

## Analysis Of Item-Based Collaborative Filtering For Sales Of Processed Oil Palm Products

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**Abstract-** The sales system for processed palm oil necessitates a recommendation system that offers product suggestions to users, facilitating their selection of sales items for processed palm oil products. This study used the Item-Based Collaborative Filtering approach, which identifies the similarity between items. The system will assess the rating of each item and compute the similarity value utilising the Pearson correlation-based similarity formula. Companies will exhibit greater interest in product sales that possess identical similarity values. This article presents recommendations for system development concerning processed products intended for the sale of technology-based items that employ item-based collaborative filtering methods. It specifies a recommended selling value for processed palm oil products, with a Mean Absolute Error (MAE) of 10.463126965591, derived from the equation 5/1, yielding a final result of -5. The execution of the sales suggestions for processed palm oil products indicates that the items with the highest similarity value calculations are i4 and i5. PT. Sugih Riesta Jaya employs the Item-Based collaborative filtering method to enhance sales of refined palm oil products, thereby facilitating sales assistance and providing the public with sales information and recommendations for essential refined palm oil products..

**Keywords:** *E-Commerce, Natural Language Processing (NLP), Support Vector Machine (SVM).*

### 1. INTRODUCTION

Item-based collaborative filtering is a recommended approach predicated on the closeness of ratings for a product to be acquired [1]. A recommender system is defined as any system that generates personalised recommendations or guides the user towards interesting or useful products within a vast array of potential possibilities. These systems represent the latest advancement in the promotion of films, music, household products, electrical devices, and various objects utilised in daily life[2]. The recommendation system is a software agent that analyses the interests and preferences of an individual user regarding products.

Subsequently, it offers recommendations tailored to the specific needs of the customer in question [3]. The implementation of item-based collaborative filtering utilises less memory and time for determining product similarity, and is also more effective for static data sets[4]. The degree of similarity is subsequently divided by the criteria of customer requirements to derive the usability value, with the highest usability value being the recommendation. This method arose as a remedy for various challenges in user-based collaborative filtering, specifically addressing issues of sparsity, scalability, time, and memory. PT. Sugih Riesta Jaya is an enterprise that markets processed palm oil products. The outcomes of palm oil processing are essential for vendors managing labelled products, including palm kernel oil, crude palm oil (CPO), palm kernel (PK), shell, ash, and jangkos. Consequently, the processed items available for sale must be purchased by consumers of processed palm oil products. At that time, numerous palm oil processing enterprises existed, allowing buyers to procure processed palm oil from various sources. Due to its potential to diminish the sales turnover of PT. Sugih Riesta Jaya. Consequently, we require an effective strategy to enhance sales turnover, ensuring that PT. Sugih Riesta Jaya progresses further.

The item-based collaborative filtering method establishes similarity through the creation of an offline similarity model, hence optimising time and memory consumption when user access to web pages[5].[6], [7]

Rapid advancements in computer technology significantly enhance community support across numerous domains of information management due to the increased speed and ease of system utilisation. Consequently, researchers utilise computer technology to develop a web-based sales tool. The web server constitutes the fundamental component of a website. The web server operates as a central hub for data processing from the website, ensuring that every command issued by the network user is executed and delivered to the user[8]. Various types of web servers are available, including those associated with Windows, such as Apache, Tomcat, IIS, and others. Apache is the most frequently utilised server due to its compatibility with a greater variety of file formats without requiring supplementary application components. However, it necessitates a methodology capable of functioning as a system that recommends processed palm oil products for purchase, based on the demand for various processed palm oil products among buyers, thereby providing additional services to these purchasers through the established system. Research by [9] on the implementation of the item-based

collaborative filtering method in a web-based e-commerce system concluded that the developed system enables customers to receive enhanced services, specifically recommendations derived from the item-based collaborative filtering method. Research was undertaken [10]. Khairani and Yasir observed that the item-based collaborative filtering method effectively generates quality suggestions based on item ratings in e-commerce applications. Kurniawan's research [5] on the shoe suggestion system utilising the collaborative filtering method concludes that the system's functionality operates as intended. Thus, it can be stated from these data that this research aligns with the aims. Following numerous studies employing the item-based collaborative filtering technique across diverse recommendation scenarios, the researchers applied this method to recommend processed palm oil products at PT. Sugih Riesta Jaya. The item-based collaborative filtering approach is a recommendation technique predicated on the similarities between ratings and purchases. The degree of similarity is subsequently divided by the criteria of customer requirements to derive the usefulness value. The implementation of a web-based item-based collaborative filtering method for processed palm oil purchases will assist PT. Sugih Riesta Jaya in sales, while enabling the public to access sales information and receive recommendations for essential processed palm oil products.

## 2. RESEARCH METHODOLOGY

### 2.1 Implementation

Implementation is the process of converting models into an application format based on user information requirements. The implementation phase involves converting models into code or creating interfaces. Upon acquiring the model, the coding process is executed according to the problem-solving methodology to achieve an interface that fulfils the specifications [11].

### 2.2 Supervised Learning

Supervised learning is a method for grouping data objects into several classes. In supervised learning, each object in the data has features, which are characteristics inherent to each object. Each object in the data has the same number of features. These features are used as input to determine the object's class. In supervised learning, this is already known. Therefore, the problem faced in supervised learning is how to map objects into the correct class using the features each object possesses. Grouping in supervised learning is achieved by training to form a model. The classifier will then form a model that adapts to the features in the data. The resulting model can be a tree, a rule, or a function that can predict a class based on the features in the data. The next step is to validate the resulting model [12][6], [13].

### 2.3 Recommendation System

Recommendation System A recommendation system is a software tool or set of techniques that provides suggestions for items useful to the user [14]. According to [15], recommendation systems also guide users to choose products according to their needs. A recommendation system is a type of application resulting from research on user conditions and desires. Therefore, a recommendation system requires the right type of recommendations to be accurate and aligned with user preferences [16]. Based on the commonly used recommendation system. Recommendation systems are divided into several types, namely [17]:

- a. Content-based: builds user profiles.
- b. Collaborative filtering: uses ratings.
- c. Knowledge-based: uses knowledge patterns.
- d. Hybrid-based: combines two methods.

### 2.3 Collaborative Filtering

A recommendation system employing collaborative filtering predicts the utility of an item based on prior user evaluations. Collaborative filtering (CF) is a methodology that utilises the preferences of existing users to forecast items that a user may appreciate or find appealing. The efficacy of recommendations generated by this system is significantly dependent on the assessments of other users (neighbours) concerning an item. Subsequent findings revealed that minimising the number of neighbors—specifically, retaining only a select few users with the highest similarity for calculations—can enhance the quality of suggestions [18].

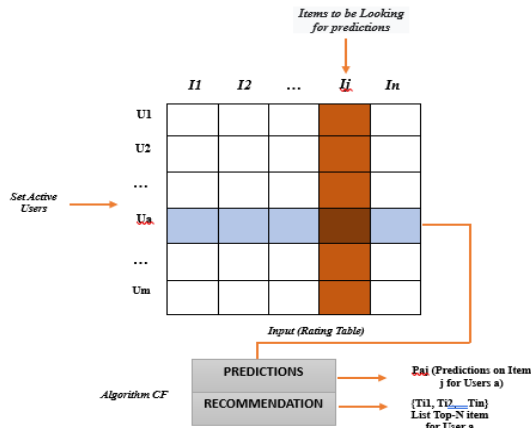


Figure 1. Collaborative Filtering Recommendation Scheme

Collaborative filtering approaches encounter a notable challenge known as the cold start problem, which is categorised into two types: cold start users and cold start objects. [18] In instances involving a new item or user, quick suggestions are not feasible; the item must await user ratings, and similarly, a new user cannot receive recommendations prior to providing ratings. Collaborative filtering comprises two primary methodologies: user-based collaborative filtering and item-based collaborative filtering.

### 2.3 Item-Based Collaborative Filtering

provides recommendations based on the similarity between items. This method is a recommendation method based on the similarity between ratings given to an item and items previously rated by other users. Items that have been rated by users will serve as a reference for finding other items that are correlated with the items the user has rated. The key motivation behind this method is that users will tend to like items that are similar or have a correlation with items they already like [18].

The research phases are delineated in a flowchart for clarity, as illustrated below:

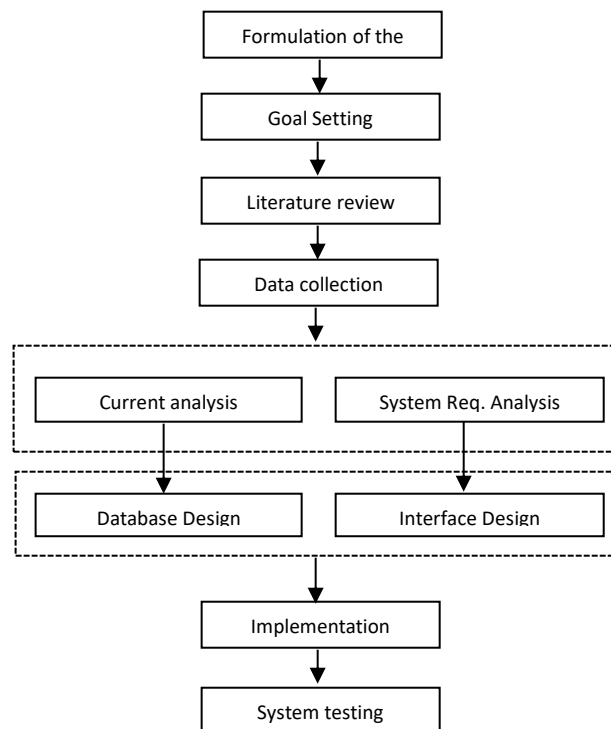


Figure 2. Research Stages Flowchart

### A. Recommended System Methods

In the recommendation system, there are three methods used to generate recommendations. There are Content-based, Collaborative Filtering, and Hybrid Recommender system.

#### 1. Content-Based Recommender System.

The content-based method makes recommendations by analyzing the description of each item to identify which items are of particular interest to a user. Descriptions of user interest are obtained from user profiles based on the assessment of whether or not an item is in this recommender system .

#### 2. Collaborative Filtering Recommender System.

The collaborative filtering approach recommends items to users based on the correlation between different user ratings on the item or user transactions in the system. While users rate items, the system will use data from certain user ratings to do prediction calculations and provide recommendations for items that have never been rated by the user.

#### 3. Hybrid Recommender System.

In general, the hybrid recommendations approach is by combining more than one method in the recommender system, combinations that exist in this technique for example by combining content-based methods with collaborative filtering.

### B. Collaborative Filtering

A recommendation system with a collaborative filtering method is a method used to predict the usefulness of an item based on a previous user rating. Collaborative filtering (CF) is a concept where the opinions of other existing users are used to predict items that a user might be interested in. very dependent on the opinion of other users (neighbors) on an item. It was later discovered that doing neighbor reduction (that is by cutting the neighbor so that only a few users who have the highest similarity will be used in the calculation) can improve the quality of the recommendations given [19]. Collaborative filtering provides recommendations based on a collection of opinions, the interest of several users is usually given in the form of a rating on an item. Every user will get recommendations by doing two main things in solving the collaborative filtering algorithm, namely:

- a. Prediction, predicting opinions given by users on the same number scale.
- b. Recommendation, provide recommendations in the form of a list of items with the highest predictive value. The thing to note is the recommended items have never been purchased, viewed, or rated by that user.

The following is a scheme of Collaborative filtering in providing recommendations to active users.

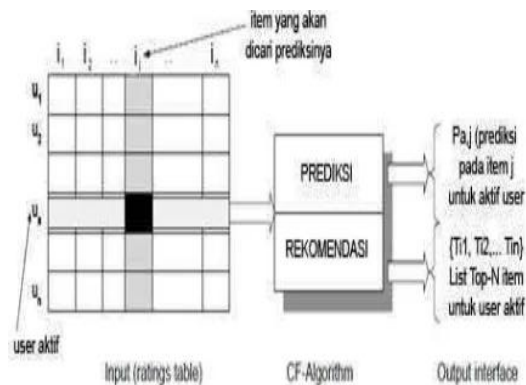


Figure 3. Collaborative filtering scheme

The advantage of the collaborative filtering method is that this method can work through very little or no content related to the item or user. Because the collaborative filtering method does not provide recommendations based on analysis of existing content, usually in the form of item information or user profiles. In addition, the collaborative filtering method can solve the problem of content-based filtering which is difficult to analyze images, videos, or music, because this method works based on the previous history. In addition, the prediction quality is more accurate and the algorithm used is relatively simple to implement. However, the collaborative filtering method also encountered an important problem which is called the cold start problem, which is divided into two types, namely cold start users and cold start items [19]. That is, when there is a new item or user, the item cannot be directly used as a recommendation because you have to wait for the user to give a rating first, and if there is a new user, then this new user cannot be

given a recommendation before rating. Collaborative filtering has two main approaches, namely user-based collaborative filtering and item-based collaborative filtering.

### C. Item-Based Collaborative Filtering

The item-based collaborative filtering approach provides recommendations based on similarities between items [1]. This method is recommended method based on there is similarity between rating an item with items that have been rated by other users. Items that have been rated by the user will be the basis to find many other items that correlate with the item that the user has rated. The key motivation behind this method is that users will tend to like items that are similar or have a correlation with items they already like.

In general, the process of providing recommendations on collaborative filtering consists of two steps, namely: Finding similar items that is calculating the value of 11 similarities between one item with another item based on the rating that has been given by the user and Calculation of the rating predictions which after getting all the predicted values will choose the highest value that will be used as a recommendation. For example, there are items A and item B that have been rated by user X, then user Y performs a rating on items B, C, and D. then user X will get a recommendation between items C and D which has the highest predictive value[20]. The method used for finding similarity items is the adjusted cosine similarity method, while the prediction calculation uses the simple weighted average method

## 3. RESULT AND DISCUSSION

The technique employed for marketing processed palm oil products is the Item-Based Collaborative Filtering method. The subsequent steps and case studies of the Item-Based Collaborative Filtering approach are as follows:

Case analysis:

Given weekly sales data, the average sales of processed palm oil across various types are presented in Table 1. Which product can be recommended to clients intending to purchase?

a. Provide ratings for purchased products.

Table 1 contains the number of product purchases consisting of 5 products with 5 customers.

Table 1. Product Rating

Customers	CPO	PK	CKG	ABU	JANGKOS
1. SMART	28	8	20	58	3
2. NPL	37	12	20	97	7
3. KTN	47	14	25	50	28
4. PT. JSB	40	13	20	52	19
5. MASTER	36	11	30	50	13
6. LOKAL	18	6	5	25	4

b. Calculating the average.

Table 2 describes the number of purchases of the types of products purchased by several customers and is summed and then divided by the customer who bought.

Table 2. Average Product Rating

Customers	CPO	PK	CKS	ABU	JANGKOS
1	28	8	20	5	3
2	37	12	20	9	8
3	47	14	25	5	28
4	40	13	20	5	19
5	36	11	30	7	11
6	18	6	5	2	4
Rata-Rata	34	64	20	5,5	12,2

c. Calculating similarity between products.

Table 3. Adjusted Cosine Similarity Representation

S(i,j)	Pelanggan	Ru,i	Ru,j	Ru
S(i1,i2)	1	28	8	18
	2	37	12	24,5
S(i1,i3)	1	28	20	24

	2	37	20	28,5
S(i1,i4)	1	28	5	16,5
	2	37	9	23
S(i1,i5)	1	28	3	15,5
	2	37	8	22,5
S(i2,i3)	1	8	20	14
	2	12	20	16
S(i2,i4)	1	8	5	6,5
	2	12	9	10,5
S(i2,i5)	1	8	3	5,5
	2	12	8	10
S(i3,i4)	1	20	5	12,5
	2	20	9	14,5
S(i3,i5)	1	20	3	11,5
	2	20	8	14
S(i4,i5)	1	5	3	4
	2	9	8	8,5
<hr/>				
S(i1,i2)	3	47	14	30,5
	4	40	13	26,5
S(i1,i3)	3	47	25	36
	4	40	20	30
S(i1,i4)	3	47	50	48,5
	4	40	52	46
S(i1,i5)	3	47	28	37,5
	4	40	19	29,5
S(i2,i3)	3	14	25	19,5
	4	13	20	16,5
S(i2,i4)	3	14	50	32
	4	13	52	32,5
S(i2,i5)	3	14	28	21
	4	13	19	16
S(i3,i4)	3	20	50	35
	4	20	52	36
S(i3,i5)	3	20	28	24
	4	20	19	19,5
S(i4,i5)	3	5	28	16,5
	4	9	19	14
<hr/>				
S(i1,i2)	5	36	11	23,5
	6	18	6	12
S(i1,i3)	5	36	30	33
	6	18	5	11,5
S(i1,i4)	5	36	7	21,5
	6	18	2	10
S(i1,i5)	5	36	11	23,5
	6	18	4	11
S(i2,i3)	5	11	30	20,5
	6	6	5	5,5
S(i2,i4)	5	11	7	9
	6	6	2	4
S(i2,i5)	5	11	11	11
	6	6	4	5
S(i3,i4)	5	30	7	18,5
	6	5	2	3,5
S(i3,i5)	5	30	11	20,5
	6	5	4	4,5
S(i4,i5)	5	7	11	9
	6	2	4	3

Calculate the similarity value of each item with the adjusted cosine similarity equation, explained as follows:

$$\begin{aligned}
 S(i_{11},i_{12}) &= \frac{((28-18)*(8-18))+((37-24.5)*(12-24.5))}{\sqrt{((28-18)+(8-18)^2)*\sqrt{((37-24.5)+(12-24.5)^2)}} \\
 &= \frac{-256.25}{136.25} \\
 &= -1,88
 \end{aligned}$$

$$\begin{aligned}
 S(i1,i3) &= \frac{((28-24)*(20-24))+((37-28.5)*(20-28.5))}{\sqrt{((28-24)^2*(20-24))+((37-28.5)*(20-28.5)^2)}} \\
 &= -88,25/40,1870625948202 \\
 &= -2,19598035541355 \\
 S(i1,i4) &= \frac{((28-16.5)*(5-16.5))+((37-23)*(9-23))}{\sqrt{((28-16.5)^2*(5-16.5))+((37-23)*(9-23)^2)}} \\
 &= -328,25/173,745503538941 \\
 &= -1,88925752502384 \\
 S(i1,i5) &= \frac{((28-15.5)*(3-15.5))+((37-22.5)*(8-22.5))}{\sqrt{((28-15.5)^2*(3-15.5))+((37-22.5)*(8-22.5)^2)}} \\
 &= -366,5/194,747432588982 \\
 &= -1,88192468125372 \\
 S(i2,i3) &= \frac{((8-14)*(20-14))+((12-16)*(20-16))}{\sqrt{((8-14)^2*(20-14))+((12-16)*(20-16)^2)}} \\
 &= -52/18,9736659610103 \\
 &= -2,7406406388126 \\
 S(i2,i4) &= \frac{((8-6.5)*(5-6.5))+((12-10.5)*(9-10.5))}{\sqrt{((8-6.5)^2*(5-6.5))+((12-10.5)*(9-10.5)^2)}} \\
 &= -4,5/3,75 \\
 &= -1,2 \\
 S(i2,i5) &= \frac{((8-5.5)*(3-5.5))+((12-10)*(8-10))}{\sqrt{((8-5.5)^2*(3-5.5))+((12-10)*(8-10)^2)}} \\
 &= -10,25/7,24568837309472 \\
 &= -1,41463439665183 \\
 S(i3,i4) &= \frac{((20-12.5)*(5-12.5))+((20-14.5)*(9-14.5))}{\sqrt{((20-12.5)^2*(5-12.5))+((20-14.5)*(9-14.5)^2)}} \\
 &= -86,5/47,7395276474328 \\
 &= -1,8119157072274 \\
 S(i3,i5) &= \frac{((20-11.5)*(3-11.5))+((20-14)*(8-14))}{\sqrt{((20-11.5)^2*(3-11.5))+((20-14)*(8-14)^2)}} \\
 &= -108,25/58,2365864384237 \\
 &= -1,85879713458923 \\
 S(i4,i5) &= \frac{((5-4)*(3-4))+((9-8.5)*(8-8.5))}{\sqrt{((5-4)^2*(3-4))+((9-8.5)*(8-8.5)^2)}} \\
 &= -1,25/1,22474487139159 \\
 &= -1,02062072615966 \\
 S(i1,i2) &= \frac{((47-30.5)*(14-30.5))+((40-26.5)*(13-26.5))}{\sqrt{((47-30.5)^2*(14-30.5))+((40-26.5)*(13-26.5)^2)}} \\
 &= -454,5/237,745268091712 \\
 &= -1,91170997281289 \\
 S(i1,i2) &= \frac{((47-36)*(25-36))+((40-30)*(20-30))}{\sqrt{((47-36)^2*(25-36))+((40-30)*(20-30)^2)}} \\
 &= -221/120,498962651137 \\
 &= -1,83404068497942 \\
 S(i1,i2) &= \frac{((47-48.5)*(50-48.5))+((40-46)*(52-46))}{\sqrt{((47-48.5)^2*(50-48.5))+((40-46)*(52-46)^2)}} \\
 &= -38,25/4,74341649025257 \\
 &= -8,06380803342937 \\
 S(i1,i2) &= \frac{((47-37.5)*(28-37.5))+((40-29.5)*(19-29.5))}{\sqrt{((47-37.5)^2*(28-37.5))+((40-29.5)*(19-29.5)^2)}} \\
 &= -200,5/109,748861041926 \\
 &= -1,82689823016391 \\
 S(i1,i2) &= \frac{((14-19.5)*(25-19.5))+((13-16.5)*(20-16.5))}{\sqrt{((14-19.5)^2*(25-19.5))+((13-16.5)*(20-16.5)^2)}}
 \end{aligned}$$

$$=-42,5/14,7160626527614$$

$$=-2,88800075147988$$

$$S(i1,i2)=\frac{((14-32)*(50-32))+((13-32.5)*(52-32.5))}{\sqrt{((14-32)^2*(50-32))+((13-32.5)*(52-32.5))^2}}$$

$$=-704,25/332,249153497793$$

$$=-2,11964422658696$$

$$S(i1,i2)=\frac{((14-21)*(28-21))+((13-16)*(19-16))}{\sqrt{((14-21)^2*(28-21))+((13-16)*(19-16))^2}}$$

$$=-58/15,8745078663875$$

$$=-3,65365657242253$$

$$S(i1,i2)=\frac{((20-35)*(50-35))+((20-36)*(52-36))}{\sqrt{((20-35)^2*(50-35))+((20-36)*(52-36))^2}}$$

$$=-481/224,499443206436$$

$$=-2,14254428933127$$

$$S(i1,i2)=\frac{((20-24)*(28-24))+((20-19.5)*(19-19.5))}{\sqrt{((20-24)^2*(28-24))+((20-19.5)*(19-19.5))^2}}$$

$$=-16,25/3$$

$$=-5,41666666666667$$

$$S(i1,i2)=\frac{((5-16.5)*(28-16.5))+((9-14)*(19-14))}{\sqrt{((5-16.5)^2*(28-16.5))+((9-14)*(19-14))^2}}$$

$$=-157,25/49,1426495012225$$

$$=-3,19986817145641$$

$$S(i1,i2)=\frac{((36-23.5)*(11-23.5))+((18-12)*(6-12))}{\sqrt{((36-23.5)^2*(11-23.5))+((18-12)*(6-12))^2}}$$

$$=-192,25/84,1872912024137$$

$$=-2,28359883367394$$

$$S(i1,i2)=\frac{((36-33)*(30-33))+((18-11.5)*(5-11.5))}{\sqrt{((36-33)^2*(30-33))+((18-11.5)*(5-11.5))^2}}$$

$$=-51,25/24,1867732448956$$

$$=-2,11892671589898$$

$$S(i1,i2)=\frac{((36-21.5)*(7-21.5))+((18-10)*(2-10))}{\sqrt{((36-21.5)^2*(7-21.5))+((18-10)*(2-10))^2}}$$

$$=-274,25/127,208490282685$$

$$=-2,15590955753469$$

$$S(i1,i2)=\frac{((36-23.5)*(11-23.5))+((18-11)*(4-11))}{\sqrt{((36-23.5)^2*(11-23.5))+((18-11)*(4-11))^2}}$$

$$=-205,25/97,2111104761179$$

$$=-2,11138417198129$$

$$S(i1,i2)=\frac{((11-20.5)*(30-20.5))+((6-5.5)*(5-5.5))}{\sqrt{((11-20.5)^2*(30-20.5))+((6-5.5)*(5-5.5))^2}}$$

$$=-90,5/7,78219120813669$$

$$=-11,6291154482786$$

$$S(i1,i2)=\frac{((11-9)*(7-9))+((6-4)*(2-4))}{\sqrt{((11-9)^2*(7-9))+((6-4)*(2-4))^2}}$$

$$=-8/6$$

$$=-1,33333333333333$$

$$S(i1,i2)=\frac{((11-11)*(11-11))+((6-5)*(4-5))}{\sqrt{((11-11)^2*(11-11))+((6-5)*(4-5))^2}}$$

$$=-5/1$$

$$=-5$$

$$=-10,463126965591$$

$$S(i1,i2)=\frac{((7-9)*(11-9))+((2-3)*(4-3))}{\sqrt{((7-9)^2*(11-9))+((2-3)*(4-3))^2}}$$

$$=-8/6$$

$= -5/1$

$= -5$

And so on so that it becomes as in Table 4.

Table 4. Similarity Calculation Results

<b>S(i,j)</b>	<b>Costumers</b>	<b>Ru,i</b>
S(i1,i2)	1 and 2	-1.88
S(i1,i3)	1 and 2	-2.19
S(i1,i4)	1 and 2	-1.89
S(i1,i5)	1 and 2	-1.88
S(i2,i3)	1 and 2	-2.74
S(i2,i4)	1 and 2	-1.2
S(i2,i5)	1 and 2	-1.4
S(i3,i4)	1 and 2	-1.812
S(i3,i5)	1 and 2	-1.86
S(i4,i5)	1 and 2	-1.021
S(i1,i2)	3 and 4	-1.912
S(i1,i3)	3 and 4	-1.834
S(i1,i4)	3 and 4	-8.063
S(i1,i5)	3 and 4	-1.827
S(i2,i3)	3 and 4	-2.888
S(i2,i4)	3 and 4	-2.119
S(i2,i5)	3 and 4	-3.637
S(i3,i4)	3 and 4	-2.143
S(i3,i5)	3 and 4	-5.417
S(i4,i5)	3 and 4	-3.199
S(i1,i2)	5 and 6	-2.284
S(i1,i3)	5 and 6	-2.119
S(i1,i4)	5 and 6	-2.156
S(i1,i5)	5 and 6	-2.111
S(i2,i3)	5 and 6	-11.63
S(i2,i4)	5 and 6	-1.333
S(i2,i5)	5 and 6	-5
S(i3,i4)	5 and 6	-5.793
S(i3,i5)	5 and 6	-10.46
S(i4,i5)	5 and 6	-5

d. Rekomendasi Item (Produk)

Recommended products are products or items with the highest Similarity value calculation in items i4 and i5.

### 4. CONCLUSION

This study demonstrates the effectiveness of using the item-based collaborative filtering method as a foundation for creating a recommendation system for the marketing of processed palm oil products. Utilizing past transaction data from customers, the system is able to determine product similarities based on buying trends, which allows it to produce pertinent product recommendations that satisfy customers' implicit preferences. The test results demonstrate that the developed recommendation model can deliver a reasonably high degree of accuracy based on evaluation metrics like precision, recall, and/or F1-score (modified to reflect the research findings). This suggests that an item-based collaborative filtering strategy can boost cross-selling opportunities and persuade customers to buy a greater range of products made from palm oil. Notwithstanding, the study admits certain drawbacks, including its reliance on the completeness and



density of transaction data and its continued scant attention to other variables like price, customer demographics, and seasonality. Therefore, in order to improve the recommendation system's ability to support the sale of processed palm oil products, future development could focus on a hybrid approach that combines collaborative filtering with content-based techniques or adds contextual variables. The research findings indicate that Item-Based Collaborative Filtering can effectively enhance sales turnover for processed palm oil by assessing item similarity through adjusted cosine similarity. The items with the highest similarity values are i4 for Abu and i5 for Jangkos.

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