INTERNATIONAL CONFERENCE ON OPERATIONS RESEARCH (ICOR)

4th

Policies and Optimal Decisions on Energy and Environment

Sam Ratulangi University, Manado,Indonesia

19 - 20 September 2019

BOOK OF ABSTRACTS

The 4th ICOR 2019

Operations Research (OR) has become powerful decision making tools worldwide. In its use, Management Science (MS) is used as another term for OR. Concept of OR is borderless as it can be derived from various disciplines such as Mathematics, Statistics, Economics, Engineering, Social, etc. to make a new set of knowledge for decision making. Today, OR has become a professional discipline which deals with the application of scientific methods in decision making theory.

The scope of OR can be used to find best solution for both simple and complex problems. It is beneficial in every aspect of human life regarding resources optimization. OR is widely used in important and main fields such as national planning and budgeting, transportation, education, agriculture, environment, and many others. Therefore, research and study involving OR are inevitable.

Number of research and study about OR or using OR as tools is high these years. This is accommodated by Indonesian Operations Research Association (IORA) IORA as one of OR organisations in an annual international conference entitled International Conference on Operations Research (ICOR). ICOR 2019 is the fourth conference (iCOR 4.0). This initiates to bring together OR/MS researchers, academicians and practitioners, whose collective work has sustained continuing OR/MS contribution to decision-making in many fields of application. It can be considered as good platforms for the OR/MS community, particularly in Indonesia, to meet each other and to exchange ideas.

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WELCOMING SPEECH
The 4th International Conference on Operations Researh 2019

Director General of Conservation of Natural Resources and Ecosystems, Ministry of Environment and Forestry
Rector of Sam Ratulangi University Prof. Dr. Ir. Ellen Joan Kumaat, MSc, DEA.
IORA President and Dean of FMIPA University of Padjadjaran Prof. Dr. H. Sudradjat Supian, MSc.

Distinguished Guests, Ladies and Gentlemen.
On behalf of ICOR 2019 Organizing Committee, I would like to Welcome you all and thank you for being here. Especially to Rector of Universitas Sam Ratulangi for fulfilling our invitation and to give opening speech for this conference. Special thanks also for Keynote Speakers, Plenary Speakers, Contributed Speakers and All Participants of this conference.

This conference can be held in collaboration of Indonesian Operations Research Association (IORA) and Faculty of Science Universitas Sam Ratulangi.

The point of this conference is to provide a perfect event for researchers, academics, and practitioners of Operations Research, to share experience, build communication and network with experts from all over the world. Furthermore, this conference is aimed at promotion and spread of scientific operations research field in Indonesia through Indonesian Operations Research Association (IORA).

The same conference had previously been held three time, initially hosted by Universitas Pakuan Bogor, followed by Universitas Terbuka Tangerang as second host and the third hosted by Unversitas Sam Ratulangi. This conference is now held at Universitas Sam Ratulangi Manado for the forth time, that is why it is known as the 4rd International Conference on Operations Research (ICOR) under a main theme entitled Policies and Optimal Decisions on Energy and Environment.

Number of participants of this conference are more than 300, from 15 countries. Selected Papers will be published on scopus indexed Journal and IOP Publications.

Lastly, we want to gratefully thank again rector for her help and support, all keynote speakers, plenary speakers, contributed speakers, all participants, and all organizing committee who have given contribution to make this conference happen.

Dr. Nelson Nainggolan, MSi
Conference Chair

FOREWORD

From the Dean
Faculty of Mathematics and Natural Sciences, Sam Ratulangi University
Prof. Benny Pinontoan, M.Sc

It is a great honor for the Faculty of Mathematics and Natural Sciences (FMIPA), Sam Ratulangi University (UNSRAT), Manado, Indonesia, to organize again the International Conference on Operations Research (ICOR); this year the 4th ICOR (iCOR 4.0), after organized the 3rd ICOR also by FMIPA UNSRAT in 2018. We thank, therefore, the Indonesian Operations Research Association (IORA) for this opportunity. It is an opportunity to open collaborations with other institutions, it is an opportunity to know other researchers, it is an opportunity to look at the problems more intense and eventually suggest some solutions, optimal solutions, to the problems.
The theme of iCOR 4.0 is Policies and Optimal Decisions on Energy and Environment. The motivation to suggest this theme as that we are facing decreasing of fossil energy sources on one side, but on the other side finding new energies, e.g. renewable energies, seems to create other conflict problems either with the efficiency of costs or with the sustainability of the environment. To look at these problems from the point of view of Operations Research is, therefore, relevant and can give better and optimal solutions.
This year, there are more than 300 participants registered. In compare with the 3rd ICOR with the theme Optimal Decisions for Marine Tourism [1], this is an increasing of about 50% more participants. The number of countries participated this year is 15 which is also increased. This shows increasing interests to both the ICOR and the theme of the conference. We also hope that number the papers successfully published in IOP Proceeding indexed in Scopus this year will be much more than last year.
Welcome to iCOR 4.0, Welcome to UNSRAT, Welcome to Manado. Enjoy your stay, enjoy the nature, the food, the hospitality and experience wonderful moments in Manado and surrounding areas.
Pakatuan wo Pakalawiden. God bless you.

Reference
[1] Pinontoan B 2019 From the Dean Faculty of Mathematics and Natural Sciences, Sam Ratulangi University IOP Conf. Series: Material Science and Engineering 567 pp. 6.

CONGRATULATORY SPEECH BY THE PRESIDENT OF THE INDONESIAN OPERATIONS RESEARCH ASSOCIATION (IORA)

Distinguissed Guest, All invited Spreakers, Participant, Ladies and Gentlement,
It is great pleasure for me On behalf of the Association of the Indonesian Operations Research Association, I would like to welcome you all at this special event International Conferece On Operations Research at the Universitas Sam Ratulangi. This event is the fourth event for IORA-ICOR and congratulations to the Universitas Sam Ratulangi be able to host.
The theme of the conference, Policies and Optimal Decisions on Energy and Environment, reflects our belief that many future challenges in our life need involvement of operations research and typical analytic operations research. Our future and our capacity to reach sustainable development goal such as ensure availability and sustainable manajemen of water and sanitation for all; ensure access to affordable, reliable, sustainable and modern energy for all; take urgent action to combat climate change and its impacts; end proverty in all its forms everywhere; conserve abd sustainably use the oceans, seas and marine resources for sustainable development; end huger, achive food security and improved nutrion and promote sustainable agriculture, ensure healthy lives and promot well-being for all at all ages, ang other challenges require the advances the roles of operations research in collaboration with other diciplines. Operations Research is the application of scientific & mathematical methods to the study & analysis of problems involving complex systems. Analytics is defined as the scientific process of transforming data into insights for making better decisions.
Operations Research is multi discipline therefore interaction with other fields of science is indispensable and proven to have given rise to new areas that improve the ability in decision making and techniques used are modeling.
Typically, applications of Operations Research in these and other areas deal with decisions involved in planning the efficient allocation of scarce resources - such as material, skilled workers, machines, money and time - to achieve stated goals and objectives under conditions of uncertainty and over a span of time. Efficient allocation of resources may entail establishing policies, designing processes, or relocating assets. OR analysts solve such management decision problems with an array of mathematical methodologies. Completely
of the operations research field can be seen in AMS 2000 or MCS 2010.
And now, I need to clarify that IORA is new association in Indonesia he is beginning piloted in workshops in Operations Research and Optimization modelling on June 4, 2011 in the Department of Mathematics Faculty of Mathematics and Natural Science, Universitas Padjadjaran, then be disseminated to several universities, government and industry.
IORA is a container that provides a forum for scientists Operational Research and to expand our horizons through the exchange of knowledge and application technology, IORA established on August 25, 2014 by deed of Notary Number 42 and the Minister of Justice and Human Rights Number. AHU-00439.60.10.2014.
IORA members came from a variety of fields, education, researcher, government, industry, practitioners etc, in 2017 members numbered 130 members and until now IORA members numbered 240 members, and we wait for those who have become members through www.iora.or.id.
Ladies and gentlement,
We need to inform that at the current conference will also be held meeting IORA board. Finally, Have a nice International Conference on Operations Research. I hope there are plenty of benefits we can share and empower through this and hopefully your participations and contributions will make this conference a productive and successful one.

President, The Indonesia Operations research Association

Prof. H. Sudradjat Supian, M.Sc., Ph.D

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Application of Obesity Determination Using the K-Nearest Neighbor (KNN) Method

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Abstract. Obesity is a common disease due to the amount of fat that accumulates over a long period of time which can interfere with health by unhealthy lifestyles. Various technologies and applications regarding obesity have been circulating a lot but usually todays applications only calculate height and weight even though many other factors can determine obesity. Based on the existing problems, an application for calculating the level of obesity will be built by considering any various factors causing obesity beyond weight and height. This application will use the K-Nearest Neighbor (KNN) algorithm to determine obesity because the KNN algorithm is tough to data that has noisy and a lot of training data. The calculation of the KNN algorithm in the application is based on the values of the sex, age, and values of the questionnaire. The methodology used in this journal is RAD (Rapid Application Development). The programming language used in application development is PHP (Hypertext Preprocessor) while the modeling tool used to describe system functionality is UML (Unified Modeling Language).Based on the tests conducted, it was concluded that the application can determine obesity using150 training data, the value of k = 3 and a single test data with the final results using the KNN method can solve the problem properly.

Keywords: Obesity, KNN, classification Introduction

1. Introduction

Obesity or overweight is an accumulation of abnormal or excessive fat that can interfere with health, as one of the common diseases that occur in humans, this disease can be experienced by anyone, both adults and children. So obesity is something that must be taken seriously because it can happen to anyone unnoticeable, especially in urban areas where most people lived by adopting unhealthy lifestyles [1].

In developing countries especially Indonesia, the factors that influence high rates of obesity are stress, lack of exercise, and heredity. However, obesity occurs due to irregular eating habits and didn't pay attention to health benefits and unhealthy lifestyles [2]. Eating habits, especially in urban areas, can be said to be far from healthy eating habits, but it leads to unhealthy eating habits such as fast food which is a type of food that contains high cholesterol, low fiber, high energy and rich in fat. Often used as an easy choice for consumption, this is supported by the availability of many places that sell

fast food with a tempting appearance, cheap prices, and convenience that made many people tempted by this and do not realize that they have been obese.

K-Nearest Neighbor (KNN) algorithm is a method for classifying objects based on learning data that is the closest distance to the object. Learning data is projected to be a multi-dimensional space, where each dimension represents the features of the data. KKN is a supervised method, where the results of the new instance query are classified based on the majority of categories in the KNN which have several advantages such as KNN is tough to noisy and effective if the training data is large [3].

From the problem above, an alternative solution in solving this problem is to design an application that can determine obesity for the users so that they can achieve a sense of self-awareness and a willingness to live using a healthy lifestyle. Therefore the right application in this problem is "Application of Determination of Obesity Using the K-nearest Neighbors (KNN) Method".

2. Literature Review

2.1. Obesity

Obesity (obesity) is overweight as much as between 10-20% of normal weight. Definitively, the definition of obesity with being overweight has a pretty basic difference. Obese people generally have different cell counts than people who have normal weight. People with normal body weight have between 30-40 billion cells, while the number of cells in obese individuals is more than double that normal person, which is around 80-120 billion. Although an individual has made efforts to slimming the body by dieting or eating less, the number of cells remains the same, the only thing that happens is that the cells experience shrinkage [4].

2.2. Obesity classification

Obesity is a situation that excess fat in the body that is generally piled up in subcutaneous tissue, around organs, and sometimes infiltration into organs. Someone who has a normal weight is considered obese if the excess reaches around 100% and its called super obese, while obesity which has caused abnormalities, complaints, or symptoms of the disease is called morbidly obese [5].

2.3. The factors causing obesity

Some common causes of obesity include:

1. Genetic or heredity factor.
   An individual who has a fat body (obese), according to genesis view, due to heredity from the condition of parents who also have a fat body [4].
2. Physical activity
   The role of physical activity on the problem of obesity is indeed something that has been proven empirically. Physical activity is considered sufficient if someone does physical exercise for 30 minutes every day, therefore the role of physical activity on the problem of obesity is also very important.
3. Eating Factor.
   Eating behavior is the cause of the problem of obesity. Three things are emphasized in a person's eating behavior, namely controlling food, emotions, and hunger.
4. Stress
   Stress is a key factor of a person to be fat. Stress is the initial driving factor for other factors that can cause obesity. The thing that distinguishes each individual is the type and cause of stress. Stress and obesity have the same effect. Stress is a trigger for obesity, while obesity can cause stress for sufferers. Stress increases cortisol levels in the blood, decreases sensitivity to insulin, creates artificial hunger and increases appetite [2].

3. Methods

3.1. Classification

Classification is the process of grouping data into class groups that characterize concepts or classes of data for specific purposes. In the classification there is information about how the data is grouped. Then it trained on the system with data that has been labeled (into which group the data is grouped), then the system will classify the new data into existing groups [6]. The following are two examples from the weight classification table.

Table 1. Classification of Overweight and Obesity Based on BMI (Body Mass Index) and Stomach Circumference [7].

BMI Classification (kg/m^2)		**Stomach Circumference / Risk of Comorbidity**	
		<90cm (Man) <80cm (Woman)	**≥ 90cm (Man) ≥ 80cm (Woman)**
Underweight	<18,5	Low (but still in risk of another clinical problems)	Medium
Normal	18,5 - 22,9	Medium	Increase
Overweight	≥23		
At risk	23 - 24,9	Increase in moderate weight	Moderate weight increases
Obese I	25 - 29,9		
Obese II	≥30		

[a] Based on Asia pacific criteria

3.2. K-nearest neighbor (KNN) method

KNN algorithm is a method for classifying objects based on learning data that is the closest distance to the object. Learning data is projected to be a multi-dimensional space, where each dimension represents the features of the data. This space is divided into sections based on the classification of learning data. A point in this room is marked with class c, if class c is the classification that is most commonly found in the nearest neighbor k of that point.

In the training phase, this algorithm only stores feature vectors and classifies data training sample. In the classification phase, the same features are calculated for data testing (classification not yet known). The distance of this new vector to all the training sample vectors is calculated and the closest number of k is taken. The new point classification is predicted to be included in the most classifications of these points.

KNN is included as an instance-based learning group. This algorithm is also one of the lazy learning techniques. KNN is done by finding the k group of objects in the training data that is closest (similar) to the object in the new data or data testing. KNN algorithm is a method for classifying objects based on learning data that is the closest to the object. Nearest Neighbor is an approach to look for cases by calculating closeness to find cases by calculating the closeness between new cases and old cases that are based on matching the weights of a number of existing features.

To define the distance between two points, namely the point in the training data (x) and the point in the testing data (y), the Euclidean distance is used, as shown in the following equation:

$$D\ (x,y) = \sqrt{\sum i\ (xi - yi)^2} \quad (1)$$

Where D is the distance between the points in the training data x and the testing data y that will be classified, where x = x1, x2, ..., xi and y = y1, y2, ... yi and i represent the attribute values and n is the attribute dimension.

In the training phase, this algorithm only keeps feature vectors and classifies training sample data. In the classification phase, the same features are calculated for testing data (whose classification is unknown). The distance of this new vector to the entire training sample vector is calculated and the closest number of k is taken. The steps to calculate the KNN method are as follows:

1. Determine Parameter K (number of closest neighbors).
2. Calculate the square of the Euclid distance (query instance) of each object against the given sample data
3. Sorting the values into groups that have the smallest Euclid distance.
4. Collecting Y category (Nearest Neighbor Classification).
5. By using the category of Nearest Neighbor which is the majority values, it can be predicted the value of the query instance that has been calculated [8].

4. Result and discussion

The system or application to be built is an application to determine the user's obesity level, where training data and test data will be implemented into the KNN method. This application will be built by calculating the Euclid distance squares of each object against the given sample data then will be sorted according to the smallest Euclid distance value then categorized later with that category namely the Nearest Neighbor category will be the most majority value will get the prediction of the query instance that has been counted.

Before conducting the calculation, training data will be sought by distributing questionnaires with a list of questions that have the function to get the calculated value on the implementation of KNN. Below is a list of questions as follows:

1. I eat ≥ 3 times a day.
2. I often consume meat.
3. I don't like vegetables and fruits.
4. I often eat junk food.
5. I usually eat at midnight.
6. I don't like the consumption of diverse foods.
7. My diet is not regular every day.
8. I like to eat snacks at night.
9. After eating usually I immediately sleep for a while.
10. I prefer soft drinks over mineral water.
11. In terms of weight control, I do it irregularly.
12. On holidays I spend a lot of time lying or sitting without doing activities that require a lot of energy.
13. I often do sedentary behavior (the habit of not doing a lot of movements such as sitting and watching television).
14. I often use motorized vehicles.
15. I am not confident when I leave the house.
16. Many of my family members suffer from obesity.
17. When I experience problems I usually make food as an object of satisfaction to vent the problem.
18. I rarely exercise.

The following is an example of a manual calculation in determining obesity using the KNN method. In table 2 contains data from respondents whose data comes from De La Salle Manado Catholic University students as much as 150 data that will be used as training data, while in tables 3a and table 3b contains data on the value of questionnaire questions that will be used as training data and distributed into 2 tables with score and questions 1-9 are in table 3a while score and questions 10-18

are in table 3b. Afterward in table 4 contains the classification of obesity levels based on respondents' ratings.

Table 2. Training data

Num.	Name	Sex	Age
1.	R1	F	20
2.	R2	M	23
3.	R3	F	20
4.	R4	F	19
5.	R5	M	23
6.	R6	M	22
7.	R7	F	20
8.	R8	M	18
9.	R9	M	19
10.	R10	F	22
11.	R11	F	22
12.	R12	F	20
13.	R13	M	23
14.	R14	F	22
15.	R15	M	20
16.	R16	M	23
17.	R17	F	22
18.	R18	M	20
19.	R19	F	20
20.	R20	M	21
..	..	..	..
149	R149	F	21
150	R150	M	20

Table 3 (a). Respondent result

Num.	Respondent Scores								
	1	2	3	4	5	6	7	8	9
1.	2	3	4	4	2	2	3	5	2
2.	3	3	2	4	3	2	2	3	3
3.	2	2	2	3	2	4	4	3	4
4.	3	4	4	5	3	4	4	4	3
5.	4	3	2	3	2	4	2	4	4
6.	2	3	2	3	2	2	5	5	4
7.	4	3	2	3	2	3	2	4	3
8.	4	3	2	3	3	2	3	4	4
9.	3	5	1	4	4	1	4	4	3
10.	3	4	2	4	3	3	4	4	3
11.	4	4	2	2	2	2	4	2	2
12.	4	3	2	3	2	2	4	2	2
13.	3	4	3	3	3	2	3	3	3
14.	3	3	1	3	3	3	5	3	3
15.	4	4	1	4	4	2	3	4	3
16.	4	4	2	5	5	3	5	5	4
17.	2	3	1	3	2	3	2	3	3
18.	5	2	1	4	4	3	2	4	3

19.	3	4	2	1	3	2	5	2	4
20.	3	3	3	2	4	3	3	4	1
…	..	..	..	..	..	..	..	..	..
149.	2	4	3	4	2	5	1	1	2
150.	4	2	3	3	3	4	3	2	3

Table 3 (b). Respondent result

Num.	Respondent Scores								
	10	11	12	13	14	15	16	17	18
1.	4	3	3	4	4	2	2	2	3
2.	3	3	3	2	4	2	2	3	4
3.	4	1	5	3	2	3	1	2	1
4.	2	1	5	5	2	3	4	3	4
5.	2	4	4	4	4	2	2	4	4
6.	4	5	2	2	2	5	1	5	3
7.	4	3	4	4	3	4	2	3	4
8.	3	2	4	4	4	3	2	3	3
9.	2	3	3	3	3	3	1	2	3
10.	2	4	4	2	3	3	2	2	3
11.	2	4	3	3	5	3	2	2	3
12.	2	2	4	2	5	2	2	4	2
13.	2	3	3	4	3	2	3	3	2
14.	1	3	4	3	5	2	1	3	4
15.	1	2	4	4	5	2	4	1	4
16.	5	5	3	4	5	1	1	3	2
17.	2	2	3	2	4	3	2	4	2
18.	2	3	3	3	1	2	1	3	4
19.	2	4	4	2	5	3	2	2	5
20.	3	3	3	3	5	3	3	3	3
…	..	..	..	..	..	..	..	..	..
149.	4	4	3	3	5	5	3	2	3
150.	3	4	3	4	2	2	2	3	2

Table 4. Classification of obesity levels

Respondent Number	Obesity Classification
1.	At risk
2.	At risk
3.	At risk
4.	Obese I
5.	Obese I
6.	Obese I
7.	Obese I
8.	Obese I
9.	At risk
10.	At risk
11.	At risk
12.	At risk
13.	At risk
14.	At risk
15.	Obese I

16.	Obese I
17.	At risk
18.	At risk
19.	At risk
20.	At risk
..	..
149	Obese I
150	At risk

The data contained in Tables 2, 3a, 3b, and 4 are used as training data for the classification system using the KNN method, after that it will be tested with a new data that do not have obesity levels yet which can be seen in tables 5a, 5b, 5c and 6 below.

Table 5 (a). Test Data

Num.	Initial Name	Sex	Age
1.	Uji1	L	22

Table 5 (b). Test Data

Initial Name	Respondent Score								
	1	2	3	4	5	6	7	8	9
Uji1	1	4	1	3	2	3	5	3	3

Table 5 (c). Test Data

Initial Name	Respondent Score							
	11	12	13	14	15	16	17	18
Uji1	4	3	3	1	3	1	2	4

Tables 5b and 5c contain answers from test data derived from questionnaires while table 5a contains additional variables which are gender and age that will be calculated by the KNN method but gender variables consist of M and F which must be converted into decimal numbers according to ASCI rules, so the value of M becomes 76 and F becomes 80 [9]. Table 6 shows the conversion of gender variables to decimal numbers.

Table 6. Conversion of sex variables

Respondent Num.	Initial Name	Sex Conversion Value
1.	R1	80
2.	R2	76
3.	R3	80
4.	R4	80
5.	R5	76
6.	R6	76
7.	R7	80
8.	R8	76
9.	R9	76
10.	R10	80
11.	R11	80
12.	R12	80

13.	R13	76
14.	R14	80
15.	R15	76
16.	R16	76
17.	R17	80
18.	R18	76
19.	R19	80
20.	R20	76
..	..	..
149.	R149	80
150.	R150	76

The next step is to implement the KNN method to determine the classification of obesity levels from the test data with a value of K are 3 then it will be measured by the Euclidean Distance equation [3] below:

$$D\ (x, y) = \sqrt{\sum\ i\ (xi - yi)^2} \qquad (2)$$

The following table 7 contains the results of the calculation of the distance of the test data and training data that has been sorted. Then the nearest neighbor will be determined based on a predetermined k value. In this calculation k are 3 is used so that the closest neighbors are ranked 1-3 which are in table 7 which marked with underlined letters.

Table 7. Determining the nearest neighbor

Num.	Distance	Ranking	Euclidean Score
1	D_{21}(21, 151)	1	20
2	D_{24}(24, 151)	2	21
3	D_{74}(74, 151)	3	27
4	D_{117}(117, 151)	4	28
5	D_{147}(147, 151)	5	30
6	D_{31}(31, 151)	6	31
7	D_{13}(13, 151)	7	31
8	D_{36}(36, 151)	8	31
9	D_{6}(6, 151)	9	31
10	D_{40}(40, 151)	10	32
11	D_{73}(73, 151)	11	33
12	D_{10}(10, 151)	12	33
13	D_{140}(140, 151)	13	34
14	D_{29}(29, 151)	14	34
15	D_{35}(35, 151)	15	34
16	D_{2}(2, 151)	16	34
17	D_{139}(139, 151)	17	36
18	D_{129}(129, 151)	18	36
19	D_{37}(37, 151)	19	37
20	D_{150}(150, 151)	20	38
…	…	…	…
149	D_{93}(93, 151)	149	123
150	D_{81}(81, 151)	150	127

So that the results of 150 training data that have the best Euclidean values are D21, D24 and D74. Then the next step is determining the majority of values that often appear from the best data.

Table 8. List of best Euclidean values

Num.	Distance	Euclidean Score	Ranking	Classification
1	D_{21}(21, 151)	20	1	At risk
2	D_{24}(24, 151)	21	2	At risk
3	D_{74}(74, 151)	27	3	At risk

In Table 8 there are the results that appear are at risk, at risk, and at risk with the majority that appears is at risk, so it can be concluded if the classification of obesity rates on respondents of unknown test data is at risk with 75.33% accuracy percentage. Here is the result of the picture from the determination of obesity.

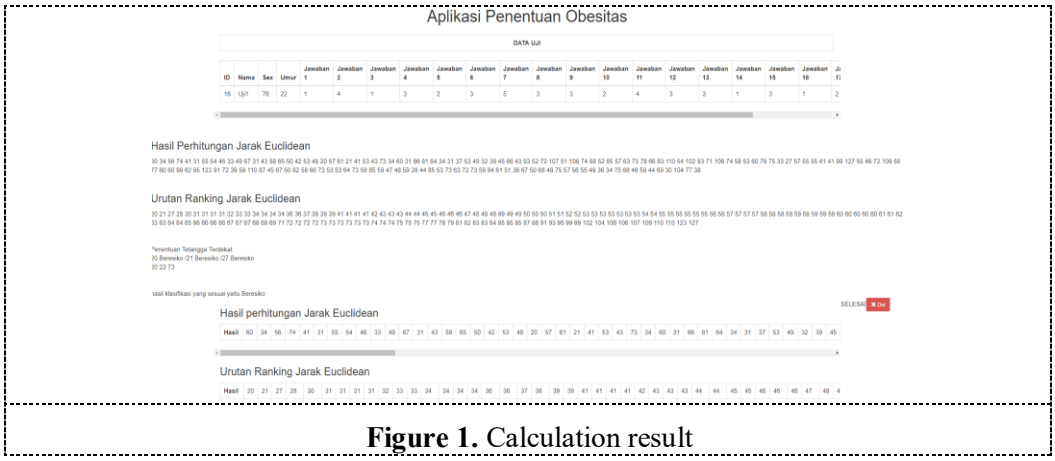

Figure 1. Calculation result

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