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Sentiment Analysis Of Spotify App In Playstore Using Classification Method

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Abstract

Spotify is a globally renowned music streaming program. The program receives a multitude of ratings, both favorable and unfavorable, on the Google Play Store from various users. This study intends to evaluate the sentiment of user evaluations for the Spotify application employing various classification techniques, including Logistic Regression, Random Forest, Support Vector Machine (SVM), C4.5, and Extreme Gradient Boosting (XGBoost). Review data was acquired via web scraping methodologies using the Google Play Scraper API. After this, text preparation was conducted to sanitize the text, enabling the execution of the data. Sentiment analysis was employed to ascertain whether a text expresses favorable or unfavorable opinions. The Random Forest approach, which has been demonstrated to yield optimal outcomes, was employed in this investigation. Testing was performed using training and test data ratios of 80:20%, 70:30%, and 60:40% across hundreds of review datasets. The Random Forest approach, utilizing an 80%:20% data split ratio, produced a precision of 82%, recall of 81%, F1-Score of 81%, and accuracy of 81%, according to the test findings.

Keywords : *Sentiment Analysis, Spotify, Google Play Store, Web Scraping, text preprocessing, Logistic Regression, Random Forest, Support Vector Machine (SVM), C4.5, XGBoost.*

INTRODUCTION

In the technology sector and mobile applications, user reviews on sites such as the Google Play Store constitute a significant source of information (Triyono & Faqih, 2025). These reviews capture users' firsthand experiences with the programs, providing insights into their satisfaction, needs, and challenges encountered during regular use.

Spotify, a prominent global music streaming platform, garners considerable attention. Despite Spotify's development of unique features and its commitment to enhancing the user experience, it is crucial to gather and assess direct customer feedback consistently (Samrat, 2023)

Sentiment analysis is a method employed to ascertain whether a statement conveys a good, negative, or neutral sentiment toward a subject. (Samanmali, 2024).

A positive attitude signifies endorsement, contentment, or affection for the subject matter. A negative attitude indicates dissatisfaction or disagreement with the subject matter. A neutral attitude signifies the absence of explicit expressions of approval or disapproval of the subject matter (Herlawati, 2020:304).

Sentiment analysis of user reviews on the Google Play Store is an effective method for understanding consumers' perceptions and evaluations of the Spotify application. This analysis can yield helpful information about users' favorable perceptions, the challenges they encounter, and the areas for Spotify's enhancement (Kanjanasukhon & Laohakiat, 2024).

To achieve optimal precision in sentiment analysis, it is essential to utilize suitable classification algorithms and feature selection techniques. Widely utilized classification techniques in sentiment analysis encompass Logistic Regression, Random Forest, Support Vector Machine, C4.5, and XGBoost.

The objective of performing sentiment analysis on Google Play Store reviews for the

Spotify application is to furnish a comprehensive understanding of users' perceptions of the program. By doing so, Spotify can utilize this information to enhance its product and strengthen user interactions, thereby preserving its position as a leading contender in the music streaming sector.

METHOD

This study employs a quantitative research method. Priyono (2018) defines quantitative

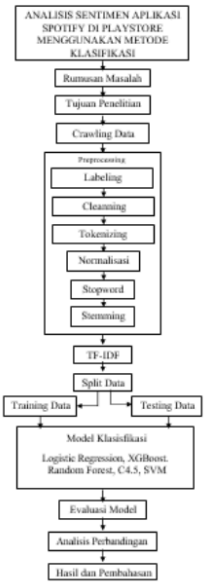

Figure 1. Research Stages

The following elucidations accompany each phase:

1. Sentiment Comparison Analysis Utilising Text Mining with RF, C4.5, XGBoost, SVM, and LR Techniques.
2. Articulation of the Issue
   Ahyar and Juliana Sukmana (2020) assert that the preliminary phase of research involves articulating an issue amenable to resolution through the investigation. Choosing a research subject for in-depth investigation is essential; thus, the phrasing of the problem must be precise and organized. This clarity enables researchers to pinpoint the variables for measurement and guarantees the accessibility of suitable measurement instruments to fulfill the research aims.

3. Research Objectives

   The research objectives refer to the outcomes that the study aims to achieve, aligned with the formulated focus. These objectives are articulated comprehensively and focus on the central questions that are key to the research problem. Through the research objectives, the operational stages of the research are reflected (Ahyar & Juliana Sukmana, 2020).

4. Literature Review

   The literature review is a research technique that aims to identify theoretical references relevant to the problems being faced or studied. This technique involves collecting data from various sources, reading and noting relevant information, and managing the research materials. Generally, a literature review serves as a method to address problems by tracing existing written sources, and it can also be referred to as a bibliographic study. In this research, the literature review is conducted using various sources, including journals and books in both physical and electronic formats (Handriani, 2019).

5. Data Crawling

   Data crawling on Spotify is a technique used to automatically gather information available on the Spotify music streaming platform through a computer program or bot. This method enables users to collect various information, including playlists, favorite songs, user reviews, and other metadata related to specific artists, albums, or music genres.

6. Data Preprocessing

   Preprocessing involves a sequence of actions performed on textual data to render it more concise, accurate, and suitable for subsequent analysis. Prevalent procedures encompass filtration and selection. The objective of this step is to enhance analysis and minimize "noise" or interference during the implementation of subsequent analytical methods (Izunnahdi et al., 2023).

   The phases of text preparation encompass multiple steps, as outlined below:

   a. Sanitation

      The initial phase is eliminating extraneous components from the text, including numerals, URLs, and symbols that are not alphabetic characters. This is accomplished by removing certain characters to concentrate the text and streamline subsequent processing.

   b. Case Normalisation

      This phase entails transforming all characters in the text to lowercase. The objective is to maintain uniformity in text processing, avoiding discrepancies in word recognition due to variations in letter case.

   c. Normalisation

      Normalization is the process of rectifying non-standard terminology resulting from typographical errors, abbreviations, and other discrepancies into standardized forms.

   d. Tokenization

      At this level, sentences inside the text are divided into distinct words. The objective is to provide additional analysis at the lexical level,

encompassing the sorting and selection of words according to specific analytical requirements.

e. Filtration

At this step, words deemed to possess minimal informative value within the context or subject of analysis are eliminated from the text. This is accomplished by removing stopwords to streamline the text representation and emphasize more pertinent words.

f. Stemming

The final stage entails transforming words with morphological variants into their base or standard forms. This facilitates the identification of synonymous words across varying forms, hence diminishing complexity in textual analysis.

7. Term Frequency-Inverse Document Frequency

Word weighting with TF-IDF vectorization entails allocating weights to each word within every text or sentence. Words that occur with greater frequency are assigned higher weights, contingent upon prior preprocessing.

The word weighting procedure has two primary stages: Term Frequency (TF) and Inverse Document Frequency (IDF). During the Term Frequency (TF) phase, weights are allocated according to the frequency of a word's occurrence inside a particular text or sentence. During the Inverse Document Frequency (IDF) phase, weights are allocated according to the infrequency of a word's occurrence over the whole document corpus. The amalgamation of these two weights facilitates the identification and emphasis of the most significant words within a specific context (Maulana et al., 2023).

8. Divide Data

a) Training data refers to the dataset utilized to instruct the system in developing categorization abilities.

b) The purpose of testing data is to evaluate the error rate of the trained and optimized system.

9. Classification Algorithms

Data classification involves identifying analogous attributes across objects in a database and categorizing them into predetermined classes based on an agreed-upon classification model. The primary objective of classification is to develop a model from the training data that can accurately categorize attributes into their respective classes. This model can subsequently be utilized to categorize qualities that lack designated classifications. The classification techniques to be employed are Random Forest, Support Vector Machine, C4.5, Logistic Regression, and XGBoost.

10. Assessment of the Model

The evaluation phase aims to assess the effectiveness of the model developed in the preceding step. The evaluation utilizes a confusion matrix to determine the accuracy of predictions from the classification outcomes.

3 RESULTS AND DISCUSSION

Data Collection

The first step in this research technique is the data collection phase, which is executed via a crawling procedure on the Google Play Store platform using Google Colab with the Python package Playstore Scraping. The gathered data comprises comments or reviews about the Spotify application. Furthermore, solely the reviews are collected.

The subsequent phase involves the data cleansing and structuring process. The pre-labeled dataset will be processed with Pandas to eliminate duplicate entries, hence streamlining the remaining processes. The outcome of the duplicate elimination procedure, illustrated in Figure 1, reveals a reduction in data from an initial total of 1,742 to 1,312 entries prepared for subsequent processing.

```
DataFrame tanpa duplikat:
              userName  score                   at  \
0       Ignatius Dennis      5  2024-03-27 13:44:58
1  Azri Achmad Danendra      5  2024-03-27 13:43:59
2          Dedy Wahyudi      1  2024-03-27 13:16:19
3   herbert rainsperger      1  2024-03-27 13:14:57
4              Hago Jb      5  2024-03-27 13:11:55

                                             content
0  Bagus-Bagus lagunya kalo galau aku sering deng...
1  Aplikasi mantap yang selalu update dengan musi...
2  aneh kali orang mau langganan malah ga bisa, p...
3                                            Lambat
4                                    Gg lagi sad gw

Jumlah data setelah menghapus duplikat: 1311 rows
```

Figure 2. Data cleaning process

The final procedure is data cleaning and organization, which involves labeling to determine the sentiment within the crawled data. The sentiment labeling seen in Figure 4.4 is conducted manually by classifying the data into two categories: positive and negative.

userName	score	at	content	label
Ignatius Dennis	0,999580324	2024-03-27 13:44:58	Bagus-Bagus lagunya kalo galau aku sering dengerin lagu dari spotify	POSITIVE
Azri Achmad Danendra	0,999458253	2024-03-27 13:43:59	Aplikasi mantap yang selalu update dengan musiknya tidak lemot juga.... Spot	POSITIVE
Dedy Wahyudi	0,999518871	2024-03-27 13:16:19	aneh kali orang mau langganan malah ga bisa, padahal jaringan bagus, blokkk	NEGATIVE
herbert rainsperger	0,999313116	2024-03-27 13:14:57	Lambat	NEGATIVE
Hago Jb	0,994068861	2024-03-27 13:11:55	Gg lagi sad gw	NEGATIVE
Aira Mlg	0,760734141	2024-03-27 12:45:34	Bagus banget. Cuma terkadang agak ngelag	POSITIVE
Ridwan Rizky	0,999545634	2024-03-27 12:37:03	Gabisa login loading terus	NEGATIVE
Vio Letta	0,99981612	2024-03-27 12:25:24	Bagusss bangett, sekarang udah bisa langsung setel ke lagunya, nggak harus ac	POSITIVE
allohu akbar	0,999824703	2024-03-27 12:12:22	The best	POSITIVE
Nathan Pranyavita	0,999849081	2024-03-27 12:02:58	woww bagus	POSITIVE
Alexandria	0,991043925	2024-03-27 11:49:13	Mantapp, tapi Spotify mod lebih mantap yeayyyy	POSITIVE
Dia Dini	0,999350369	2024-03-27 11:35:26	Sangat suka	POSITIVE
Indah Indahlestari44	0,999871016	2024-03-27 11:31:23	Lagu ini sangat bagus sekali	POSITIVE
Halim Kadir	0,999850392	2024-03-27 11:14:56	Nice To Relax With Hear A Beautifully Song's	POSITIVE
Nengsih Nengsih	0,965797961	2024-03-27 10:59:01	kebanyakan iklan	NEGATIVE
Zindah Permata	0,999842405	2024-03-27 10:56:44	Bagus kok	POSITIVE
Nazwa nazwa	0,987327158	2024-03-27 10:52:26	iklan mlu 1 lagu 1 iklan..	NEGATIVE
yohanes manurung	0,987944007	2024-03-27 10:36:25	Ajing gapain lagu lagu Minang jadi favorit	POSITIVE
Untung Aditya	0,99976176	2024-03-27 10:21:49	Banyak iklan mengecewakan	NEGATIVE
Aan Nurjaman	0,999859571	2024-03-27 10:18:30	Bagus apk nya sampe hp ku sabil di cas mulu	POSITIVE
Restu JagoanFf	0,965797961	2024-03-27 10:17:55	Kebanyakan iklan	NEGATIVE
Pemuda Indonesia	0,998798728	2024-03-27 10:08:28	Bagus bisa buat obat galau	POSITIVE
Martina 123	0,978026867	2024-03-27 10:07:28	Spotify p...	NEGATIVE
abi nurhuda	0,999858737	2024-03-27 10:02:51	Bagus banget	POSITIVE
dicky dirgahayu	0,999508977	2024-03-27 10:01:31	Sungguh susah pingin punya playlist. Tak seperti di tetangga sebelah.	NEGATIVE
Tri No Limite	0,999274433	2024-03-27 09:46:11	Tolong untuk pembelian premium di perbaiki lagi, entah kenapa pas mau beli	NEGATIVE

Figure 3. Data Labeling Process

Following labeling, the dataset is analyzed using the Matplotlib toolkit to determine the percentages of positive and negative attitudes and to generate a pie chart, as shown in Figure 3. This yields a positive sentiment percentage of 44.9% and a negative sentiment proportion of 55.1%.

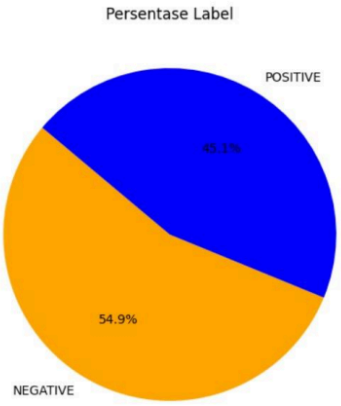

Figure 4. Data Labeling Percentage

Data Preprocessing

Data preparation is executed to eliminate noise or extraneous information, transform the data format into a processable form, and perform tokenization.

1. Sanitization / Case Normalisation

   Data cleaning is a process that involves removing unnecessary characters, punctuation, and special symbols from the text.

Table 1. Cleaning/Casefolding Process Results

Before	After
The songs are good. When I'm feeling down, I often listen to songs from Spotify.	The songs are great. When I'm feeling down, I often listen to songs from Spotify.
A great application that is always updated with music and is not slow either... Spotify is always in my heart... Let's continue to develop it to be even better... Joss	A great application that is always updated with music that is not slow. Spotify is always in the heart. Come on, keep developing it to be even better, great.
It's strange that people want to subscribe but can't, even though the network is good, it's blocked	It's strange that people want to subscribe but can't even though the network is good, it's blocked

2. Tokenization

   The tokenization method entails dividing strings, rendering this phase effective for deconstructing phrases or paragraphs into discrete words or tokens. At this stage, the NLTK library will be installed, the Punkt tokenizer will be acquired, and the `word_tokenize` function will be imported. Tokenizing refers to the text processing phase

that breaks down text into its smallest components, known as "tokens."

Table 2. Tokenizing Process Results

Before	After
The songs are good. When I'm feeling down, I often listen to songs from Spotify.	['goodgood','the song','if','disturbed', 'i, 'often', 'listen','song', 'from', 'Spotify']
A great application that is always updated with music and is not slow either... Spotify is always in my heart... Let's continue to develop it to be even better... Joss	['application', ' excellent ', ' which', 'always','update', 'with', 'thesong', 'no','slow', ' also ', 'spotify', 'always', 'in','heart','come on', 'keep going','develop ', 'become', 'more', 'good', 'again', 'joss']
It's strange that people want to subscribe but can't, even though the network is good, it's blocked	['strange', 'maybe', 'people', 'want', 'subscribe', 'even', 'no', 'can', 'even though', 'network', 'good', 'block']

3. Normalization

   Normalization is the procedure of refining raw text to diminish variances and inconsistencies in the textual material prior to subsequent analysis. The objective is to optimize the data for more efficient processing by machine learning algorithms and other analytical methods.

Table 3. Results of the Normalization Process

Before	After
The songs are good. When I'm feeling down, I often listen to songs from Spotify.	['good', 'song', 'if', 'confused', 'me', 'often', 'listen', 'song', 'from', 'Spotify']
A great application that is always updated with music and is not slow either... Spotify is always in my heart... Let's continue to develop it to be even better... Joss	['application', 'awesome', 'that', 'always', 'update', 'with', 'music', 'not', 'slow', 'also', 'Spotify', 'always', 'in', 'heart', 'come on', 'continue', 'develop', 'become', 'more', 'good', 'again', 'joss']

4. Stopwords

   Stopwords are beneficial for eliminating prevalent terms that lack significant significance or are superfluous. This phase continues to utilize the nltk library, subsequently downloading and importing stopwords.

Table 4. Stopwords Process Results

Before	After
The songs are good. When I'm feeling down, I often listen to songs from Spotify.	['nice', 'song', 'confused', 'listen', 'song', 'Spotify']
A great application that is always updated with music and is not slow either... Spotify is always in my heart... Let's continue to develop it to be even better... Joss	['application', 'cool', 'update', 'music', 'slow', 'Spotify', 'heart', 'come on', 'develop', 'great']

5. Stemmer
   Stemmer is the process of transforming words or their affixed variants into their fundamental forms (stems). At this juncture, the Sastrawi library will be installed, followed by the importation of the stemmer factory.

Table 5. Stemmer Process Results

Before	After
The songs are good. When I'm feeling down, I often listen to songs from Spotify.	['good','song','galau','listen', 'song', 'Spotify']
A great application that is always updated with music and is not slow either... Spotify is always in my heart... Let's continue to develop it to be even better... Joss	['application', 'cool', 'update', 'music', 'lot', 'Spotify', 'heart', 'come on', 'flower', 'joss']
It's strange that people want to subscribe but can't, even though the network is good, it's blocked	['strange', 'times', 'people', 'subscribers', 'networks', 'good', 'blokkkk']

6. Transformation (TF IDF)
   The objective at this juncture is to transform text into numerical values suitable for algorithmic processing. This research employs the TF-IDF approach, which weights text data by counting the frequency of each word's occurrence. This phase necessitates the installation of sci-kit-learn followed by the importation of the TfidfVectorizer.

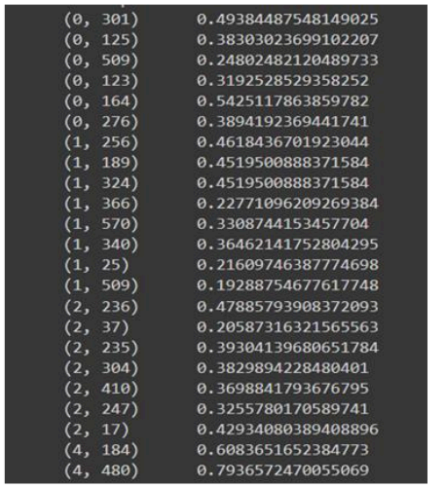

Figure 5. Transformation Results

Split Data

The data partitioning procedure entails dividing the dataset into two subsets: training data and testing data. After the use of TF-IDF, the data is partitioned in the ratios of 70:30, 60:40, and 80:20.

Classification Method

a. C4.5

The C4.5 algorithm for classification utilizes specific Python libraries, notably the C45Classifier from the sci-kit-learn decision tree module, which is used to implement the C4.5 algorithm. We will employ measures like the confusion matrix, accuracy score, precision score, recall score, and F1 score for model assessment.

Table 6. C4.5 Classification Results

	Ratio 70:30 (%)		Ratio 60:40 (%)		Ratio 80:20 (%)	
Accuration	76		70		73	
	+	-	+	-	+	-
Precision	70	83	63	78	64	82
Recall	81	72	76	65	78	70
F1-Score	70	75	69	71	70	75

b. Support Vector Machine

Classification using the Support Vector Machine (SVM) algorithm requires specific Python libraries, notably the SVC class from `sklearn.svm`, which is a component of scikit-learn for the SVM algorithm. We assess the model utilizing criteria including the confusion matrix, accuracy score, precision score, recall score, and F1 score.

Table 7. SVM Classification Results

	Ratio 70:30 (%)		Ratio 60:40 (%)		Ratio 80:20 (%)	
Accuration	76		80		77	
	+	-	+	-	+	-
Precision	76	76	76	85	74	81
Recall	68	83	81	80	71	83
F1-Score	72	79	78	82	72	82

c. Xboost

Classification using the XGBoost technique requires specific Python modules, notably the XGBClassifier from the xgboost package, which is integral to the XGBoost framework for boosting algorithms. We evaluate the model using criteria such as the confusion matrix, accuracy score, precision score, recall score, and F1 score.

Table 8. XGBoost Classification Results

	Ratio 70:30 (%)		Ratio 60:40 (%)		Ratio 80:20 (%)	
Accuration	75		74		78	
	+	-	+	-	+	-
Precision	70	81	68	81	69	87
Recall	79	73	79	71	84	74
F1-Score	74	77	73	76	76	80

d. Logistic Regression

Classification employing the Logistic Regression methodology requires specific Python libraries, notably the LogisticRegression class from `sklearn.linear_model`, which is a component of scikit-learn for logistic regression methods. We evaluate the model using criteria such as the confusion matrix, accuracy score, precision score, recall score, and F1 score.

Table 9. Logistic Regression Classification Results

	Ratio 70:30 (%)		Ratio 60:40 (%)		Ratio 80:20 (%)	
Accuration	79		81		81	
	+	-	+	-	+	-
Precision	81	79	78	84	80	82
Recall	70	87	80	82	73	87
F1-Score	75	83	79	83	76	85

e. Random Forest Classification using the Random Forest algorithm requires specific Python libraries, notably the RandomForestClassifier from `sklearn.ensemble`, which is a component of scikit-learn for Random Forest methodologies. We evaluate the model using criteria such as the confusion matrix, accuracy score, precision score, recall score, and F1 score.

Table 10. Random Forest Classification Results

	Rasio 70:30 (%)		Rasio 60:40 (%)		Rasio 80:20 (%)	
Accuration	81		79		81	
	+	-	+	-	+	-
Precision	78	86	74	85	75	87
Recall	83	81	83	77	82	81
F1-Score	80	83	78	81	78	84

CONCLUSION

The evaluation findings of the categorization model yield the following conclusions:

1. This study evaluates five classification algorithms: C4.5, Support Vector Machine (SVM), XGBoost, Logistic Regression, and Random Forest. Each algorithm is evaluated using three training and testing ratios: 80:20, 70:30, and 60:40.
2. Evaluation Results:
   - C4.5: Exhibits commendable performance, achieving the most fantastic accuracy of 76% at the 70%:30% data ratio.
   - SVM: Attains optimal performance with an accuracy of 80% at the 60%:40% data ratio.
   - XGBoost: Demonstrates consistent performance, achieving the most fantastic accuracy of 79% at an 80%:20% data ratio.
   - Logistic Regression: Achieves a maximum accuracy of 82% with a 60%:40% data ratio.
   - Random Forest: Exhibits superior performance with a maximum accuracy of 82% at both the 70%:30% and 60%:40% data ratios.

The Random Forest method excels in data classification, attaining superior metrics for

precision, recall, F1 score, and accuracy. This indicates that Random Forest exhibits superior proficiency in effectively classifying data compared to other algorithms..

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