The K-Nearest Neighbor Algorithm for the Classification of Internet Users in Rural Campus

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***Abstract*—Internet users can be classified based on their activities so that these activities can determine their behavior. One of these classification methods can be done using the K-Nearest Neighbor Algorithm. The purpose of this study was to classify the characteristics of students in accessing the internet using wi-fi in rural campuses. This study involved 60 students as respondents from rural campuses, of which 40 respondents came from the Informatics Engineering group, 18 respondents from Information Systems, and two respondents from Information Management. The classification of user characteristics is based on the study program, the device used, and the application accessed. While the results obtained show that as many as 25 students who use rural campus Wi-Fi access are used to learn to use browsers in search applications, and 5 other students are used to search for news. In addition, 27 other students use Wi-fi for entertainment, and the last three students use Wi-fi for everything, be it learning, entertainment, and news.**

Keywords—classification, k-nearest neighbor, internet, wi-fi, rural campus.

I. INTRODUCTION

The internet is a link between humans using computer facilities to interact with each other in different places [1]. The number of internet users in Indonesia in January 2021 was recorded at 202.6 million with a penetration of 73.7%. Of the total 202.6 million internet users in Indonesia, 96.4 percent of them use smartphones to access the internet [2]. The development of the internet has changed the lifestyle of people in studying, working, communicating, and other aspects of life in a negative or positive direction [3]. The use of the internet among the public is certainly supported by the function and purpose of the initial development of the internet, such as to build easy access to information, communication [4], and to make it easier to work [5, 6]. In addition, the use of the internet among the public is certainly supported by the function and purpose of the initial development of the internet [7, 8], such as to build easy access to information, communication, and to make it easier to work [9]. At present, internet access can be done in two network modes, namely wired and wireless-based networks [10]. People now use wireless networks to access the internet [11, 12], this is one of the advances in technology, where the use of wireless networks is considered cheaper and easier [13-15]. a transmitting device on a wireless network is a device called a wireless access point or better known as Wi-Fi [16]. With the Wi-Fi network, it is easier to access by mobile with hardware and network maintenance which is quite cheap and easy, so it is widely used by the public today [17]. The provision of free Wi-Fi facilities in educational settings is not fully used to access academic information only [18]. It is necessary to have analysis and grouping to find out what sites are often accessed by the community in an educational environment [19]. Internet users can know their behavior through the classification of their activities [20], this is commonly known as a Cyber Profile [21]. Classification can be done using the K-Nearest Neighbor or K-NN algorithm [22], which is the simplest algorithm where the results of a new instance are classified based on the majority of the k-nearest neighbor category [23]. Not only that, K-NN is an algorithm that can be used in many fields such as statistical pattern recognition [24-26], data grouping, data processing, image processing, and other applications [27, 28]. This study aims to classify internet sites that are frequently accessed by Rural Campus [29] students when using free internet services using the k-Nearest Neighbor algorithm. This research is expected to be able to generate considerations for the campus in managing internet access better, as well as a new understanding of the implementation of the k-NN algorithm in the Rural Campus environment.

II. METHOD

The research is experimental, where experimental research is a systematic research method that seeks to find the effect of a particular treatment given to a variable on another variable [30], which is not given treatment under controlled conditions [31]. Experimental research is a type of quantitative research that is very strong in measuring causal relationships [32, 33]. The following is the experimental research procedure: First, Identifying the problem [15, 16, 18, 24, 34, 35], namely identifying the existing network management in rural campus and what kind of use it is for students [22, 36-39]. Second, conducting a literature study, namely reading previous research that discusses the campus network and the K-NN algorithm [15, 16, 24, 25, 34]. Three, identification of variables, namely determining the variables that will be used as research material in the scope of rural campus [19]. Four, data collection, namely data collection in the form of questionnaires that were distributed randomly to

students [24]. Five, after data collection, the data obtained is examined and sorted to proceed to the analysis stage using the K-NN algorithm [27]. Six, the results of data analysis, namely the results of data analysis obtained from calculations using the K-NN algorithm [23]. Data analysis using the K-NN Algorithm can be seen in Figure 1.

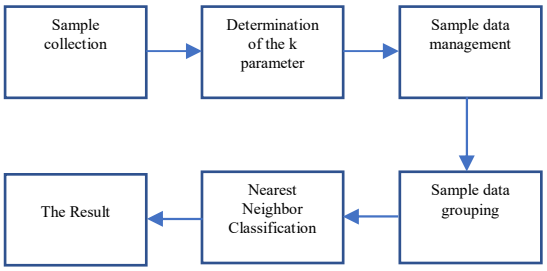

Fig. 1. The K-Nearest Neighbor Algorithm

The sample collection carried out in this study using the Slovin formula [17]. Where the Slovin formula is a formula or formula for calculating the minimum number of samples if the behavior of a population is not known with certainty. The research data collected were 60 respondents from 3 study programs in the rural campus. This data collection was carried out randomly by distributing online questionnaires, with the results of 40 respondents from Informatics Engineering, 18 respondents from Information Systems, and two respondents from Information Management.

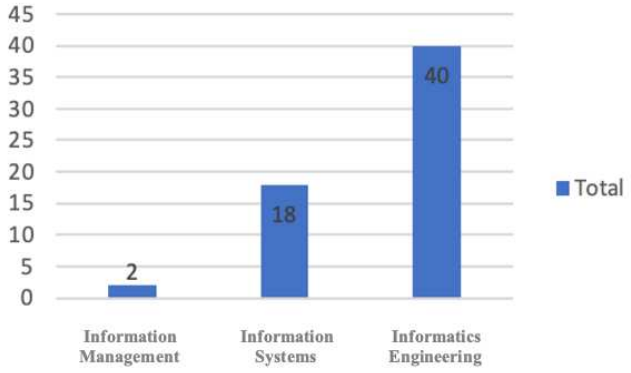

Fig. 2. The Respondents Based on Study Program

Furthermore, based on the devices used to access the internet as follows, 38 respondents answered using mobile smartphones, while 22 others used computers or laptops.

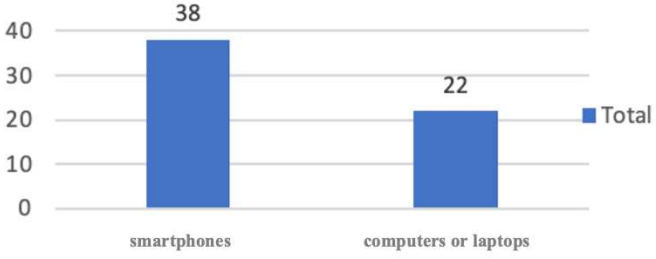

Fig. 3. The Respondents Based on the devices

Next, we determine the parameter k (number of nearest neighbors), where the value of k used is three, this is the result of grouping the sample data from the smallest to the largest value, by determining the three closest values from the smallest value, and the three closest values from the largest value. Then, the sample data is processed by calculating the square of the euclidian distance of each object to the given sample data [40].

$$d(x_i, x_j) = \sum_{r=1}^{n} |x_i - y_i|$$

$d(x_i, x_j)$: Eucledean Distance
x_i : record i
x_j : record j

Fig. 4. The Respondents Euclidean Distance [40]

Then sort the previous result values into groups that have the smallest distance [25], then collect the Y value which is the result of the nearest neighbor classification, so that the nearest neighbor category can be calculated from predictable query instances.

III. Results and Discussion

Data collection of respondents based on the devices used to access the internet on the rural campus wi-fi network can be seen in table one.

TABLE I. Respondents and Access Tools

Row Labels	Count of Study Program	Count of Level
Information Management	2	2
Level three	2	2
Smartphone phone	1	1
Computer or Laptops	1	1
Information System	18	18
Level one	7	7
Smartphone phone	5	5
Computer or Laptops	2	2
Level two	6	6
Smartphone phone	3	3
Computer or Laptops	3	3
Level three	5	5
Smartphone phone	2	2
Computer or Laptops	3	3
Teknik Informatika	40	40
Level one	6	6
Smartphone phone	3	3
Computer or Laptops	3	3
Level two	11	11
Smartphone phone	10	10
Computer or Laptops	1	1
Level three	14	14
Smartphone phone	9	9
Computer or Laptops	5	5
Level four	9	9
Smartphone phone	5	5
Computer or Laptops	4	4
Grand Total	60	60

In addition to the device used, the classification of respondents is also grouped based on the application used to access the rural campus wi-fi network.

TABLE II. ACCESS TOOLS AND APPLICATIONS

Access Tools	Applications
Smartphone phone	WhatsApp; Youtube; Google Chrome
Smartphone phone	Instagram; Whattsapp; Youtube; e-commerce (Lazada, Tokopedia, shopee)
Computer or Laptops	Google Chrome
Computer or Laptops	WhatsApp; Google Chrome; E-learning campus; Game Online (PUBG, Mobile legend)
Smartphone phone	Google Chrome; Google Classroom; E-learning campus
Smartphone phone	Instagram
Computer or Laptops	Youtube; Google Chrome; e-commerce (Lazada, Tokopedia, shopee)
Smartphone phone	Instagram; Whattsapp; Google Chrome; Google Drive; Google Classroom; E-learning campus; E-mail
Computer or Laptops	Instagram; Google Chrome; Game Online (PUBG, Mobile legend); Tiktok
Computer or Laptops	Instagram; Google Chrome; Google Drive; Google Classroom
Smartphone phone	News Website (Inews, Detik)
Computer or Laptops	Instagram; Whattsapp; Youtube; Google Chrome; Google Drive; E-learning campus; e-commerce (Lazada, Tokopedia, Shopee); Game Online (PUBG, Mobile legend); News Website (News, Detik.com); JOOX, spotify
Smartphone phone	Instagram; Whatsapp; Facebook; Viu; Google Chrome; Google Classroom; E-learning campus; e-mail
Smartphone phone	Instagram
Smartphone phone	Google Chrome; Viu; Browser
Smartphone phone	Instagram; Whatsapp; Facebook; Youtube; Google Play; Google Drive; Google Classroom; E-learning campus; e-mail; e-commerce (Lazada, Tokopedia, Shopee); Game Online (PUBG, Mobile legend)
Smartphone phone	WhatsApp; Youtube; E-learning campus
Smartphone phone	Google Chrome; Google Classroom; E-learning campus
Smartphone phone	Instagram; Whattsapp; Twitter; Youtube; Google Chrome; E-learning campus; E-mail; e-commerce (Lazada, Tokopedia, shopee); Game Online (PUBG, Mobile legend)
Computer or Laptops	Youtube
Computer or Laptops	Youtube
Computer or Laptops	Google Chrome; Google Drive; E-learning campus; E-mail
Smartphone phone	Instagram; Youtube
Computer or Laptops	Youtube; Google Drive; E-learning campus
Smartphone phone	WhatsApp; Twitter; Youtube; Google Chrome; E-learning campus
Smartphone phone	Instagram; Whatsapp; Facebook; Google Chrome; E-learning campus; E-mail
Smartphone phone	Google Chrome; Google Classroom; E-learning campus
Smartphone phone	Instagram; Whattsapp; E-learning campus
Smartphone phone	Whatsapp
Smartphone phone	Whatsapp
Computer or Laptops	WhatsApp; Youtube; Google Chrome; Google Drive; Google Classroom; E-learning campus
Computer or Laptops	Youtube
Smartphone phone	Whatsapp
Smartphone phone	Instagram; Whatsapp; Facebook; Google Chrome; E-learning campus
Smartphone phone	WhatsApp; Youtube; Google Chrome; Google Classroom; E-learning campus; e-commerce (Lazada, Tokopedia, shopee)
Computer or Laptops	E-learning campus; E-mail
Computer or Laptops	Youtube
Smartphone phone	Google Chrome
Computer or Laptops	Google Chrome
Smartphone phone	Whatsapp
Smartphone phone	Google Drive
Computer or Laptops	Youtube; Google Chrome; Google Classroom; E-learning campus; E-mail
Computer or Laptops	Instagram; Whatsapp; Facebook; Youtube; Viu; Google Chrome; Google Play; Google Drive; E-learning campus; Game Online (PUBG, Mobile legend); JOOX, Spotify
Smartphone phone	Instagram; Whatsapp; Facebook; Youtube; Google Chrome; E-learning campus; Game Online (PUBG, Mobile legend); News Website (News, Detik); JOOX, Spotify
Computer or Laptops	Instagram; Whatsapp; Facebook; Twitter; Youtube; Viu; Google Chrome; Google Classroom; E-learning campus; E-mail; e-commerce (Lazada, Tokopedia, Shopee); Game Online (PUBG, Mobile legend); News Website (News, Detik); JOOX, Spotify
Smartphone phone	WhatsApp; Youtube; Google Chrome
Smartphone phone	Instagram; Whattsapp; Youtube; e-commerce (Lazada, Tokopedia, shopee)
Computer or Laptops	Google Chrome
Computer or Laptops	WhatsApp; Google Chrome; E-learning campus; Game Online (PUBG, Mobile legend)
Smartphone phone	Google Chrome; Google Classroom; E-learning campus
Smartphone phone	Instagram
Computer or Laptops	Youtube; Google Chrome; e-commerce (Lazada, Tokopedia, shopee)
Smartphone phone	WhatsApp; Google Chrome; Google Play; Google Drive; E-learning campus
Smartphone phone	Instagram
Smartphone phone	Instagram; Whattsapp; Facebook; Youtube; Google Chrome; E-learning campus; e-commerce (Lazada, Tokopedia, shopee); Game Online (PUBG, Mobile legend); News (Inews, Detik)
Computer or Laptops	WhatsApp; Youtube; E-learning campus
Smartphone phone	Instagram; Whattsapp; Youtube
Computer or Laptops	Google Chrome; E-learning campus
Smartphone phone	Instagram; Whattsapp; Youtube
Computer or Laptops	Instagram; Youtube; Google Chrome; Google Classroom; E-learning campus
Smartphone phone	Instagram; Youtube; Google Chrome; E-learning campus; JOOX, Spotify
Smartphone phone	Instagram; Whattsapp; Youtube; Google Chrome; Google Classroom; E-learning campus
Computer or Laptops	Youtube; Google Chrome; Google Classroom; E-learning campus
Smartphone phone	Instagram; Whattsapp; Youtube; Viu; Google Chrome; E-learning campus
Smartphone phone	Instagram; Whattsapp; Youtube; Google Chrome; Google Play; Google Drive; E-learning campus
Smartphone phone	Google Chrome; E-learning campus; E-mail
Smartphone phone	Instagram; Whattsapp; Youtube; Google Chrome; E-learning campus

Determining the classification using the k-nearest neighbor algorithm, the value of k must be determined first, therefore in this study, the value of k is determined by three as the determinants of the classification.

TABLE III. APPLICATIONS AND NUMBER OF VISITS

Applications	Number of visits
Tiktok	1
Browser	1
Twitter	3
Google Play	4
Viu	4
Music Streaming	5
News Website	5
E-commerce	8
Facebook	8
Game Online	9
Email	10
Google Drive	11
Google Classroom	14
Instagram	27
Whatsapp	31
Youtube	31
E-learning campus	35
Google Chrome	37

To get the results of the interval calculation, the data collected is sorted from the smallest to the largest value, then the value of k is determined to take the nearest neighbor from the largest and smallest values.

From the order of the smallest and largest data, determine the three closest numbers to be made into a temporary group. For data that is not included in a group, it is used as sample data to calculate the square of the Euclidean distance for each group object. The sample data used as a determinant of

the group is the value of visits that are not included in the three closest neighbors of the smallest and largest values.

TABLE IV. EUCLID DISTANCE SQUARED SAMPLE DATA

Data	Data Sample	Result
1	6	7.071067812
2	6	5.656854249
3	6	4.242640687
4	6	2.828427125
5	6	1.414213562

From the results of the calculation of the square of the Euclidean distance, there are three classifications, then the amount of data is divided into three groups from the results of the square of the Euclidean distance to determine the interval distance between groups.

TABLE V. ORDER GROUP K = 3

Applications	Number of Visits	Groups
Tiktok	1	1
Browser	1	1
Twitter	3	1
Google Play	4	1
Viu	4	1
Music Streaming	5	1
News Website	5	1
E-commerce	8	1
Facebook	8	1
Game Online	9	1
E-mail	10	1
Google Drive	11	1
Google Classroom	14	3
Instagram	27	2
Whatsapp	31	2
Youtube	31	2
E-learning campus	35	2
Google Chrome	37	2

The following table shows the results of the classification of rural campus wifi network usage based on frequently used applications

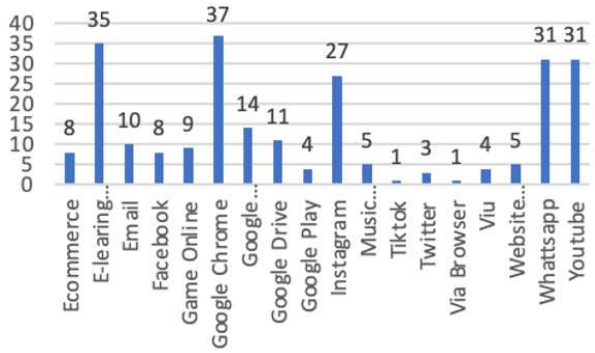

Fig. 5. Graph of Number of Visits by Application

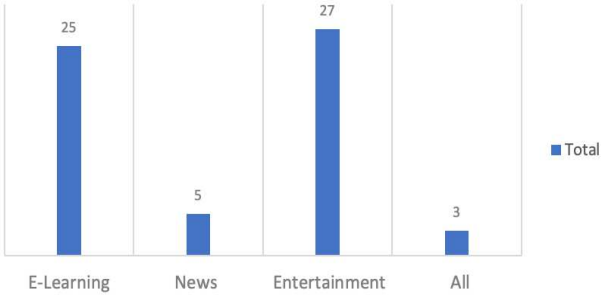

Fig. 6. Access Content

Meanwhile, based on the type of content accessed by rural campus students when connected to the internet, it is shown in the following figure six.

Following are the results of respondent data based on three classifications, namely: Interval one, Interval two, and Interval three. Furthermore, Interval one is a group with 12 members which are the most members with an interval of 1-13, meaning that the value of visits ranging from 1 to 13 times is carried out by students, including the high group with the lowest visits. While Interval two is the group with the least number of members, but visits to the site are not the lowest, with intervals of visits ranging from 13 to 25 times carried out by 60 respondents. And Interval three is a group with a moderate number of members but most frequently visited by students with intervals of visits ranging from 25 times to 37 times from 60 respondents.

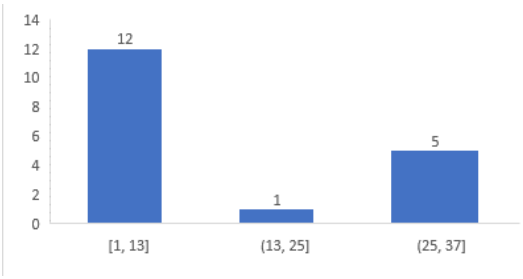

Fig. 7. Interval classification graph

Group One, the number of visits to e-commerce applications, Facebook eight times, E-mail 10 times, Online games nine times, Google play, Viu four times, Google Drive 11 visits, Music streaming five times, and Twitter has three visits, so it is included in the Interval One classification with the highest number of members, namely 12 applications with a distance of 1-13 intervals. This means that the value of visits in the range of 1 to 13 times was carried out by students including the high group with the lowest visits. While group Two, the number of visits to the Google classroom application is 14 times, so it is included in the Interval Two classification which is the group with the least number of members, namely only one application with an interval of 13-25 times, so it is included in the group with an average number of visits. . Finally, group Three, with the Instagram application being visited 27 times, WhatsApp and Youtube 31 times, and Google Chrome 37 times, is included in the third interval classification with an interval of visits of 25-37 times, therefore the visit value ranges from 25 to 37 times. is the group with the highest number of visits. Based

on these results, 25 students using rural campus Wi-Fi access are used for learning using a browser on a search application, and 5 other students are used to search for news. In addition, 27 more students use Wi-fi for entertainment, and the last three students use Wi-fi for everything, be it learning, entertainment and news.

IV. CONCLUSION

Based on the results of research that has been done shows that the respondents, in this case, are students in rural campuses accessing the internet via a wi-fi network with three classifications, namely; high, medium, and low, so that the Euclidean distance value formed in each group is 12, of which 37% most frequently access Google Chrome applications using computers or laptops and smartphones.

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