

# **Leveraging Sentiment Analysis of Steam Reviews for Growth in Game Success Metrics**

## **Applied Research Proposal**

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### **ABSTRACT**

Sentiment analysis, an essential component of Natural Language Processing and Text Mining, has gained significant traction in understanding user opinions and attitudes. This dissertation presents a comprehensive sentiment analysis framework, encompassing data collection, preprocessing, and classification using Naive Bayes, Support Vector and Decision Tree classifiers. The study utilizes a dataset comprising reviews from Steam, a leading digital distribution platform for games. Through experimentation, the performance of various feature selection techniques and classifiers is evaluated. Additionally, the research investigates the impact of different preprocessing methods on classification accuracy. The trained classifier holds promise for predicting sentiments in unlabelled reviews, offering valuable insights to companies aiming to optimize profits in the dynamic global digital product market.

Steam to predict and enhance game success metrics(Urriza and Clariño, 2021).(Panwar and Bhatnagar, 2022)

Sentiment, defined as the subjective attitude or evaluative judgment shaped by personal emotions or experiences, holds considerable significance within consumer contexts. A notable manifestation of sentiment emerges in individuals' post-consumption appraisals, such as reflections following a cinematic experience or a dining occasion. Particularly in the domain of online commerce, the retrospective evaluations encapsulated in previous reviews assume a critical role in shaping consumer decision-making processes. This underscores the imperative of precise sentiment prediction derived from such reviews, given its potential to substantially influence profitability(Fang and Zhan, 2015).

### **1. INTRODUCTION**

The digital gaming industry has witnessed significant growth over the past decade, with platforms like Steam at the forefront. As the industry continues to evolve, understanding the factors that contribute to a game's success becomes increasingly important. This dissertation proposal explores the potential of leveraging sentiment analysis of user reviews on

Total global video games revenue, by segment (US\$bn)

■ Social/casual gaming ■ PC games ■ Console games ■ Integrated video games advertising

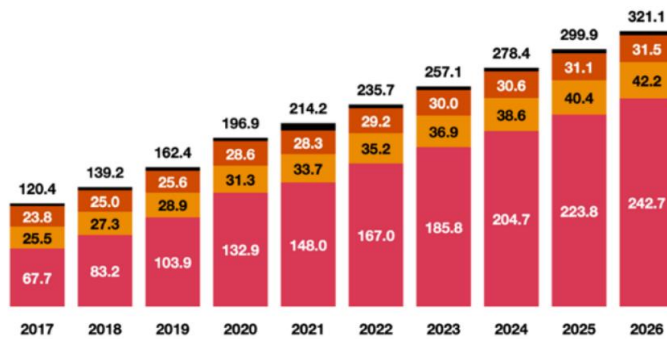


Figure 1- Global Gaming Market Growth (Source-PwC)

User reviews are a rich source of information, reflecting players' experiences and perceptions of a game. However, these reviews are often underutilized in traditional game success prediction models (Utz et al., 2012). This research proposal suggests a novel approach that harnesses the power of sentiment analysis to extract meaningful insights from user reviews and correlate them with game success metrics.

This research proposal aims to develop a predictive model that assesses a game's success using sentiment analysis on Steam user reviews. The primary objective is to establish a reliable forecast of game success, while the secondary objective focuses on providing actionable insights to game developers to enhance their decision-making processes based on user feedback.

The structure of the proposal is as follows: Chapter 2 introduces the research questions and explores the current state of sentiment analysis in the gaming industry. Chapter 3 presents a comprehensive literature review. Chapter 4 outlines the proposed methodology for data collection and sentiment analysis execution. Chapter 5 discusses the expected results, summarizes the key findings, and suggests future research directions.

Overall, this study aims to connect sentiment analysis with game success metrics, potentially revolutionizing

how game developers utilize player feedback to improve game design and player satisfaction.

## 2. RESEARCH QUESTIONS

The primary research question investigates the performance of different machine learning classifiers- Naive Bayes, Support Vector Machines, and Decision Trees in analysing sentiments within gaming reviews. The study aims to determine which classifier offers the highest accuracy in sentiment categorization.

The research further explores the impact of feature selection techniques, such as n-grams and TF-IDF, on classifier performance, aiming to identify the most effective features for sentiment analysis in the gaming context. It also examines how various preprocessing methods like tokenization, stemming, and lemmatization affect analysis accuracy, seeking to pinpoint optimal strategies for processing user reviews.

Additionally, the dissertation assesses whether sentiments from user reviews can quantitatively predict a game's success on Steam, correlating sentiment analysis results with sales and player retention metrics. The final aspect of the study explores how game developers can apply insights from sentiment analysis to improve game design and marketing strategies, thus enhancing player satisfaction and commercial success.

This research aims to provide actionable insights on leveraging sentiment analysis to inform game development and marketing within the gaming industry.

## 3. LITERATURE REVIEW

In Recent advancements in machine learning, such as BERT, BiLSTM, and CRF, have significantly enhanced sentiment analysis of game reviews on platforms like Steam. The study by Al Mursyidy Fadhurrahman et al. (2023) is particularly notable, demonstrating that the integration of LSTM architectures with CRF effectively retains contextual

information, thus improving sentiment classification accuracy. This research sets a robust benchmark for NLP applications and enriches our understanding of computational linguistics in analysing complex user-generated content.(Al Mursyidy Fadhlurrahman et al., 2023)

Further exploration into the nature of online reviews has been undertaken by Pengze Bian et al. (2021), who investigated the detection of spam in game reviews using semi-supervised learning methods. Their work identifies a substantial portion of reviews as spam, underscoring the challenges and prevalence of deceptive practices on online platforms. This study highlights the necessity for robust mechanisms to detect and filter inauthentic content that can mislead consumers and skew sentiment analysis outcomes.(Bian et al., 2021)

In their 2002 paper, Bo Pang, Lillian Lee, and Shivakumar Vaithyanathan investigated the effectiveness of machine learning algorithms, namely Naïve Bayes, maximum entropy classifiers, and support vector machines, in performing sentiment analysis on movie reviews. Despite surpassing human baselines, these techniques faced greater challenges with sentiment analysis compared to traditional topic-based categorization. The authors emphasize the complexities inherent in sentiment classification, such as the nuanced and contextual nature of language, which pose significant hurdles to achieving high accuracy in automated sentiment analysis.(Pang et al., 2002)

Thiago Alexandre Salgueiro Pardo (2023) introduced the SteamBR dataset, focused on Brazilian Portuguese game reviews, utilizing machine learning algorithms to evaluate the helpfulness of reviews effectively differentiating between helpful and unhelpful content. The methodology leverages feature extraction techniques that account for metadata, semantic elements, and distributional characteristics, highlighting the nuanced approach required to manage language-specific traits in sentiment analysis.(Jorge and Pardo, 2023)

In a 2021 study published in Kinetik, (Taqiuddin et al., 2021) addressed the issue of opinion spam on Steam using a Support Vector Machine (SVM) with lexicon-based features and TF-IDF weighting. Aimed at combating review bombing, their model achieved an 81% accuracy, distinguishing between valid reviews and opinion spam in a dataset of 236 reviews. The implementation of a user-friendly dashboard in a web application further assists Steam users in identifying credible reviews, thus improving their purchasing decisions. This research is a significant step towards enhancing the authenticity of user-generated content on digital platforms.(Taqiuddin et al., 2021)

Adding to the complexity of review analysis, Mustika Kurnia Mayangsari et al. (2023) examined the prediction of bug severity in game reviews using classifiers such as KNN, Decision Trees, and Naïve Bayes. Achieving a notable mean accuracy score of 72%, their approach aids in categorizing reviews based on reported technical issues, enhancing the utility of reviews for game developers focused on prioritizing bug fixes and improvements.(Mayangsari et al., 2023)

In their 2022 paper, "Network Public Opinion Sentiment Analysis based on Bert Model," Dong et al. introduced a Bert-based sentiment analysis method that significantly reduces the complexity of traditional approaches. This method efficiently maps input text into Query, Key, and Value vectors, simplifying processing and improving analysis by addressing the shortcomings of RNNs. The approach demonstrated high accuracy and F1 scores of 98.72% and 98.5%, respectively, proving its effectiveness in handling network public opinion with reduced computational demand.(Dong et al., 2022)

Moreover, Zhi Wang et al. (2021) expanded the analysis to predictors of review helpfulness and funniness using techniques like Random Forest and Gradient Boosting Decision Trees. Their findings are pivotal for platforms aiming to enhance user

interaction by prioritizing content that is both helpful and engaging, thereby improving the overall user experience and utility of reviews.(Wang et al., 2021)

Research by Dayi Lin et al. (2019) underscored the unique characteristics of game reviews compared to mobile app reviews, particularly how playtime before reviewing influences review content and helpfulness. These insights are invaluable for developers and marketers by illustrating how players' experiences and interactions with games impact their feedback and subsequent consumer decisions.(Lin et al., 2019)

The influence of game updates on player perceptions, especially in esports, was analysed by Yang Yu et al. (2021) using topic modelling to assess feedback on game changes. Such studies provide methodological insights beneficial for developers seeking to use player feedback more effectively to refine games and extend their lifecycle.(Yu et al., 2021)

Lastly, Lukas Eberhard et al. (2018) identified factors contributing to the perceived helpfulness of game reviews, finding that longer reviews and more extensive gameplay before reviewing are associated with higher helpfulness ratings. This suggests that both review content and reviewer experience are crucial in guiding prospective buyers.(Eberhard et al., 2018)

Collectively, these studies provide a comprehensive view of the multifaceted aspects of game reviews, from sentiment analysis to spam detection and the evaluation of review helpfulness. They enhance our understanding of how digital platforms can leverage sophisticated NLP techniques to better serve both consumers and developers in the dynamic landscape of online gaming.

#### 4. PROPOSED METHODOLOGY

This research will employ a comprehensive and structured multi-stage methodology to analyse sentiment in digital product reviews, specifically focusing on user-generated reviews from Steam, a leading digital distribution platform for games and

software. The approach will include phases of data collection, preprocessing, feature selection, and model evaluation, utilizing advanced text mining techniques and machine learning classifiers.



Figure 2- Example of a Steam Review

##### 4.1 Data Collection

Initially, data will be collected through three primary methods to ensure a comprehensive and reliable dataset. Real-time data acquisition will be conducted using third-party tools such as SteamDB and SteamSpy, which provide access to extensive datasets of user reviews and gaming metrics. Direct scraping of review data will also be performed from the official Steam website using Scrapy, a powerful web-crawling framework in Python, to obtain the most recent and relevant review texts. Additionally, structured data retrieval will be achieved through the Steam API, facilitating the efficient collection of review data in a format conducive to analysis.(Zuo, 2018)

##### 4.2 Data Preprocessing

After data collection, the dataset will undergo extensive preprocessing to enhance its quality and suitability for sentiment analysis. This will involve

cleaning the text by removing special characters, digits, and punctuation marks. All text will be normalized by converting it to lowercase to maintain consistency across the dataset. Frequently used words that add minimal semantic value, known as stop words, will be removed using the Natural Language Toolkit (NLTK) in Python. The preprocessing phase will also include stemming to reduce words to their base or root form, simplifying the analysis process, and filtering out hyperlinks and excessively short reviews to eliminate noise and maintain the integrity of the data.

#### **4.3 Feature Selection and Vectorization**

The feature selection phase will utilize various methods to extract meaningful features from the pre-processed text. N-gram analysis will be conducted to identify common word sequences and patterns indicative of the linguistic structure within the reviews. Information Gain (IG) will be used to quantify the effectiveness of features in classifying documents, aiding in the identification of the most discriminative features. Term Frequency-Inverse Document Frequency (TF-IDF) will be applied to assign weights to terms based on their frequency in a document relative to their rarity across all documents, highlighting important features for analysis.(Urriza and Clariño, 2021)

#### **4.4 Model Selection and Evaluation**

For the sentiment analysis, the research will use two supervised machine learning classifiers, namely Naive Bayes, Support Vector and Decision Tree classifiers. These classifiers are selected for their demonstrated efficacy in handling textual data and their distinct approaches to classification. A grid search approach will be adopted to systematically tune the hyperparameters of these models to determine their optimal configurations. Model evaluation will be conducted using cross-validation techniques, where the dataset will be randomly divided into training and testing sets to assess the generalization ability of the models and ensure robust performance across different subsets of data.(sharma and Dey, 2013)

This methodology is designed to rigorously assess the sentiments expressed in Steam reviews and explore their potential to predict and improve game success metrics. By employing advanced text mining techniques and robust evaluation methods, this research aims to contribute valuable insights to the fields of sentiment analysis and consumer behaviour in digital marketplaces.

### **5. EXPECTED RESULTS**

This research aims to evaluate the effectiveness of sentiment analysis techniques for predicting game success on the Steam platform, utilizing advanced machine learning classifiers and feature selection methods. The anticipated outcomes include a detailed comparison of Naive Bayes, Support Vector Machines, and Decision Tree classifiers in analysing gaming reviews. The goal is to identify which classifier or combination offers the highest accuracy in sentiment prediction, acknowledging that different classifiers may have varying effectiveness due to the complexities of gaming review data.

Additionally, the study will explore the impact of feature selection techniques such as N-grams, Information Gain, and TF-IDF on classifier performance. We aim to determine which methods best enhance precision and efficiency in sentiment analysis by pinpointing features that strongly correlate with expressed sentiments. These findings are expected to improve the accuracy of sentiment-based predictions and provide game developers with more reliable insights for enhancing game design and marketing strategies.

The study will also examine the influence of various preprocessing methods on sentiment analysis accuracy. We expect to demonstrate how text normalization, stemming, and the removal of stop words affect the classifier's performance in accurately classifying sentiments. This will lead to the development of best practices for data preprocessing tailored to the specific textual characteristics of game reviews.(Zhang, 2022)

This research hypothesizes a significant correlation between the sentiments expressed in Steam user reviews and game success metrics such as sales, download rates, and user engagement. The anticipated findings aim to confirm that positive sentiments align with improved success metrics, highlighting the benefits of integrating sentiment analysis into game development and marketing strategies.

The study seeks to provide actionable insights for game developers by pinpointing which game features elicit positive or negative sentiments. Understanding sentiment trends over time could inform decisions on game updates, feature changes, and customer engagement tactics. Overall, this research intends to demonstrate how sentiment analysis can be a powerful tool for continuous enhancement in game design and marketing efforts.

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