

IMPLEMENTATION OF K-NEAREST NEIGHBOR METHOD FOR SELECTION OF NEW EMPLOYEE CANDIDATES (CASE STUDY: CV. SYNTAX CORPORATION INDONESIA)

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ABSTRACT

K-Nearest Neighbor (KNN) is a method that belongs to the group in classifying data that is simple and easy to implement, effective on larger data, and can classify data appropriately. One of the advantages possessed by the K-Nearest Neighbor algorithm is that it can be applied to large amounts of data and has a lot of noise so this method is quite easy to implement. This study aims to utilize the advantages of the K-NN algorithm in data-based classification to increase efficiency and accuracy in the employee selection process in determining suitable employee candidates by the criteria determined by the company. The results showed that the results of employee presets received from 21 testing data were 51% and for employee presentations that failed as much as 49% while from the entire data set of 140 data, the accuracy level produced after being tested using rapid miner tools resulted in 82% accuracy. So it can be concluded that the percentage accuracy of 82% shows that most prospective employees have been predicted or classified correctly by the model. This high level of accuracy can be an indication that the K-Nearest Neighbor method used in combination with Rapidminer can handle prospective employee data well.

KEYWORDS Employee, Classification, K-Nearest Neighbor, Rapidminer.



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INTRODUCTION

A company certainly has employees or employees, where employees are an important component in the running of a company because almost all company activities are carried out by employees. Along with the growth and development of the company, there is a need to add a workforce or new employees. To determine whether

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or not it is feasible to be an employee, the company will make a selection to produce competent employees who are suitable and needed by the company.

In general, the stages of employee acceptance include *screening* or selection of job applications and CV (*Curriculum Vitae*), written tests (logic and basic mathematics) for certain sections, *interview* tests, health checks, and the last stage, namely signing contracts. The selection of new employees is the foundation of any company's growth and sustainability. With a good selection process, companies can ensure that they bring in individuals who not only have the right technical qualifications, but also values, competencies, and potentials that are in line with the company's goals and culture. In an era of ever-changing business dynamics and increasingly fierce competition, employee selection is not a task that can be considered trivial. Instead, the employee selection process becomes a strategic element in securing the company's future. Decisions made in the selection process can have a long-term impact on a company's productivity, efficiency, and overall success.

CV. Syntax Corporation Indonesia (SCI) is a company engaged in services, located on Jl. Sultan Ageng Tirtayasa No. 12 Kedungjaya, Cirebon. In the process of accepting talent or new employees, many things must be considered, usually, company staff when *screening* application files or job CVs prioritize candidates who have competency certificates, as well as the completeness of other supporting files. After the process is complete, it will proceed to the *interview* process. However, in the process, sometimes companies have difficulty recruiting job applicants, so applicants who do not meet the criteria or needs are included in the interview process, or even accepted to work at the company. As a result, the company will have employees who are not needed by the company. This can indirectly hamper the company's productivity (Hertyana, 2019). The company has its standards in selecting prospective new employees, in the selection process prospective employees must pass several tests including: (1) administrative selection, this selection is carried out by verifying job application documents including ID cards, CVs, and the last diploma of prospective employees. (2) After the completion of personal data, prospective employees must also complete personal data with a certificate of competence. This selection is carried out by looking at the suitability of the competency certificate with the field to be applied for by prospective employees. (3) An academic potential test is conducted to measure the level of intelligence at which the applicant is declared passed if he achieves a minimum score of 80. (4) This test interview test is conducted to determine the character, value of religiosity, communication skills and high interest in learning possessed by applicants.

To minimize the above problems, the author uses the data mining method. Data mining is the process of sifting through large amounts of data in search of meaningful patterns and insights. This includes data collection, extraction, analysis, and statistical measurement. *Knowledge discovery, knowledge extraction, data/pattern analysis, information harvesting*, and other terms are used to describe data mining (Arhami et al., 2020). Because the problem is how to facilitate the company in making decisions, the author uses the K-Nearest Neighbor (KNN) algorithm system.

Implementation of K-Nearest Neighbor Method for Selection of New Employee Candidates (Case Study: CV. Syntax Corporation Indonesia)

K-Nearest Neighbor (KNN) is a method that belongs to the group in classifying data that is simple and easy to implement, effective on larger data, and can classify data appropriately. Therefore, the KNN method is in the data used in this study. One of the advantages of the K-Nearest Neighbor algorithm is that it can be applied to large amounts of data and has a lot of *noise* so this method is quite easy to implement.

Based on research conducted (Supriana & Astuti, 2019), entitled "Implementation of K-Nearest Neighbor on Determining Poor Families for Tabanan Regency Social Office", the high poverty rate in Tabanan Regency which reached 5% made the relevant agencies to overcome it, but the poverty alleviation program that has been carried out is still not optimal because the data used as a reference is inaccurate. To overcome this, a system was created that can determine poor families correctly. The test results of 12 data were identified and classified by the system with 2 classification differences when compared to the manual process, the accuracy of the resulting data was 83.33%.

Research by (Sitepu & Buulolo, 2017) Number 1 Vol.7 entitled "Implementation of the Nearest Neighbor Algorithm in Accepting New Employees at MTS Ikhwanuts Tsalits Talun Kenas", this study states that K-NN is effective in the employee recruitment system by calculating the value of closeness between old cases and new cases. Each scoEachetermined by the user with the specified requirements, namely GPA scores, TOEFL scores, achievements, experience, age, and status.

Research conducted by (Khasanah et al., 2016) entitled "Classification of White Blood Cells Based on Color and Shape Characteristics by the K-Nearest Neighbor (K-NN) Method" states Classifying blood cells by type using a microscope has long been a standard practice in hatologyhaematologyies. Haematology laboratories use it as the main diagnostic and monitoring tool. There are also time-consuming manual procedures to pass a series of laboratory tests. As a result, the study focused on the early stages of the automatic classification of white blood cell types in the medical field. Blood cell morphology can be used in image processing techniques to address time problems and early diagnosis. Researchers used K-Nearest Neighbor to classify white blood cells based on cell morphology (K-NN). Hough circle, threshold, and feature extraction are the image processing algorithms used. Finally, the K-Nearest Neighbor (K-NN) classification is used. To identify the type of image, 100 images were analyzed. Results from segmentation and classification tests showed accuracy rates of 78% and 64%, respectively. Another study discusses the application of K-Means in the Geographic Information System for Grouping Crime Rates in Malang City. The results of the research analysis obtained the smallest accuracy analysis using the Davies Bouldin Index, which is 2,401 with the division of safe intensity areas (C1), namely Kedungkandang District, in the cluster (C2) is quite vulnerable, B District, in the cluster (C3) is vulnerable, namely Klojen, Sukun and in the very vulnerable cluster (C4). Mapping is done using QGIS 2.18 tools. From some of the research above, it can be concluded that the K-Means method can and is suitable for grouping data in Geographic Information Systems (Wijaya et al., 2023).

Research conducted by (Dzikrulloh, 2017) with the title: Application of the K-Nearest Neighbor (KNN) Method and the Weighted Product (WP) Method in Accepting Prospective Teachers and New Administration Employees with Technology Insight (Case Study: Muhammadiyah 2 Kediri Vocational High School) states that, making a program using a combination of the K – Nearest Neighbor and Weighted Product methods for the acceptance of prospective teachers and new administrative employees. Data collection using manual methods is the reference for making this program. The KNN method is used to determine distance with a classification of good, medium and bad criteria. Then the calculation results are inputted into the Weighted Product process to rank the best employees. The test results by comparing the selection results of prospective employees with the precissiprecisionall testing system obtained an accuracy value of 94%, and precissioprecision reconf all 80%.

Research conducted by (Imron & Kusumah, 2018) Number 1 Vol. 1 entitled "Application Of Data Mining Classification Method For Student Graduation Prediction Using K-Nearest Neighbor (K-NN) Algorithm" states that student graduation rate is one of the indicators to improve the accreditation of a course. It is necessary to monitor and evaluate the graduation of residencies, timely or not. One of them is predicting graduation rates by utilizing data mining techniques. The Data mining classification method used is the K-Nearest Neighbor (K-NN) algorithm. The data used came from student data, student grade data, and student graduation data for the years 2010-2012 with a total of 2,189 records. The attributes used are gender, school origin, and IP study program Semester 1-6. The results showed that the K-NN method produced a high accuracy of 89.04%.

Based on the problems described above, this study aims to implement a decision support system to select new employees on CVs. Syntax Corporation Indonesia (SCI) Cirebon. Then in this study, the K-Nearest Neighbor method was applied to select new employees on CVs. Syntax Corporation Indonesia (SCI) Cirebon makes it easier for companies to classify new employees as accepted or not accepted.

RESEARCH METHOD

This study uses qualitative methods using the K-Nearest Neighbor algorithm to determine the classification results in the form of recommendations for accepting prospective employees. The research steps are :

Algoritma K-Nearest Neighbor (Anshori et al., 2018)

1. Specify Parameter k number of closest neighbours.
2. Calculate the Euclidean Distance of each object against the existing data sample with equation (1)

$$d_i = \sqrt{\sum^p (x_{2i} - x_{1i})^2} \dots\dots\dots (1) \quad i=1$$

X1 = data sample ; X2 = Test Data ; i = Variable Data; d = Distance; p= Data Dimensions ;

3. Sort objects into groups with a small Euclidean distance.

The K-Nearest Neighbor of an instance x is the K instance with the smallest distance (nearest) to x. The proximity and distance of neighbours are calculated based on Euclidean Distance using equation (2)

$$D(a,b)= \sqrt{\sum^d (a - b)^2} \dots\dots\dots (2) \quad k=1 \quad k \quad k$$

Where the matrix D (a,b) represents the scalar distance from both vectors a and b of the matrix. To determine the K value seen from the number of classifications, if the number is even, you should use an odd K value, on the other hand, if the number of classifications is odd, you should use an even K value. The process of the K-Nearest Neighbor method can be seen in Figure 1. (Kurniawan & Saputra, 2019).

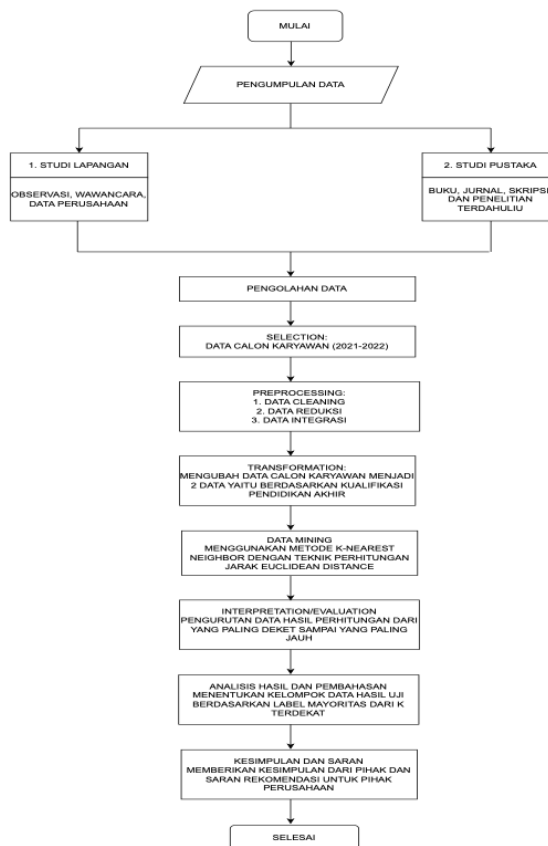


Figure 1. KNN Testing Process Flowchart

RESULT AND DISCUSSION

K-Nearest Neighbor Test

In the calculation of K-NN to determine prospective employees on CV. Syntax Corporation Indonesia uses criteria and weights, consisting of the latest Education criteria, certificates of expertise, academic test scores and interview test scores, where the last Education consists of attributes (SMA/SMK with weights (1), DIII with weights (2), and SI-S2 with weights (3)). The criteria for expertise certificates consist of attributes (1 certificate of expertise with a weight (1) and <2 certificates of expertise with a weight (2)). The criteria for academic test scores consist of attributes (<25 with weights (1), 25-50 with weights (2), 50-80 with weights (3) and <80 with weights (4)). And for the criteria for the value of the interview test results consist of attributes (<25 with weight (1), 25-50 with weight (2), 50-80 with weight (3) and <80 with weight (4)). Here are the criteria and weights used by researchers. In this process, what is used as an evaluation of test data is prospective employee acceptance data and then compared with existing training data. The Data Set used is 21 data which can be seen in Table 1.

Table 1. Prospective Employee Dataset

No	Name	Recent Education	Academic Test Scores	Interview Test Scores	Certificate of Expertise
1	NM	SI	55	55	0
2	SL	SI	53	53	0
3	JS	SI	44	44	0
4	MR	SI	80	86	1
5	FA	SI	77	77	0
6	DP	SI	77	77	0
7	TF	SI	71	71	0
8	NE	SI	82	80	0
9	M. MR	SI	82	80	0
10	NS	SI	80	80	1
11	L F.S	DIII	83	82	0
12	SP	SI	84	82	2
13	RP	SI	80	80	0
14	IA	SI	83	82	0
15	An A D.L	SI	81	82	3
16	PRA	SI	81	83	0
17	E R F	SI	77	77	0
18	SA	SI	77	77	0
19	P I F	SI	77	77	0
20	IF	SI	82	81	0
21	R S	SI	86	84	0

After obtaining weights according to the variables that have been determined based on the dataset and training data above, then the next step is to perform calculations using Euclidean Distance. The table below displays the calculation results using the formula.

Table 2. Euclidean Distance Calculation

Data		Euclidean Distance Calculation	Result
1	21	$= \sqrt{(3-3)^2 + (0-0)^2 + (3-4)^2 + (3-4)^2}$ $= \sqrt{(0)^2 + (0)^2 + (-1)^2 + (-1)^2}$	1,414
2	21	$= \sqrt{(3-3)^2 + (0-0)^2 + (3-4)^2 + (3-4)^2}$ $= \sqrt{(0)^2 + (0)^2 + (-1)^2 + (-1)^2}$	1,414
3	21	$= \sqrt{(3-3)^2 + (0-0)^2 + (2-4)^2 + (2-4)^2}$ $= \sqrt{(0)^2 + (0)^2 + (-2)^2 + (-2)^2}$	2.828
4	21	$= \sqrt{(3-3)^2 + (1-0)^2 + (3-4)^2 + (4-4)^2}$ $= \sqrt{(0)^2 + (1)^2 + (-1)^2 + (-0)^2}$	1.414
5	21	$= \sqrt{(3-3)^2 + (0-0)^2 + (3-4)^2 + (3-4)^2}$ $= \sqrt{(0)^2 + (0)^2 + (-1)^2 + (-1)^2}$	1.414
6	21	$= \sqrt{(3-3)^2 + (0-0)^2 + (3-4)^2 + (3-4)^2}$ $= \sqrt{(0)^2 + (0)^2 + (-1)^2 + (-1)^2}$	1.414
7	21	$= \sqrt{(3-3)^2 + (0-0)^2 + (3-4)^2 + (3-4)^2}$ $= \sqrt{(0)^2 + (0)^2 + (-1)^2 + (-1)^2}$	1.414
8	21	$= \sqrt{(3-3)^2 + (0-0)^2 + (4-4)^2 + (3-4)^2}$ $= \sqrt{(0)^2 + (0)^2 + (0)^2 + (-1)^2}$	1
9	21	$= \sqrt{(3-3)^2 + (0-0)^2 + (3-4)^2 + (4-4)^2}$ $= \sqrt{(0)^2 + (0)^2 + (-1)^2 + (0)^2}$	1
10	21	$= \sqrt{(3-3)^2 + (1-0)^2 + (3-4)^2 + (3-4)^2}$ $= \sqrt{(0)^2 + (1)^2 + (-1)^2 + (-1)^2}$	1.732
11	21	$= \sqrt{(3-3)^2 + (0-0)^2 + (4-4)^2 + (4-4)^2}$ $= \sqrt{(0)^2 + (0)^2 + (0)^2 + (0)^2}$	0
12	21	$= \sqrt{(3-3)^2 + (2-0)^2 + (4-4)^2 + (4-4)^2}$ $= \sqrt{(0)^2 + (2)^2 + (0)^2 + (0)^2}$	4
13	21	$= \sqrt{(3-3)^2 + (0-0)^2 + (3-4)^2 + (3-4)^2}$ $= \sqrt{(0)^2 + (0)^2 + (-1)^2 + (-1)^2}$	1.414
14	21	$= \sqrt{(3-3)^2 + (0-0)^2 + (4-4)^2 + (4-4)^2}$ $= \sqrt{(0)^2 + (0)^2 + (0)^2 + (0)^2}$	0
15	21	$= \sqrt{(3-3)^2 + (2-0)^2 + (4-4)^2 + (4-4)^2}$ $= \sqrt{(0)^2 + (2)^2 + (0)^2 + (0)^2}$	4

16	21	$= \sqrt{(3 - 3)^2 + (0 - 0)^2 + (4 - 4)^2 + (4 - 3)^2}$ $= \sqrt{(0)^2 + (0)^2 + (0)^2 + (-1)^2}$	1
17	21	$= \sqrt{(3 - 3)^2 + (0 - 0)^2 + (3 - 4)^2 + (3 - 4)^2}$ $= \sqrt{(0)^2 + (0)^2 + (-1)^2 + (-1)^2}$	1.414
18	21	$= \sqrt{(3 - 3)^2 + (0 - 0)^2 + (3 - 4)^2 + (3 - 4)^2}$ $= \sqrt{(0)^2 + (0)^2 + (-1)^2 + (-1)^2}$	1.414
19	21	$= \sqrt{(3 - 3)^2 + (0 - 0)^2 + (3 - 4)^2 + (3 - 4)^2}$ $= \sqrt{(0)^2 + (0)^2 + (-1)^2 + (-1)^2}$	1.414
20	21	$= \sqrt{(3 - 3)^2 + (0 - 0)^2 + (4 - 4)^2 + (4 - 4)^2}$ $= \sqrt{(0)^2 + (0)^2 + (0)^2 + (0)^2}$	0

Rapid miner

Design for the designing using Rapid Miner as Fiiisre 2 while the results of K-NN Testing can be seen in Figure 3.

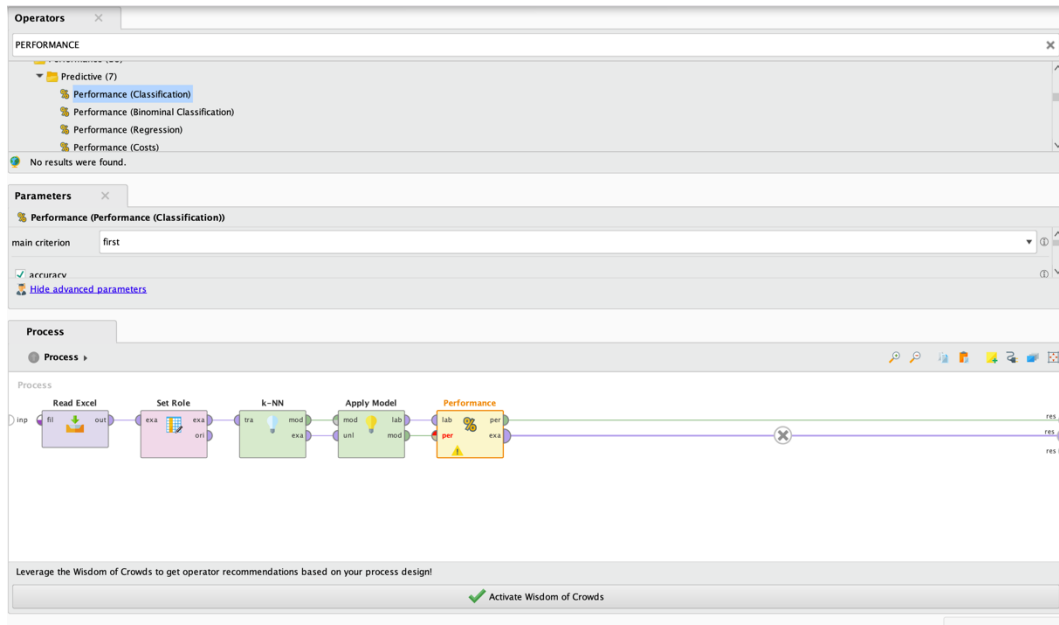


Figure 2. K-NN Test Design with Rapidminer

Row No.	No	Hasil	prediction...	confidence...	confidence...	Nilai Tes A...	Nilai Tes W...	Sertifikat K...	Nama	Pendidikan...
1	1	Gagal	Gagal	1	0	-1.858	-1.850	-0.419	Nurul Mu'mi...	SI
2	2	Gagal	Gagal	1	0	-2.038	-2.031	-0.419	Shopa Labib...	SI
3	3	Gagal	Gagal	1	0	-2.847	-2.844	-0.419	Jajang Supri...	SI
4	4	Diterima	Diterima	0.365	0.635	0.390	0.951	0.838	Malik Risma...	SI
5	5	Gagal	Gagal	1	0	0.120	0.138	-0.419	Frisca Aprilya	SI
6	6	Gagal	Gagal	1	0	0.120	0.138	-0.419	Dodi Puradi	SI
7	7	Gagal	Gagal	1	0	-0.420	-0.404	-0.419	Tri Filria	SI
8	8	Diterima	Diterima	0.374	0.626	0.569	0.409	-0.419	Nur Ela	SI
9	9	Diterima	Diterima	0.374	0.626	0.569	0.409	-0.419	M. Maulana R	SI
10	10	Diterima	Diterima	0.182	0.818	0.390	0.409	0.838	Nur Saebah	SI
11	11	Diterima	Diterima	0.375	0.625	0.659	0.590	-0.419	Luthfi F.S	DI
12	12	Diterima	Diterima	0	1	0.749	0.590	2.094	Sherina Prah...	SI
13	13	Gagal	Gagal	1	0	0.120	-0.043	-0.419	Rio Pratama	SI
14	14	Diterima	Diterima	0.375	0.625	0.659	0.590	-0.419	Irfan Azis	SI
15	15	Diterima	Diterima	0.161	0.839	0.479	0.590	3.351	Anisa Ayu D.L	SI
16	16	Gagal	Diterima	0.438	0.562	0.479	0.680	-0.419	Puspita Risk...	SI
17	17	Gagal	Gagal	1	0	0.120	0.138	-0.419	Eva Rosnabi...	SI
18	18	Gagal	Gagal	1	0	0.120	0.138	-0.419	Solikhin Agil	SI
19	19	Gagal	Gagal	1	0	0.120	0.138	-0.419	Patin Indi F	SI
20	20	Gagal	Diterima	0.437	0.563	0.569	0.499	-0.419	Irma Fiyana	SI
21	21	Diterima	Diterima	0.374	0.626	0.929	0.770	-0.419	Riska Rahayu	SI

Figure 3. K-NN Test Results

accuracy: 90.48%			
	true Gagal	true Diterima	class precision
pred. Gagal	10	0	100.00%
pred. Diterima	2	9	81.82%
class recall	83.33%	100.00%	

Figure 4. Accuracy Performance Vector (Performance) Results

Based on K-NN testing data in the picture above, states that 81.82% of the true prediction accuracy rate **is accepted** by the use of K-NN in the process of accepting new employees in CV. Syntax Corporation Indonesia.

Conclusion of K-NN Classification Test Results

Table 3. K-NN Test Results

No	Name	Recent Education	Academic Tests	Interview Value	Certificate	Result	K-3	K-5	K-7	K-9	K-19	% Fail	% Accepted
1	NM	SI	55	55	0	Fail	Fail	Fail	Fail	Fail	Fail	100%	0%
2	SL	SI	53	53	0	Fail	Fail	Fail	Fail	Fail	Fail	100%	0%
3	JS	SI	44	44	0	Fail	Fail	Fail	Fail	Fail	Fail	100%	0%
4	MR	SI	80	86	1	Accepted	Accepted	Accepted	Accepted	Accepted	Accepted	0%	100%
5	FA	SI	77	77	0	Fail	Accepted	Fail	Fail	Fail	Fail	80%	20%
6	DP	SI	77	77	0	Fail	Fail	Fail	Fail	Accepted	Accepted	60%	40%
7	TF	SI	71	71	0	Fail	Fail	Fail	Fail	Fail	Fail	100%	0%
8	NE	SI	82	80	0	Accepted	Fail	Accepted	Accepted	Accepted	Accepted	20%	80%
9	M. MR	SI	82	80	0	Accepted	Accepted	Accepted	Accepted	Accepted	Accepted	0%	100%
10	NS	SI	80	80	1	Accepted	Accepted	Accepted	Accepted	Fail	Fail	40%	60%
11	L.F.S	DIII	83	82	0	Accepted	Accepted	Accepted	Accepted	Accepted	Accepted	0%	100%
12	SP	SI	84	82	2	Accepted	Accepted	Accepted	Accepted	Accepted	Accepted	0%	100%
13	RP	SI	77	75	0	Fail	Fail	Fail	Fail	Fail	Fail	100%	0%
14	IA	SI	83	82	0	Accepted	Accepted	Accepted	Accepted	Accepted	Accepted	0%	100%
15	An A D.L	SI	81	82	3	Accepted	Accepted	Accepted	Accepted	Accepted	Accepted	0%	100%

16	PRA	SI	81	83	0	Fail	Accepted	Accepted	Accepted	Accepted	Fail	20%	80%
17	ERF	SI	77	77	0	Fail	Fail	Fail	Fail	Fail	Fail	100%	0%
18	SA	SI	77	77	0	Fail	Fail	Fail	Fail	Fail	Fail	100%	0%
19	PIF	SI	77	77	0	Fail	Fail	Fail	Fail	Fail	Fail	100%	0%
20	IF	SI	82	81	0	Fail	Accepted	Accepted	Accepted	Accepted	Accepted	0%	100%
21	RS	SI	86	84	0	Accepted	Accepted	Accepted	Accepted	Accepted	Fail	20%	80%
											Means	49%	51%

From the table above, the average produced by the K-Nearest Neighbor (K-NN) classification system in determining prospective new employees Corporation Indonesia for employee presets results received from 21 attesting, namely 51% and for employee presentations that failed as much as 49%.

Classification Results from 140 Training Data and 21 Data Testing

Here are the results that CV has obtained. Syntax Corporation Indonesia tested prospective employees using the K-Nearest Neighbor and Rapidminer methods as much as 82% and the results of the percentage of inappropriate data as much as 18%. The percentage of 82% is considered good because the percentage reflects how well the model or method successfully predicts or classifies prospective employees. Thus, an accuracy rate of 82% indicates that most prospective employees have been correctly predicted or classified by the model. This high level of accuracy can be an indication that the K-Nearest Neighbor method used in combination with Rapidminer is able to process prospective employee data well. Here is the explanation: 1). Puspita Risky Alia's brother on the actual data was declared a failure, but after testing was carried out on the K-NN classification system, Puspita's brother Risky Alia was accepted as a prospective employee, because the K value that got 4 labels was accepted, namely K3, K5, K7, and K9. The label is as much as 1, namely at the K19 value and can accumulate 80% of that accuracy level Brother Puspita Risky Alia received. 2). Irma Fiyana's brother on the actual data was declared a failure, but after testing on the K-NN classification system, Puspita Risky Alia's brother was accepted as a prospective employee, because the grades K3, K5, K7, K9 and K19 received labels.

CONCLUSION

Based on research that has been done by testing the classification of prospective CV employees. Syntax Corporation Indonesia by using the K-Nearest Neighbor (K-NN) method can be included in the following: 1). The classification system of prospective employee acceptance on CV. Syntax Corporation Indonesia by using K-Nearest Neighbor (K-NN), has been effective in answering the needs of employee recruitment in accordance with criteria. This study used 4 variables, namely final education, academic test scores, interview test scores and certificates of expertise. 2). Test results using K-Nearest Neighbor (K-NN) and Rapidminer tools with several K values taken, namely K-3, K-5, K-7, K-9 and K-19, found the best accuracy of 85% on K-7. 3). Of the 21 data used, there were only 2 prospective employees who did not match the prediction while the other 19 data were by The results of the analysis prove that the K-Nearest Neighbor (K-NN) method used can be used as a reference to classify or predict the new employee acceptance system in CV. Syntax Corporation Indonesia.

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