



## Implementation of the Content-Based Filtering Method in Menu Recommendations at Pandawa Pondok Kopi

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### Abstract

The rapid growth of the coffee shop industry and the wide variety of menu offerings at Pandawa Pondok Kopi demand a system capable of delivering accurate and personalized menu recommendations. This study aimed to develop a web based menu recommendation application using Content Based Filtering (CBF), leveraging TF-IDF for document vectorization and Cosine Similarity to measure product description similarity. The system was implemented with PHP and MySQL, featuring a responsive interface across three main modules: the homepage (displaying the menu list), the menu detail page (providing full information and similar recommendations), and the admin dashboard (for menu data management). Menu descriptions were preprocessed (tokenization, stop word removal, and stemming) before computing TF-IDF weights. Given a user's selected menu item, the system calculated Cosine Similarity between its description vector and those of all other menu items, then presents the top three matches. Functionality was verified via Black Box Testing to ensure that admin login, menu addition/editing, recommendation displays, and interface navigation conform to specifications. Test results showed an average Cosine Similarity score ranging from 0.62 to 0.78, indicating satisfactory accuracy in matching user preferences. The system also achieved an average response time of under one second under standard load, meeting efficiency criteria. In conclusion, the Content Based Filtering implementation successfully enhances the relevance of menu recommendations and user experience, thereby supporting increased customer satisfaction and operational effectiveness at Pandawa Pondok Kopi.

**Keywords:** *Content-Based Filtering, TF-IDF, Cosine Similarity, Recommendation Systems.*

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### 1. Introduction

The rapid growth of the coffee shop industry in Indonesia, particularly in recent years, has become both a social and economic phenomenon that cannot be overlooked. The increasing public interest in coffee-drinking culture is no longer merely a lifestyle, but has become part of social interactions that connect various groups, ranging from students, university students, and workers to hobby [1]. This trend has encouraged many business actors to compete in opening coffee shops with unique and innovative concepts [2]. Coffee shops today do not only serve beverages; they also offer comfortable atmospheres, fast internet access, and aesthetically pleasing (instagrammable) spaces to attract visitors [3]. The development of the digital era further strengthens this trend, as information technology becomes a key aspect in promoting efficiency and competitiveness. As a result, the coffee shop industry is no longer competing solely in terms of taste quality and pricing, but also in service, digital innovation, and personalization of customer experience. This competition leads business owners to recognize the importance of implementing technologies capable of solving complex problems, including supporting consumers in making decisions when faced with numerous menu choices that appear highly similar [4].

Pandawa Pondok Kopi, one of the popular cafés in Lamongan Regency, faces a common challenge in the modern culinary industry: the phenomenon of overchoice. This term refers to a situation in which customers experience confusion when confronted with too many menu options that share similar characteristics. For example, choices of coffee with various flavor variants, sizes, and brewing methods can create hesitation among customers when deciding on a menu that suits their preferences [5]. Instead of increasing satisfaction, an excessive number of choices may actually reduce the customer experience, as more time is spent making decisions and the service process becomes less efficient [6]. In a business context, this issue can negatively impact employee productivity and decrease customer loyalty. To address this, cafés must not only offer diverse menus but also provide practical solutions that help customers make quick, accurate, and preference-aligned decisions [7]. One promising approach is the use of recommendation system technology, which can automatically suggest menu items based on individual preferences or product characteristics [8].

A Content Based Filtering (CBF) recommendation system emerges as an effective solution to address the overchoice challenge faced by Pandawa Pondok Kopi. This method operates by analyzing the attributes or descriptions of each product and matching them with the

customer preferences already stored in the system. Unlike rating or review based systems that rely on active customer participation, CBF requires only product data to generate recommendations. One important technique in this approach is Term Frequency Inverse Document Frequency (TF-IDF), which is used to assign weights to words in menu descriptions so the system can identify the most relevant keywords [9]. Next, Cosine Similarity is used to measure the level of similarity between products based on these word weights. This approach has proven effective in several research domains, such as the recommendation system for Emina cosmetic products, which achieved the highest cosine similarity value of 0.7195, and a reference book recommendation system that attained 90% precision and 100% recall [10]. Similar studies also show that CBF can help customers determine beverage menus according to their preferences, making the shopping experience more efficient and enjoyable [11].

Based on these issues, this study aims to implement the CBF method in the menu recommendation system at Pandawa Pondok Kopi and evaluate the accuracy of the recommendations generated [12]. The system implementation utilizes a combination of TF-IDF for word weighting and Cosine Similarity for similarity measurement between menu items. It is expected that the developed recommendation system will be able to provide menu suggestions that are relevant to customer needs, reduce confusion caused by excessive options, and improve customer satisfaction and loyalty [13]. Furthermore, the application of this system also enhances the café's operational efficiency, as customers can make decisions more quickly while employees can focus on delivering quality service. With the support of this information technology based system, Pandawa Pondok Kopi is expected to better face the competitive challenges of the modern coffee shop industry in the digital era. In addition, this study is expected to serve as both an academic and practical reference for similar business owners in implementing content-based recommendation systems as a strategy to enhance competitiveness and business efficiency in an increasingly competitive coffee industry.

## 2. Research Methods

This study was conducted through several stages, including program development, literature review, testing, experimentation and data collection, program revision, system design, and drawing conclusions. In this research, the primary focus is directed toward the implementation of the Content-Based Filtering (CBF) method combined with Term Frequency Inverse Document Frequency (TF-IDF) and the Cosine Similarity (CS) algorithm [14]. This combination is used to perform weighting calculations in order to determine the accuracy level of the system being developed. Such an approach is expected to produce recommendations that are more relevant and precisely targeted, as the system utilizes in depth content similarity analysis based on vector representations of the processed data. Through this weighting process, the system is able to evaluate the degree of compatibility between the recommended data and the user's preferences or needs in a more measurable and objective manner [15].

The Content Based Filtering (CBF) method is an effective approach in recommendation systems because it analyzes item features and matches them with user preferences. Without relying on data from other users, CBF can generate more personalized and relevant recommendations [16]. The Content Based Filtering system builds a representative user model based on previous behavior, such as items viewed, liked, or purchased, to identify features that best align with user interests. This makes CBF highly suitable for recommendation systems that require personalization and independence from other user data.

In addition, the Content-Based Filtering approach excels in addressing the cold-start problem, especially for new users with limited interactions [17]. Because it relies solely on individual data, the system remains capable of providing recommendations even when data from other users is minimal. This method is efficient, flexible, and applicable to various content based platforms. Generally, the Content-Based Filtering (CBF) approach depends entirely on internal content attributes without involving opinions, reviews, or external data from other users. This makes CBF an independent method in building recommendation systems, as it focuses only on content and individual preferences. Therefore, CBF is highly suitable when data from other users is limited or when an objective, structured, and information-based recommendation system is required [15].

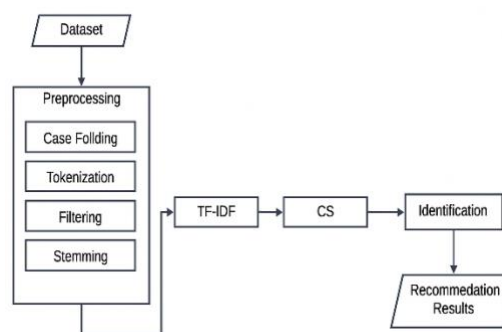


Fig. 1: Flowchart CBF

Figure 1 illustrates the workflow of a Content Based Filtering recommendation system, beginning with the dataset collection process. The workflow then proceeds to the preprocessing stage, which includes case folding (converting all letters to lowercase), tokenization (breaking text into individual words), filtering (removing irrelevant words or stopwords), and stemming (reducing words to their root form). The results of this preprocessing are then processed using the Term Frequency Inverse Document Frequency (TF-IDF) method to calculate word weights based on their importance. These weights are subsequently analyzed using the Cosine Similarity method to measure the similarity between data items [15]. The similarity values are used in the identification stage to determine the most relevant items or data, ultimately producing recommendation results that align with the user's needs or preferences [6].

## 2.1. Dataset

The process begins with a dataset containing raw data to be processed, whether in the form of text or other relevant information required to generate recommendations.

## 2.2. Preprocessing

The dataset then undergoes a preprocessing stage to clean and prepare the data for further processing. This stage includes:

1. Case Folding, which converts all letters to lowercase to maintain consistency.
2. Tokenization, which breaks text into word units (tokens).
3. Filtering, which removes irrelevant words or words classified as stopwords.
4. Stemming, which reduces words to their base form to minimize variations of words with similar meanings.

## 2.3. TF-IDF

TF-IDF is a natural language processing algorithm used to calculate the importance of a word within a document relative to the entire collection of documents. This method combines Term Frequency (TF) and Inverse Document Frequency (IDF) to assign more accurate word weights [7].

## 2.4. Cosine Similarity (CS)

The first step in this method is converting the text into word indices, which are then transformed into vector form. The process begins with data collection and continues with several preprocessing stages: case folding to convert all menu descriptions into lowercase; tokenizing to break descriptions into individual words; filtering to remove common words such as “and,” “the,” “in,” as well as punctuation marks; and stemming to convert the filtered words into their root forms.

## 2.5. Identification

The identification stage plays a crucial role in determining which items or data entries are most relevant to the user based on the similarity values generated in the previous step. At this stage, the system evaluates the Cosine Similarity scores for each item within the dataset and ranks them according to their degree of similarity to the target item or user preference profile. Items with higher similarity values indicate stronger relevance, suggesting that they share more common features or characteristics with the user’s interest. In addition, the identification process ensures that the system filters out items with extremely low similarity scores to maintain the quality of the recommendations. This filtering mechanism prevents irrelevant or unrelated items from being suggested to the user [7]. The system may also apply threshold values to determine the minimum similarity level required for an item to be included in the recommendation list. By performing this identification step, the system is able to present a curated list of candidate items that closely match the content features preferred by the user, thus improving both the accuracy and reliability of the recommendation results.

## 2.6. Recommendation Results

The final stage of the workflow produces the recommendation results, which represent the system’s output in the form of personalized suggestions tailored to the user's preferences or needs. These recommendations are generated after the system fully analyzes the similarity scores and selects the most relevant items identified in the previous stage. The output typically consists of a ranked list of recommended items, starting from the most similar to the least similar, allowing users to make quicker and more informed decisions. Furthermore, the recommendation results contribute not only to user convenience but also to enhancing the overall user experience. By providing suggestions that closely match what the user might prefer, the system reduces decision making time, minimizes confusion caused by too many choices, and increases the likelihood of user satisfaction. In the context of menu recommendations, this helps customers discover food or beverage options that align with their taste preferences, even if they are unfamiliar with the available choices [7]. Additionally, these recommendation results can support business objectives by encouraging customer engagement, promoting menu items that align with user interests, and potentially increasing sales. Over time, the system can also adapt to evolving user behavior by integrating new data, making the recommendations more dynamic and personalized. Thus, the recommendation results serve as both a decision-support tool for users and a value-added feature that enhances service quality for businesses.

Table 1: Sample Data

Menu 1	Menu 2
Tubruk Robusta is a traditional brewed coffee that has the distinct bitter taste characteristic of Robusta beans. Served hot without added milk, this beverage is made from 100% Robusta coffee beans with high caffeine content, producing a strong bitter coffee aroma and flavor.	Arabica Tubruk Coffee offers a mild acidic taste typical of Arabica beans with a neutral level of sweetness. Served hot without added milk, this coffee is made from 100% Arabica coffee beans with high caffeine content, providing a fresh and light coffee taste sensation.

## 2.7. Preprocessing

### a. Casefolding

The casefolding process in Table 2 aims to convert words or sentences that initially contain uppercase letters into lowercase letters. The purpose of this step is to ensure uniformity and consistency in the data contained within the descriptions. The implementation results can be seen in the table below.

**Table 2:** Casefolding Table

Before	After
Tubruk Robusta is a traditional brewed coffee that has the distinctive bitter flavor of Robusta beans. Served hot without milk, this beverage is made from 100% Robusta coffee beans with high caffeine content, producing a strong bitter coffee aroma and taste. Arabica Tubruk Coffee offers a soft acidic taste typical of Arabica beans with a neutral sweetness level. Served hot without milk, this coffee is made from 100% Arabica beans with high caffeine content, giving a fresh and light coffee flavor sensation.	Tubruk robusta is a traditional brewed coffee that has the distinctive bitter flavor of robusta. served hot without milk, this drink is made from 100% robusta coffee beans with high caffeine content, producing a strong bitter coffee aroma and taste. Arabica tubruk coffee offers a soft acidic taste characteristic of arabica beans with a neutral sweetness level. served hot without milk, this coffee is made from 100% arabica beans with high caffeine content, providing a fresh and light coffee sensation.

## b. Tokenizing

The process shown in Table 3 aims to separate input strings into tokens or individual words based on spaces or predefined delimiters. At this stage, the descriptive data associated with each menu item is split into separate words. The tokenizing process can be seen in the table below.

**Table 3:** Tokenizing Table

Before	After
Tubruk robusta is a traditional brewed coffee that has the distinct bitter taste characteristic of robusta beans. served hot without added milk, this beverage is made from 100% robusta coffee beans with high caffeine content, producing a strong bitter coffee aroma and flavor. Arabica tubruk coffee offers a mild acidic taste typical of arabica beans with a neutral level of sweetness. served hot without added milk, this coffee is made from 100% arabica coffee beans with high caffeine content, providing a fresh and light coffee taste sensation.	[Tubruk, robusta, is, a, traditional, brewed, coffee, that, has, the, distinct, bitter, taste, characteristic, of, robusta, beans, served, hot, without, added, milk, this, beverage, is, made, from, 100%, robusta, coffee, beans, with, high, caffeine, content, producing, a, strong, bitter, coffee, aroma, and, flavor] [Arabica, tubruk, coffee, offers, a, mild, acidic, taste, typical, of, arabica, beans, with, a, neutral, level, of, sweetness, served, hot, without, added, milk, this, coffee, is, made, from, 100%, arabica, coffee, beans, with, high, caffeine, content, providing, a, fresh, and, light, coffee, taste, sensation]

## c. Filtering

The filtering process shown in Table 4 below is carried out to identify and select relevant keywords from the document set and menu description data by removing words that do not hold informational value in the context of recommendation generation, such as conjunctions, prepositions, and pronouns (e.g., "di", "yang", "ke", "dari") This process is conducted manually by carefully reviewing each word, then filtering and removing any words that do not contribute to the meaningful representation of the data [17]. Filtering is a crucial step because the presence of functional words may affect the results of text processing and reduce the accuracy of similarity computations between menu items. Therefore, filtering plays an essential role in preparing clean and meaningful data. The complete results are shown in the table below.

**Table 4:** Filtering Table

Before	After
[tubruk, robusta, is, a, traditional, brewed, coffee, that, has, the, distinct, bitter, taste, characteristic, of, robusta, beans, served, hot, without, added, milk, this, beverage, is, made, from, 100%, robusta, coffee, beans, with, high, caffeine, content, producing, a, strong, bitter, coffee, aroma, and, flavor] [arabica, tubruk, coffee, offers, a, mild, acidic, taste, typical, of, arabica, beans, with, a, neutral, level, of, sweetness, served, hot, without, added, milk, this, coffee, is, made, from, 100%, arabica, coffee, beans, with, high, caffeine, content, providing, a, fresh, and, light, coffee, taste, sensation]	[tubruk, robusta, is, a, traditional, brewed, coffee, that, has, distinct, bitter, taste, characteristic, robusta, beans, served, hot, without, added, milk, beverage, made, 100%, robusta, coffee, beans, high, caffeine, content, producing, strong, bitter, coffee, aroma, flavor] [arabica, tubruk, coffee, offers, mild, acidic, taste, typical, arabica, beans, neutral, sweetness, served, hot, without, added, milk, coffee, made, 100%, arabica, coffee, beans, high, caffeine, content, providing, fresh, light, coffee, taste, sensation]

## d. Stemming

The stemming process shown in Table 5 aims to extract the root form of words that have gone through the filtering stage. Stemming functions by removing prefixes, suffixes, infixes, and combinations of affixes. This process is performed using the Sastrawi library, which is capable of converting affixed words in the document into their base forms. The stemming results can be found in the table below.

**Table 5:** Stemming Table

Before	After
[tubruk, robusta, is, a, traditional, brewed, coffee, that, has, distinct, bitter, taste, characteristic, robusta, beans, served, hot, without, added, milk, this, beverage, is, made, from, 100%, robusta, coffee, beans, with, high, caffeine, content, producing, strong, bitter, coffee, aroma, flavor] [arabica, tubruk, coffee, offers, mild, acidic, taste, typical, arabica, beans, with, neutral, sweetness, served, hot, without, added, milk, coffee, made, 100%, arabica, coffee, beans, high, caffeine, content, providing, fresh, light, coffee, taste, sensation]	[tubruk, robusta, is, brew, coffee, own, bitter, taste, typical, robusta, serve, hot, without, add, milk, drink, make, 100, robusta, coffee, beans, high, caffeine, produce, aroma, bitter, coffee, taste] [arabica, tubruk, coffee, offer, acidic, mild, taste, typical, arabica, beans, neutral, sweet, serve, hot, without, add, milk, coffee, make, 100, arabica, coffee, beans, high, caffeine, give, fresh, light, coffee, taste]

### 3. Results and Discussion

At this stage, the implementation of the entire system that was previously designed is carried out. This implementation process includes an explanation of each part that has been developed. The implementation of the menu recommendation system using the Content-Based Filtering (CBF) method at Pandawa Pondok Kopi is described in detail in this section.



Fig. 2: Customer Homepage

Figure 2 shows the user interface of a menu recommendation system designed to be modern and responsive, where users can choose from various types of beverages displayed in visual card format containing product images, menu names, prices, and short descriptions that explain the characteristics of each drink. All elements are designed to facilitate user interaction in finding their favorite beverages intuitively and informatively through this AI-based system.



Fig. 3: Menu Recommendation Page

Figure 3 displays the detailed menu page of the recommendation system, which presents complete information about a beverage using the “Bamboo Drip Arabica” menu as a reference, along with its price, description, and a list of similar recommended menus based on similarity levels.

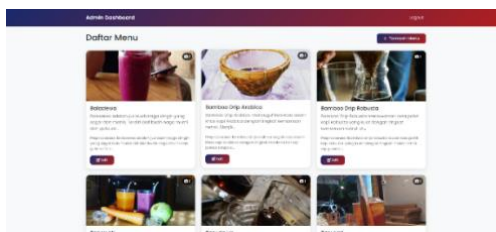


Fig. 4: Admin Dashboard Page

Figure 4 shows the interface of the admin dashboard page of the recommendation system, designed to be modern and responsive. It displays various food or drink menu items in a grid format with visual elements such as product images, names, short descriptions, and prices. It is also equipped with interactive features such as “Edit” and “Add Menu” buttons, which help admins easily manage content, providing an intuitive user experience in managing menu information within the system.

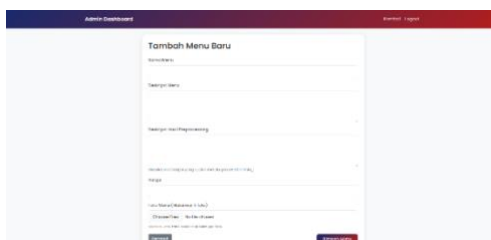


Fig. 5: Add New Menu Page

Figure 5 shows the “Add New Menu” page in the admin dashboard of the recommendation system, functioning as a data input form for adding food or beverage items into the system. The available elements include fields for entering the menu name, description, preprocessing results (for analysis or content matching purposes), price, and image upload features supporting up to five pictures with certain size

limitations. The entire interface is designed to be minimalist and consistent with the system's visual theme, providing "Back" and "Save Menu" buttons for navigation and efficient data storage, supporting ease of use and seamless data integration into the Content-Based Filtering based system.



Fig. 6: Edit Menu Page

Figure 6 shows the "Edit Menu" page in the admin dashboard, allowing users to update menu data such as the menu name, original description, preprocessed description (likely used for text processing such as stemming within the content-based filtering mechanism), price, and previously uploaded images. The interface emphasizes simplicity and efficiency, with a clean layout and well-structured input forms to facilitate accurate editing before the data is saved back into the database.

This study implements the Content Based Filtering (CBF) method in a menu recommendation system at Pandawa Pondok Kopi to help customers choose beverages more quickly and according to their preferences. The recommendation process includes several stages such as text preprocessing of menu descriptions, weighting using TF-IDF, and calculating similarity with Cosine Similarity. The system then displays the top three menu recommendations based on these calculations.

The test results show that the system operates as designed, both in terms of functionality and performance. Black Box Testing confirms that the admin login, menu management, and recommendation display features work properly. The average Cosine Similarity value ranges between 0.62 and 0.78, indicating that the relevance level of the recommendations is quite high. The system's response time is also relatively fast, under 1 second, supporting efficient usage.

Overall, the implementation of the CBF method has proven effective in improving the accuracy of menu recommendations and enhancing user experience. The system helps reduce customer confusion due to numerous menu choices and supports improved customer satisfaction and operational efficiency at Pandawa Pondok Kopi. In the future, further development may include integrating additional methods or incorporating dynamic user context for more personalized recommendations.

## 4. Conclusion

Based on the results of the design, implementation, and testing conducted in the study entitled Implementation of the Content Based Filtering Method for Menu Recommendation at Pandawa Pondok Kopi, it can be concluded that the Content-Based Filtering (CBF) method using the TF-IDF and Cosine Similarity approaches has been successfully applied in the web-based menu recommendation system. The system is capable of generating three top menu recommendations that are relevant based on the similarity of product descriptions. The Cosine Similarity calculations show sufficiently high similarity values, indicating that CBF is reliable in matching menu characteristics with user preferences.

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