

# Marketplace Seller Recommender with User-Based Multi Criteria Decision Making

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## Introduction - Background

- ▶ This research develops a recommender system for seller selection of several online marketplace in Indonesia. Since users are provided with too many merchants with various offers regarding a product, it then creates such difficulty and longer time for them to decide which merchant they should choose to get the efficient effort but optimum results.
- ▶ Case studies in several of the most popular online shops were adopted: Tokopedia, Shopee and Bukalapak, where respondents make online transaction the most. Criteria stated are product price, seller location, seller reputation, the number of sold products and expedition support.
- ▶ This study applied a method of Fuzzy Simple Additive Weighting to normalize by using weight authorized from user preference.
- ▶ The experiment applied a user-based method of testing due to each preference and method to place the rankings. At the end, a merchant with the highest point placed as the top rank and displayed as the recommendation.

## Methods

### Data Acquisition

- ▶ This study employs data from Tokopedia, Shopee and Bukalapak online shops about products, sellers and attributes chosen from respondents user experience. There are 50 samples of data of products and 120 rank combination orders of respondent data taken from each marketplace.

There are five criteria defined as the weighted attributes:

1. Products price, identified by the nominal in Rupiah currency.
2. Distance of seller location to the users location, identified by the information of city or district from the merchants page.
3. Sellers reputation, identified by how many star(s) collected by merchant through users feedback.
4. The number of products sold by seller, identified by how many product(s) a merchant had been sold.
5. Number of delivery supports, identified by how many expedition company are supporting the users destination area.

### Fuzzy - Simple Additive Weighting

- ▶ This framework presents a suitable explanation for knowledge management system development. Its main components are stakeholders, processes (business process and knowledge processes), knowledge strategies, infrastructures and results.

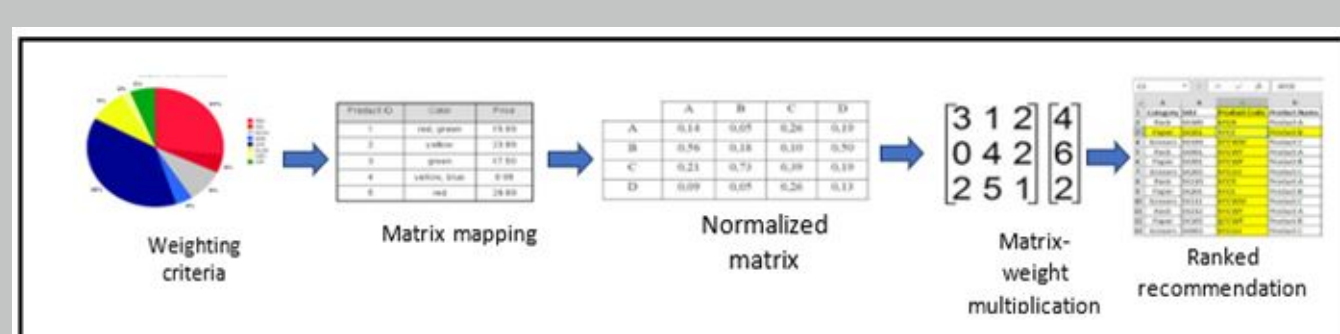


Figure 1: Workflow of Fuzzy-SAW Methodology

- ▶ The weighting part is done by giving a value of a scale of 0-1. After that, in the matrix mapping stage, the data of sellers is sold that sell similar products along with the value of the attributes of each alternative matrix and attributes.
- ▶ The second stage is the stage of normalization of the matrix. Each alternative seller/merchant candidate calculated the normalization value per attribute, adjusted for the type of attribute.

Table 1: RAW MATRIX OF ALTERNATIVES

| Alternative | C1    | C2  | C3  | C4   | C5 |
|-------------|-------|-----|-----|------|----|
| A1          | 9000  | 713 | 4.6 | 701  | 1  |
| A2          | 29000 | 394 | 3.9 | 0    | 1  |
| A3          | 12000 | 370 | 4.6 | 646  | 3  |
| A4          | 12000 | 403 | 4.7 | 26   | 2  |
| A5          | 11000 | 258 | 4.5 | 342  | 3  |
| A6          | 29200 | 390 | 4   | 0    | 1  |
| A7          | 10282 | 208 | 4.6 | 71   | 3  |
| A8          | 9300  | 399 | 4.5 | 304  | 2  |
| A9          | 7900  | 713 | 4.5 | 2030 | 1  |
| A10         | 13000 | 238 | 4.6 | 391  | 1  |

## Results: Implementation and Accuracy Evaluation

- ▶ After accomplishing data pre-processing and implementation, Fig. 2 presents the interface of the personal recommender system.

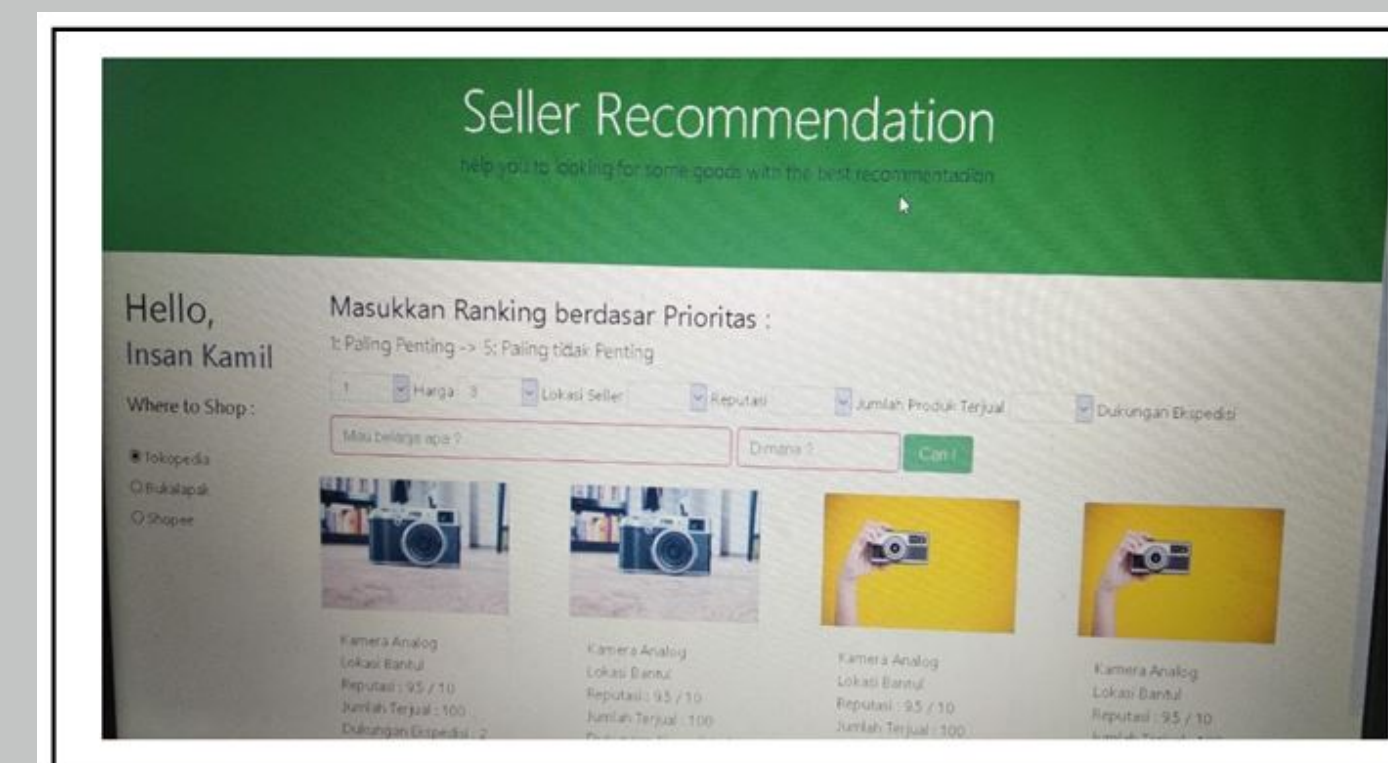


Figure 2: Recommender System Prototype Interface

- ▶ Table 1 illustrates the normalized value matrix toward a Laundry Basket product at Shopee. There are at least ten sellers who sell the product with the same visual (type, brand and size) which will be processed by the Fuzzy-SAW method.
- ▶ The normalized result table is then multiplied by the weighting number. Out of the 120 types of ranking methods, we can take an example of the 1-2-3-4-5 ranking sequence for price attributes-location-reputation-sold product-support expeditions. Three consecutive sellers who get the highest score are A7-A9-A5.

$$\begin{bmatrix} 0.877778 & \dots & 0.33333 \\ \vdots & \ddots & \vdots \\ 0.607692 & \dots & 0.33333 \end{bmatrix} \times \begin{bmatrix} 0.5 \\ 0.3 \\ 0.15 \\ 0.1 \\ 0.05 \end{bmatrix} = \begin{bmatrix} 0.7244 \\ 0.4357 \\ 0.7264 \\ 0.6686 \\ 0.8114 \\ 0.4396 \\ 0.8844 \\ 0.7730 \\ 0.8478 \\ 0.7487 \end{bmatrix}$$

Figure 3: Alternative Matrix Calculation Results with 1Weight Matrix

- ▶ This study employs an accuracy of the rank result calculation method. The accuracy is calculated based on the recommendations given by the system to data compared to the data given by respondents which is divided into data training to find the most optimum weight; and data testing in ratio of 4:1.
- ▶ In the data testing, a random sample of products with various combination of attributes rank order is applied. Accuracy value of each product search result is defined if a target seller is found as the first recommendation result.
- ▶ Table 2 shows a sample of data testing that compares seller target to output from system. From the table, the accuracy of the correct amount of data can be calculated compared to the number of data testing.
- ▶ Attribute rank show the user preference respectively for price, location, number of sold product, seller reputation, and the number of expedition provider support. The accuracy generated by Fuzzy-SAW in this personal recommender system is 75%.

Table 2: SAMPLE OF DATA TESTING

| Product  | Attribute Rank | Seller Target         | Seller Result         |
|----------|----------------|-----------------------|-----------------------|
| Aceh     | 1-5-2-3-4      | Kopi Tubruk Indonesia | Kopi Tubruk Indonesia |
| Arabica  | 1-2-3-4-5      | Q House of Coffee     | Kopi Tubruk Indonesia |
| Coffee   | 2-1-3-4-5      | Boenboen Coffee       | Boenboen Coffee       |
|          | 3-1-2-4-5      | Kopi Tubruk Indonesia | Kopi Tubruk Indonesia |
| Zara     | 1-3-4-2-5      | Kimi Shop             | Kimi Shop             |
| Floral   | 2-4-1-5-3      | Kimi Shop             | Value Bags            |
|          | 3-1-5-4-2      | Kimi Shop             | Kimi Shop             |
| Simbadda | 4-1-5-2-3      | Travarillo            | Travarillo            |
| Music    | 1-2-3-4-5      | IT Shop Online        | Simbadda Official     |
| Player   | 2-1-5-4-3      | IT Shop Online        | IT Shop Online        |

## Conclusions

- ▶ From the results of accuracy and data from participants, the price attribute becomes the attribute that respondents were being considered the most, since it originally belongs to a product, while the other attributes belong to each merchant.
- ▶ Some criteria ranking combinations produce the same sellers who are always ranked in the top-4 recommendations, one of the trigger factors because the values in almost all attributes are the most optimum number of each attribute type.