http://ijeecs.iaescore.com | ISSN 2502-4752, e-ISSN 2502-4760

Indonesian Journal of Electrical Engineering and Computer Science

CiteScore 2021 2.4 Scopus | Q3 | SJR 2021 0.276 | SNP 2021 0.513

Intelektual Pustaka Media Utama

Indonesian Journal of Electrical Engineering and Computer Science

The Indonesian Journal of Electrical Engineering and Computer Science (IJEECS), p-ISSN: 2502-4752, e-ISSN: 2502-4760 is a monthly peer-reviewed international journal in English, indexed by **Scopus** (CiteScore 2021: **2.4**, SNIP 2021: **0.513**, SJR 2021: **0.276**, Scimagojr Q3 on *Electrical and Electronic Engineering*, Q3 on *Computer Networks and Communications*, Q3 on *Signal Processing*, and Q3 on *Control and Optimization*), EI (INSPEC, IET), Google Scholar Metrics, ProQuest, EBSCO, BASE, Scinapse, SHERPA/RoMEO, etc. The purpose of this publication is to disseminate high-quality articles that are devoted to discussing any and all elements of the most recent and noteworthy advancements in the fields of electrical engineering and computer science. The applications of telecommunications and information technology, applied computing and computer science, instrumentation and control engineering, electrical engineering (power), and electronics engineering are all included in its purview. To view the citation counts for this journal on Google Scholar, <click here>.

IJEECS has a rolling submission process, so authors can send in their work at any time during the year.

Submit your paper now through Online submission ONLY.

The criteria for acceptance of manuscripts are the quality of work. This will be concretely reflected in the following aspects: novelty & practical impact; technical soundness; appropriateness and adequacy of: literature review; background discussion & analysis of issues; and presentation (overall organization, English & readability). For a contribution to be acceptable for publication, these points should be at least at the middle level.

Authors should submit only papers that have been carefully proofread and polished to avoid having to re-work the manuscript later in the review process. Authors should present their work honestly without fabrication, falsification, plagiarism, or inappropriate data manipulation. Manuscripts are accepted with the understanding that they are original or extended versions of previously published papers in conferences and/or journals and that, if the work received official sponsorship, it has been duly released for open publication. Before submission, please make sure that your paper is prepared using the journal paper template. It is available as a word and latex version. Kindly please **download the journal template (MS Word)** or **LATEX version**. This will ensure fast processing and publication. Any papers not fulfilling the requirements based on the guidelines to authors will not be processed.

Reasons for publishing (Authors' benefits) their paper in this journal:

1. **Open access**: All research articles published in this journal are open access and immediately accessible online to the entire global research community. Our open access policy ensures high visibility and maximum exposure for your work-anyone with online access can read your article.
2. **High citation**: This journal has high citations, so you are easily increasing your H-index. Please <click here> to find citation counts for this journal.
3. **Rapid publication**: Online submission, electronic peer review, and production make the process of publishing your article simple and efficient.
4. **Quality, reputation and high standard of peer review**: This journal has a high standard of peer review. Each editor and reviewer conducts the evaluation of manuscripts objectively and fairly.
5. **Included in all major bibliographic databases**: All articles published in this journal are included in many bibliographic databases, so that your work can be found easily and cited by researchers around the world.

Please do not hesitate to contact us if you require any further information by email: **ijeecs.iaes@gmail.com**, ijeecs@iaescore.com

Announcements

Does not accept any papers suggestion from conference organizers

Dear Sir/Madam,

Due to huge regular papers submission, we apologize that our journal does not accept any papers suggestion from other conference organizers.

Your attention and cooperation is very highly appreciated.

Best Regards,
IJEECS Editorial Office

Posted: 2020-06-01 More...

More Announcements...

Vol 30, No 3: June 2023

Table of Contents

http://ijeecs.iaescore.com | ISSN 2502-4752, e-ISSN 2502-4760

Indonesian Journal of Electrical Engineering and Computer Science

CiteScore 2021 2.4 Scopus | Q3 | SJR 2021 0.276 | SNIP 2021 0.513

Intelektual Pustaka Media Utama

Journal Contact

Mailing Address

Indonesian Journal of Electrical Engineering and Computer Science

- D2, Ngoto Asri, Bangunharjo, Sewon, Bantul, Yogyakarta 55187, Indonesia
- C5 JEC Resd, Plumbon, Banguntapan, Bantul, Yogyakarta 55198, Indonesia
- No. 15, CJE, Plumbon, Banguntapan, Bantul, Yogyakarta 55198, Indonesia

Principal Contact

Prof. Dr. Seifedine Kadry
Principal Contact
Email: ijeecs@iaesjournal.com

Support Contact

IJEECS Technical Support
Email: ijeecs.iaes@gmail.com

http://ijeecs.iaescore.com | ISSN 2502-4752, e-ISSN 2502-4760

Indonesian Journal of Electrical Engineering and Computer Science

CiteScore 2021 2.4 Scopus | Q3 | SJR 2021 0.276 | SNIP 2021 0.513

Intelektual Pustaka Media Utama

Editorial Team

Advisory Editors

Prof. Dr. Patricia Melin, Tijuana Institute of Technology, Mexico
Prof. Neil Bergmann, The University of Queensland, Australia
Dr. Argyrios Zolotas, Cranfield University, United Kingdom
Prof. Daniel Thalmann, Nanyang Technological University, Singapore
Prof. Ajith Abraham, VSB Technical University of Ostrava, Czech Republic

Editor-in-Chief

Prof. Dr. Seifedine Kadry, Lebanese American University, Lebanon

Editors

Prof. Dr. Leo P. Ligthart, Delft University of Technology, Netherlands
Prof. Dr. Omar Lengerke, Universidad Autónoma de Bucaramanga, Colombia
Assoc. Prof. Dr. Wanquan Liu, Sun Yat-sen University, China
Dr. Arianna Mencattini, University of Rome "Tor Vergata", Italy
Mark S. Hooper, Analog/RF IC Design Engineer (Consultant) at Microsemi, United States

Associate Editors

Prof. Dr. Ahmad Saudi Samosir, Universitas Lampung (UNILA), Indonesia
Prof. Dr. Faycal Djeffal, University of Batna, Batna, Algeria
Prof. Dr. Muhammad Irfan, Beijing Institute of Technology, China
Prof. Dr. Nidhal Bouaynaya, Rowan University, United States
Prof. Dr. Nik Rumzi Nik Idris, Universiti Teknologi Malaysia, Malaysia
Prof. Dr. Luis Paulo Reis, University of Minho, Portugal
Prof. Dr. Sanjay Kaul, Fitchburg State University, United States
Prof. Dr. Srinivasan Alavandar, CK College of Engineering and Technology, India
Prof. Dr. Vijayakumar Varadarajan, The University of New South Wales, Australia
Prof. Dr. Maja Stula, University of Split, Croatia
Prof. Anjan Kumar Ghosh, Tripura University, India
Prof. Essam M. Rashad, Tanta University, Egypt
Prof. Ezra Morris Gnanamuthu, Universiti Tunku Abdul Rahman, Malaysia
Prof. João Crisóstomo Weyl, Universidade Federal do Parádisabled, Brazil
Prof. Larbi Boubchir, University of Paris 8, France
Prof. Mohammed Alghamdi, Al-Baha University, Saudi Arabia
Assoc. Prof. Octavian Postolache, ISCTE-Lisbon University Institute, Portugal
Prof. Ranathunga Arachchilage Ruwan Chandra Gopura, University of Moratuwa, Sri Lanka
Assoc. Prof. Ahmed Nabih Zaki Rashed, Menoufia University, Egypt
Assoc. Prof. Dr. Jumril Yunas, Universiti Kebangsaan Malaysia, Malaysia
Assoc. Prof. Dr. Lunchakorn Wuttisittikulkij, Chulalongkorn University, Thailand
Assoc. Prof. Dr. Mario Versaci, Università degli Studi di Reggio Calabria, Italy
Assoc. Prof. Dr. Valentina Emilia Balas, Aurel Vlaicu University of Arad, Romania
Asst. Prof. Dr. Ahmet Teke, Çukurova University, Turkey
Asst. Prof. Dr. Dinh-Thuan Do, Ton Duc Thang University, Viet Nam
Asst. Prof. Dr. Ehsan O. Sheybani, University of South Florida, United States
Asst. Prof. Dr. Supavadee Aramvith, Chulalongkorn University, Thailand
Assoc. Prof. Dr. Ljiljana Seric, University of Split, Croatia
Dr. Abdalhossein Rezai, University of Science and Culture, Iran
Dr. Ahmed Boutejdar, German Research Foundation DFG Braunschweig-Bonn, Germany
Dr. Anand Nayyar, Duy Tan University, Viet Nam
Assoc. Prof. Aniruddha Chandra, National Institute of Technology, India
Dr. Arafat Al-Dweik, Khalifa University, United Arab Emirates
Assoc. Prof. Dr. Arcangelo Castiglione, University of Salerno, Italy
Assoc. Prof. Chau Yuen, Singapore University of Technology and Design, Singapore
Dr. Chinmay Chakraborty, Birla Institute of Technology, India
Dr. Faqiang Wang, Xi'an Jiaotong University, China
Assoc. Prof. Han Yang, University of Electronic Science and Technology of China, China
Dr. Harikumar Rajaguru, Bannari Amman Institute of Technology, India
Dr. Imran Shafique Ansari, University of Glasgow, United Kingdom
Assoc. Prof. Jinsong Wu, Universidad de Chile, Chile
Dr. Makram Fakhry, University of Technology, Baghdad, Iraq
Dr. Mohammed Dregham Zidan, University of Science and Technology, Egypt
Dr. Mohd Khair Hassan, Universiti Putra Malaysia, Malaysia
Dr. Munawar A Riyadi, Universiti Teknologi Malaysia, Malaysia
Dr. N. Ramesh Babu, M Kumarasamy College of Engineering, India
Dr. Nuno Rodrigues, Instituto Politécnico de Bragança, Portugal
Asst. Prof. Dr. Praveen Malik, Dr. B. R. Ambedkar National Institute of Technology, India
Asst. Prof. Dr. Rama Reddy, Kakatiya University, India
Assoc. Prof. Shahrin Md. Ayob, Universiti Teknologi Malaysia, Malaysia
Dr. Sudhanshu Shekhar Jha, Leipzig University, Germany
Prof. Surinder Singh, Sant Longowal Institute of Engg. & Technology Longowal, India
Dr. Tarek Djerafi, Institute of Energy, Materials and Telecommunications (INRS), Canada
Dr. Tianhua Xu, Tianjin University, China
Dr. Vassilis S. Kodogiannis, CEng, University of Westminster, United Kingdom
Assoc. Prof. Dr. Wei Wang, Harbin Engineering University, China
Prof. Wei Zhouchao, China University of Geosciences, China
Dr. Yin Liu, Symantec Core Research Lab, United States
Dr. Youssef Errami, Chouaib Doukkali University, Morocco
Dr. Yutthapong Tuppadung, Provincial Electricity Authority (PEA), Thailand

Editorial Board Members

Assoc. Prof. Murad Abusubaih, Palestine Polytechnic University, Palestinian Territory, Occupied
Prof. Abdelmadjid Recioui, Universitry of Boumerdes, Algeria
Prof. Ahmed El Oualkadi, Abdelmalek Essaadi University, Morocco
Prof. Meerja Akhil Jabbar, Vardhaman College of Engineering, India
Prof. Arthur Swart, Central University of Technology, South Africa
Prof. Felix J. Garcia Clemente, University of Murcia, Spain
Prof. Mohamed Hababeh, International Islamic University Malaysia, Malaysia
Prof. Priya Ranjan, Bhubaneswar Institute of Technologydisabled, India
Prof. Sattar B. Sadkhan, University of Babylon, Iraq
Prof. Wajeb Gharibi, University of Missouri-Kansas City, United States
Dr. Arun Sharma, Delhi Technological University, India
Dr. Dimitri Papadimitriou, University of Antwerp, Belgium
Dr. Duy Huynh, HUTECH University, Viet Nam
Dr. Hamed Mojallali, University of Guilan, Iran, Islamic Republic of
Dr. Hasan Ali Khattak, National University of Sciences & Technology, Pakistan
Asst. Prof. Dr. Jérome Le Masson, CREC Saint Cyr, France
Dr. Jitendra Mohan, Jaypee Institute of Information Technology, India
Assoc. Prof. Jose Soler, Technical University of Denmark, Denmark
Dr. Kamal Kant Sharma, Chandigarh University, India
Dr. Kamil Dimililer, Yakın Doğu Universitesi, Cyprus
Dr. Ke-Lin Du, Concordia University, Canada
Dr. K.K. Thyagharajan, RMK College of Engineering and Technology, India
Dr. Maria Chiara Caschera, Istituto Di Ricerche Sulla Popolazione E Le Politiche Sociali, Italy
Dr. Milica Petkovic, University of Novi Sad, Serbia
Asst. Prof. Dr. Marwan Nafea, University of Nottingham Malaysia, Malaysia
Dr. Media A Ayu, Sampoerna University, Indonesia
Dr. Mohammad Yazdani-Asrami, University of Glasgow, United Kingdom
Dr. Mohd Syakirin Ramli, Universiti Malaysia Pahang, Malaysia
Dr Mritha Ramalingam, University Malaysia Pahang, Malaysia
Assoc. Prof. Dr. Norliza Noor, Universiti Teknologi Malaysia, Malaysia
Dr. Pratap Kumar Sahu, Foxconn, Taiwan
Dr. Philipp Fechteler, Fraunhofer HHI, Germany
Dr. Ratna Kalos Zakiah Sahbudin, Universiti Putra Malaysia, Malaysia
Dr. Rupak Kharel, University of Central Lancashire, United Kingdom
Prof.Dr. Sai Kiran Oruganti, Jiangxi University of Science and Technology Ganzhou, China
Dr. Sanjaya Kumar Panda, National Institute of Technology, India
Assoc. Prof. Dr. Santoso Wibowo, Central Queensland University, Australia
Dr. Stylianos Basagiannis, United Technologies, Cork, Ireland
Dr. Suneeta Suneeta, Vemana Institute of Technology, India
Asst. Prof. Dr. Taghi Javdani Gandomani, Shahrekord University, Iran

Indonesian Journal of Electrical Engineering and Computer Science
http://ijeecs.iaescore.com | ISSN 2502-4752, e-ISSN 2502-4760
CiteScore 2021 2.4 Scopus
Q3
SJR 2021 0.276
SNIP 2021 0.513
Intelektual Pustaka Media Utama

Vol 22, No 2

May 2021

DOI: http://doi.org/10.11591/ijeecs.v22.i2

Table of Contents

http://ijeecs.iaescore.com | ISSN 2502-4752, e-ISSN 2502-4760

Indonesian Journal of Electrical Engineering and Computer Science

K-means method for clustering learning classes

A. D. Indriyanti, D. R. Prehanto, T. Z. Vitadiar

Abstract

Learning class is a collection of several students in an educational institution. Every beginning of the school year the educational institution conducts a grouping class test. However, sometimes class grouping is not in accordance with the ability of students. For this reason, a system is needed to be able to see the ability of students according to the desired parameters. Determination of the weight of test scores is done using the K-Means method as a grouping method. Iteration or repetition process in the K-Means method is very important because the weight value is still very possible to change. Therefore, the repetition process is carried out to produce a value that does not change and is used to determine the ability level of students. The results of the class grouping test scores affect the ability of students. Application of K-Means method is used in building an information system grouping student admissions in an educational institution. Acceptance of students will be grouped into 3 groups of learning classes. The results of testing the system that applies K-Means method and based on data on the admission of prospective students from educational institutions have very high accuracy with an error rate of 0.074.

Keywords

Clustering; Learning classes; K-means

Full Text:

PDF

DOI: http://doi.org/10.11591/ijeecs.v22.i2.pp835-841

Refbacks

- There are currently no refbacks.

Indonesian Journal of Electrical Engineering and Computer Science
Vol. 22, No. 2, May 2021, pp. 835~841
ISSN: 2502-4752, DOI: 10.11591/ijeecs.v22.i2.pp835-841

K-means method for clustering learning classes

A D Indriyanti[1], D R Prehanto[2], T Z Vitadiar[3]
[1,2]Department of Information System, Faculty of Engineering, Universitas Negeri Surabaya, Indonesia
[3]Department of Information System, Faculty of Information Technology, Universitas Hasyim Asy'ari, Indonesia

Article Info

Article history:

Received Mar 10, 2020
Revised Dec 4, 2020
Accepted Jan 11, 2021

Keywords:

Clustering
K-means
Learning classes

ABSTRACT

Learning class is a collection of several students in an educational institution. Every beginning of the school year the educational institution conducts a grouping class test. However, sometimes class grouping is not in accordance with the ability of students. For this reason, a system is needed to be able to see the ability of students according to the desired parameters. Determination of the weight of test scores is done using the K-means method as a grouping method. Iteration or repetition process in the K-means method is very important because the weight value is still very possible to change. Therefore, the repetition process is carried out to produce a value that does not change and is used to determine the ability level of students. The results of the class grouping test scores affect the ability of students. Application of K-means method is used in building an information system grouping student admissions in an educational institution. Acceptance of students will be grouped into 3 groups of learning classes. The results of testing the system that applies K-means method and based on data on the admission of prospective students from educational institutions have very high accuracy with an error rate of 0.074.

Corresponding Author:

A D Indriyanti
Department Information System
Faculty of Engineering, Universitas Negeri Surabaya
Building E1, Jl. Ketintang, Surabaya City, East Java 60231, Indonesia
Email: ariesdwi@unesa.ac.id

1. INTRODUCTION

Class grouping is important and implemented by educational institutions when beginning learning, this grouping aims to group students into the variables that have been determined so that they can gather students into the right group [1]. The purpose of this class grouping is to facilitate the instructor in adjusting the material presented by paying attention to the categories of student groups that have been determined, so that students have the readiness or ability to accept lessons that will be given by the instructor [2].

From several articles studied mention that class grouping is done through questionnaires and interviews with teachers in providing learning over a period of 5 to 11 years [3], this is of course the results are less precise because it should be questionnaire and interview about grouping learning classes given to students who will start the process learning is not to the instructor [4], and the determination of class groups takes a long time because they have to wait for evaluation for several years [5]. In another article also mentioned the process of class grouping is done with the questionnaire choice "a" and "b" [6] and only to measure the student's personality value [7], this is less precise if what the institution wants is the potential value or ability of students to determine the concentration of certain lessons [8].

Based on the background and problems above, the writer has a solution by creating a grouping system of learning classes using the K-means algorithm method [9]. K-means method is a very appropriate method in grouping students because of the characteristics of K-means that do the classification with clear

and precise variables[10], this is in accordance with the types of lessons that can be called by these variables [11]. K-means was also proven to be able to analyze the air-pollution constituents PM10 and BC over a period of 1 year by grouping several day profiles so as to produce characteristic models that explain weather conditions, seasons and daily human activities [12], another article also mentions K-means are used in grouping hybrid based learning optimization by using a 3 phase hybrid comparison method [13]. Where the two articles that contain K-Means can also be applied in the grouping of learning classes [14].

2. RESEARCH METHOD

2.1. Information system

The system can be interpreted as a collection or set of processes that communicate with each other, are connected, and are interdependent in doing certain goals. Information is the result of processing data that can be justified into a form that is beneficial to the recipient. Information systems can be described as a set of processes that process and present information in such a way that it benefits the recipient [15].

2.2. K-Means method

Classification methods are intended to find models or functions that explain or distinguish concepts or data classes to be able to estimate classes and objects whose labels are unknown [16]. In the process of grouping data or clustering data, there are two ways that are often used, namely clustering hierarchy and non clustering hierarchy [17]. The Hierarchy Method is a grouping of two or more objects that have the closest resemblance [18]. Then proceed to other objects and so on so that the cluster will produce a pattern 'tree' where there are clear levels (hierarchy) between objects, from the most similar to the least similar [19]. While the non-hierarchy method is initially set by the number of clusters (two, three, or others) first [20]. After the number of clusters is determined, then the cluster process is carried out without following a hierarchical process or randomly [21].

K-means is a data method with a non-hierarchical method that aims to partition data into one or more clusters [22]. The purpose of this data clustering method is to minimize the objective function set in the clustering process [23]. Following the stages of data clustering using the K-Means method is commonly done with the basic algorithm as follows [24]:

a) There are 3 classes which will then be determined by K-means namely classes a, b and c, where one of these classes becomes the selected cluster point. Then randomly assign pieces of data k as a starting point cluster, in this step random determination is still based on class data that has been obtained previously.
b) Euclidian Distance is used in calculating the distance between data and cluster points. The euclidean formula can be calculated by the following equation [25]:

$$\mathrm{d}\,(x, ci = \sqrt{(x1i - c1i)^2 + (x2i - c2i)^2 + \cdots + (xmi - ci)^2} \quad (1)$$

Where, d (x,c) is distance of data x to cluster center c, xmi is Data i on attribute data k, ci is the center point to j on attribute k.

c) The data is placed in the nearest cluster then perform calculations from center of the cluster. If data has been assigned to closest cluster, the next process is to determine the cluster center. How to determine center of a new cluster is to find the average value in the previous centroid using the formula(2):

$$C_k = 1/ n_k \sum d_k \quad (2)$$

where, Ck is new centroid, nk is amount of data that is a member in the cluster, and d_k is data in the cluster k

d) The value of the centroid as a reference in determining cluster center and data placement, if centroid value changes continuously, process of determining cluster center will be repeated [26].

Type of data that will be used in clustering is quantitative. Exam results from grade level inclusions included quantitative data types because they are numeric and can be counted.

3. RESULTS AND ANALYSIS

This information system framework focuses on data processing, where at the input stage there are collecting data on the results of test scores based on variables 1, 2, 3, 4, 5 as input to the processing system. Then the system will do the clustering process using the K-Means method to determine learning classes A, B, C as the output of the system in the Figure 1.

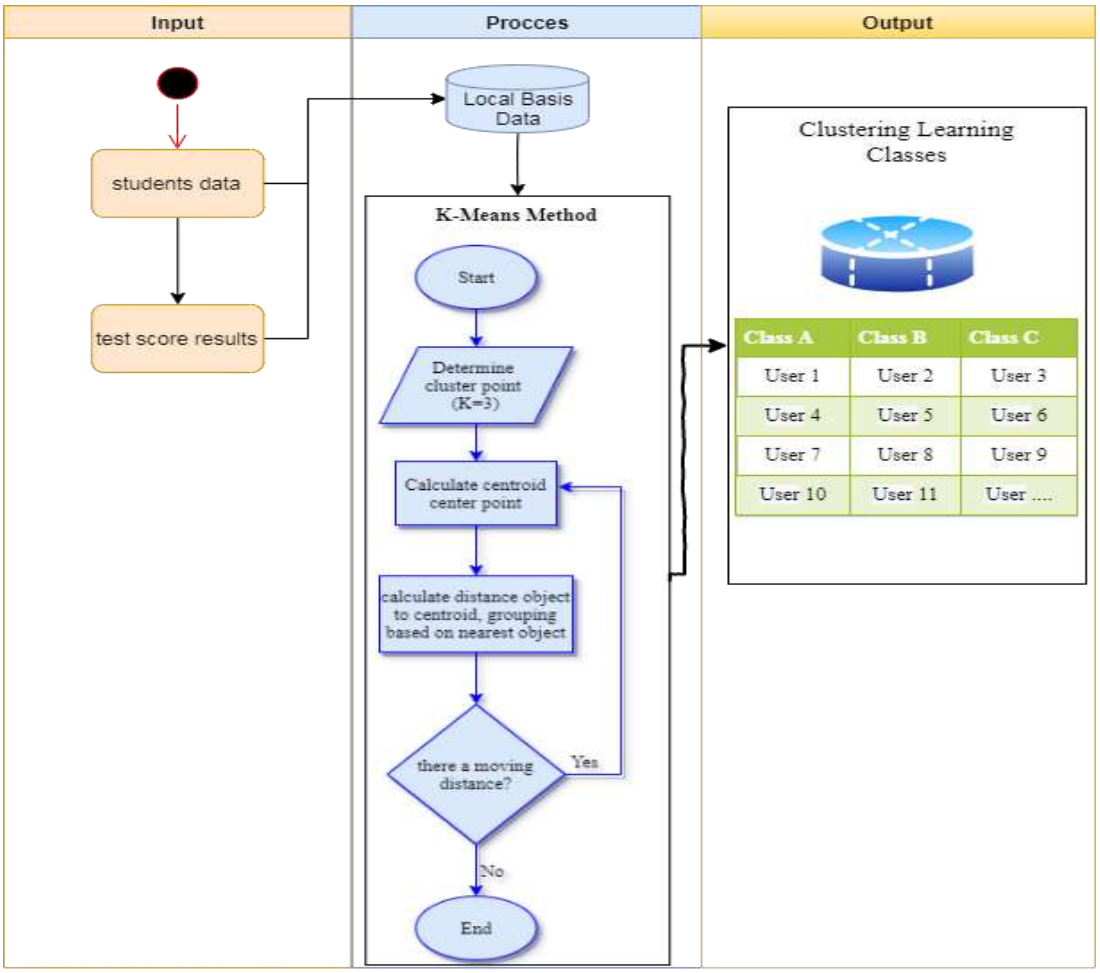

Figure 1. Framework system

The initial stage of the calculation using the K-means method is to determine the centroid point. There are 3 centroid points taken because there are 3 learning classes in this system. The class is class A, B, and C. The selected data is data 1 as centroid 1, data 4 as centroid 2, and data 10 as centroid point 3. The following are examples of data determined by the class using K-means method presented in Table 1.

The initial stage of the calculation using the k-means method is to determine the centroid point. There are 3 centroid points taken because there are 3 classes in this system. The class is class A, B, and C. The selected data is data 1 as centroid 1, data 4 as centroid 2, and data 10 as centroid 3. After determining the centroid data point in the process of the k-means method is iterating by finding the closest value from the predetermined centroid point. The following is the calculation used in the search for the closest distance to the first data.

Table 1. Data training

No	Name	Var 1	Var 2	Var 3	Var 4	Var 5
1	Habib	45	50	50	55	70
2	Aldi	92	87	80	80	85
3	Bima	50	45	50	55	65
4	Hasan	75	70	60	70	72
5	Elfira	75	70	78	80	78
6	Allisa	80	80	75	85	85
7	Nancy	78	75	70	80	70
8	Resty	90	90	80	85	80
9	Wulan	80	85	75	78	80
10	Winda	82	85	78	82	90

$$d(1,1) = \sqrt{(45-45)^2 + (50-50)^2 + (50-50)^2 + (55-55)^2 + (70-70)^2}$$
$$d(1,2) = \sqrt{(45-75)^2 + (50-70)^2 + (50-60)^2 + (55-70)^2 + (70-72)^2}$$
$$d(1,3) = \sqrt{(45-82)^2 + (50-85)^2 + (50-78)^2 + (55-82)^2 + (70-90)^2}$$

In the above calculation, the first count of the santri data is as stated in Table 2.

Table 2. Initial distance

No	Name	Centroid Point			Distance Value	Class
		1	2	3		
1	Habib	0	40	67	0	A
2	Aldi	73	35	11.7	11.7	C
3	Bima	8.7	40	69	8.6	A
4	Hasan	40	0	32.6	0	B
5	Elfira	52.7	21	20	20	C
6	Allisa	62	27	8.5	8.4	C
7	Nancy	52	15	24	15	B
8	Resty	74	36	14	14	C
9	Wulan	60.8	24	11	11	C
10	Winda	67	32.6	0	0	C

In Table 2 a distance search of 10 data. After searching for values closest next step is to check the value of the centroid point is changing or no. The following is a calculation to find a new centroid point in cluster 1.

$$C1(\text{Var } 1) = \frac{1}{2}(45+50)$$
$$C1(\text{Var } 2) = \frac{1}{2}(50+45)$$
$$C1(\text{Var } 3) = \frac{1}{2}(50+50)$$
$$C1(\text{Var } 4) = \frac{1}{2}(55+55)$$
$$C1(\text{Var } 5) = \frac{1}{2}(70+65)$$

The above calculation is a calculation for finding the new first centroid point as shown in Table 3. In Table 4 is the result of calculating the search for new centroid points. If there is a change iterate again until centroid value does not change using formula like searching for iteration 1. In Table 4 shows the iteration 2.

Table 3. New centroid

No	Variable 1	Variable 2	Variable 3	Variable 4	Variable 5
1	47.5	47.5	50	55	67,5
2	76,5	72,5	65	75	71
3	83,16667	82,83333	77,66667	81,66667	83

Table 4. Iteration 2

No	Name	Centroid Point			Distance Value	Class
		1	2	3		
1	Habib	4	46	64.6	4.3	A
2	Aldi	73.3	30	10	10.3	C
3	Bima	4.3	46	65.8	4.3	A
4	Hasan	40	7.7	28	7.7	B
5	Elfira	53	16	16	16	B
6	Allisa	63	21.5	6.3	6.3	C
7	Nancy	52.1	7.7	18	7.7	B
8	Resty	74.6	30	11	11	C
9	Wulan	61	19	6.6	6.6	C
10	Winda	68	27.6	7.4	7.4	C

In Table 5 is the search distance from 10 data. After searching for the closest value next step is to check the value of centroid point has changed or not. The following is a calculation to find a new centroid point in cluster 1. In Table 6 the centroid point does not change so that the iteration process is stopped, so that calculation process using the k-means method produces as in Table 7. Final result as shown in Table 8.

Table 5. New centroid 2

No	Variable 1	Variable 2	Variable 3	Variable 4	Variable 5
1	47.5	47.5	50	55	67.5
2	76	71.66667	69.33333	76.66667	73.33333
3	84.8	85.4	77.6	82	84

Table 6. Iteration 3

No	Name	Centroid Point			Distance Value	Class
		1	2	3		
1	Habib	4.3	47.8	67.2	4.3	A
2	Aldi	73	27.4	8.1	8.1	C
3	Bima	4.3	48	68.5	4.3	A
4	Hasan	40	11.7	30.5	11.7	B
5	Elfira	52.	10.5	19.3	10.6	B
6	Allisa	62.8	18	8.3	8.3	C
7	Nancy	52	6.1	20.3	20.3	B
8	Resty	74.6	27.5	8.9	8.9	C
9	Wulan	61	19	6.6	6.6	C
10	Winda	68	27.6	7.4	7.4	C

Table 7. Centroid tetap

No	Variable 1	Variable 2	Variable 3	Variable 4	Variable 5
1	47.5	47.5	50	55	67.5
2	76	71.7	69.3	76.7	73.3
3	84.8	85.4	77.6	82	84

Table 8 Final result

No	Name	Class
1	Habib	A
2	Aldi	C
3	Bima	A
4	Hasan	B
5	Elfira	B
6	Allisa	C
7	Nancy	B
8	Resty	C
9	Wulan	C
10	Winda	C

The accuracy/error calculation of the K-means method system that the author has made with manual calculations is used the MSE formula. Based on the formula in this study, 54 actual data (At) were obtained. These data are data obtained from educational institutions. While the system data (St) of 52. This data was obtained from the calculation of the system that the author made. In order to obtain the results of MSE system data and actual data as follows:

$$MSE = \frac{(54-52)^2}{54} = 0{,}074074$$

After calculating the accuracy of the system, it turns out there is an error 0.074074. This error is considered small because it is close to 0. This shows that the grouping done by the system has high accuracy so that it can be applied to the educational institution system.

4. CONCLUSION

Based on the system that has been created and tested conclusions can be drawn that the system which is made by the K-means method can be used to determine the class of learning with based on the results of the grade level exam scores. Values data in the form of determined subjects are then calculated using the k-means method to determine class. As well as the system which is created using the PHP programming language and data is taken from the MySQL database. System which is has been made to have a very low error rate of 0.074074 so that it can perform grouping well.

REFERENCES

[1] G S Permadi, A Kusworo, and R Gernowo, "Application Mail Tracking Using RSA Algorithm As Security Data and HOT-Fit a Model for Evaluation System," *31 in E3S Web of Conferences*, Semarang, 2018, doi: 10.1051/e3sconf/20183111007.

[2] Y Chen, *et al.,* "Coherent Clustering Method Based on Weighted Clustering of Multi-Indicator Panel Data," *IEEE Access* vol. 7, pp. 43462-43472, 2019, doi: 10.1109/ACCESS.2019.2907270.

[3] S Kumar, M Singh, "A novel clustering technique for efficient clustering of big data in Hadoop Ecosystem," *Big Data Mining and Analytics*, vol. 2, no. 4, pp. 240-247, 2019, doi: 10.26599/BDMA.2018.9020037.

[4] A D Indriyanti, D R Prehanto, G S Permadi, C. Mashuri, T.Z. Vitadiar, "Using Fuzzy Time Series (FTS) and Linear Programming for Production Planning and Planting Pattern Scheduling Red Onion" *in E3S Web of Conferences, Semarang*, vol. 125, p. 23007, 2019, doi: 10.1051/e3sconf/201912523007.

[5] Z Wang, Z Yu, C. L. P Chen, J You, T Gu, H-S Wong, J Zhang, "Clustering by Local Gravitation," *IEEE Transactions on Cybernetics*, vol. 48, no. 5, pp. 1383-1396, 2018, doi: 10.1109/TCYB.2017.2695218.

[6] T Liu, H Li, X Zhao, "Clustering by Search in Descending Order and Automatic Find of Density Peaks," *IEEE Access*, vol. 7, pp. 133772-133780, 2019, doi: 10.1109/ACCESS.2019.2939437.

[7] W Huang, A Ribeiro, "Hierarchical Clustering Given Confidence Intervals of Metric Distances," *IEEE Transactions on Signal Processing*, vol. 66, no. 10, pp. 2600-2615, 2018, doi: 10.1109/TSP.2018.2813322.

[8] G S Permadi, T Z Vitadiar, T Kistofer, A H Mujianto, "The Decision Making Trial And Evaluation Laboratory (Dematel) And Analytic Network Process (ANP) For Learning Material Evaluation System," in *E3S Web of Conferences, Semarang*, vol. 125, 2019.

[9] H Jia and Y-M Cheung, "Subspace Clustering of Categorical and Numerical Data With an Unknown Number of Clusters," *IEEE Transactions On Neural Networks And Learning Systems*, vol. 29, no. 8, pp. 3308-3325, 2017, doi: 10.1109/TNNLS.2017.2728138.

[10] T Kistofer, G S Permadi, T Z Vitadiar, "Development of Digital System Learning Media Using Digital Learning System," *Advances in Social Science, Education and Humanities Research*, vol. 379, pp. 177-182, VEIC, 2019.

[11] M Banikhalaf, M A Khder, "A Simple and Robust Clustering Scheme for Large-Scale and Dynamic VANETs," *IEEE Access*, vol. 8, pp. 103565-103575, 2020, doi: 10.1109/ACCESS.2020.2999368.

[12] W Liang, Y Zhang, J Xu, D Lin, "Optimization of Basic Clustering for Ensemble Clustering: An Information-Theoretic Perspective," *IEEE Access*, vol. 7, pp. 179048-179062, 2019, doi: 10.1109/ACCESS.2019.2950159.

[13] V Albert, D Sano, H Nindito, "Application of K-Means Algorithm for Cluster Analysis on Poverty of Provinces in Indonesia," *ComTech: Computer, Mathematics and Engineering Applications*, vol. 7, no. 2, pp. 141-150, 2016, doi: 10.21512/comtech.v7i2.2254.

[14] S G Lee, C Lee, "Developing an Improved Fingerprint Positioning Radio Map using the K-Means Clustering Algorithm," *International Conference on Information Networking (ICOIN)*, 2020, doi: 10.1109/ICOIN48656.2020.9016627.

[15] Y Zhou, R Xie, T Zhang, J Holguín-Veras, "Joint Distribution Center Location Problem for Restaurant Industry Based on Improved K-Means Algorithm With Penalty," *IEEE Access*, vol. 8, pp. 37746-37755, 2020, doi: 10.1109/ACCESS.2020.2975449.

[16] Z Wu, R Li, C Li, "Adaptive Speech Information Hiding Method Based on K-Means," *IEEE Access*, vol. 8, pp. 23308-23316, 2020, doi: 10.1109/ACCESS.2020.2970194.

[17] L Wang, S Ding, H Jia, "An Improvement of Spectral Clustering via Message Passing and Density Sensitive Similarity," *IEEE Access*, vol. 7, pp. 101054-101062, 2019, doi: 10.1109/ACCESS.2019.2929948.

[18] X Wang, C Shao, S Xu, S Zhang, W Xu, Y Gua, "Study on the Location of Private Clinics Based on K-Means Clustering Method and an Integrated Evaluation Model," *IEEE Access*, vol. 8, pp. 23069-23081, 2020, doi: 10.1109/ACCESS.2020.2967797.

[19] E Saboori, S Parsazad, A Sadeghi, "Improving the K-means algorithm using improved downhill simplex search," *2010 2nd International Conference on Software Technology and Engineering*, vol. 2, pp. V2-350, 2010, doi: 10.1109/ICSTE.2010.5608792.

[20] D R Prehanto, A D Indriyanti, K D Nuryana, S Soeryanto, A S Mubarok, "Use of Naïve Bayes classifier algorithm to detect customers' interests in buying internet token," *Journal of Physics: Conference Series*, vol. 1402, no. 6, p. 066069, *IOP Publishing*. 2019.

[21] J Hou, A Zhang, "Enhanced Dominant Sets Clustering by Cluster Expansion," *IEEE Access*, vol. 6, pp. 8916-8924, 2018, doi: 10.1109/ACCESS.2018.2808485.

[22] W'An Zhou, Q Zhou, "Deep Embedded Clustering With Adversarial Distribution Adaptation," *IEEE Access*, vol. 7, pp. 113801-113809, 2019, doi: 10.1109/ACCESS.2019.2935388.

[23] C Mashuri, A H Mujianto, H Sucipto, R Y Arsam, G S Permadi, "Production Time Optimization using Campbell Dudek Smith (CDS) Algorithm for Production Scheduling," *E3S Web of Conferences*, vol. 125, p. 23009. 2019.

[24] K P. Sinaga, M-S Yang, "Unsupervised K-Means Clustering Algorithm," *IEEE Access*, vol. 8, pp. 80716-80727, 2020, doi: 10.1109/ACCESS.2020.2988796.

[25] N Pang, J Zhang, C Zhang, X Qin, "Parallel Hierarchical Subspace Clustering of Categorical Data," *IEEE Transactions on Computers*, vol. 68, no. 4, pp. 542-555, 2019, doi: 10.1109/TC.2018.2879332.

[26] G S Permadi, T Z Vitadiar, T Kistofer, "Sistem Evaluasi Bahan Pembelajaran Menggunakan Metode DEMATEL dan ANP," *JSINBIS (Jurnal Sistem Informasi Bisnis)*, vol. 9, no. 2, pp. 228-235, 2019, doi: 10.21456/vol9iss2pp228-235.

BIOGRAPHIES OF AUTHORS

Aries Dwi Indriyanti received hir S.Kom degree from the Information Systems Department, STIKOM, Surabaya, Indonesia, at 1998, and an M.Kom degree from the Masters in Information Systems, Postgraduate School, Diponegoro University, Semarang, Indonesia in 2009. She is currently completing a doctoral program in information systems, Diponegoro University. She is currently a lecturer and researcher at Department of Information Systems, State University of Surabaya, Indonesia. His current research interests include statistics, forecasting, supply chain and big data.

Dedy Rahman Prehanto received her S.Kom degree from the Information Systems Department, STIKOM, Surabaya, Indonesia, at 2005, and an M.Kom degree from the Masters in Information Systems, Postgraduate School, Diponegoro University, Semarang, Indonesia in 2012. He is currently completing a doctoral program in information systems, Diponegoro University. He is currently a lecturer and researcher at Department of Information Systems, State University of Surabaya, Indonesia. His current research interests include big data, expert systems, and IoT.

Tanhella Zein Vitadiar received hir S.SI degree from the Information Systems Department, University of Jember, Indonesia, at 2014, and an M.Kom degree from the Masters in Information Systems, Postgraduate School, Diponegoro University, Semarang, Indonesia in 2017. He is currently a lecturer and researcher at Information systems department, Hashim Ashari University, Jombang, Indonesia. His current research interests include machine learning, expert systems, forecasting, and scheduling.