The Implementation of K-Means Algorithm to Analyse the Level of Employee Job Satisfaction Using Laravel Framework

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ABSTRACT

Every company needs to know the level of job satisfaction of their employees that can be used as suggestion and critics to help consider the way to manage their human resources. It aims to encourage their employees to work optimally. One of the ways to find out the level of employee job satisfaction is by conducting one on one (face-to-face meeting between boss and employee) to get information about job satisfaction in terms of workload, work environment, team relationship, and other aspects. The information given to HRD and top manager is then used as consideration for the company to increase the human resource management. For time efficiency, it is made an application using Laravel framework that implements K-Means algorithm. In this case, the implementation of K-Means algorithm becomes a solution by analyzing data of employee job satisfaction in the company. The result of calculation process of K-Means algorithm forms a cluster used to obtain the description of the level of employee job satisfaction toward policies in the company.

Keywords : One on one, Cluster, K-Means, Job Satisfaction, Framework, Laravel.

I. INTRODUCTION

In a company, employees are valuable assets that should be managed properly by the company in order to make them give their optimal contribution. One of the factors causing poor working condition is the low level of job satisfaction. Job satisfaction is behavior and feeling of satisfied or dissatisfied of employees in doing their job. Job satisfaction is the starting point of problems that occur in a company because the employees' attitude and feeling toward all aspects of their work environment will affect the attitude and behavior in doing their tasks. Every company certainly wants their employees to be satisfied with their company since employee job satisfaction can affect their performance.

Every company needs to know the level of employee job satisfaction to their company as a consideration in managing the company's human resources. One of the ways that PT XYZ carries out to find out the level of employee job satisfaction is conducting monthly one on one meeting between boss and employee. One on one meeting is a term used in some companies to hold face-to-face meeting with boss (manager). During *one on one* meeting, the boss will ask about the employee job satisfaction, in terms of workload, work environment, relationship within his/her work team, and many other aspects. And then, the information obtained from one on one meeting will be collected by the boss to be forwarded to HRD and top manager as a consideration for the company to improve human resources management.

As for time efficiency, it is created an application by utilizing Laravel framework that implements K-Means algorithm. Laravel is a free web-based open source PHP framework created by Taylor Otwell and is used

to develop web application following model-view-controller (MVC) or architecture pattern. The application applies K-Means algorithm as a solution to analyze data of employee job satisfaction. The result of the calculation using K-Means algorithm forms a cluster which is functioned as a description of the level of employee job satisfaction to the company's policies.

The application can be accessed by employees to inform their job satisfaction. Through this application, it is also possible for HRD to find out the information of job satisfaction of every employee and to monitor the curve of job satisfaction which can be used as a consideration in improving human resources management.

In a research previously conducted by Aldi Nurzahputra (2017), K-Means algorithm is applied for clustering related to the valuation of student satisfaction to lecturer. In this research, algorithm and valuation process have not been implemented into the application to support the performance valuation. In a research conducted by Renato Cordeir (2016), it is explained that K-Means as a concept of weighting features and algorithm that overcomes the problem critically as well as analyzes some of the most popular and innovative feature weighing mechanism. K-Means algorithm is also applied by Istiqomah Sumadikarta (2014) for designing application to analyze transaction and to find out potential products

II. METHODS AND MATERIAL

This research was conducted by implementing K-Means algorithm. K-Means is one of popular clustering algorithms. K-Means method tries to classify data into some groups, in which characteristics of data within the group are different from one another, and characteristics of data of a group are different from data of other groups.

In general, the flow of K-Means algorithm is as follow:

1. Determining the number of cluster.
2. Determining centroid.
3. Does the centroid change?
   a. Yes, continue to calculate data distance from centroid
   b. No, then iteration is finished.
4. Classifying data based on the nearest distance.

The first step of this research was collecting data through survey on the employee job satisfaction conducted in October 2018 by using job satisfaction data (Virgana, 2014) and questions data got from HRD and Top Manager. Aspects/indicators of satisfaction and questions proposed in survey can be seen in Table 1 below:

Table 1. Questions

Indicators of Satisfaction	Questions
Work Environment	Is the work environment conducive?
Workload	Does your capability meet the workload?
Manager's Role	Has the manager carried out his/her role?
Facilities	Do the facilities support your work?
Promotion Opportunity	Is there an opportunity to develop position in the organizational structure?
Coworkers	Is there a good team work with other coworkers?
Salary	Is the salary equal to the workload?

Based on the survey, data consisting 20 records of valuation on employee job satisfaction with the company at PT. XYZ is taken. Table 2 shows the data

of valuation on employee job satisfaction in October 2018.

Table 2. Initial Data of Valuation on Job Satisfaction

Employee	P1	P2	P3	P4	P5	P6	P7
K1	N	A	N	A	SA	A	SA
K2	A	SA	SA	N	N	A	SA
K3	A	A	A	N	N	N	N
K4	A	SA	A	A	SA	N	SA
K5	SA	N	A	A	A	SA	SA
K6	N	SA	SA	SA	N	A	SA
K7	N	N	A	A	N	N	A
K8	A	SA	N	N	N	N	A
K9	SA	A	A	SA	SA	SA	SA
K10	N	SA	SA	A	SA	SA	SA
K11	SA	SA	A	A	N	A	A
K12	SA	N	SA	A	A	N	N
K13	SA	A	SA	N	N	SA	N
K14	A	N	A	N	A	A	N
K15	N	A	N	A	A	A	N
K16	N	N	N	N	A	SA	A
K17	A	SA	SA	A	SA	SA	N
K18	SA	A	SA	N	SA	SA	SA
K19	N	N	SA	N	N	A	N
K20	A	A	SA	A	N	N	SA

Based on the data of survey on job satisfaction, there is scoring system based on the criteria of answer that is obtained through Likert Scale. Likert Scale is usually used as valuation scale since it scores something (Maryuliana, Ibnu Subroto, & Cha, 2016). Table 3 shows the criteria of answer and score of each criteria of the answer.

Table 3. Answer

Criteria of Answer	Score
SA (Strongly Agree)	5
A (Agree)	4
N (Neutral)	3
D (Disagree)	2
SD (Strongly Disagree)	1

After then, K-Means algorithm is applied through the following steps:

1. Determining the number of cluster; the number of cluster is 3.
2. Determining the cluster center randomly. In this case, the values of cluster center are presented in table 4 below.

Table 4. *Centroid* Iteration 1

Cluster	P1	P2	P3	P4	P5	P6	P7
K1	3	4	3	4	5	4	5
K2	5	5	4	4	3	4	4
K3	4	4	5	4	3	3	5

3. Determining cluster value of each data. It is important to determine which cluster value is the nearest to the data. Thus, it necessary to calculate distance of each data and central point of each cluster. In this step, Distance Space is used to calculate distance between data and centroid. One of the equations that can be used is Euclidean Distance Space. It is used in calculating distance because the result is the shortest distance between two points. The following formula is used with Euclidean Distance Space equation:

$$d_{(xj,cj)=} \sqrt{\sum_{j=1}^{n}(x_j - c_j)^2} \qquad (1)$$

On equation (1), *d* is the calculation of distance of each data and central point of each cluster; *n* is the

number of data dimension; j is the number of data; c is centroid/value of cluster center; and x is source data.

4. After determining cluster value in the first iteration by using Euclidean Distance equation, the result of calculation is put into the table of distance calculation as in table 5.

Table 5. Result of Calculation of Distance-Iteration 1

Cluster	P1	P2	P3	P4	P5	P6	P7	dc1	dc2	dc3
K1	3	4	3	4	5	4	5	0	3.31662	3.16228
K2	4	5	5	3	3	4	5	3.31662	2	1.73205
K3	4	4	4	3	3	3	3	3.4641	2.23607	2.44949
K4	4	5	4	4	5	3	5	2	2.64575	2.44949
K5	5	3	4	4	4	5	5	2.82843	2.64575	2.82843
K6	3	5	5	5	3	4	5	3.16228	2.64575	2
K7	3	3	4	4	3	3	4	2.82843	3	2
K8	4	5	3	3	3	3	4	3	2	2.64575
K9	5	4	4	5	5	5	5	2.64575	2.82843	3.31662
K10	3	5	5	4	5	5	5	2.44949	3.31662	3.16228
K11	5	5	4	4	3	4	4	3.31662	0	2.23607
K12	5	3	5	4	4	3	3	3.87298	2.82843	2.64575
K13	5	4	5	3	3	5	3	4.24264	2.23607	3.16228
K14	4	3	4	3	4	4	3	3	2.82843	3
K15	3	4	3	4	4	4	3	2.23607	2.82843	3.31662
K16	3	3	3	3	4	5	4	2.23607	3.4641	3.60555
K17	4	5	5	4	5	5	3	3.31662	2.82843	3.60555
K18	5	4	5	3	5	5	5	3.16228	3	3.16228
K19	3	3	5	3	3	4	3	3.74166	3.31662	2.82843
K20	4	4	5	4	3	3	5	3.16228	2.23607	0

5. The next step is classifying data according to its cluster, which is data with the shortest distance on table is classified into Table 6.

Table 6. Result of Data Classification

Cluster	dc1	dc2	dc3	c1	c2	c3
K1	0	3.31662	3.16228	OK		
K2	3.31662	2	1.73205			OK
K3	3.4641	2.23607	2.44949		OK	
K4	2	2.64575	2.44949	OK		
K5	2.82843	2.64575	2.82843		OK	
K6	3.16228	2.64575	2			OK
K7	2.82843	3	2			OK
K8	3	2	2.64575		OK	
K9	2.64575	2.82843	3.31662	OK		
K10	2.44949	3.31662	3.16228	OK		
K11	3.31662	0	2.23607		OK	
K12	3.87298	2.82843	2.64575			OK
K13	4.24264	2.23607	3.16228		OK	
K14	3	2.82843	3		OK	
K15	2.23607	2.82843	3.31662	OK		
K16	2.23607	3.4641	3.60555	OK		
K17	3.31662	2.82843	3.60555		OK	
K18	3.16228	3	3.16228		OK	
K19	3.74166	3.31662	2.82843			OK
K20	3.16228	2.23607	0			OK

6. Calculating the next centroid iteration by calculating the average of source data based on data classification presented in Table 7 below.

Table 7. Centroid Iteration 2

Cluster	P1	P2	P3	P4	P5	P6	P7
K1	3.5	4.16667	3.66667	4	4.66667	4.33333	4.5
K2	4.5	4.125	4.25	3.375	3.75	4.25	3.75

Cluster	P1	P2	P3	P4	P5	P6	P7
K3	3.66667	3.83333	4.83333	3.83333	3.16667	3.5	4.16667

7. If the new centroid value is different from the previous centroid value, iteration process will be carried out again as in the initial step by using centroid above and applying Euclidean distance space formula. In this case, iteration is carried out for 3 times because the new centroid value is the same as the previous centroid value. After then, the classification process is finished and the last centroid is obtained

III.RESULTS AND DISCUSSION

Calculation process using K-Means algorithm results in the last centroid which is presented in Table 8..

Table 8. *Last Centroid*

Cluster	P1	P2	P3	P4	P5	P6	P7
K1	3.5	4.16667	3.66667	4	4.66667	4.33333	4.5
K2	4.55556	4	4.33333	3.44444	3.77778	4.11111	3.66667
K3	3.4	4	4.8	3.8	3	3.6	4.4

The result of K-Means algorithm becomes the analysis of the level of job satisfaction with the company and is presented in the application that utilizes Laravel framework.

In the application, it is shown the information about the indicator of the highest and the lowest level of job satisfaction. It can be used by the company to monitor the level of job satisfaction and to give consideration in improving human resources management.

Figure 2 is *Login* page, which is used by Admin, HRD, Top Manager, and Employees to access the application. In this case, the application is used by the employees to give valuation on their job satisfaction. Meanwhile Admin, HRD, and Top Managers can access the application to see the result of analysis of employee job satisfaction.
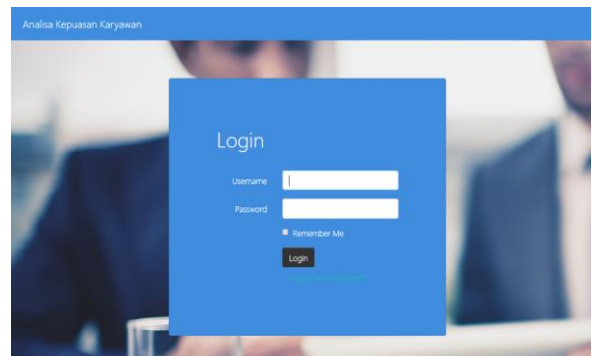

Figure 1. *Login* Page

Figure 3 is the home page that shows the chart of the monthly analysis of the level of employee job satisfaction according to the indicator of job satisfaction.
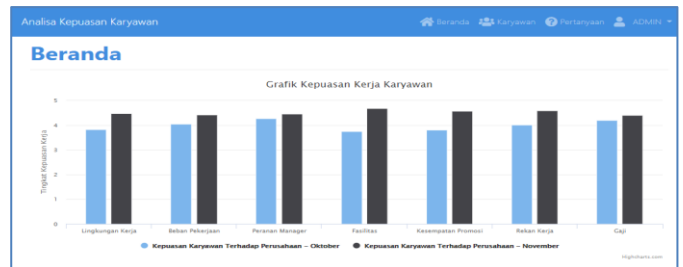

Figure 2. Chart of Monthly Analysis of Employee Job Satisfaction

Figure 4 is the page for Admin and HRD to add questions that include the indicator of employee job satisfaction.
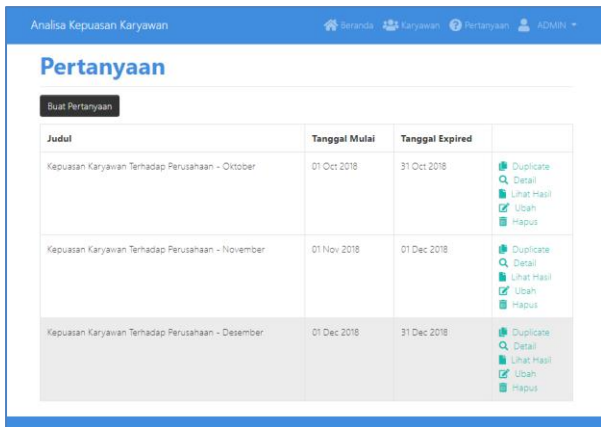
Figure 3. List of Question

Figure 5 is the page for employees to value their job satisfaction in the company based on the provided questions.
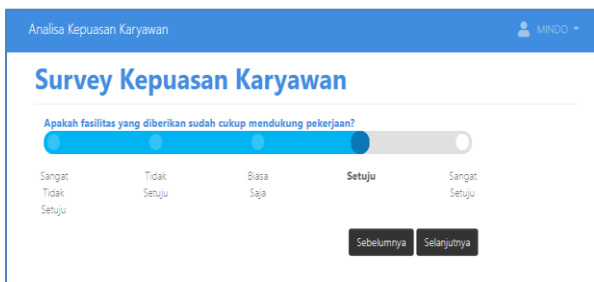

Figure 4. Survey on Job Satisfaction Page

Figure 5 is the page showing the result of analysis of the level of job satisfaction in certain month.

Figure 5. Chart of the Analysis of Job Satisfaction

IV. CONCLUSION

Based on the explanation above, it can be concluded that:

1. By using K-Means algorithm implemented on the result of survey on employee job satisfaction in October, it can be obtained information that the highest indicator of job satisfaction is the Role of Manager with the score of 4.26667 and the lowest indicator of job satisfaction is Facility with the score of 3.74815. The result is in line with the last centroid in the fourth iteration, which has been the same as the third iteration, so the iteration process is finished in the third iteration.

2. With the recent development of mobile technology, it is expected that the next research need to consider developing access system through smartphone with various platforms. That way, users will easily value the level of job satisfaction.

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