APPLICATION OF K-MEANS ALGORITHM ON FAVORITE MENU SELECTION AT WARUNG NASI ALAM SUNDA

Lisnawati Fitriyani a,1,*, Neneng Komariah a,2, Yusu Bintang Fajar a,3, Sudin Saepudin a,4, Muhamad Muslih a,5

a Department of Information System, Nusa Putra University, Jl. Raya Cibolang Kaler No.21, Kab. Sukabumi 43152, Indonesia
1 lisnawati.fitriyani_si17@nusaputra.ac.id; 2 neneng.komariah_si17@nusaputra.ac.id; 3 yusep.bintang_si17@nusaputra.ac.id;
4 sudin.saepudin@nusaputra.ac.id; 5 muhamad.muslih@nusaputra.ac.id

* Corresponding Author

Received 13 May 2022; revised 17 May 2022; accepted 22 May 2022

ABSTRACT

Warung Nasi Alam Sunda is a stall that does sundanese culinary business that serves several dishes of various vegetables, soto, chicken, fish, and others. In the application of favorite menu, Warung Nasi Alam Sunda determines it randomly, so it does not match the report given. This research aims to assist the restaurant in determining the favorite menu. This research uses data mining techniques with K-Means. Input attributes in this study include price, taste, favorites. In this study, it can be produced that the results of grouping into 3 groups namely c-1=fried chicken, c-2=fried carp and c-3=soto betawi. After 9 iterations, the 8th and 9th results are the same as c-1=9, c-2=22 and c-3=16. Then get the highest result as follows fried chicken=53, oxtail soup=49 and intestinal satay=42. Judging from the largest to smallest order of the sample 47 variables taken only 3 representatives. So the highest result is fried chicken. That will be the favorite menu at Warung Nasi Alam Sunda. System design using UML, system implementation using PHP and MySQL. The goal that this study wanted to achieve was to be able to cluster your favorite food menus using the K-Means algorithm.

KEYWORDS

Warung Nasi Alam Sunda
favorite Menu
Data Mining
K-Means

This is an open-access article under the CC-BY-SA license

1. Introduction

Warung Nasi Alam Sunda is one example of food and beverage business that is currently developing. Warung Nasi Alam Sunda was established in 2009, in Cianjur Regency with the first branch located in Jakarta (Tanah Abang) and growing rapidly so that in 2019 it has grown to 13 branches. In Sukabumi there is a branch of Warung Nasi Alam Sunda on Jl. Ahmad Yani.

Of the many restaurants and cafes that exist, must have a menu that becomes a favorite menu of customers. Warung Nasi Alam Sunda itself does not have a favorite menu that is characteristic of the stall. From the existing menu data can be used in classifying favorite menus at Warung Nasi Alam Sunda. Favorite menu is a menu that can shorten a person in ordering food and drinks. That way, a system can be created to cluster the favorite menu that is useful for the owner. Because there is no system to customize the favorite menu in the restaurant.
The graph above is data from the results of the customer questionnaire showing the results of the questionnaire against the selection of favorite menus as many as 53 respondents. From answering the highest favorite menu is fried chicken as much as 53, the second highest is fried carp as much as 52 and the third is soto betawi as much as 51. Of the 53 respondents who answered there was the most selected menu, fried chicken. From the data that has been obtained can be grouped into several clusters based on the similarity of the data, so that data that has the same characteristics are grouped in one cluster and that have different characteristics grouped in another cluster that has the same characteristics.

In this case, it takes a method to answer the problem in order to help in determining the customer's favorite menu, the author tries to use one method that is the K-means Clustering Algorithm method, the method has its own advantages. The K-Means algorithm can be performed when it is implemented and executed. The time it takes to do learning is relatively faster, very flexible, adaptation is easy to do, very common in use and using simple principles can be explained in non-statistics.

Previously, many have researched the case for example the selection of favorite food and beverage menus using the K-Means method produces the highest preference value for favorite menus in What's Up Café with the highest value (436) is Bule Fried Rice. While the results of normality testing using SPSS showed the probability value or significance is 0.276. This means that the significance is greater than 0.05 then H0 is also accepted which means that there is no average difference between the four criteria groups tested with the value F (1,329) the four most important criteria obtained are strongly agreed, agreed, disagreed, strongly disagreed, from the results the author tried to develop the method of K-means Algorithm. Although the case is similar but there are differences from the research object and the name of the material is expected there will be better results as well as knowing the differences in different processes even though the results are the same.

The research, related is prepared based on references that have similar methods and even related objects to limit the methods and systems that will be developed further, then the authors describe some of the research as follows:

Research made by Erdi Setiawan, Soegiarto with the research title "Application of Healthy Food Menu Recommendations For Children With Obesity Using Fuzzy Tahani Method". In this program, the value of recommendations is based on the membership degree limit resulting from the calculation process processed into fire strength. The variables used include the nutritional content of food, namely: energy, protein, fat, carbohydrates, calcium, phosphor and iron. From these variables obtained results in the form of twelve food menus with the highest recommendation value. For testing applications that are built is done by means of algorithmic tests, namely by testing white boxes and black boxes, then implementation tests, the conformity between the selection of healthy food menus does not use the application by using the application. The method used to measure the program results of healthy food selection recommendations for children with obesity is precision and recall. The results obtained from 100 food menu data taken on the list of food ingredient composition (DKBM) obtained...
implementation test results from 10 test data with a ratio comparison result with a high accuracy rate of 70% and a low accuracy rate of 30%.[1]

Furthermore, the research was made by Istiqomah Sumadikarta and Liya Andrayani with the research title "Implementation of Data Mining For Clustering Favorite Foods And Drinks Using K-Means Algorithm (Case Study: What's Up Cafe South Tangerang). What's Up provides dozens of diverse food and beverage menus with different price variations. In applying the favorite menu, What’s Up determines it randomly, so it does not match the report given. This study aims to help the restaurant in determining the favorite menu. This study uses data mining techniques with KMeans. The input attributes in this study include the number of transactions and prices. In this study, it was found that the results obtained in the form of grouping into 3 groups. From each group, it will be seen which number of transactions is highest, that is what will be the favorite menu in What’s Up. System design using UML, system implementation using PHP and MySQL. The aim to be achieved in this study is to be able to cluster favorite food and beverage menus using the KMeans algorithm.[2]

Related research was made by Yustria Handika Siregar1 and Sri Rahayu with the research title "Support System for Food Menu Selection Decisions for Children with Analytical Hierarchy Process (AHP) Method". The selection of a good food menu for children is a factor that needs to be considered to optimize the growth and development of the baby. In this case, the role of parents is needed in the selection of a good food menu for children. The food menu needed for children must contain balanced nutrients such as carbohydrates, protein, fiber content, and water. As is the case with children in Taqwa Perkebunan Gunung Melayu kindergarten where the arrangement of diet in children is very dependent on the mother's knowledge in choosing, processing and arranging the food needed for the child's school supplies. For that, a decision support system is needed in determining the ranking of healthy food menus using the AHP method. The AHP method helps in decision-making through complex comparisons into more accurate alternatives. This method also allows measurement of ratio scales for criterion weights and alternate scoring. So that a solution or result of several alternatives to be taken a decision. With the support system of food menu selection decisions for children is expected to help parents in choosing food menus quickly and appropriate for children's needs.[3]

Further research made by Nurul Mawaddah Nst, Riska Devi Hanum and Anjelina Farida Siahaan. With the title of the study "Support System for Food Menu Selection Decisions in Obese People using the MOORA Method". Decision support system is a system that can channel the ability to solve problems or the ability to communicate with unstructured and semi-structured conditions. In this era of globalization it is inevitable if the development of science and knowledge increases so that it becomes very important for the needs of humans without limits, many career families are very not concerned about the physical and spiritual family, career parents think mostly when their children eat a lot and eat until they look fat that is considered healthy and strong. Actually, a fat body is not good for health or obesity if it is not balanced with physical or recreational activities. This research is to help obese people to be able to choose a good food menu for health by paying attention to the content of a good menu consumed or not. As for the results of this study test it is known that the MOORA method can be used in determining the selection of food in obese people properly.[4]

Application of K-Means Algorithm for Cluster Analysis on Poverty of Provinces in Indonesia, The objective of this study was to apply cluster analysis or also known as clustering on poverty data of provinces all over Indonesia. The problem was that the decision makers such as central government, local government and non-governmental organizations, which involved in poverty problems, needed a tool to support decision-making process related to social welfare problems. The method used in the cluster analysis was kmeans algorithm. The data used in this study were drawn from Badan Pusat Statistik (BPS) or Central Bureau of Statistics on 2014. Cluster analysis in this study took characteristics of data such as absolute poverty of each province, relative number or percentage of poverty of each province, and the level of depth index poverty of each province in Indonesia. Results of cluster analysis in this study are presented in the form of grouping of clusters' members visually. Cluster analysis in the study can be used to identify more quickly and efficiently on poverty chart of all provinces all over Indonesia. The results of such identification can be used by policy makers who have interests of eradicating the problems associated with poverty and welfare distribution in Indonesia, ranging from government organizations, non-governmental organizations, and also private organizations.[8]
Application of K-Means Algorithm for Cluster Analysis on Poverty of Provinces in Indonesia

Kmeans algorithm is an iterative algorithm that tries to partition the dataset into K predefined distinct non-overlapping subgroups (clusters) where each data point belongs to only one group. It tries to make the inter-cluster data points as similar as possible while also keeping the clusters as different (far) as possible. It assigns data points to a cluster such that the sum of the squared distance between the data points and the cluster's centroid (arithmetic mean of all the data points that belong to that cluster) is at the minimum. The less variation we have within clusters, the more homogeneous (similar) the data points are within the same cluster.[8]

Kmeans algorithm is an iterative algorithm that tries to partition the dataset into K predefined distinct non-overlapping subgroups (clusters) where each data point belongs to only one group. It tries to make the inter-cluster data points as similar as possible while also keeping the clusters as different (far) as possible. It assigns data points to a cluster such that the sum of the squared distance between the data points and the cluster's centroid (arithmetic mean of all the data points that belong to that cluster) is at the minimum. The less variation we have within clusters, the more homogeneous (similar) the data points are within the same cluster.[9]

Application of K-Means Clustering in Mapping of Central Java Crime Area Crimes occur in many places and reason complex troubles which have enormous influences on all degrees of society. Crime is associated with numerous elements which include crime index, the ratio of the wide variety of police to the population, population density and poverty fees. In this take a look at looking to increase an data gadget that is capable of show and map crime-inclined regions in Central Java. Based on those factors, it’s far used to classify areas in Central Java, specifically the class of safe, pretty inclined, prone and really susceptible. K Means clustering technique, is very suitable for use in predicting and grouping which areas are blanketed inside the four classes. The formulation of the problem is to discover areas prone to crime in Central Java. Based at the outcomes, there are eleven areas with safe classes, 4 areas with pretty prone categories, 13 regions with prone categories and 6 areas with very vulnerable classes.[10]

Application of user behavior analysis based on k-means clustering algorithm in e-commerce With the fast improvement of financial system and laptop community, increasingly fierce opposition makes the agency comprehend that the customer aid may be very vital for the employer to win. In order to complete the software of user conduct evaluation in e-trade, the writer makes use of clustering evaluation in records mining to put in force purchaser segmentation in e-commerce enterprise, and adopts progressed K-approach algorithm based on nearest neighbor propagation set of rules to understand the layout and consciousness of the device, in order to attain the correct initial cluster center and enhance the pleasant of the cluster. The very last have a look at shows that applying the clustering set of rules to person conduct evaluation and proposing possible marketing strategies could make the e-commerce enterprise continuously enhance.[11]

Application model of k-means clustering: Insights into promotion strategy of vocational high school Admission process is required in promoting the strategy to achieve the target. Through determining the strategic promotion, minimizing the cost in the marketing process could be reached with determining the appropriate promotion strategy. Data mining techniques in this initiative were applied to achieve in determining the promotional strategy. Using Clustering K-Means algorithm, it is one method of non-hierarchical clustering data in classifying student data into multiple clusters based on similarity of the data, so that student data that have the same characteristics are grouped in one cluster and that have different characteristics grouped in another cluster. Implementation using Weka Software is used to help find accurate values where the attributes include home address, school of origin, transportation, and reasons for choosing a school. The cluster of students was classified into five clusters in the following: the first cluster 22 students, the second cluster 10 students, the third cluster 10 students, the fourth cluster a total of 33 students, and the fifth cluster 25 students. The pattern of this result is supposed to contribute to enhance the significant data mining to support the strategic promotion in gaining new prospective students.[12]

Decision-Making Enhancement in a Big Data Environment: Application of the K-Means Algorithm to Mixed Data Big data research has become an important discipline in information
systems. However, the flood of data being generated on the Internet is increasingly unstructured and non-numeric in the form of images and texts. Thus, research indicates that there is an increasing need to develop more efficient algorithms for treating mixed data in big data for effective decision making. In this paper, we apply the classical K-means algorithm to both numeric and categorical attributes in big data platforms. We first present an algorithm that handles the problem of mixed data. We then use big data platforms to implement the algorithm, demonstrating its functionalities by applying the algorithm in a detailed case study. This provides us with a solid basis for performing more targeted profiling for decision making and research using big data. Consequently, the decision makers will be able to treat mixed data, numerical and categorical data, to explain and predict phenomena in the big data ecosystem. Our research includes a detailed end-to-end case study that presents an implementation of the suggested procedure. This demonstrates its capabilities and the advantages that allow it to improve the decision-making process by targeting organizations' business requirements to a specific cluster/profile based on the enhancement outcomes.[13]

Clustering Applied to the Education: A K-means and Hierarchical Application

The purpose of this paper became to give a clustering of European international locations consistent with the quantity of desktop computers available to college students in primary faculties (ISCED 1), lower secondary colleges (ISCED 2) and higher secondary colleges (ISCED three). Was used the database evolved via the ES Open Data Portal for the yr 2019 on “ICT in Education”. For the class have been used the hierarchical clustering and K-way techniques and the statistical software program Rcran three.6.3. These techniques have been used as they have got the potential to institution a large number of elements into clusters, based totally on the similarity found out. This paper concludes that the nations with the best GDP aren't the ones that have the most computer computers of their schools. Bulgaria is the united states of america with the major quantity of computer computer systems in their colleges.[14]

K-means clustering-based electrical equipment identification for smart building application

In this paper, we advocate a ok-means clustering-based totally electric equipment identity in the direction of smart building application which could routinely pick out the unknown equipment linked to BIoT structures. First, load traits are analyzed and electrical capabilities for system identity are extracted from the accumulated data. Second, k-method clustering is used two times to construct the identification version. Preliminary clustering adopts traditional ok-way set of rules to the full harmonic modern-day distortion information and separates equipment statistics into two to 3 clusters on the idea of their electric traits. Later clustering uses an progressed ok-way set of rules, which weighs Euclidean distance and makes use of the elbow method to determine the variety of clusters and analyze the results of preliminary clustering. Then, the system identity model is built by means of choosing the cluster centroid vector and distance threshold. Finally, identification results are received on line on the premise of the model outputs by using the use of the newly accumulated records. Successful packages to BIoT gadget affirm the validity of the proposed identity approach. [15]

Unsupervised K-means clustering algorithm

In this paper, we assemble an unmonitored getting to know schema for the okay-means algorithm in order that it’s miles freed from initializations without parameter selection and can also concurrently locate an most desirable variety of clusters. That is, we suggest a unique unsupervised okay-means (U-ok-means) clustering algorithm with mechanically finding an superior quantity of clusters without giving any initialization and parameter choice. The computational complexity of the proposed U-ok-means clustering set of rules is also analyzed. Comparisons between the proposed U-ok-manner and different present techniques are made. Experimental results and comparisons sincerely reveal those right aspects of the proposed U-ok-means clustering set of rules.[16]

A dynamic K-means clustering for data mining

In this paper, we address this issue by proposing a new K-Means clustering algorithm. The proposed method performs data clustering dynamically. The proposed method initially calculates a threshold value as a centroid of K-Means and based on this value the number of clusters are formed. At each iteration of K-Means, if the Euclidian distance between two points is less than or equal to the threshold value, then these two data points will be in the same group. Otherwise, the proposed method will create a new cluster with the dissimilar data point. The results show that the proposed method outperforms the original K-Means method.[17]
**Decision-Making Enhancement in a Big Data Environment: Application of the K-Means Algorithm to Mixed Data.** In this paper, we apply the classical K-means algorithm to both numeric and categorical attributes in big data platforms. We first present an algorithm that handles the problem of mixed data. We then use big data platforms to implement the algorithm, demonstrating its functionalities by applying the algorithm in a detailed case study. This provides us with a solid basis for performing more targeted profiling for decision making and research using big data. Consequently, the decision makers will be able to treat mixed data, numerical and categorical data, to explain and predict phenomena in the big data ecosystem. Our research includes a detailed end-to-end case study that presents an implementation of the suggested procedure. This demonstrates its capabilities and the advantages that allow it to improve the decision-making process by targeting organizations’ business requirements to a specific cluster[s]/profile[s] based on the enhancement outcomes. See less

**Application of K-Means Clustering Algorithm for Determination of Fire-Prone Areas Utilizing Hotspots in West Kalimantan Province** The purpose of this observe is to use the clustering technique using the k-means algorithm with a purpose to decide the hotspot susceptible areas in West Kalimantan Province. And examine the effects of the cluster that has been received from the clustering approach using the okay-means set of rules. Data mining is a appropriate approach in order to find out facts on hotspot regions. The information mining technique used is clustering because this method can method hotspot data into statistics which could tell areas prone to hotspots. This clustering uses okay-method set of rules that is grouping information primarily based on comparable traits. The hotspots statistics acquired are grouped into 3 clusters with the consequences obtained for cluster 0 as many as 284 hotspots including dangerous regions, 215 hotspots together with non-prone regions and 129 points that belong to very vulnerable areas. Then the clustering consequences had been evaluated the use of the Davies-Bouldin Index (DBI) method with a fee of three.112 which shows that the clustering results of three clusters had been no longer most appropriate.[19]

The k-means algorithm: A comprehensive survey and performance evaluation This paper afford a dependent and synoptic review of research conducted at the k-manner set of rules to overcome such shortcomings. Variants of the ok-manner algorithms including their latest traits are discussed, where their effectiveness is investigated based totally at the experimental evaluation of quite a few datasets. The precise experimental evaluation in conjunction with a radical comparison amongst extraordinary ok-way clustering algorithms differentiates our work compared to different present survey papers. Furthermore, it outlines a clear and thorough understanding of the okay-method algorithm at the side of its exceptional research guidelines.[20]

An efficient approximation to the K-means clustering for massive data Due to the dynamic development of the sum of information accessible in a wide assortment of logical areas, it has gotten to be more troublesome to control and analyze such data. In show disdain toward of its reliance on the introductory settings and the expansive number of remove computations that it can require to merge, the K-means calculation remains as one of the foremost prevalent clustering strategies for gigantic datasets. In this work, we propose an productive estimation to the K-means issue planning for gigantic information. Our approach recursively allotments the complete dataset into a little number of subsets, each of which is characterized by its agent (center of mass) and weight (cardinality), a short time later a weighted adaptation of the K-means calculation is connected over such neighborhood representation, which can definitely diminish the number of separations computed. In expansion to a few hypothetical properties, exploratory comes about demonstrate that our strategy beats well-known approaches, such as the K-means++ and.[21]

**k-means clustering of extremes**, Electronic Journal of Statistics The k-means clustering set of rules and its variation, the round k-means clustering, are most of the maximum critical and popular techniques in unsupervised learning and pattern detection. In this paper, we explore how the spherical okay-method algorithm may be implemented inside the evaluation of handiest the extremal observations from a facts set. By utilizing multivariate extreme fee analysis we display how it can be adopted to discover “prototypes” of extremal dependence and derive a consistency end result for our cautioned estimator. In the unique case of max-linear fashions we show furthermore that our manner
presents an opportunity way of statistical inference for this magnificence of fashions. Finally, we provide records examples which show that our approach is able to discover relevant styles in extremal observations and allows us to categorise extremal activities.[22]

Improved logistic regression model for diabetes prediction by integrating PCA and K-means techniques, Our major goal was to decide ways of enhancing the okay-approach clustering and logistic regression accuracy result. Our version accommodates of PCA (important issue evaluation), k-approach and logistic regression set of rules. Experimental effects display that PCA superior the k-approach clustering algorithm and logistic regression classifier accuracy versus the end result of different published studies, with a ok-method output of 25 greater efficiently labeled information, and a logistic regression accuracy of one.98% higher. As such, the model is proven to be useful for routinely predicting diabetes the use of affected person digital health data information. A similarly test with a brand new dataset showed the applicability of our model for the predication of diabetes [23]

k-means: A revisit, Neurocomputing, In this paper, a special ok-method form is given. Diverse from most of k-method versions, the clustering strategy is pushed by means of an express objective include, that’s viable for the complete l2-space. The classic egg-bird circle in ok-approach has been rearranged to a common stochastic optimization strategy. The way of okay-method turns into less demanding and merges to a broadly way better nearby optima. The adequacy of this modern variation has been examined obviously in uncommon settings, counting report clustering, closest neighbor look and picture clustering. Predominant in general execution is found over interesting circumstances. In this paper, a unique ok-method version is provided. Different from most of k-method editions, the clustering method is pushed via an express goal feature, that is viable for the entire l2-space. The classic egg-bird loop in ok-approach has been simplified to a natural stochastic optimization procedure. The manner of okay-method turns into easier and converges to a extensively better local optima. The effectiveness of this new variant has been studied appreciably in special contexts, including report clustering, nearest neighbor search and picture clustering. Superior overall performance is found across unique situations,[24]

k-means clustering with outlier removal, Outlier detection is an important records evaluation challenge in its personal right and doing away with the outliers from clusters can enhance the clustering accuracy. In this paper, we make bigger the k-method set of rules to provide information clustering and outlier detection simultaneously by means of introducing an additional “cluster” to the okay-manner algorithm to preserve all outliers. We layout an iterative procedure to optimize the objective characteristic of the proposed algorithm and establish the convergence of the iterative technique. Numerical experiments on each artificial information and real records are provided to illustrate the effectiveness and performance of the proposed algorithm.[25]

Frame of Mind In completing the research, the author created a frame of thought as a guideline or reference for this study, so that the research can be done consistently. This research consists of several stages such as in the frame of thought below. The problem in this study is the unknown selection of decisions for predictions of favorite menus at Warung Nasi Alam Sunda. Therefore, the method used is Clustering K-means to determine the criteria that will be used as a reference in decision making. Here's a depiction of his frame of mind.
2. Method

This research method is a step collecting data or information as obtained. This research method is goals and determine the answers to conducted for the creation of A-favorite menus at Warung Nasi. The data collection techniques in taken by researchers in the process of well as conducting analysis on the data also the most important way to achieve problems that occur. Research was Means application model in the selection of Alam Sunda.

this study are as follows:
The stages of research conducted by the author are as follows:

2.1. Primary Data
Primary data is data obtained directly from research objects in the field and not through intermediaries data collection results obtained from various sources. The information obtained will be processed to be the object of analysis, especially in interpreting or explaining the meaning of the data obtained. [5] From the observations obtained 3 criteria, namely price, taste and favorites with each criterion has a weight of criteria, the weight of the criteria researchers can be seen in the table below.

Table 1. Criterion Weights

| Criteria | Bobot Kriteria | Persentase |
|----------|----------------|------------|
| Harga    | 0.20           | 20%        |
| Rasa     | 0.30           | 30%        |
| Favorit  | 0.50           | 50%        |

2.2. Secondary Data
It is written data that is not obtained from the field directly. Secondary data is data obtained from library studies that is data collection by reading, studying and analyzing literatur sources that have to do with research objects, in this case about the favorite menu that is most liked by sukabumi people. The form can be the results of research, scientific articles published scientifically such as journals and so on.[6]

2.3. Data Analysis Stages
Data analysis techniques used are K-Means, data is processed into a useful form by manual or computerized. In this stage data processing is done by moving and processing the data received in the form of writing into the form of microsoft excel data so that it can be processed by clustering method K-Means.
2.4. K-Means Clustering

Is one of the algorithms inside centroid is the arithmetic mean of an object's shape from all points in the object. [7] The implementation of K-Means Clustering can be done with the following step-by-step procedures:

- Prepare vector training data.
- Set the value to K cluster.
- Set the centroid initial value.
- Calculate the distance between the data and centroid using the Euclidean Distance formula.
- Partition data based on minimum values.
- Then as the is still more to still then
- If the group is previous data group, then stop iteration.

![K-Means Clustering Algorithm FlowChart](image)

3. Results and Discussion

Questionnaires were shared as many as 53 questionnaires by listing 47 menus that will be chosen by customers as a reference for the determination of favorite menus, with 3 criteria selected namely price, taste and favorites.
Implementing the K-Means Algorithm Using Microsoft Excel 2010

The implementation of the K-means algorithm using Microsoft Excel 2010 has the following steps:

3.1. **Determining the Cluster Center Point**

The cluster's central point or centroid is used as a reducing value for calculating the distance between data to each cluster or called distance. In this process, the determination of the cluster's central point value can be selected randomly as the researcher wishes provided that the centroid value is still included in the range of data values on each attribute.

| Cluster | Centroid Value | Closest Distance |
|---------|----------------|------------------|
| C1      | 52             | 53               |
| C2      | 50             | 51               |
| C3      | 49             | 51               |

We choose random and we determine the value of cluster-1 namely Ayam Goreng, cluster-2 namely Gurame Goreng and cluster-3 namely Soto betawi.

3.2. **Calculating Data Distance to each Cluster**

After determined the central point value of each cluster the next process is to calculate the distance of data to each available cluster or it can be called distance.

| Cluster | Centroid Value | Closest Distance |
|---------|----------------|------------------|
| C1      | 52             | 53               |
| C2      | 50             | 51               |
| C3      | 49             | 51               |
3.3. Grouping Data

After the calculation of data distance to each cluster is completed then the next process is to group the data into each cluster formed. This order to determine the cluster and the next into Clusters
calculation of data cluster is completed then group the data into each data grouping is done in central point of the new process.
Can be seen in the table above the initial iteration obtained \( C_1 = 1, C_2 = 1 \) and \( C_3 = 45 \)

**Table 6. Lots of 1st Iteration Cluster Data**

| K-Means | Banyak Data |
|---------|-------------|
| C1      | 1           |
| C2      | 1           |
| C3      | 45          |

After performing centroid calculation and clustering data on the 1st to 9th iterations that contain similar number of cluster data in clustering table 4.33 and 4.37 the result remains the same as data \( C_1 = 9, C_2 = 22 \) and \( C_3 = 16 \), then there is no need for further process.
Table 7. Cluster 1 Results

| No | Menu          | Harga | Rasa | Favorit |
|----|---------------|-------|------|---------|
| 1  | Ayam Goreng  | 52    | 53   | 53      |
| 2  | Ayam Bakar   | 50    | 49   | 45      |
| 3  | Cumi Tumis   | 50    | 49   | 50      |
| 4  | Goreng Bakar | 49    | 50   | 50      |
| 5  | Goreng Goreng| 50    | 51   | 52      |
| 6  | Nila Bakar   | 48    | 49   | 49      |
| 7  | Nila Goreng  | 47    | 49   | 48      |
| 8  | SateCumi Asia| 50    | 50   | 49      |
| 9  | Soto Betawi  | 50    | 49   | 51      |

Table 8. Cluster 2 Results

| No | Menu          | Harga | Rasa | Favorit |
|----|---------------|-------|------|---------|
| 1  | Nasi          | 51    | 38   | 43      |
| 2  | Nasi Merah    | 45    | 46   | 44      |
| 3  | Bebek Goreng | 48    | 45   | 42      |
| 4  | Bakar         | 46    | 45   | 44      |
| 5  | Udang Sayur Penang | 45 | 44 | 43 |
| 6  | Kukus Peda   | 45    | 44   | 43      |
| 7  | Pepes Ayam   | 44    | 47   | 49      |
| 8  | Pepes Ikan Mas| 45    | 46   | 46      |
| 9  | Sate Kulit   | 45    | 44   | 44      |
| 10 | Sate Udang   | 48    | 47   | 48      |
| 11 | Sayur Asam   | 45    | 47   | 45      |
| 12 | Sop Buntut   | 44    | 48   | 49      |
| 13 | Sop Ija      | 46    | 48   | 48      |
| 14 | Et Jeruk     | 45    | 45   | 49      |
| 15 | Et Teh Namas | 47    | 45   | 46      |
| 16 | Et Teh Tawar | 44    | 45   | 46      |
| 17 | Jus Almudat  | 48    | 47   | 48      |
| 18 | Jus Manora   | 45    | 41   | 45      |
| 19 | Jus Melon    | 42    | 40   | 44      |
| 20 | Jus Snowball | 45    | 42   | 45      |
| 21 | Jus Nanas    | 47    | 45   | 46      |
| 22 | Jus Naga     | 48    | 47   | 44      |
|    | Rata-rata    | 46    | 45   | 46      |
Conclusion of the highest favorite menu in cluster 1 namely Ayam Goreng, cluster 2 namely Sop Buntut and cluster 3 namely Sate Usus.

3.4. Test Application

Test Application in this study using Black Box Testing. Black box testing focuses on the functional needs of the software, based on the specifications of the needs of the software. Black Box testing is a software testing method that tests application functionality that conflicts with internal or working structure. Here is a test of the functionality of Black Box Testing. Here are the black box testing scores against 5 testers.

Table 10. Black Box Testing Test Scores

| Pengujian | Nilai Rata-rata |
|-----------|----------------|
| Pengujian 1 | 60 |
| Pengujian 2 | 70 |
| Pengujian 3 | 65 |
| Pengujian 4 | 60 |
| Pengujian 5 | 65 |
| Pengujian 6 | 70 |
| Pengujian 7 | 71 |
| Pengujian 8 | 60 |
| Pengujian 9 | 66 |
| Pengujian 10 | 80 |
| Pengujian 11 | 60 |
| Pengujian 12 | 65 |
| Pengujian 13 | 70 |
| Pengujian 14 | 75 |
| Pengujian 15 | 70 |
| Pengujian 16 | 75 |
| Pengujian 17 | 80 |
| Pengujian 18 | 75 |
| Pengujian 19 | 80 |
| Total Nilai Rata-rata | 69.6 |
4. Conclusion

In this case study using the K-Means clustering method can be graphically described so that it is easy to understand by all parties involved in decision making. In this case, the K-Means method helps to give weight to each influence so that decision-making can make decisions appropriately and effectively, namely the favorite menu of food that gives the highest weight will be prioritized first by consumers. In the completion of the calculation used Ms. Excel. The problems that will be resolved will be described into elements, namely goals, criteria and alternatives as follows:

- Level 1, is the goal or goal that will be obtained is the favorite menu
- Level 2, is a criterion, in this case the criteria that are often used by consumers are: price, taste and favorites.
- Level 3, is an alternative. In this case will be taken 7 food menus namely: Fried Chicken, Grilled Chicken, Oxtail Soup, Sate Usus, Sop Iga, Bebek Goreng and Cumi Tumis.

Next will be created a matrix of comparisons of pairs of criteria and alternatives to obtain weight values (priority) of each favorite food. From the table of 4.38 the highest score obtained by the Fried Chicken menu with a value of 53 compared to other menus. So the alternative Fried Chicken is a favorite food menu priority for buyers.

References

[1] E. Setiawan, "Application of Healthy Food Selection Recommendations For Children With Obesity Using Fuzzy Tahani Method," Progressive J. Ilm. Komput., vol. 13, no. 1, pp. 1525–1690, 2017.
[2] I. Sumadiikarta and L. Andrayani, "IMPLEMENTATION OF DATA MINING FOR CLUSTERING FAVORITE FOODS AND DRINKS USING K-MEANS ALGORITHM (Case Study: What's Up Cafe South Tangerang)," J. Ilm. Fak. Tech. LIMIT'S, vol. 15, no. 1, pp. 40–49, 2019.
[3] Y. H. Siregar and S. Rahayu, "Support System for Food Menu Selection Decisions for Children with Analytical Hierarchy Process (AHP) Method," J. Teknol. Inf., vol. 2, no. 1, p. 24, 2018, doi: 10.36294/jurti.v2i1.404.
[4] W. D. Marsono, Ahmad Fitri Boy, "Support System for Food Selection Decisions in Obese People using the Topsis Method," Semin.NAS. Techno Science. Inf., pp. 135–140, 2018.
[5] Annisa Fitri Iriani, "Customer Interest in The Use of Mobile Banking in Customers of Bank Syariah Mandiri Kota Palopo," J. Islam. Manag. Bussines, vol. 2, no. 2, pp. 99–111, 2018.
[6] Y. Marizan, "Literature Study on The Use of Autodesk Software Revit Case Study Planning Center Sukajadi Kota Prabumulih," J. Ilm. Bering's, vol. 06, no. 01, pp. 15–26, 2019.
[7] A.B. W. Putra, R. Rihartanto, and A.M. Alhumaerah, "Application of K-Means Clustering In Matte Lip Cream Lipstick Grouping Based on RGB Color," JST (Journal of Science Ter., vol. 5, no. 1, 2019, doi: 10.32487/jst.v5i1.527.
[8] Sano ANindito H, Application of K-Means Algorithm for Cluster Analysis on Poverty of Provinces in Indonesia, ComTech: Computer, Mathematics and Engineering Applications, (2016), 7(2)
[9] Dabbura I, K-means Clustering: Algorithm, Applications, Evaluation Methods, and Drawbacks, Towards Data Science, (2018)
[10] Vulandari RSaptomo WAditama D, Application of K-Means Clustering in Mapping of Central Java Crime Area, Indonesian Journal of Applied Statistics, (2020), 3(1)
[11] Deng J, Application of user behavior analysis based on k-means clustering algorithm in e-commerce, , Journal of Advanced Oxidation Technologies, (2018), 21(2)
[12] Abadi SMat The KNasir B et al., Application model of k-means clustering: Insights into promotion strategy of vocational high school, International Journal of Engineering and Technology(UAE), (2018), 7(2).27 Special Issue 27
[13] Koren OHallin CPerel N et al., Decision-Making Enhancement in a Big Data Environment: Application of the K-Means Algorithm to Mixed Data , Koren OHallin CPerel N et al., Journal of Artificial Intelligence and Soft Computing Research, (2019), 9(4)
[14] Gil-Vera VPuerta IQuintero-López C, Clustering Applied to the Education: A K-means and Hierarchical Application, Review of European Studies, (2020), 12(3)

[15] Zhang GLi YDeng X, K-means clustering-based electrical equipment identification for smart building application, Information (Switzerland), (2020), 11(1)

[16] Kristina P. SinagaMiin Shen Yang, Unsupervised K-means clustering algorithm, IEEE Access (2020)

[17] [Hossain MAkhtar MAhmud R et al., A dynamic K-means clustering for data mining, ndonesian Journal of Electrical Engineering and Computer Science, (2019), 13(2)

[18] Koren OHallin CPerel N et al, Decision-Making Enhancement in a Big Data Environment: Application of the K-Means Algorithm to Mixed Data, Journal of Artificial Intelligence and Soft Computing Research, (2019), 9(4)

[19] Khairani NSutoyo E, Application of K-Means Clustering Algorithm for Determination of Fire-Prone Areas Utilizing Hotspots in West Kalimantan Province, International Journal of Advances in Data and Information Systems, (2020), 1(1)

[20] Ahmed MSeraj RIslam S, The k-means algorithm: A comprehensive survey and performance evaluation,, Electronics (Switzerland), (2020), 9(8)

[21] Capó MPérez ALozano J, An efficient approximation to the K-means clustering for massive data, Knowledge-Based Systems, (2017), 117

[22] Janßen AWan P, k-means clustering of extremes, Electronic Journal of Statistics, (2020), 14(1)

[23] Zhu CIademudia CFeng W, Improved logistic regression model for diabetes prediction by integrating PCA and K-means techniques, Informatics in Medicine Unlocked, (2019), 17

[24] Zhao WDeng CNgo C, k-means: A revisit, Neurocomputing, (2018), 291

[25] Gan GNg M, k-means clustering with outlier removal, Pattern Recognition Letters, (2017), 90