. Computational process has been completed through Bag of Word Vectorization, Handle Imbalanced Data, Train Test Split to prepare data for further examination.

#### 3.3.1 Bag of Word Vectorization

Bag of Word Vectorization refers to a process that turns arbitrary text into a fixed length vectors after the calculations of the frequency of a word appears (Victor Zhou, 2019).

#### 3.3.2 Handle Imbalanced Data

Imbalanced data is a general problem in machine learning, where a class has remarkable higher units of observations than the other, resulting in poor performance on the minority class. The method used to balance the dataset was Synthetic minority over-sampling technique, abbreviated as 'SMOTE'. An oversampling technique includes developing synthetic examples of the minority group by interpolating between existing minority class group (Satpathy, 2023).

*Figure 3. 1 Coding of SMOTE*

```
:  
# Instantiate the SMOTE object  
smote = SMOTE()  
  
# Perform oversampling  
X_oversampled, y_oversampled = smote.fit_resample(X, y)
```

Source: Saloni, 2023

### 3.3.3 Train Test split

A separation of dataset into training set and testing set, known as Train Test Split. The separated training set is to train the model, while the testing set is to test the model. This process allows us to train our model on the training set, also to test model accuracy on unseen testing set (Shiksha, 2023).

*Figure 3. 2 Train Test Split*

```
#Train Test split
X_train, X_test, y_train, y_test = train_test_split(X_oversampled,
                                                  y_oversampled,
                                                  test_size=0.15,
                                                  random_state=17, stratify=y_oversampled)

print(X_train.shape)
print(X_test.shape)
print(y_train.shape)
print(y_test.shape)
```

Source: Kaggle, 2023

## 3.4 Proposed Data Analysis Tool

### 3.4.1 Descriptive Analysis

Descriptive Analysis is widely used to examine the collected data and present it in an understandable and straightforward way. Researchers usually create tables or other visual imagery to show patterns of the data. The sample size of this research is 2,293 units. Each of the data collected consists of a review title, review content, and rating, which are related to ChatGPT. Descriptive Analysis is conducted to identify the mean, SD, Median of the variables.

### **3.4.2 Review Analysis**

Review Analysis is a process of transforming unstructured review data into a structured version, which can later guide decision making. Managerial levels utilized the processed and structured data to assist them in innovating product feature ideas, roadmap prioritization, and identification of bug. In this research, a review analysis was conducted to create label for the sentiment of data. Besides, this process incorporated title of review and review context into complete review (Dye, 2022).

#### **3.4.2.1 Features Extration**

The process of converting unprocessed data into numerical features that may be handled while keeping the information in the original data set is known as feature extraction. Compared to applying machine learning directly to the raw data, it produces better outcomes. Count Vectorizer is a popular text preprocessing method for natural language processing (NLP) jobs. which turns a set of text documents into a numerical representation (Otten, 2023).

### 3.4.3 Sentiment Analysis

#### 3.4.3.1 Logistic Regression

Logistic Regression is widely used for predictive analytics and classification. This analysis model predicts the probability of an event happening. It could estimate events such as voted or did not vote through the analysis of given dataset of independent variables.

*Figure 3. 3 Logistic Regression*

```
# Initialize and train the logistic regression model
model = LogisticRegression()
model.fit(X_train, y_train)

# Make predictions on the test set
y_pred = model.predict(X_test)

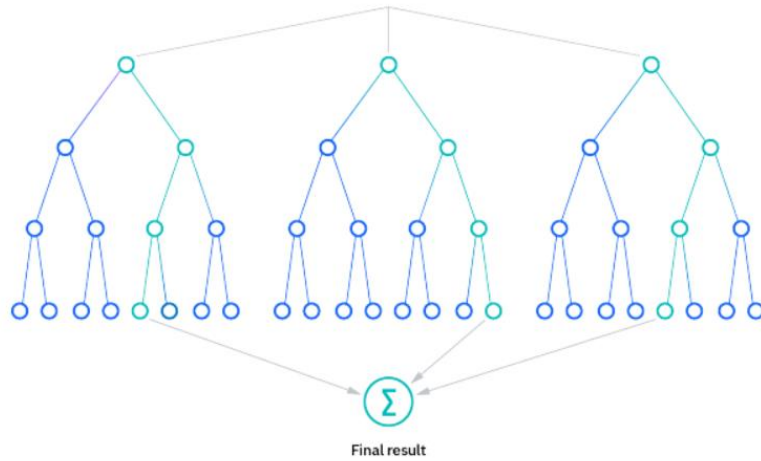
# Calculate accuracy
print(classification_report(y_pred, y_test))
```

Source: Kaggle, 2023

#### 3.4.3.2 Random Forest

Random forest is a machine learning algorithm consist of numeral decision tree, which work in a complementary way, to create a single outcome. To split the data, Random Forest asks a series of related questions, which make up the decision nodes in the tree (IBM, 2024).

Figure 3. 4 Random Forest

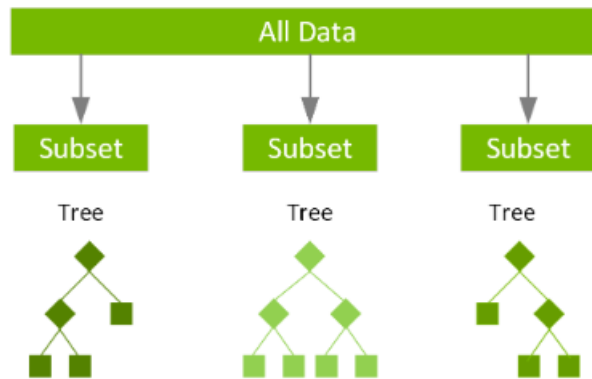


Source: IBM, 2024

### 3.4.3.3 XGBoost

XGBoost, known as Extreme Gradient Boosting, is a distributed boosted decision tree machine learning library. XGBoost builds upon decision trees, ensemble learning, and gradient boosting. Gradient Boosting Decision Trees is an ensemble learning algorithm sharing similarity with random forest. However, it consists of multiple machine learning algorithms to create a more effective model (NVIDIA, 2024).

Figure 3. 5 XGBoost



Source: NVIDIA, 2024

#### **3.4.3.4 Sentiment Polarity Analysis**

TextBlob is one of the functions in Python library for processing textual data. It offers an easy-to-use API for tackling standard natural language processing (NLP) tasks like sentiment analysis, categorization, noun phrase extraction, part-of-speech tagging, and more. The sentiment property returns a namedtuple of the form `Sentiment(polarity, subjectivity)`. The polarity score is a float within the range `[-1.0, 1.0]`.

### **3.5 Chapter Summary**

This chapter provided a clear understanding of several aspects of the data collected. A brief description of the access and source of data obtained were stated. Besides, Descriptive Analysis, Review Analysis, and Sentiment Analysis were introduced in this chapter. Lastly, title and context of reviews have been combined into complete reviews.



## Chapter 4: RESULT AND FINDINGS

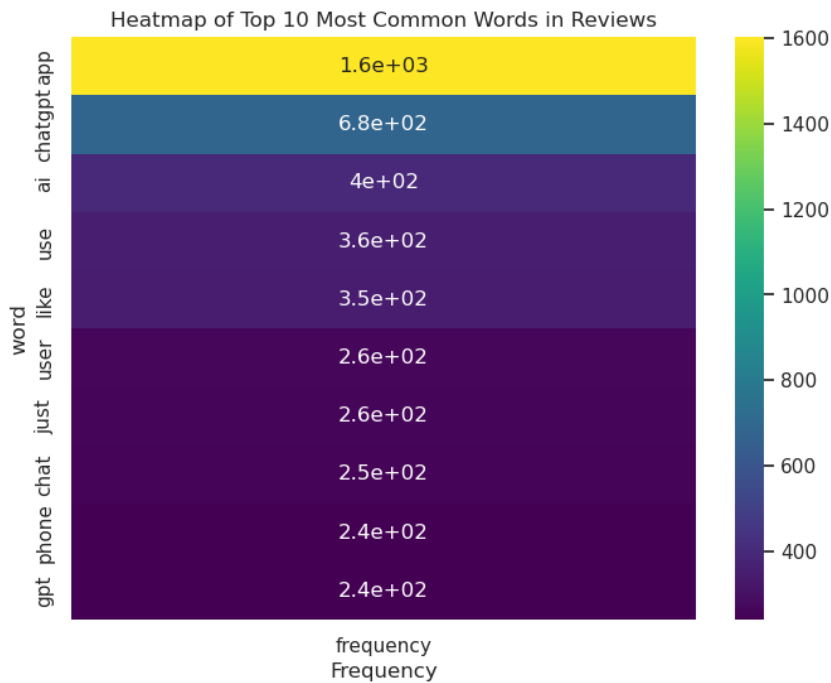
### 4.0 Introduction

Chapter 4 discusses the findings of the data analysis using Sentiment Analysis Model.

### 4.1 Data Screening

In this research, there are 2,293 units of sample collected and recorded by the author. A qualified data must consist of a written review and rating. Each data collected review is qualified and eligible for conducting this research. A data preprocessing is conducted to sort the related bigrams. These bigrams are the words that significantly relate to the ChatGPT. Figure 4.1 shows the Top 10 Most Common Words in Reviews.

Figure4. 1 Top 10 Most Common Words in Reviews

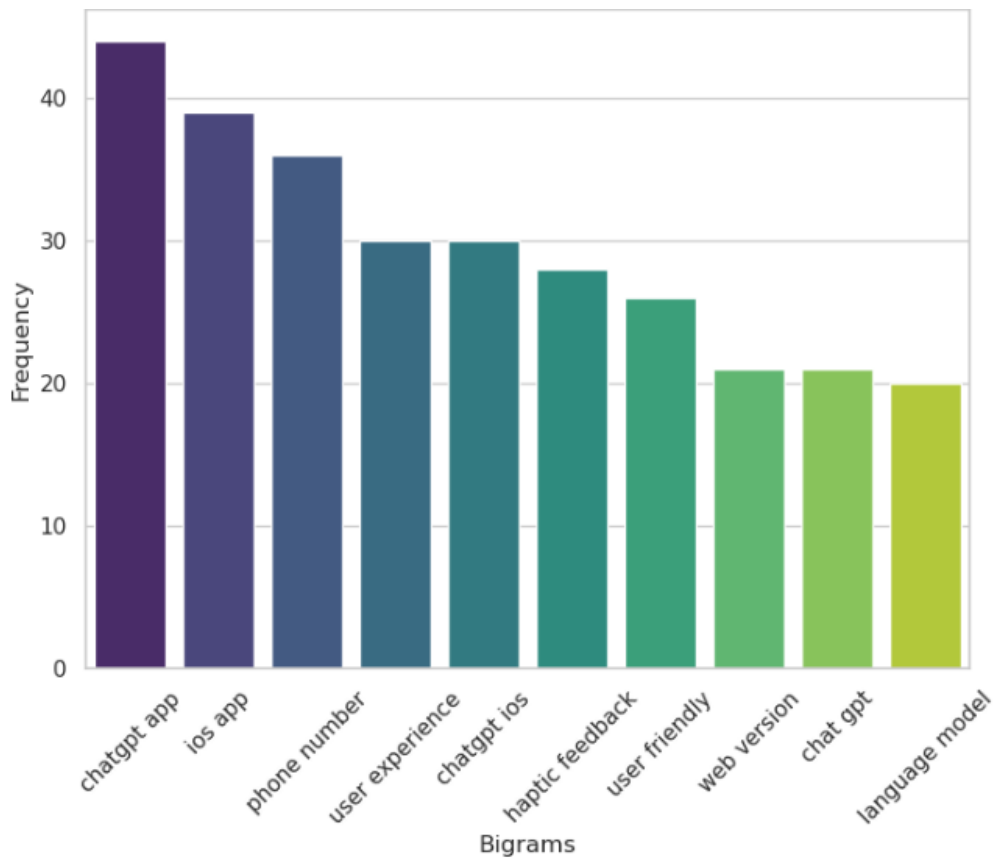


## 4.2 Descriptive Analysis

### 4.2.1 Complete Review

Figure 4.1 indicates the Top 10 Common Bigrams in Reviews. There was an approximate total of 300 bigrams frequently appeared in the context of review. The most frequently mentioned bigram was 'chatgpt app', the frequency was around 40 times. Bigrams such as 'user experience' and 'chatgpt ios' was on an average of 30 times. The least mentioned bigram was 'language model', on a 20-time frequency.

Figure4. 2 Top 10 Common Bigrams in Reviews



### 4.2.2 Sentiment Polarity

Figure 4.2 indicates the Sentiment Polarity Distribution. Sentiment Polarity Distribution indicates the expressed sentiment of a content. It identifies the whether the text is expressing positive, neutral, or negative sentiment of the user about the entity in consideration (IGI, 2023).

Figure4. 3 Sentiment Polarity Distribution

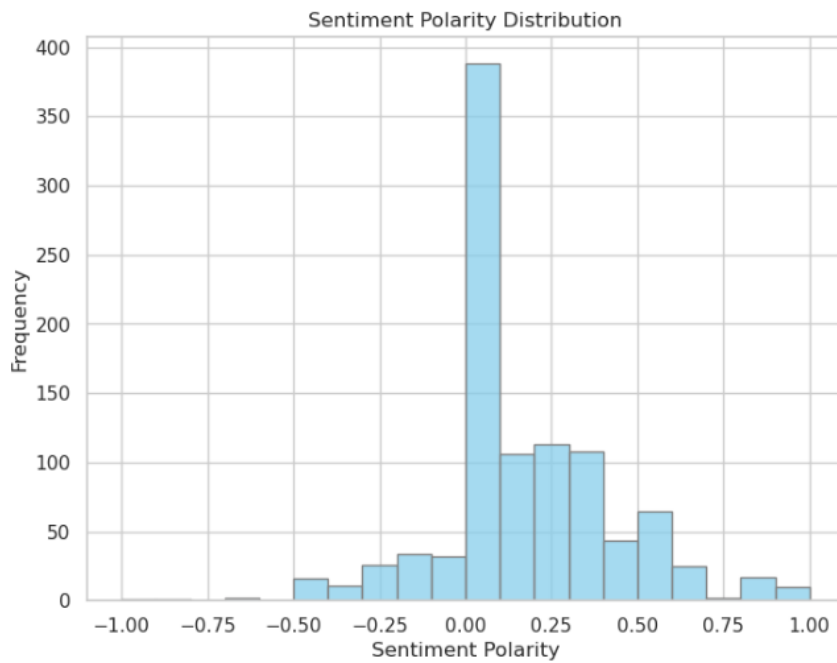


Table 4. 1 Sentiment Polarity Distribution

Quantile Statistic		Descriptive Statistic	
Minimum	1	Standard Deviation	<b>1.62511</b>
5-th percentile	1	Coefficient of variation (CV)	0.44774
Q1	2	Kurtosis	-1.20393
Median	4	Mean	<b>3.62958</b>
Q3	5	Median Absolute Deviation (MAD)	1.45433
95-th percentile	1	Skewness	-

Maximum	5	Sum	8 319
Range	4	Variance	2.63984
Interquartile range (IQR)	3		

The means of Sentiment Polarity Distribution is 3.62958, while the Standard Deviation has a score of 1.62511.

### 4.2.3 Rating

Figure 4.4 indicates the rating counts of all reviews in the dataset.

*Figure4. 4 Rating Count*

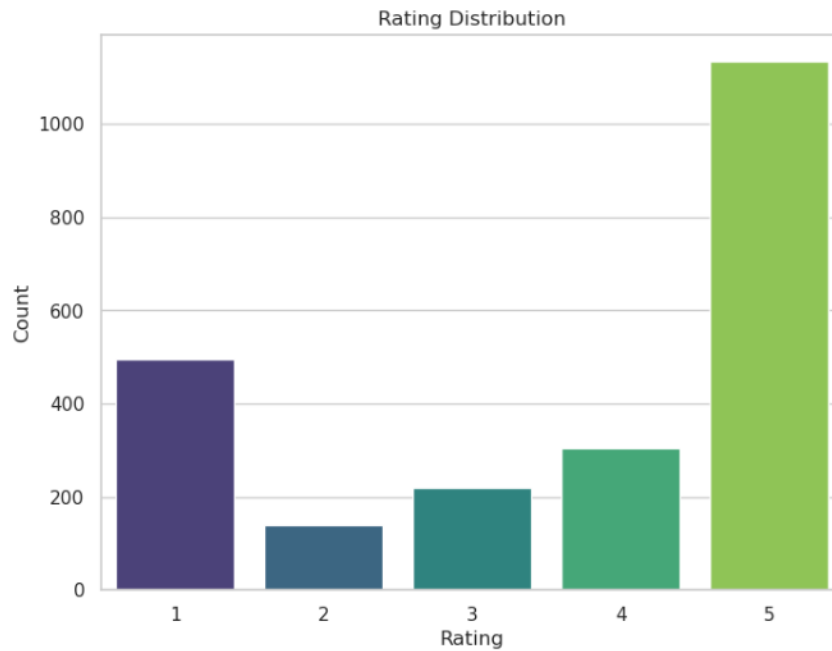


Table 4. 2 Rating Count

Quantile Statistic		Descriptive Statistic	
Minimum	1	Standard Deviation	<b>1.62511</b>
5-th percentile	1	Coefficient of variation (CV)	0.44774
Q1	2	Kurtosis	-1.20393
Median	4	Mean	<b>3.62958</b>
Q3	5	Median Absolute Deviation (MAD)	1.45433
95-th percentile	1	Skewness	-
Maximum	5	Sum	8 319
Range	4	Variance	2.63984
Interquartile range (IQR)	3		

The mean of rating count is 3.62958, while the Standard Deviation is 1.62511.

## 4.3 Inferential Analysis

### 4.3.1 Logistic Regression

This model predicts positive statements at a percentage of f1-score of 78%. The overall accuracy of sentiment prediction is at 68%. This indicates the accuracy of predicting the sentiment of ChatGPT App Review is 68%

Table 4. 3 Logistic Regression

	precision	recall	f1-score	support
0	0.47	0.74	0.57	137
1	0.86	0.56	0.68	329
2	0.72	0.86	0.78	182
accuracy			0.68	648
macro avg	0.68	0.72	0.68	648
weighted avg	0.74	0.68	0.69	648

### 4.3.2 Random Forest

This model has a better f1-score performance in identifying negative and neutral sentiment when compared to Logistic Regression. The accuracy of sentiment prediction is 69%, marked a higher percentage than Logistic Regression. This indicates the accuracy of predicting the sentiment of ChatGPT App Review is 69%


Table 4. 4 Random Forest

	precision	recall	f1-score	support
0	0.47	0.81	0.59	125
1	0.89	0.57	0.69	337
2	0.73	0.84	0.78	186
accuracy			0.69	648
macro avg	0.69	0.74	0.69	648
weighted avg	0.76	0.69	0.70	648

### 4.3.3 XGBoost

This model has the best performance among all models. XGBoost scored the highest f1-score of all sentiments among other models. Besides, the accuracy of sentiment prediction is the highest, which is 85%. This indicates the accuracy of predicting the sentiment of ChatGPT App Review is 85%

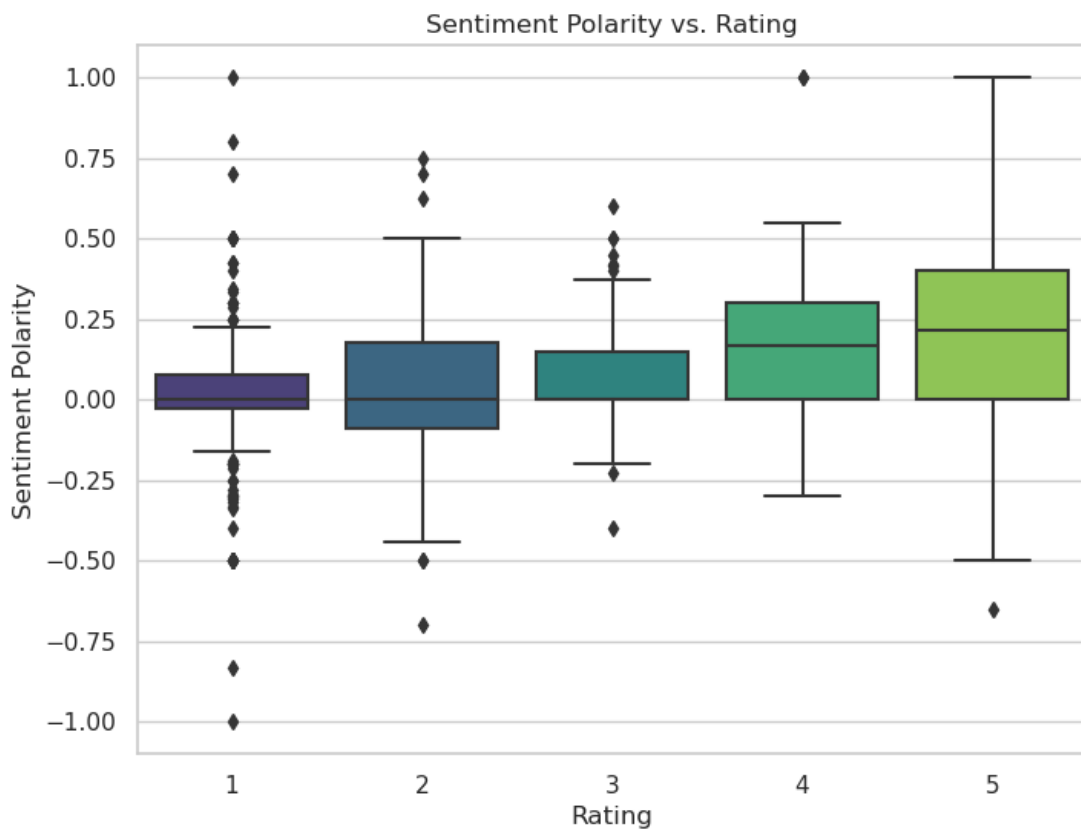
Table 4. 5 XGBoost

	precision	recall	f1-score	support
0	0.76	0.88	0.82	186
1	0.88	0.91	0.89	208
2	0.91	0.77	0.83	254
accuracy			0.85	648
macro avg	0.85	0.85	0.85	648
weighted avg	0.85	0.85	0.85	648

### 4.3.4 Sentiment Polarity Analysis

Sentiment Polarity Analysis paired Sentiment Polarity with Rating. This indicates the relationship between their sentiment and rating. The average Sentiment Polarity is high when people award a 5-star rating. While the average Sentiment Polarity shows low when people give one-star rating.

Figure4. 5 Sentiment Polarity vs. Rating





## 4.4 Hypothesis Testing

Table 4.6 represents the result of hypothesis testing. Null hypothesis is accepted when average accuracy  $>70\%$  or Sentiment Polarity is positive. Therefore, H1 examining the relationship between Complete Review and Review and H2 examining the relationship between Sentiment Polarity and Review are both accepted.

*Table 4. 6 Hypothesis Testing*

Hypothesis Testing	Average Result	Conclusion
H1: There is a relationship between Complete Review and Review	74% $>70\%$	Supported
H2: There is a relationship between Sentiment Polarity and Review	3.629 $> 0$	Supported

## 4.5 Chapter Summary

This chapter summarizes the findings of each analysis model. Besides, hypotheses have been tested and proven.

## **Chapter 5 DISCUSSION AND CONCLUSION**

### **5.1 Discussion on 1<sup>st</sup> Research Objective – To investigate public acceptance towards ChatGPT.**

Based on the outcomes in Chapter 4, an average of positive Sentiment Polarity is obtained. The Sentiment Polarity Distribution indicates the public has a generally high positive sentiment towards ChatGPT. This analysis is based on the expression words from the users in their review content. Generally, a greater number of positive expressions, will result in higher score of Sentiment Polarity. As a conclusion, the public has high acceptance towards ChatGPT.

### **5.2 Discussion on 2<sup>nd</sup> Research Objective - To examine the relationship between user's review and rating of ChatGPT using sentiment analysis.**

The complete review has a positive relationship with rating. This is due to the accuracy of review analysis model scored an average of 74%, as mentioned in Chapter 4. The review analysis model analyses the content of review. If the review is analysed as positive and with a high star rating, the review analysis is considered as accurate. On the other hand, if the review is analysed as negative but with a high star rating, the review analysis is considered as inaccurate. In short, the higher the accuracy, the higher chance of the relationship between complete review and rating proven positive is higher.

According to the results in Chapter 4, a positive Sentiment Polarity was obtained. The score of sentiment polarity was paired with rating respectively. The figure showed that three-star rating to five-star rating have averagely high score of Sentiment Polarity.

However, one-star rating to two-star rating were showing more negative scores of Sentiment Polarity. As mentioned in Chapter 4, the Sentiment Polarity Distribution was showing to the right averagely, which indicates the relationship between user's review and rating has a positive relationship.

## **5.3 Implications**

### **5.3.1 Industry**

This research contributes ideas to the industry organization regarding on the development of new technology.

The AI industry revolutionizes technology regularly and every new revolution of technology comes with latest features. Creating new technologies can be a gruelling process, it includes high costs in identifying potential opportunities. Organizations often involve high investments in surveying the market to look for potential needs of new technologies. Time costs are especially high when there are millions of requests in the market. It is almost impossible for organizations to analyse them one by one. Therefore, Review Analysis allows organization to save time by analysing them collectively. This research helps organizations in filtering non-genuine reviews with fake ratings. Which provides organizations with confidence in believing a high rating comes with good comments.

Besides, Review Analysis allows organizations to gain insights into new technology ideas. Organizations can now identify the most frequent request from uncountable reviews. This research has proven to process raw data and visualize it into graphs which is comprehensible. With these terminologies sorted and presented visually in graphs and table, organizations can now identify the topics in reviews and search for potential opportunities. On the

other hand, it provides a certain level of convenience for organizations to understand the features to be improved.

### **5.3.1 Academic Researchers**

This research contributes insights for academic researchers into the exploration of technology.

Sentiment Analysis provides an ease for academic researchers in analysing the directions of their future research. It allows academic researchers to understand the current viral topics in the market. Reviews of users provides academic researchers an opportunity to analyse and predict the current and future hot topic of technology. To be specific, academic researchers are now capable to have a clear picture of public perspective towards ChatGPT. With this information, they are now able to accurately conduct an in-depth analysis or research in certain aspect. For instance, academic researchers can conduct in-depth research into exploring potential usage of ChatGPT when the sentiment is analysed as positive. On the other hand, academic researchers may identify the ChatGPT's drawbacks and relevant resolutions when the sentiment is showing negative.

### **5.3.2 Policy Maker**

This research contributes insights for policy maker in their policy making decision.

The security of the internet must be supervised and monitored by the government. A complete policy is playing especially crucial role in maintaining a safe technology environment. The results from Sentiment Analysis allow policy makers to understand the range in which policies should cover. Nowadays, the easy access of technology poses potential risks to every user of the technology. The misuse of technology in numerous fields has caused negative impacts to the society. People are using Chatbots to act as a scam tool to scam for money. Cybersecurity has become a controversial topic in today's digital world. As analysed above, the general users of ChatGPT are showing a positive sentiment towards the application, which indicates there might be a potential increase in the users of ChatGPT. Therefore, this potential event urges the policy maker to develop and strengthen relevant policy guidelines to prevent misuse of technology.

## **5.4 Limitations and Recommendation**

### **5.4.1 Data Inconsistency**

In this research, there is a total of 2,293 sample size used as secondary data from the dataset given. However, there may be a possibility of consisting spam data, such as spam written review, which will eventually cause a higher chance of outcome inaccuracy.

### **5.4.2 Imbalanced data**

One of the limitations of the study is the imbalance of data. The secondary data obtained from the dataset is solely based on the reviews of ChatGPT in the IOS App Store. The users of ChatGPT are limited to the users who downloaded the app from IOS App Store. Therefore, the result may not be robust and persuasive enough to represent all of the users of ChatGPT.

### **5.4.3 Analysis Method**

In this research, XGBoost, Random Forest, and Logistic Regression are used to examine the relationship between Complete Review and Rating. Besides that, Sentiment Polarity is being used to examine the relationship between Sentiment Polarity and Review. The current analysis methods may be insufficient to accurately examine the hypotheses.

## **5.5 Recommendations**

### **5.5.1 Spam Filtering**

Create or make use of algorithms that can recognise patterns, keywords, or other signs to automatically flag reviews as possibly spam reviews. Besides, NLP methods can be used to examine review text for indications of spam, like keyword overuse, strange language patterns, or repetitive content.

### **5.5.2 Balancing the Data**

To overcome the limitations of the imbalanced data. Researchers may obtain reviews from various platform to precisely generate outcomes in order to represent the entire number of users.

### **5.5.3 Increase Analysis Methods**

It is suggested that the research shall incorporate additional analysis methods to examine the data. Numerous analysis methods provide a comprehensive analysis on research and a complete understanding of the data. This is because the characteristics of each analysis method are different and therefore resulting in generating a comprehensive analysis. Also, the use of different analysis methods allows additional in-depth analysis on certain directions when there are conflicting results. Moreover, potential biases on specific directions can be avoided with the implementation of numerous analysis methods. In short, incorporating more analysis methods increase the robustness, credibility, and validity of the research outcomes.

## **5.6 Conclusion**

As a conclusion, this chapter provides a thorough and comprehensive discussion on the hypotheses. Besides that, limitations and respective recommendations have been proposed as a fundament for future research.

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