APPLICATION OF CASE-BASED REASONING FOR SELECT THE LOCATION FOR INSTALLATION OF FIRE SMART ALARM

By Sopiyan Dalis
APPLICATION OF CASE-BASED REASONING FOR SELECT THE LOCATION FOR INSTALLATION OF FIRE SMART ALARM

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Abstract – Fire is one of the concerns the citizens of Jakarta. In addition to causing substantial material damage, even hundreds of residents who are victims. One of the efforts made by the Jakarta administration is the installation of fire prevention equipment in fire-prone areas are connected via the telephone in the home residents with firefighters are smart alarm. But these efforts are constrained because there are several factors for the installation of smart alarms that are not met by the residents. This paper discusses the determination of the location of the installation of smart alarms to help firefighters wag to tackle the spread of fire to many houses. Taken from the cases determining the location of the previous installation of smart alarm as the experience for firefighters. Therefore, the implementation of the system of Case Base Reasoning (CBR) to the Nearest Neighbor algorithm approach is most appropriate, because this system will take the experience from past cases similar to the value of proximity.

Keywords: Smart Alarm Fire, Case-Based Reasoning, Nearest Neighbor Algorithm

I. Introduction

In the midst of the fire danger is a daily occurrence in Jakarta, citizen self-help efforts to suppress the incident is still minimal. Anticipation by people just improvised. Concerns are victims of fire has increased because it is difficult to rely only on the firefighters who have limitations. Concerns of cases will increase and spread of fire hit the house or the neighborhood itself is recorded from the results of a survey conducted for Reuters by telephone the citizens of Jakarta. Nine out of ten respondents expressed such concerns. This concern is reasonable. Data Fire Department and the Provincial Disaster Management Jakarta showed, during the year 2011, which has been running for three months there has been 174 fires. Average of two events occur within a day of fire [1].

Numerous attempts, have been carried out by the Jakarta City Government in cooperation with Jakarta firefighters to minimize the occurrence of fires, such as the socialization of the means to hold fire-fighting involving the community, to conduct training to the village level. In addition sosilinsi fire and disaster management training for the general public, the fire department has also installed smart Jakarta alarm as much as 2638 units throughout the village, and RW-RW especially prone to fires in the city. Smart alarm which is connected with the telephone, directly connected with the place of existing monitoring in the office of the Office or sub Damkar PB in five regions of the city.

In this study applied a method of Case Based Reasoning (CBR) for determining the location of the installation of smart alarm using the Nearest Neighbor algorithm approach, which aims for consideration for the Jakarta administration and the Department or Agency Damkar PB, as well as aids in determining the location of the installation of smart alarm that is more accurate.

II. Methodology

A. Case Based Reasoning (CBR)

Case Based Reasoning (CBR) or case-based reasoning is a problem solving approach that emphasizes previous experience solving problems for the future or in other words a new problem solved by using it again and if necessary adapting the solutions to similar problems are solved in the past [3].

CBR is one method of knowledge-based approach to study and solve problems based on past experience. Past experience is collected and stored in a place called the "Base Case". Base case is a collection of cases that never happened. A new case solved by searching for cases that have been stored in the base case has similarities with the new case. If no cases which have similarities to the solution of the case is the analysis of the expert or experts on
the case, and then it will be a new case is stored in the base case.

There are four steps in the CBR system [6]:
1. Retrieve, the process of obtaining similar cases for comparison with the collection of past cases. The process begins with problem recognition stage and ends when the case to look for a solution has been found similarity to existing cases. The stages that exist in this retrieval is as follows:
   a. identification of Problems
   b. Starting the Match
   c. Selecting
2. Reuse, i.e. the reuse of existing cases (past cases) are used to find the solution of new problems (treat this now). Reuse of a case in the context of the new case focuses on two aspects, namely the difference between the cases with new case and which parts of the retrieved case which can be used in new cases. There are two ways to be used to reuse existing cases are: reuse of case solutions that already exist (transformation reuse) or reuse existing methods to make the case that the solution (derivational reuse).
3. Revise, is the process of change and adopt the proposed solution if necessary. Revise it at this stage there are two main tasks:
   a. Evaluation of Solutions
      Evaluation of the solution that is how the results obtained after comparing the solution with the actual circumstances. At this stage of evaluation often requires a long time depending on what applications are being developed.
   b. Fix Improvements
      Include the introduction of a case of an error made solutions and take or make an explanation of the error.
4. Retain. In this process the last fixed using a solution as part of the new cases. At this stage there is a process of incorporation of a new case solution is correct to the existing knowledge. There are three stages include: extract, index and integrate.

Case based reasoning scheme is shown by the figure below:

![Figure 2.1. CBR Process Scheme](image)

In the Figure 2.1 schematic process flow of the CBR looks CBR methodology in solving a problem. In the event of new issues, first the system will perform the retrieval process will perform three processing steps are: problem identification, matching, and selection of problems in the database. Then the system will make the process of reuse that will use the previous information with similar problems to solve new problems. Further revise the process, the information will be evaluated, and repaired again to resolve errors that occur in the new issue. In the last process, the system will make the process will retain the indexing, integrating, and extract the new solution. Furthermore, the new solution will be stored into the knowledge base to solve problems that will come.

B. Nearest Neighbor Algorithm

Nearest neighbor an approximation algorithm to find the case with the closeness between the new case with the old case, which is based on the suitability of the existing weight of a number of features [6]. This method to find the distance to the destination of the data that has been stored previously. When you are away and then look for the closest distance. The shortest distance is used to search for identity purposes. Case in point, for example wants to find a solution to the problem of a new patient to save a solution of the old patients. To find solutions of the new patients used the proximity to the case of old patients, the solution of old cases that have affinity with the new case is used as a solution.

Nearest neighbor algorithms are grouped into two types, namely 1-NN and k-NN. If the 1-NN classification process performed on the data label closest 1 while if k-NN classification process performed on the data label closest k (k> 1). In the processing process, both are new data to calculate the distance to each data label later determined that the data has a minimum distance to the nearest or most.

![Figure 2.2. Case Illustration Nearest Neighbor Algorithm](image)
The illustration in Figure 2.2 above there are four new patients and old patients (A, B, C, and D). When there are new patients taken then the solution is the solution of the case is a kind of old patients the greatest intimacy. For example j1 is the distance between a new patient to patient A, j2 is the distance between a new patient to patient, j3 is the distance between a new patient to patient C, j4 is the distance between a new patient to patient D. From the illustrations shown that j1 is the most close to the new case. Thus, the solution of the case patient is to be used as a solution of the new patients.

The formula used in the calculation of proximity (similarity) is as follows [6]:

$$\text{Similarity}(p, q) = \frac{\sum_{i=1}^{n} f(p_i, q_i) X w_i}{w_i}$$

(1)

Description:
- p = new case
- q = the case is in the storage
- n = Number of attributes in each case
- i = an individual attribute from 1 to n

The function f = attribute similarity between the case p and case q

w = weight given to the i attribute

Proximity value is between 0 and 1. A value of 0 means that both cases are similar or not is absolutely not the same, contrary to the absolute value of first two cases are similar or the same.

### C. Smart Alarm

Smart alarm is a fire detection equipment in fire-prone area or not, are placed in local homes using the home telephone network. The attributes in the case of determining the location of the attribute is smart alarm fires, no phone, willingness, and captions. Description attribute is an attribute which is used as a goal in the proximity between the cases. The first case is if the area is prone to fire, no telephone and not willing, then the house can’t be placed for the installation of smart alarm. The second case if the fire-prone area, there is a telephone alarm smart and willing to be paired, so the house can be placed for the installation of smart alarm. The third case if the area is not prone to fire, no phone and smart alarms are willing to be paired, then the house cannot be placed for the installation of smart alarm. Following the installation of smart alarm incident data are presented in Table 2.1.

<table>
<thead>
<tr>
<th>No.</th>
<th>Fire-prone</th>
<th>Telephone</th>
<th>Willingness</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Prone</td>
<td>There are</td>
<td>not willing</td>
<td>not installed</td>
</tr>
<tr>
<td>2</td>
<td>Prone</td>
<td>There are</td>
<td>Willing</td>
<td>Installed</td>
</tr>
<tr>
<td>3</td>
<td>Not prone</td>
<td>None</td>
<td>Willing</td>
<td>not installed</td>
</tr>
</tbody>
</table>

The following example measures the proximity of the new case if the fire-prone area, there would be paired up the phone and smart alarm, whether the house is worth for paired smart alarm or not.

To measure proximity, then will be given weight to the attributes, the weight is not the purpose of inter-attribute can be defined with a value. Weighting values are given between 0 and 1. A value of 0 means that if the attribute has no effect, and conversely the value 1 if the attribute is very influential. Weighting the data following attributes:

<table>
<thead>
<tr>
<th>Table 2.2. Attribute weights</th>
</tr>
</thead>
<tbody>
<tr>
<td>attribute</td>
</tr>
<tr>
<td>fire-prone</td>
</tr>
<tr>
<td>Telephone</td>
</tr>
<tr>
<td>willingness</td>
</tr>
</tbody>
</table>

Next proximity between attributes can be defined with a value. Weighting values are given between 0 and 1. A value of 0 means that if you do not have the closeness between the attribute and vice versa if the inter-attribute value of 1 is very close. The closeness between the attributes are defined as follows:

<table>
<thead>
<tr>
<th>Table 2.3. Fire Prone proximity Weight Attribute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value 1</td>
</tr>
<tr>
<td>---------</td>
</tr>
<tr>
<td>Prone</td>
</tr>
<tr>
<td>Prone</td>
</tr>
<tr>
<td>Not Prone</td>
</tr>
<tr>
<td>Not Prone</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 2.4. Telephone proximity Attribute Weights</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value 1</td>
</tr>
<tr>
<td>---------</td>
</tr>
<tr>
<td>There are</td>
</tr>
<tr>
<td>There are</td>
</tr>
<tr>
<td>None</td>
</tr>
<tr>
<td>None</td>
</tr>
</tbody>
</table>

| Table 2.5. Willingness proximity Weight Attribute |

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III. Results and Discussion

To predict whether smart alarm can be installed in local homes or not, then count the proximity of new cases compared with the old case data. Proximity calculations performed with the above formula.

1. Proximity of new cases by case number 1
A: The closeness of the weight attribute of fire-prone (prone to prone) = 1
B: The weight of fire-prone attributes = 1
C: Closeness weights telephone (no to no) = 0.5
D: The weight of the telephone attribute = 1
E: Proximity willingness weight (not willing to be willing) = 0.5
F: Weight willingness attribute = 0.5
Calculation:

\[
\text{Similarity} = \frac{((A*1) + (C*0.5) + (E*0.5))}{1+0.5+0.5}
\]

\[
= \frac{1.75}{2.5}
\]

\[
= 0.7
\]

2. Proximity of new cases by case number 2
A: The closeness of the weight attribute of fire-prone (prone to prone) = 1
B: The weight of fire-prone attributes = 1
C: Closeness weights telephone (there is a no) = 0.5
D: The weight of the telephone attribute = 1
E: Proximity willingness weight (willing to be willing) = 1
F: Weight willingness attribute = 0.5
Calculation:

\[
\text{Similarity} = \frac{((A*1) + (C*0.5) + (E*0.5))}{1+0.5+0.5}
\]

\[
= \frac{2}{2.5}
\]

\[
= 0.8
\]

3. Proximity of new cases by case number 3
A: The closeness of the weight attribute fires (not prone to prone) = 0.8
B: The weight of fire-prone attributes = 1
C: Closeness weights telephone (no to no) = 0.2

D: The weight of the telephone attribute = 1
E: Proximity willingness weight (not willing to be willing to) = 0.5
F: Weight willingness attribute = 0.5
Calculation:

\[
\text{Similarity} = \frac{((A*1) + (C*0.5) + (E*0.5))}{1+0.5+0.5}
\]

\[
= \frac{(0.8*1) + (0.2*1) + (0.5*0.5)}{1+0.5+0.5}
\]

\[
= \frac{1.25}{2.5}
\]

\[
= 0.5
\]

Having calculated the value of its proximity to the highest is the case number 2. Thus the case closest to the new case is case number 2. So the house can be placed smart alarm installation.

IV. Conclusion

CBR uses Nearest Neighbor pendekan may be one approach to address the problem of determining the location of the installation of smart alarm, so hopefully that does not happen again the same case as in the failure of past experience.

CBR does not guarantee the best solution or the optimum solution for CBR only provides a solution based on the stored cases. To get the right solution, CBR requires a lot of cases, and complete. More and more cases are available, it will get a more precise solution. But the weakness is due to the CBR requires a large storage area to store a lot of cases.

References


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