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# Application of the case based reasoning & sorenson-dice coefficient method for fitness exercise program

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**Abstract.** Fitness Training Program Recommendation is a web-based system using C # language and SQL Server database that can help find the results of fitness training program recommendations for system users. The making of this application aims to recommend a fitness training program in accordance with input data that are considered attributes in the selection of fitness training programs, gender, age, weight, height, sports activities, and muscle specialization. The making of this application uses the system development method of system development life cycle and the process of selecting an exercise program using the case based reasoning method with the stages of retrieve, reuse, revise, retain and rule base methods to determine the results of a more optimal fitness training program recommendation. The results of testing the fitness exercise recommendation system programs that are based on the user as a whole shows 51.14% of respondents stated strongly agree, 40.19% of respondents agreed that the system was able to recommend a fitness training program and provide information needed by the user.

## 1. Background

Sport is a physical activity that is very influential on the health of the body and has many advantages if done according to its portion. Losing weight is one of the promised results when routine and optimal in exercising. Doing exercise not only for weight loss for overweight people but for people who have ideal body weight is also highly recommended. With regular exercise can reduce the risk of disease, can improve mood, regulate body weight, increase body energy, improve sleep quality and make you stay young.

In this modern era, the development of technology is very fast, almost all aspects enter the realm of technology. Starting from searching for information, buying and selling goods, even offering services. With the many digitizations that make it easy in all aspects for the community, making people forget the important thing to maintain physical fitness by exercising.

In the midst of a busy community, a healthy lifestyle is one of the people's choices. Fitness can be an option to start a healthy life. Fitness is a combination of health and fitness throughout the body for daily activities, and a muscular or slim body is the result of fitness training. By running the three main components, namely exercise, fulfillment of nutrition, and adequate rest.

Fitness facilities available with adequate services and facilities as well as efforts to foster public interest in sports have been circulating in various cities such as Jakarta. Data from the Central Statistics Agency in 2016 showed that the results of a survey in 2015, only 27.61 percent of Indonesia's population who exercise at least once a week. Lack of knowledge about fitness movements, no self-motivation, the cost to exercise and lack of time are reasons that cause someone not to exercise.

The existence of Taman Surya Sport Club which offers training programs with more and more modern tools will help in the training process of Taman Surya Sport Club members or usually called members. Running a fitness exercise program as a beginner certainly requires guidance from a personal trainer to develop an exercise program that suits the desired target. Weight loss, weight gain,



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muscle formation, aerobic exercise, body beauty, diabetics and elderly sports are a kind of fitness exercise program that is often offered at various fitness centers.

Each personal trainer has different knowledge about fitness training so that each personal trainer will provide a different training program design. Given the personal trainers in most fitness centers have scheduled work hours and serve more than one member, causing less intensive and less optimal in training members. It is different when a member chooses private trainer personal that is by paying more expensive fees to get private trainer personal services.

The design of the training program offered does not always use tools, it can also utilize body weights such as push ups, sit ups, planks and squats. The advantages of using a body weight training program can be done anytime and anywhere. But the problem when doing an exercise program without a personal trainer is often to forget the exercises that have been given previously so that the program error occurs. To overcome this problem, documentation of each exercise program that has been designed and that will be designed for the next training program is needed.

This application uses data from [www.msn.com](http://www.msn.com), [www.gymguider.com](http://www.gymguider.com), [www.muscleandfitness.com](http://www.muscleandfitness.com) as many as 136 data because the website msn, muscleandfitness, and gymguider have a data exercise movement exercise program that is complete enough to compile a fitness exercise program so that it can help the comparison process in this application

With the problems that have been explained, a recommendation system design was made using the Case Based Reasoning and Sorensen-Dice Coefficient method to help facilitate members and personal trainers in determining the fitness exercise program. Not only members, for people who don't have time to register or visit a fitness center, they can also use this recommendation system to develop a fitness exercise program at home.

## 2. Literature Study

The application of this decision support system is given the name "Implementation of Case Based Reasoning Method & Sorensen-Dice Coefficient for Fitness Exercise Program"

### 2.1 Case Based Reasoning (CBR)

Case Based Reasoning is a method for solving problems by remembering similar or similar events that have occurred in the past, then using that knowledge or information to solve new problems. In other words, Case Based Reasoning can solve problems by adapting solutions that have been used in the past. <sup>1</sup>In Case Based Reasoning there are four stages which include :

#### a. Retrieve

Get / retrieve cases that are most similar / relevant (similar) to new cases. This retrieval phase begins by describing / describing a portion problem, and ends if it is found matches the previous problem with the highest level of compatibility. This section refers to the terms of identification, initial compatibility, search and selection and execution.

#### b. Reuse

Model / reuse old case knowledge and information based on the most relevant weight weights into a new case, so produce proposed solutions where possible an adaptation to the problem is needed the new.

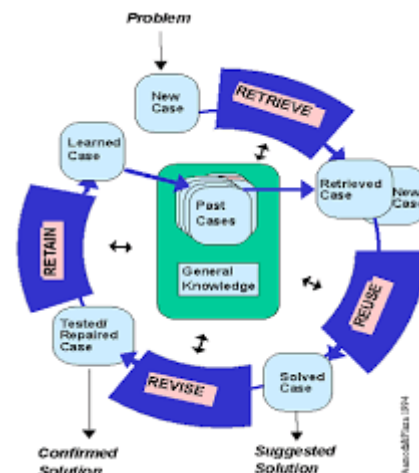
#### c. Revise

Revisiting the proposed solution then tested in a real case (simulation). If needed then the solution will improved to fit the new case.

#### d. Retain

Integrate / save new cases that are has succeeded in getting a solution so that it can used by subsequent cases which similar to the case. But if the solution the new failed, then explained failure, fixing a solution used, and test it again.

The four processes above, each involving a number of specific steps to be explained in Figure 1.



**Figure 1.** Case Based Reasoning Method Cycle

### 2.2 Sorensen-Dice Coefficient

<sup>2</sup>Sorensen-Dice Coefficient or can be known as Sorensen-Dice Index. Sorensen-Dice Coefficient is a statistic to compare the similarity of two samples. The basic formula used is:

$$S = (2 | A \cap B |) / (| A | + | B |)$$

Description:

S: similarity value

| A | : Number of species from sample A

| B | : Number of species from sample B

| A ∩ B | : The number of samples is unique and has the same structure of each the sample being compared

## 3. Research Method

### 3.1 Problem Analysis

Based on the identification of problems that have been explained earlier, then the authors do analysis of problems that are already stated by analysis of the selection of a fitness exercise program for people who are still confused to choose an exercise program that suits specialization and the lack of information about fitness exercise movements.

Peoples is still looking for information on fitness training movements at random [www.google.com](http://www.google.com) which results in inaccurate selection. In addition, people only seek information based on the opinions of relatives who have participated in a fitness exercise program with a personal trainer. Judging from the aforementioned problems, a recommendation system for the choice of a fitness exercise program is needed by using the specialization attributes needed by people.

### 3.2 Research variable

Based on the analysis of problems that have been stated, then variables can be determined needed to reinforce the concept of solutions obtained in interviews with personal trainers, are as follows :

- a. Gender
- b. Age
- c. Weight
- d. Height
- e. Sports activities
- f. Muscle specialization

## 4. Result & Discussion

Based on the variables that have been determined, the Case Based Reasoning and Sorensen-Dice Coefficient methods will be implemented.

There is a new user case data as seen in table 1, the retrieve process will be carried out comparing new cases with all cases in the case database and searched for weights its similarity:

**Table 1.** New User Case Data

<b>Id</b>	<b>Gen der</b>	<b>Age</b>	<b>BMI</b>	<b>Spor ts activities</b>	<b>Che st</b>	<b>Sho ulde r</b>	<b>Bac k</b>	<b>Leg</b>	<b>Butt ocks</b>	<b>Abs</b>	<b>Bice ps</b>	<b>Tric eps</b>
11	Male	20	skin ny	neve r	1	1	1	1	0	1	1	1

The next step is to calculate the similarity value of the new case id M011 with the old case id M001 as shown in table 2 and table 3.

**Table 2 & Table 3.** Similarity Case id M011 & id M001

<b>Id</b>	<b>M011</b>		<b>Id</b>	<b>M001</b>
<b>Gender</b>	Male	1	<b>Gender</b>	Male
<b>Age</b>	24	0	<b>Age</b>	22
<b>BMI</b>	Ideal	0	<b>BMI</b>	Overweight
<b>Sports activities</b>	Always	0	<b>Sports activities</b>	Never
<b>Chest</b>	1	0	<b>Chest</b>	0
<b>Shoulder</b>	1	0	<b>Shoulder</b>	0
<b>Back</b>	1	0	<b>Back</b>	0
<b>Leg</b>	1	0	<b>Leg</b>	0
<b>Buttocks</b>	1	1	<b>Buttocks</b>	0
<b>Abs</b>	1	0	<b>Abs</b>	1
<b>Biceps</b>	1	0	<b>Biceps</b>	0
<b>Triceps</b>	1	0	<b>Triceps</b>	0

Calculate the similarity between M011 and M001 using the Sorensen-Dice Coefficient formula:

$$\begin{aligned}
 S(M011, M001) &= (2(2)) / ((12 + 12)) \\
 &= 4/24 \\
 &= 0.1667
 \end{aligned}$$

With the same calculation process, then similarity between the new case id 11 with 10 cases which already stored in the database obtained results as shown in table 4.

**Table 4.** Similarity Value

<b>Case</b>	<b>The results of the similarity value</b>
M011-M001	0.1667
M011-M002	0.25
M011-M003	0.667
M011-M004	1
M011-M005	0.3333
M011-M006	0.5
M011-M007	0.75
M011-M008	0.4167
M011-M009	0.5833
M011-M010	0.667
Max Value	1

The solution will be provided by the system in this case new based on the highest similarity value between new cases (M011) with old cases. Table 4 shows that the new case (M011) has similarity the highest (1) with cases ever with M001, so the recommended solution is to use the results of similar fitness exercise movements recommendations with what was on M001. If the similarity value has not reached the threshold value, the system will use the second process to find out the results of the temporary recommendation.

The second process (the process of finding the highest similarity value to the training program data that has been collected). In the second retrieve process, a comparison is made between the two data, namely testing data and 136 training program case data. The attributes of the two data used as a comparison are gender, sports activities and muscle specialization. . In Table 5 is the training program data from 136 training program data that has been collected.

**Table 5.** Training Program Data

Movement name	Type of tool	Gender	Tiers	Chest	Shoulder	Back	Leg	Buttocks	Abs	Biceps	Triceps
Push Up	Body weight	Unisex	Beginner	1	1	0	0	0	0	0	1

After getting the training program data and new case data for the second retrieve process the next step is to compare the similarity of the training program data that has been provided with the new case data using SDC.

The next step is to calculate the similarity value of the new case id M011 with the old case id M001 as shown in table 6 and table 7

**Table 6 & Table 7.** Similarity of Case push up training program with ID M011

Id	M011		Movement name	Push Up
Gender	Male	1	Type of tool	Body weight
Age	24		Gender	Unisex
BMI	Ideal		Tiers	Beginner
Sports activities	Always		Chest	1
Chest	1		Shoulder	1
Shoulder	1		Back	0
Back	1		Leg	0
Leg	1		Buttocks	0
Buttocks	1		Abs	0
Abs	1		Biceps	0
Biceps	1		Triceps	1
Triceps	1			

Calculation of the level of similarity of push-up movement training program data with Id M011 data using the Sorensen-Dice Coefficient formula:

$$S(\text{Id M011, pushupmovementdata}) = (2(4)) / ((10+ 10)) = 8/20 = 0.40$$

With the same calculation process, then similarity between the new case id 11 with 10 cases which already stored in the database obtained results as shown in table 8.

**Table 8.** Value Similarity to the case data of the training program

Case	The results of the similarity value
M011- Push Up Movement	0.40
M011- Bent Over Reach to Sky Movement	0.50
M011- Chin Up Movement	0.60
M011- EZ-Bar Pullover Movement	0.80
M011- Floor I Raise Movement	0.50
M011- Sumo Deadlift Movement	0.50

From the calculation of the similarity level of Id M011 to the six training program data can be seen which has the highest similarity value to the training program data that is when Id M001 is compared with EZ-bar pullover movement then chin up movement, bent over reach to sky movement, floor I raise movement, the deadlift sumo movement and finally the push up movement.

Next the revision process is the process of reviewing the cases and solutions provided. Because the results given in the retrieve process are still temporary and not yet optimal, improvements are made by adding rules that influence when selecting the training program including:

#### 1. Rule Based I

Rule Based I are rules that are used to categorize users according to their sporting activities. This rule is processed when after passing through the second retrieve process, which is the process of finding the highest similarity with the data of the training program cases that have been collected. The following rule based I can be seen in table 9.

**Table 9.** Rule Based Rules I

IF Sports Activity "Not at All" THEN Beginners category
IF Sports Activity "Ordinary" THEN Intermediate category
IF Sports Activity is "Frequent" THEN the Advanced category

#### 5. Conclusion

Based on the final results from point number 4 above it can be concluded that:

1. The results of testing 10 user data by Case Based Reasoning and Sorensen-Dice Coefficient methods can be concluded that the testing data is very close to the user data 4 values similarity 1. Therefore testing data will be recommended movements that are also used by users 4
2. The test results of 6 training program case data using Case Based Reasoning and Sorensen-Dice Coefficient methods can be concluded that the EZ-bar pullover movement is the first recommendation movement used then the chin up movement, bent over reach to sky movement, floor I raise movement, sumo deadlift movement and the last push-up movement for exercise movement recommendation Id M011 from 6 training program data with similarity values 0.80, 0.70, 0.60, 0.50, 0.50, 0.40
3. The results of testing the data on the Case Based Reasoning and Sorensen-Dice Coefficient methods in the third process, namely the revised process, obtained the recommended number of movements using rule base I. From the results of rule base I, the Id M001 data is categorized as a beginner (judging by the sport activity)

#### References

- [1] Aamodt, A., Plaza, E., "Case Based Reasoning: Foundation Issues Methodological Variations, and System Approaches". AI Communication Vol 7 Nr. 1 March 1994. p 39-59
- [2] Irawan, Albert. *Rancang Bangun Sistem Pencarian Alternatif Produk dengan Metode Collaborative Collective Intelligence Dan Sorensen-Dice Coefficient Berbasis Website* (Studi Kasus Minimarket Dua Putri) p.12
- [3] Valatehan Lucky, Fachrulloz Muhammad, Arsalan Osvari. 2016 *Identifikasi Kalimat Pemborosan Menggunakan Rule Based Reasoning*. (Palembang : Teknik Informatika Fakultas Ilmu Komputer Universitas Sriwijaya)p.205-206
- [4] Utomo, Ahmad Yudha. 2012. *Sistem Pakar Pelatih Personal Berbasis Web Untuk*

[5] Menghasilkan Program Latihan Kebugaran Dan Rasio Makronutrisi Menggunakan Phpexpertsystem. (Surabaya : Institut Teknologi Sepuluh Nopember) p.10-30