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Design and Development of Job Recommendation System Based On Two Dominants On Psychotest Results Using KNN Algorithm

Joshua Suharyadi[1], Adhi Kusnadi[2]
Faculty of Engineering and Informatic, Universitas Multimedia Nusantara Tangerang Indonesia
adhi.kusnadi@umn.ac.id

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***Abstract*—Employees are an important factor in the progress of a company. Employees with good performance will certainly provide positive results for the company. One that can determine employee performance is the right placement in the job. To find out the right place in a job, one way can be done psychologically. Psychotest can help to know the nature of an employee and suitable work based on their nature. The construction of a job recommendation application system was created to help prospective employees know their true identity and suitable work so that they can apply according to their expertise. This system is built with the programming language PHP, Javascript, HTML for web-based platforms and the KNN algorithm as the method. The KNN algorithm is used to measure the closest distance between training data and test data to produce job recommendations. Training data is taken from the expert, and book references. System trials are given to users by filling in psychological tests and questionnaires regarding the satis-faction of system use. After getting feedback from users, the value of system satisfaction reached 85%. This states that the system can provide job recommendations that are in accordance with the psychological test results of the user.**

***Index Terms*— Dominant, job recommendation, psychotes, psychological tests, KNN**

I. INTRODUCTION

A company is a form of business in the form of an organization or business entity established, work-ing and domiciled in the territory of the Indonesian state for profit [1]. For business owners and workers, they certainly agree that the ideal worker is the one who is the right man on the right place. The unique-ness of each person becomes an important capital for the industrial world to keep surviving because with variations, it can fill the gap with each other.

Companies rarely have the right people in the right position lately. It will have a psychological im-pact on employees because they will lose their moti-vation to work. Psychological examination needs to be done by psychological tests to help map out the potential and ability of a person to be able to fill in the right points [2]. Therefore a psychological test system is needed to produce work recommendations in accordance with the results of the psychology test.

In this study, the algorithm that will be used is k-nearest neighbor. This algorithm is a method that uses a supervised algorithm where the results of query instances are classified based on the majority of the categories in the KNN. This rule simply retains the entire training set during learning and assigns to each query a class represented by the majority label of its k-nearest neighbors in the training set [3]. The k-nearest neighbor algorithm has a fairly simple way of work-ing, namely by calculating the shortest distance from the test data to sample data to determine the KNN [4]. The KNN algorithm has been used in several previous studies. In the study entitled "Comparison of Accura-cy of K-NN and Naïve Bayes for Student Final Predic-tion System Algorithms" [5] yielded better results for KNN, namely 95% and only 68% with Naïve Bayes.

In another study entitled "Determination of the Department of Senior High School Using the K-Nearest Neighbor Classi-fier Method at SMAN 16 Semarang"[6] obtained the results of 79.68% in the study, so the application was made Job recommendations with two personality dominants from psychological results using KNN rhythm in order to get good results with a high percentage of success so that it can help users to find suitable work based on psychological results.

II. LITERATURE STUDIES

A. *Recommendation System*

The recommendation system is an application to provide choices to users according to the criteria of the user. This program is commonly used to predict an item, such as movies, books, music, etc, that attract users. This system can run by collecting data from users directly or indirectly. Direct data collection can be done as follows [7].

1. Asks the user to give rate an item.

2. Asks the user to give rank favorite items at least choose one item.
3. Give the user several choices of items and ask him to choose the best.
4. Ask the user to register the most preferred item and the item they don't like.

Indirect data collection can be done as follows [7].

1. Observe items that users see on an e-commerce website.
2. Collect transaction data at an online store.

The results of data collection, will be processed with a certain algorithm that is in accordance with the problem and produces recommendations in accordance with the parameters of the user [7].

B. *Psychotest*

Psychology comes from two words, phsicology which means someone's psychology and tests which means a way to find out one's abilities [8]. So the psychological test is a test conducted to find out one's abilities by exploring the psychological aspects of that person [8]. Psychology tests in companies are usually carried out by third parties to ensure the neu-trality of the results of the assessment [2]. The purpose of the Psychological Test is usually for employee ac-ceptance, employee mapping, and for evaluating em-ployee performance which later can be considered as a promotion for employees [2]. Psychological examination consists of three, namely psychological test, observation, and interview [2]. There are 4 personality types in human beings namely sanguinis, melancholy, koleris, plegmatis [2]. However, there is no human who has 100% of the four personalities [9]. Usually, someone will have a combination of two or three personality types and one or two dominant ones will appear [9]. According to D. W. Ekstrand, there are 12 combinations that become two dominant in human personality, such as [9],

1. Sanguine – Phlegmatic
2. Sanguine – Melancholy
3. Sanguine – Choleric
4. Melancholy – Choleric
5. Melancholy – Phlegmatic
6. Melancholy – Sanguine
7. Choleric – Melancholy
8. Choleric – Sanguine
9. Choleric – Phlegmatic
10. Phlegmatic – Choleric
11. Phlegmatic – Melancholy
12. Phlegmatic – Sanguine.

C. *KNN Algorithm*

The KNN algorithm is a method for classifying objects based on learning data which is closest to the object. Learning data is projected into a large dimension space, where each dimension presents features of the data. The KNN algorithm includes methods that use supervised algorithms [10].

The difference between supervised learning and unsupervised learning is that supervised aims to find new patterns in data by connecting existing data patterns with new data [10].

Whereas in unsupervised learning, data does not yet have any pattern, and the aim is to find patterns in a data [10]. The KNN algorithm uses neighboring classifications as predictive values from examples of new test data [10]. Near or near neighbors are usually calculated based on the euclidean distance represent-ed in the equation where matrix D (a, b) is the scalar distance of both formula vectors [11].

$$D(a,b) = \sqrt{\sum_{k=1}^{d} (a_k - b_k)^2}$$

Where:

D (a, b) = distance between test data and training data

d = number of training data

a = test data

b = training data

III. APPLICATION DESIGN

A. *Data Flow Diagram*

Data flow diagrams are used to design data flow in the job recommendation system with two dominant using the KNN method. There are two entities namely user and expert.

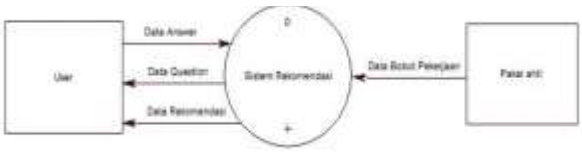

Fig 1. Level 0 DFD

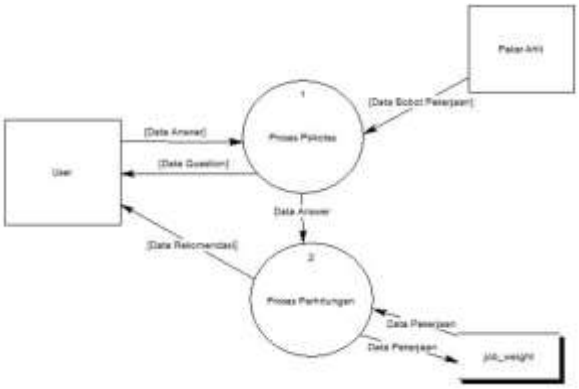

Fig 2. Level 1 DFD

The figure 1 shows DFD level 0. There are two entities, namely user and expert expert. Expert experts provide information about the work weights used as a comparison for training data and test data. The system will display questions to the user to answer, then sistem will do the calculation process using the KNN method and produce recommendations to the user regarding the appropriate work based on the answers to the psychological question.

The figure 2 above illustrates DFD level 1. There are two entities and two processes in DFD level 1. Psychological process are when the system gives a question to the user and the user provides answers to questions to the system. The calculation process is when the system matches the psychological test answer data with the work weight to produce recommendations.

B. Flowchart

Flowchart is used to describe the flow of the overall system work process. The workflow of the system is built as follows.

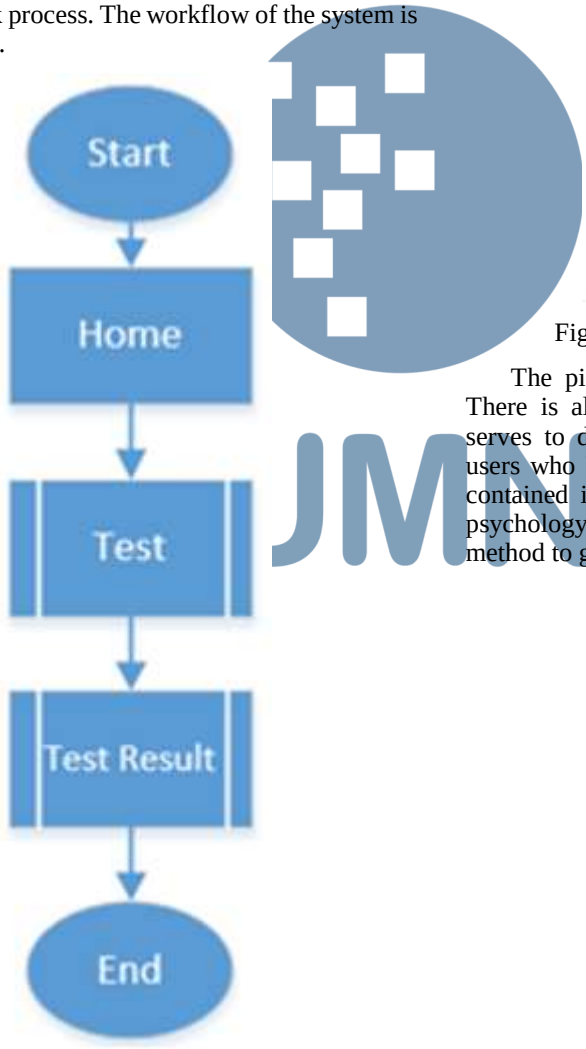

Fig 3. Flowchart System

The picture 3 illustrates the flow process of the user getting work recommendations starting from when accessing the website. When user star use sistem, user will go directly to the start page that contains the psychological test and about. Furthermore, the user can choose a psychological test to find out the recommendations of work based on the system.

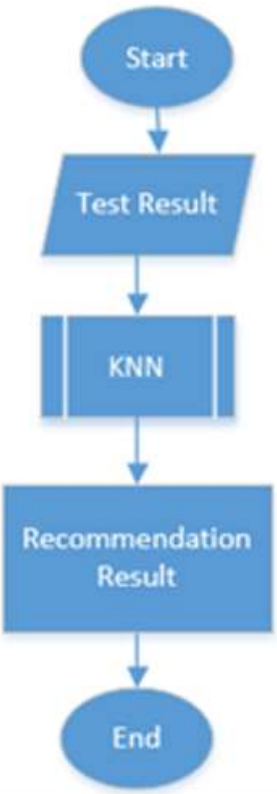

Fig 4. Recommendation Result Flowchart

The picture 4 describes subprocess in figure 3. There is algorithm that is used KNN. This process serves to display the results of recommendations to users who have filled out all psychological questions contained in the system. After getting the results of psychology tests, the system will calculate the KNN method to get work recommendations.

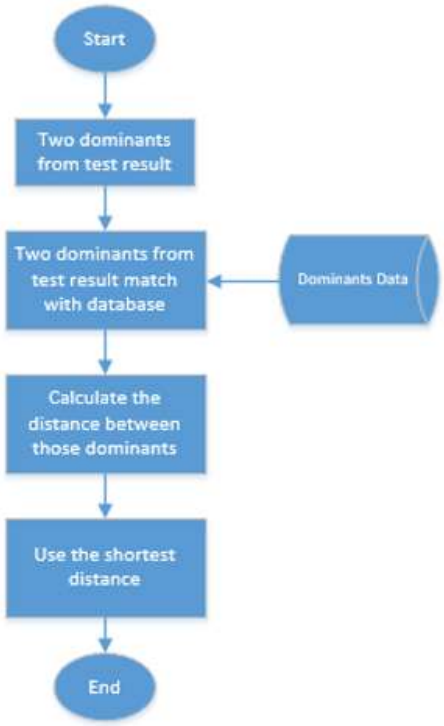

Fig 5. Calculation KNN Flowchart

The figure 5 is the process of KNN calculation flow to produce job recommendations. Data received from the user will be calculated using the euclidean distance formula to compare the closest distance be-tween test data and training data in the database. The data compared is the first and the second dominant dominant from the results of the psychological test with the first dominant and the second dominant on the weight of the work contained in the database. Af-ter comparing the two data, the shortest distance is calculated to produce a job recommendation to the user..

IV. Implementation and Testing

A. *Implementation*

This implementation is to show the design of the application that has been created and how it works. The following are pieces of the application image that have been built.

Fig 6. Home Page

The picture 6 is the start page of the system. There are 2 features on this page, namely psychotest and about. Users can take a psychological test to get a job recommendation by clicking the psychotest button. The feature contains information about the system.

Fig 7. Question Page

The picture above illustrates the psychotest page. There are 40 questions that must be answered by the user to get work recommendations. Each question can only be answered with one answer. After selecting an answer, the user can click the next button to answer the next question. The results obtained from the psychological test questions will be calculated using the KNN method to produce work recommendations that are in accordance with the character.

Fig 8. Recommendation Page

The picture above illustrates the results of recommendations after the user answers all psychological questions. Recommendation results show main character and secondary character from each user, and provide job recommendations that are in accordance with user characteristics. If you want to take a psychological test again, you can click the test button again, it will return to the start page..

B. *Testing*

There are 2 tests on this system, namely manual calculation testing to show whether the manual KNN algorithm calculation is the same as the results of the system and the system display testing obtained from user feedback. The manual calculation shows compat-

ibility with the system calculation, so the KNN algorithm used runs well on this system. Display testing gets the percentage of satisfaction using the system from the questionnaire given to the user by 85%. This shows that the recommended work recommendations match the user's personality. The following is a table of recapitulation of the results of questionnaires from the user.

Table 1. Recapilutation Questioner.

No	Question	Score					Persentation
		1	2	3	4	5	
1	Suitability of color and background design	0	1	6	17	7	79%
2	Color compatibility of writing with background	0	0	9	11	11	81%
3	Button color suitability	0	0	5	15	11	84%
4	The accuracy of the button functions according to the menu	0	0	5	17	8	79%
5	Ease in operating the website	0	0	7	12	12	83%
6	Comfort in using the website	0	1	8	11	11	80%
7	Satisfaction gets the results of the recommendations from the system	0	0	7	9	15	85%

V. CONCLUSION

The job recommendation system that serves to provide job choices to users based on two dominant personalities from the results of the psychological test has been successfully designed and built. The KNN algorithm used in this study has been successfully applied in calculating the shortest distance to produce job recommendations for users. This system can also provide recommendations that are in accordance with the two principles of the psychological test results that are filled in by the user. This is evidenced by user satisfaction in using this system which reaches 85% on the results of the questionnaire.

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