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Enhance Web-Based Job Search Recommendation System of Hybrid-Based Recommendation

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Abstract

The main activity carried out daily for an individual to earn money is by working. Finding a job that matches our educational background is not easy. Many individuals do not know their abilities and the limited information on job vacancies is also an obstacle for applicants who want to find work. Therefore, a 'toolkit is needed that can provide recommendations on what fields of work are by the educational background in question. The hybrid approach method is to combine collaborative-filtering techniques (decision tree algorithm) and content-based (nearest neighbor algorithm). The decision tree algorithm is used to classify the fields of work while for job recommendations, the nearest neighbor algorithm is used. In the nearest neighbor, the similarity formula is used to calculate the proximity between applicants and job vacancies based on matching the existing weights and attributes. The output generated from this system is a list of job recommendations that match the applicant's educational background.

Keywords
job recommendations; hybrid approach; decision tree; nearest neighbor

I. Introduction

Work is the main activity that humans do by completing a task or work that makes money for someone. Work is also known as a profession. There are various professions today. Finding a job that matches our interests, talents and educational background is not easy. Many individuals do not understand or know their own abilities. In addition, the limited information on job vacancies is also an obstacle for applicants who want to find work. These factors become obstacles for an applicant to find a job that suits their abilities and background, especially for a fresh graduate who still has no work experience.

Personality and character development patterns must be carried out systematically and continuously by involving aspects of knowledge, feelings, and actions. (Siregar et al, 2020). According to Sembiring et al (2019) Character is the attitude and way of thinking, behaving and interacting as a characteristic of an individual in life, acting and working together, both within the scope of the family, community and nation.

To overcome this problem, we need a 'tool' that can provide recommendations (to job seekers) what field of work is in accordance with the interests, talents and background concerned. This system will also store various job vacancies from various fields so that the results of this system will provide job vacancies suggestions that are suitable for the individual.

Recommendation system is defined as an application to propose information and provide facilities that users want in making a decision. The recommendation system is divided into 3 types, namely content-based recommendation, Collaborative recommendation and hybrid approaches. The application of hybrid approaches is to combine collaborative-filtering and content-based techniques, which are expected to help

the limitations that exist in both methods so as to produce better output. Decision tree is one of the algorithms in collaborative-filtering and a popular algorithm that has been widely used .The advantages of a Decision tree include; simplify complex problems into simpler ones in content-based filtering, the Nearest Neighbor Algorithm is used which is an algorithm to calculate the proximity between the new case and the old case, which is based on matching the weights of a number of existing attributes.

Today's applications Web-based is becoming increasingly important. Web development techniques can be found on various sites e-business based to online service provider websites free, such as job vacancies sites. Web-based applications as a telecommunications medium increasingly evolve according to need about the technology. On the one hand with the existence of these web-based applications make it easier for users to do product offerings (advertising) or services through the website. To make a simple website and offers products or services are only small in scale and simple, we can make a static website with only using HTML scripts. However, static website creation can't done to create a website which serves a variety of scalable product and service information big.

Therefore, we need create a dynamic website means we can change the existing data without changing the whole look which exists. To create a website this dynamic, we can't make it only with HTML script. However, we need to make it by using a script that is server-side. Example of a script that is server-side eg PHP, ASP. JSPs, etc.

However, the author prefers php because it can be accessed multi-platform. Programming using server-side This script uses a lot of functions that have functions vary. With functions that, a website is formed which dynamic. But if we have a function of the application program different on different platforms which has a function similar to that of we generate for our application make, the story we want to use the function without the need to create again that function. However This kind of integration cannot done like this. With Web technology services now, allows us to exchange usage functions that exist between applications so that we can use one application's functions to create another application on different network.

Exchange These functions can not only performed on similar applications only, but can also be used on different types of applications. Even This technology allows us to integrate an application program with various types of application programs another and even between platforms. Because this technology is flexible on various types of programming languages, then the author wants to raise this topic as research.

II. Review of Literature

In an effort to help applicants to provide information on job vacancies and find jobs that match the applicant's background, an approach or system that can be used to provide information is needed job vacancies and can also be used to provide recommendations for job applicants in determining jobs that match the applicant's educational background. Job vacancies and can also be used to provide recommendations for job applicants in determining jobs that match the applicant's educational background.

Previous researchers have make a journal about Web services that composed by Tri Kuntoro Priyambodo Faculty of Mathematics and Natural Sciences UGM, 2005 by designing information systems integrated tourism that developed using web service technology.

In this section, an example of two web services is described, namely the Cultural Tourism web-service Java which serves to provide recommendations for tourist attractions in Central Java Province and Region Special Yogyakarta, and web-service an exchange

rate that serves to provide daily information on exchange rates amount of foreign currency against the currency rupiah. The two web-services integrated to provide overview of a multi-tier system and used to build a web application program. With journal-title "Web service implementation" for Service System Development Integrated Tourism". Tantos, Basecamp Medical records UGM, in 2008, about a hospital information system created by utilizing Web services to solve various needs in the hospital include:

Handling patient registration Social data handling and processing patients, Handling and data processing medical (diagnosis, action, and therapy) patients, Handling and data processing patient visits, Handling payment for actions and services (Cash, Askes or debt), Handling patient referred/referral, Application Pharmacy, Material Warehouse Application, Personnel Applications, Finance and hospital accounting, Reporting internally (on the management side) as well as External reporting. By title "Web services application in the system Hospital Information". Andi Guttu, Medy W. Prohatmono and Suryadi Hozeng Faculty of Engineering

Electrical Engineering Post UNHAS Program, year 2010, about service-oriented Architecture (SOA) implement how the system composed and modeled work together with a group service serves as a component.

Components as a services provided in a location which can be accessed by clients directly dynamic. Services can be in the form of: closed system using CORBA, RMI, DCOM, while open system using Web services. With the title of the proceedings "Web Service Implementation and Model Service-Oriented Architecture", Moh. Arafa, Ihsan Manuscript and Nurhasanah, Faculty of Electrical Engineering Post-UNHAS Program, 2010 about what if website access not only Html files? Or upload and download files? Internet access will be more useful if between applications programs can communicate. Component a program that is on a website that can be accessed from other known websites with the term Web services. By title proceedings of "Describing Web Services", Of the four studies both in in the form of a journal or the form of the author's proceedings have not found research that discusses specifically about the job search Web service. To that the author makes the application of technology Web service in building a website job vacancy information service much needed online, thing

This is supported by increasing the current number of job seekers, taking into account the source that in some areas more seekers work than the employer in terms of this is a company. The problem make them have to look for job opportunities elsewhere Of course, you need some information.

As it is known that So far, job seekers have been hampered by job vacancy information limited to newspapers, magazines, and tabloids. Besides, the difficulty anticipating the acceptance deadline job application set by the company. With a website It is hoped that this will help the giver and job seekers in providing and get a job.

III. Research Methods

3.1. Database

Database management system (DBMS) is an organized set of facilities for accessing and maintaining one or more databases. The use of DBMS is carried out in the integration of a system that uses the data in a software. According to Beynon-Davies, DBMS is divided into 4 types, namely: Data definition, Data maintenance, Data retrieval and Data Control.

3.2. Recommendation System

Recommendation systems are software tools and techniques that provide suggestions for items that can be used by users. In general, a recommendation system is defined as a support system that helps users to find information, products and services by combining and analyzing suggestions from other users, which means reviewing from several parties and user attributes.

Recommendation systems have become an important field of research since the appearance of the first papers on collaborative-filtering in the mid-1990s. The purpose of the recommendation system is to produce useful recommendations to the user for the items or products that are most beneficial to the user. The Recommendation System according to Melville and Sindhwani is divided into 3 types, namely: Content-based Filtering, Collaborative Filtering and Hybrid-based Filtering.

3.3. Decision Tree

Data classification can be described as the controller of a learning algorithm in the machine learning process. Decision tree is a representation of the decision procedure to determine the class and is constructed into a non-incremental tree-induction algorithm or an incremental tree-induction algorithm. The Decision tree method in this application is used for filtering data that has been inputted by the previous user. The Decision tree method is carried out on filtering the data that has been previously inputted so as to produce the appropriate parameters for ranking.

3.4. Nearest Neighbor Algorithm

The nearest neighbor method directly exploits the distance between the sample data to perform classification. Nearest neighbors independently evaluate the distance between one data and another. The nearest neighbor rules identify the categories of new data points (new cases) based on the nearest neighbor of the data (old cases) with known values.

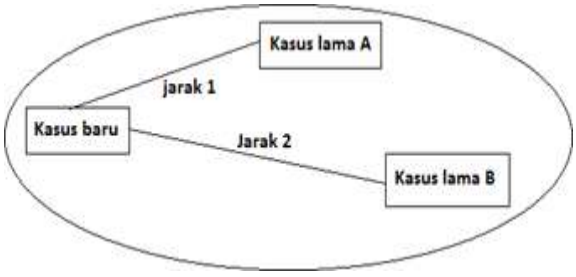

Figure 1. *Case Closeness*

In Figure 1 it can be seen that there are two old cases, namely case A and case B. When a new case appears, the solution used to solve the new case is the old case A because distance 1 is the new case and case A is closer than the distance 2 is the distance between the new case and case B. Then it is concluded that the new case is solved by case A. To obtain a ranking on the nearest neighbor, the system calculates the closeness (similarity) between 2 cases. Here is the formula for that used in the nearest neighbor method.

$$similarity\ (T,S)$$
$$\sum_{i=1}^{n} f(T_i, S_i) * W_i$$

Where :

Q: New case

S : Case in memory/database (old case)

n : Number of attributes in each case
i : variable attribute between 1 s/dn
f : similarity function of attribute i between case T and case S
w : weight given to the i-th attribute

Determination of proximity is usually in the value between 0 to 1. A value of 0 means that the two cases have absolutely no similarities, on the contrary for a value of 1, it means that the cases are absolutely identical.

3.5. Data Used

The data used in this system is taken from 2 sources, namely jobsdb for job vacancies data and the University of North Sumatra for university majors data. In the following table 1 will be described about the source, the amount of data and the year of the data to be used:

Table 1. Source data

No	Source	Amount data	Month/Year	Collected data
1	Jobsdb (www.jobsdb.com)	1600	January 2013 – March 2013	data vacancy profession
2	University Sumatra North (www.usu.ac.id)	58	March 2013	Faculty data and USU's majors

The data used in this research is sourced from the job search website data, namely jobsDB. Data taken through internet media accessed from the jobsdb.com website is in the form of job vacancies information. From the same source, data on job vacancies in 2010 – 2013. Table 2 below is a sample of job vacancies data taken from jobs.

To build a recommendation system on In this study, the hybrid-approches method was used. This hybrid-approches method is a combination of 2 methods, the Content-based method and the Collaborative Filtering method.

The Content-based method uses the Decision Tree technique and the method for Collaborative Filtering uses the Nearest Neighbor algorithm.

Table 2. Job data sample profession

No	**Job Name**	**Type Education**	**Qualification Education**	**IP**
1	Web application developer (maven lab pte ltd)	Information technology	S1	2.75
2	ASP.Net Developers	Knowledge computer	D3	3.00
3	Temporary Payroll Executive – PT MindChamps Indonesia	accountant	D3	2.75
4	Accounting Staff/Staff Accounting	economy	D3	2.75
5	SILVER BOX, UD Finance Staff Eurokars Group	economy	S1	2.75
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
1000	Architects (ARC – SML) MAS RAIL LAND	Architecture	S1	2.75

So from these data it can be seen that the educational qualifications of s1 applicants are in the field of technology education and the type of information technology (IT) education. from this data, qualification is then carried out to produce parameters. which can then be continued to the nearest neighbor calculation.

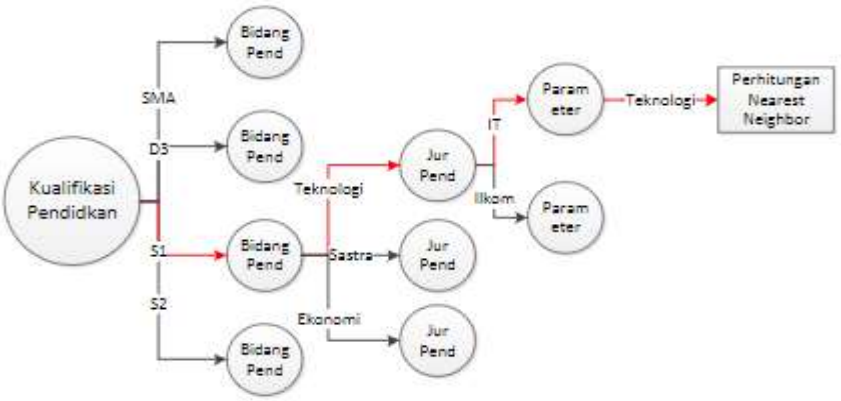

Figure 2. *Parameter Schemes*

Nearest neighbors will provide job recommendations using ranking information based on data that has been entered by the user. User data entered will be searched and compared with the data stored in the database first. Each data will be given a weight and then the data will be compared with the values of the weights and proximity in the variables. These variables will be calculated similarity (similarity) using the Nearest Neighbor algorithm and then filtered or ranked based on the results of the scattered distance from the calculation of the weight of each variable.

IV. Results and Discussion

Display of Job Recommendations From this research, output will be produced in the form of job recommendations that are in accordance with the background and field of education of a job applicant. Job applicants will be given a choice of job vacancies arranged based on the rank of the job that best suits the applicant. The list will display the job name and job description. such as for example the most suitable recommendation is in the form of a job at Ray White Indonesia which accepts new applicants graduating from university with a calculation result of 0.860.

Figure 3. *Output results of work recommendations*

Testing data on the system After testing the system using 100 data, the next test will be carried out on 7 fields of work. Each field is taken as much as 250 data. So the total data is 1750 job vacancies. The job vacancies data are taken from the jobsdb website for the period 2011 –2013. Tests are carried out on the same hardware and execution at the time of system execution. The next test is to test the data to determine the running time of the system that has been created. The following table is the result of running time testing on 250 data in the technology field.

Table 3. Running time sistem

No	Data	*Running time*
1	50 data	11.90/s
2	100 data	17.13/s
3	150 data	17.67/s
4	200 data	23.68/s
5	250 data	25.46/s

After looking at the data in table 3, the data can be made a graph which can be seen in the figure below:

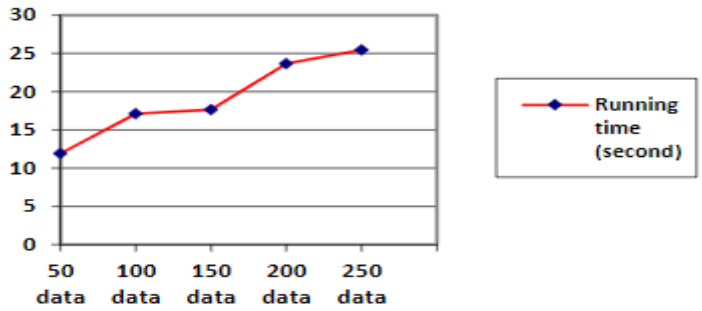

Figure 4. *Graphic Running time of the system*

By analyzing the data and graphs that have been described previously, it can be concluded that the process in the average system consumes about 25 seconds to display 250 data.

V. Conclusion

Based on the discussion of implementation and testing that has been carried out, several conclusions can be obtained:

1. Utilization of a recommendation system with the decision tree method with the nearest neighbor algorithm can be implemented in providing job recommendations to applicants who want jobs by the applicant's educational background.
2. With this system, applicants can easily access and obtain information about job vacancies at companies that need new workers or employees.
3. Applicants also get recommendations that are by the applicant's qualifications and the requirements desired by the company without having to search for or choose jobs one by one (manually), so that applicants can choose and work in the field of work that is by the applicant's educational background.

4. Based on testing, the average time required to run the recommendation system is about 25 seconds.
5. Qualification of job vacancies is very influential on the results of the recommendations. The more variations in job vacancies qualifications, the better the accuracy of the job recommendations. So that the variation of qualifications can produce more accurate job recommendations.

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