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Article

Gym location search in Malang using simple additive weighting method: case study at Asia Malang Institute

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***Abstrak*—The main problem in this research is the large selection of gyms in Malang Raya with various different criteria, which makes the process of selecting the right gym difficult for prospective users. This research aims to develop the best gym location recommendation system in Malang Raya using the Simple Additive Weighting (SAW) method. The SAW method is used to evaluate gyms based on the main criteria, namely price, facilities, cleanliness, mentoring system, and distance. Data collected through surveys and observations was then analyzed using SAW to produce a ranking of gyms in the region. The results showed that Momon Gym ranked first with the highest score, while WWGYM ranked last. Tests comparing the actual ranking results with the results from the computer program using the SAW method showed high consistency, indicating that the method is reliable in providing objective recommendations. This research also shows that SAW is effective in analyzing multi-criteria data for more accurate and efficient decision-making in selecting gyms that match users' preferences.**

***Keywords*—gym; simple additive weighting (saw); recommendation system.**

1. Introduction

Physical health and fitness are important components in improving the quality of life, productivity, and well-being of individuals (Mahindru et al., 2023; Mustafa, 2022) In recent years, there has been an increase in awareness of the importance of a healthy and active lifestyle, especially among the productive age (Monzera, 2022) This trend has also encouraged the significant growth of the fitness industry in various regions, including the Greater Malang area which is known as the center of educational and urbanization activities. The high population of students and young workers in this region has caused the demand for gym services to increase significantly.

The increasing number of gym facilities in the Greater Malang area has caused the process of choosing gyms to become more complex. Each facility offers different advantages, both in terms of price, facilities, location, cleanliness, operational schedule, and quality of instructors. This complexity arises due to differences in preferences in determining election priorities based on the needs of each individual. Some service users consider the cost of membership more, while others prioritize the quality of equipment, strategic location, or the expertise of the trainer. Without a systematic selection method, the decision-making process tends to be subjective and not optimal.

In the context of academic life and busy activities, the existence of a gym that meets the needs has great potential in supporting increased productivity, stress management, and balance between physical and mental (Mumtaz, 2024) However, the many alternative fitness facilities without a structured assessment system often make it difficult to make the right and efficient choice.

The Multi-Criteria Decision Making (MCDM) method is a relevant approach to solve selection problems with various considerations (Dhurkari, 2022; Namin et al., 2022) One of the

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methods widely used in MCDM is Simple Additive Weighting (SAW) (Habibi & Manurung, 2023; Rahman, 2025). This method has advantages in terms of simplicity of calculation and the level of clarity in the results provided. SAW works by giving weight to each criterion based on the level of importance of each, then accumulating scores from each alternative to obtain the most optimal ranking (Farida & Wahyuni, 2022; Zumarniansyah et al., 2021). This process results in more objective, measurable, and methodologically accountable decisions (Kuryanti et al., 2024)

Research by applying the SAW method has been widely applied to various fields in previous research. The SAW method can be applied to determine business locations (Wati, 2021) The criteria used in this study include market, price, and area. The results of the research can be the best recommendation for entrepreneurs to establish a strategic place of business according to their wishes. The order of location selection resulting from the application of the SAW method is Teluk Naga with a final score of 6, followed by Poris with a final score of 566667, and the last is Dadap with a final score of 5. In another study, the SAW method was also applied to determine retail locations (Harahap et al., 2022) The criteria used in this study include population density, proximity to competitors, average income, and rental costs. The results show that location A is the optimal selection location, as it shows the highest weight value. The SAW method can also be used to determine the location of gold store branches (Mustika & Wibawanti, 2022) The purpose of the research is to open new branches so that the market reach is more widespread. The criteria used in this study include cost, level of competition, access to location, security, and environment. The result of this study is a recommendation in the form of the best alternative order that can help store owners in determining the location of branch stores.

In the field of Education, the SAW method can be used to determine the place of street vendors for vocational school students (Sutrisno, 2023) The results of the ranking help the optimal selection of street vendor alternatives. A support system for the placement of street vendors at SMK Negeri 4 Malang. Utilize the Moora and Simple Additive Weighting methods for ranking. In addition, the SAW method can also be used to determine superior grades (Rofi'ah et al., 2025)'an reading scores, book readings, and average report card scores. The research was conducted by collecting data through observation, interviews, and documentation. The results of the implementation show that this system is able to increase the efficiency of the selection process by up to 40% compared to the manual method. The system also improves the accuracy of data processing through automatic validation, so that the selection results are more objective and accountable.

In the agricultural sector, the SAW method has also been applied to the selection of superior cayenne pepper seeds (Pawan et al., 2022) The criteria used in this study include rainfall, harvest time, number of stalks, chili weight, and chili age. The results of this study show that the SAW method can help farmers in selecting the right cayenne pepper seeds. In addition, the SAW method can also be applied in companies for the selection of the best employees (Kuryanti et al., 2024) The criteria used include work experience, technical skills, communication skills, and cooperation skills. The results show that the results of the recommendation to determine the best employee using the SAW method, the best employees who are selected become the best not only because they have the appropriate qualifications. However, the best employees are also able to contribute to the Company.

This research aims to develop a recommendation system for the selection of fitness facilities based on the SAW method, with a case study in the Greater Malang area. The system is designed to generate gym selection references that fit a wide range of assessment criteria and the general preferences of fitness service users. The results of the implementation of the recommendation system are expected to not only provide ease of decision-making, but can also be used as a strategic input for gym managers in improving competitiveness and service quality. In addition, this research has the potential to be a reference in the development of similar systems in other sectors that require the objective selection of alternatives based on multivariate data and criteria.

2. Method

This study applies the Simple Additive Weighting (SAW) method because of its ability to evaluate various criteria systematically, simply, but still effectively (Saragih, 2024) The SAW method allows the calculation of the aggregate value of a number of factors that influence the decision to choose a gym location, taking into account the weight of each criterion according to its level of importance.

In the context of choosing a gym in the Greater Malang area, a number of determining variables are used as the basis for assessment, including membership fee, completeness of facilities, cleanliness standards, distance from residence or campus, and availability of personal trainers or mentoring systems. Each of these criteria is analyzed quantitatively, then normalized and weighted to produce an objective calculation. This process allows for the accurate ranking of gym alternatives based on the total score obtained from the calculation of the SAW method.

The results of the analysis showed that the highest-rated gyms were those that offered a combination of competitive membership prices, complete training facilities, maintained cleanliness, strategic location, and personal trainer services or an effective mentoring system. The recommendations from the ranking results contribute to supporting the decision-making process, especially for students within the Asia Institute of Malang, in choosing gym facilities that suit their preferences and needs.

The application of the SAW method in this study not only provides benefits for consumers, but can also be a strategic reference for fitness service providers in designing and developing services that are more adaptive to market needs. This SAW-based decision-making model also has the potential to be adopted in other contexts involving multi-criteria selection. In general, the stages carried out in the SAW-based recommendation system include (Farida & Wahyuni, 2022; Kuryanti et al., 2024; Rahman, 2025)

a. Data collection in the form of a dataset containing gym alternatives and the value of their assessment attributes.
b. The process of entering data into the system and determining the weight of each attribute based on the level of importance.
c. The normalization of the value in the dataset uses a formula that is adjusted for both cost and benefit criteria.
d. Weighting of normalization results in obtaining the final

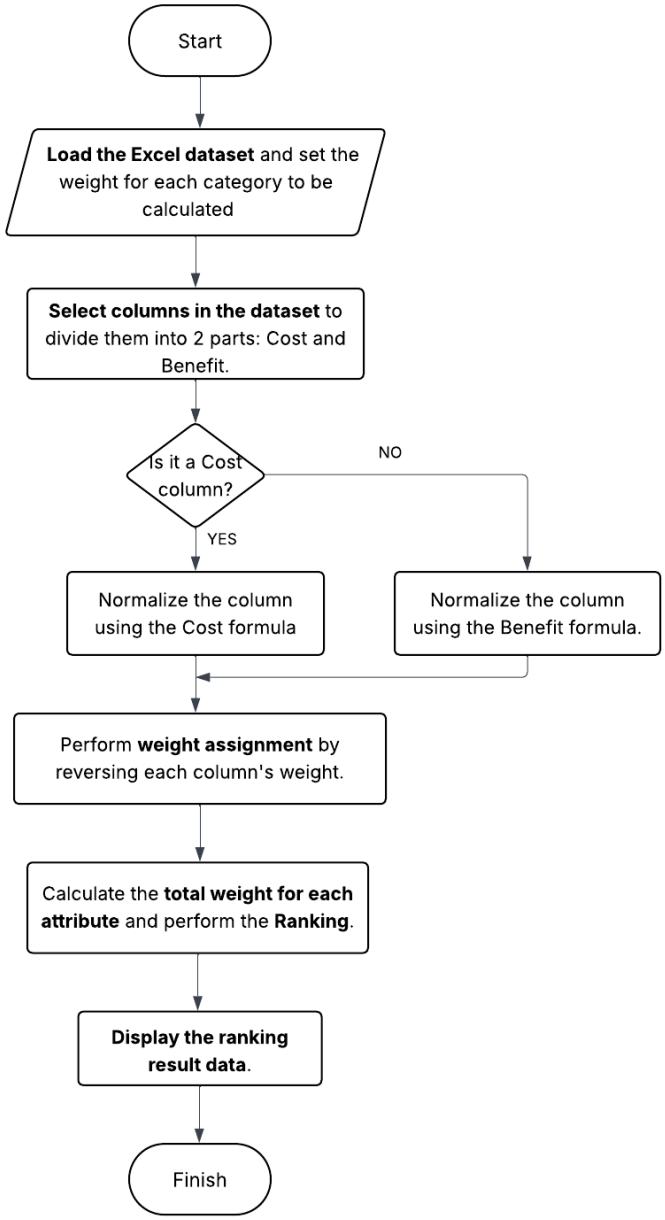

Fig. 1. SAW application flowchart

value of each alternative.

e. Alternative ranking based on the total score obtained, in order to determine the priority order of gym selection.

An illustration of the flow of the SAW method process in this study is shown in Figure 1 in the form of a system flowchart.

2.1. Data collection

The first stage in the gym location recommendation system in Malang Raya is data collection, which begins with the identification and collection of relevant information regarding various gym facilities around the Asia Institute Malang. The data input process is a crucial step to ensure that all the information needed is available in a structured format and ready for further analysis. The attributes included in this dataset include membership fees, completeness of facilities, hygiene standards, mentoring system, and distance between the gym location and the Asia Institute Malang. The dataset used in this study can be seen in Table 1.

Table 1. Dataset

No	Gym	Price (Rp)	Facilities	Hygiene	Mentoring System	Distance (km)
1	Best Gym	120,000	7.6	9.0	8.3	0,35
2	Fitness plus	160,000	9.2	8.3	8.1	3,2
3	Gond Gym	120,000	8.8	8.3	9.3	4,9
4	My Gym	125,000	8.1	9.0	8.5	5,7
5	Momon Gym	60,000	8.3	8.8	8.8	4,5
6	Smart Gym	185,000	8.6	9.3	8.3	3,5
7	Starfit Gym	175,000	7.6	9.2	9.0	3,2
8	The Gym Asifa	195,000	7.1	7.8	7.8	1,3
9	WWGYM	195,000	9.2	9.0	9.1	1,6
10	Xtreme Gym	115,000	7.5	8.3	8.3	0,5
Max/Min		60,000	9.2	9.3	9.3	0.35

Based on Table 1, the next stage is the determination of criteria in the analysis of gym location recommendations in Malang Raya. This process involves identifying and assigning weights for various factors that influence gym selection decisions. The main criteria considered in this analysis include membership fees, completeness of facilities, cleanliness, mentoring system, and distance between the gym and the Asian institute Malang. Facilities are measured by the number and quality of gym equipment available, the variety of services (e.g. cardio rooms, weightlifters, exercise classes, etc.), and the availability of additional facilities, such as Wi-Fi, lockers, showers, and others. Cleanliness criteria are assessed based on the frequency of cleaning carried out, cleanliness conditions, and from customer reviews or ratings about gym cleanliness on social media. The system monitoring criteria are assessed based on the quality of the training offered, the trainer's experience, and the effectiveness of the mentoring system.

Weighting is determined through an approach that includes group discussions, user surveys, and priority analysis that have been carried out previously. The goal is to ensure that the final assessment reflects relevant and representative preferences for potential gym users in Malang Raya.

2.2. Dataset weighting

The weight determination stage in the analysis of gym location recommendations in Malang Raya is carried out systematically to ensure that each criterion is assessed according to its level of importance to users. This process begins with the identification of the main criteria that influence the decision to choose a gym, namely the price of the membership, the facilities provided, cleanliness, the mentoring system, and the distance from the user's location. The collected data is then processed to calculate the relative weight of each of these criteria.

The determination of weights for each criterion is carried out based on user preferences or pre-established standards, with the aim of reflecting the relative level of importance of each factor. For example, the price of membership may be given a

Table 2. Weights and analysis of criteria

No	Attribution	Weight	Analysis
1	Harga	0.3	Cost
2	Fasilitas	0.2	Benefit
3	Kebersihan	0.2	Benefit
4	Sistem_Mentoring	0.2	Benefit
5	Jarak	0.1	Cost

higher weight than the perennial, if cost is a major factor in decision-making. In this study, the weights set for each criterion were: membership price of 0.3, facilities 0.25, cleanliness 0.2, mentoring system 0.15, and distance 0.1. These weights reflect the priority given by users in choosing the gym that suits their needs.

This process ensures that the weights assigned accurately reflect the user's priorities and needs, making the final analysis more relevant and providing greater benefits in decision-making.

2.3. Normalization of costs and benefits

Normalization is needed to align the scale of various attributes so that they can be directly compared (Hidayat et al., 2025; Hutagaol et al., 2021) For attributes that function as costs, such as price and distance, normalization is done with (1).

$$Rij = \begin{cases} \dfrac{\text{Min } Xij}{Xij} & \text{, if } j \text{ is the cost attribute ,} \\ \dfrac{Xij}{\text{Max } Xij} & \text{, if } j \text{ is the benefit attribute.} \end{cases} \quad (1)$$

On the other hand, for attributes that function as benefits, such as facilities, cleanliness, and mentoring systems, normalization is carried out with (1).

This normalization process ensures that all attribute values are in a uniform range, usually between 0 and 1, where higher values indicate better quality after normalization (Candra & Witanti, 2024; Hidayatullah & Santoso, 2024).

2.4. Weighting of normalization results

The weighting step involves taking the normalized value calculated for each characteristic or attribute and multiplying it by a weight assigned to that attribute. These weights are determined in advance and serve to indicate how important each attribute is relative to the others, aligning with the preferences set by the user or decision-maker. For instance, if we assign a weight of 0.3 to the price attribute, 0.2 to facilities, 0.2 to cleanliness, 0.2 to the mentoring system, and 0.1 to distance, these numbers show the perceived importance of each factor. Following the normalization and weight assignment, the next required action is to multiply the normalized values for each attribute by the corresponding weight.

This calculation step is crucial as it aims to produce a final numerical score for each option being considered. This resulting score incorporates the relative importance given to each attribute. The overall purpose of this process is to arrive at a score that accurately represents the user's priorities as defined by the initial assessment criteria, thereby guiding the decision towards the most preferred outcome based on the weighted evaluation.

Table 3. Normalization results

No	Gym	Price	Facilities	Hygiene	Mentoring System	Distance
1	Best Gym	0,500	0,826	0,968	0,892	1,000
2	Fitness plus	0,375	1,000	0,892	0,871	0,109
3	Gond Gym	0,500	0,956	0,892	1,000	0,071
4	My Gym	0,480	0,880	0,967	0,914	0,061
5	Momon Gym	1,000	0,902	0,946	0,946	0,078
6	Smart Gym	0,324	0,934	1,000	0,892	0,100
7	Starfit Gym	0,342	0,826	0,989	0,968	0,109
8	The Gym Asifa	0,308	0,771	0,839	0,839	0,269
9	WWGYM	0,308	1,000	0,968	0,978	0,219
10	Xtreme Gym	0,521	0,815	0,892	0,892	0,700

3. Results and discussion

A system for recommending gym locations in the Malang Raya area often employs the Simple Additive Weighting (SAW) method. This approach is frequently applied within the field of data analysis. The SAW method is a common technique in machine learning used to order data based on a defined set of standards or rules established beforehand. By evaluating various possibilities against these predetermined standards, this method can provide recommendations that are objective and correspond with a user's specific needs or preferences. This systematic evaluation helps users make informed decisions about suitable gym locations.

3.1. Data normalization

The normalization process is necessary to align the scale of the various attributes, so that the values of the attributes can be directly compared. This normalization ensures that all attribute values are within a uniform range, usually between 0 and 1, where higher values indicate better quality after normalization. For attributes that function as costs, such as price and distance, normalization is carried out based on equations (1) and (2). The results of this normalization process can be shown in Table 3.

At the normalization stage of cost and benefit in manual testing, data that has been collected regarding various attributes of gym locations in Malang Raya is processed to ensure a fair and consistent comparison between criteria. This normalization is necessary because each criterion has a different scale; For example, lower prices are more desirable (cost), while more facilities are more desirable (benefits). In the normalization process, the attribute values included in the cost category will be changed so that the lowest value becomes the most desirable, while the benefit attribute values will be changed so that the highest value becomes the most desirable. Thus, this normalization ensures that all criteria are measured on a uniform scale, allowing for a more accurate and balanced analysis. This process is very important in the application of the Simple Additive Weighting (SAW) method to determine the best gym location recommendations.

Table 6. Weighting results

No	Gym	Price	Facilities	Hygiene	Mentoring System	Distance
1	Best Gym	0.150	0.165	0.194	0.178	0.100
2	Fitness plus	0.113	0.200	0.178	0.174	0.011
3	Gond Gym	0.150	0.191	0.178	0.200	0.007
4	My Gym	0.144	0.176	0.194	0.183	0.006
5	Momon Gym	0.300	0.180	0.189	0.189	0.008
6	Smart Gym	0.097	0.187	0.200	0.178	0.010
7	Starfit Gym	0.103	0.165	0.198	0.194	0.011
8	The Gym Asifa	0.092	0.154	0.168	0.168	0.027
9	WWGYM	0.092	0.200	0.194	0.196	0.022
10	Xtreme Gym	0.157	0.163	0.178	0.178	0.070

Table 4. Real ranking results

No	Gym	Real Ranking
1	Momon Gym	1
2	Best Gym	2
3	Xtreme Gym	3
4	Gond Gym	4
5	WWGYM	5
6	My Gym	6
7	Fitness plus	7
8	Smart Gym	8
9	Starfit Gym	9
10	The Gym Asifa	10

3.2. Weighting results

At the weighting stage, each criterion that has been normalized will be given weight according to its level of importance in determining the best gym location in Malang Raya. This weight reflects the priority given to each criterion based on consumer preferences.

The weighting process is carried out by multiplying the normalization value of each criterion by the weight that has been set for each gym. The result of this multiplication will result in a weighted score for each criterion, which is then added up to obtain the total score for each gym. This weighting stage is crucial because it ensures that the final analysis accurately reflects consumer preferences and needs, so that the resulting recommendations become relevant and reliable in decision-making. The weighting results are shown in Table 4.

The weighting process generates a weighted value for each attribute, which can then be added up to obtain each gym's final score. This weight reflects the relative importance level of each attribute, according to the user's preferences. For example, if the weights set for the price attribute are 0.3, facilities 0.2, cleanliness 0.2, mentoring system 0.2, and distance 0.1, then the normalized values of each attribute will be multiplied by the corresponding weight. The result of this multiplication provides a weighted value for each attribute, which is then added up to get the final score for each gym.

3.3. Ranking results

In the ranking stage, the total scores obtained from the weighting stage for each gym will be sorted from highest to lowest. This score reflects the final assessment obtained based on all normalized and weighted criteria, where the highest-scoring gym is considered the best choice. This process ensures that all relevant factors are considered proportionately, providing recommendations that best suit the needs and preferences of consumers. In this study, the ranking of gym places was determined, based on observations and interviews with students at the Asian Institute of Malang. The results are used as a Real rating compared to the SAW method.

After determining the rankings based on the total score, the results of the gym rankings will be compared in real terms with the results obtained from the program using the Simple Additive Weighting (SAW) method. In computer-based applications, the process of normalization, weighting, and ranking is automated, allowing researchers to process large amounts of data more quickly and accurately. The results of these two methods will then be examined to ensure the consistency and validity of the recommendations given. This verification process is important to ensure that the manual method provides results comparable to those obtained from program-based applications, which can ultimately increase confidence in the validity of the analysis. Table 5 shows the results of the real ranking done manually. Meanwhile, the results of the ranking using the SAW method are shown in Table 6.

Table 5. Results of SAW method ranking

No	Gym	Total Score
1	Momon Gym	0.867
2	Best Gym	0.787
3	Xtreme Gym	0.747
4	Gond Gym	0.727
5	WWGYM	0.703
6	My Gym	0.702
7	Fitness plus	0.676
8	Smart Gym	0.673
9	Starfit Gym	0.670
10	The Gym Asifa	0.609

The ranking results obtained through the Simple Additive Weighting (SAW) method show that Momon Gym ranks first with the highest score of 0.866707, while WWGYM ranks last with the lowest score of 0.744066. Based on tests conducted by comparing real ranking results with ratings obtained using the SAW method, researchers found that both methods produced consistent gym rankings. This shows that this study successfully applied the Simple Additive Weighting (SAW) method to analyze and provide recommendations for the best gym location in Malang Raya, taking into account the criteria of price, facilities, cleanliness, mentoring system, and distance.

The evaluation used in this study is the accuracy of the rating by applying (2).

$$\begin{aligned} \text{accuracy} &= \frac{\text{Number of Correct Ratings}}{\text{Total Number of Ratings}}\ x\ 100\% \\ &= \frac{10}{10}\ x\ 100\% \\ &= 100\% \end{aligned} \quad (2)$$

Based on the results of the comparison, it shows that the real rating is in accordance with the rating by applying the SAW method.

4. Conclusion

This study successfully employed the Simple Additive Weighting (SAW) method to evaluate potential gym locations in Malang Raya. The analysis aimed to identify and suggest the most suitable options based on several key factors. These criteria included price, available facilities, the level of cleanliness, the quality of the mentoring system, and the distance from users. Following the application of the SAW method, the analysis results indicated that Momon Gym received the highest score, positioning it as the most favorable choice according to the criteria established for the study. In contrast, WWGYM received the lowest score among the gyms evaluated.

To confirm the reliability of the method, tests were conducted comparing actual user ratings with the results generated by a program applying the SAW method. This comparison demonstrated a high degree of agreement, showing strong consistency between the two sets of ratings. Specifically, the test results showed complete alignment, with 100% of the actual rating results matching the ratings obtained using the SAW method. This outcome confirms that the SAW method can be used effectively to provide objective recommendations that align with user preferences.

In summary, this research demonstrates that the Simple Additive Weighting (SAW) approach is well-suited for addressing problems that require making decisions based on multiple criteria simultaneously. It proved particularly effective in determining the optimal gym selection within the Malang Raya area. These conclusions offer valuable information that can serve as a basis for developing comparable recommendation systems in other fields where choices depend on evaluating several factors concurrently.

Data availability

All data produced or examined during this study are present in this paper.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Authors' contributions

All authors participated in the study design, writing, and manuscript revision. BP drafted and revised the manuscript, and SYR supervised the study. All authors have reviewed and approved the final manuscript.

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Photograph and biography of the authors (Bima Prasetyo and Suastika Yulia Riska) were not available at the time of publication.