Predict the **gate status** using Case-Based Reasoning algorithm, with the following attribute values;

Table 1

|  |  |
| --- | --- |
| **Attribute** | **Value** |
| Dam Water Level | 29.50 |
| Sg. Pahang | 12 |
| Sg. Soi | 20.00 |
| Sg. Pekan | 22 |
| Sg. Gambang | 20 |

Table 2 depicts the case-base for spillway gate decision for Kuantan Dam. There are four river connected to the Kuantan Dam that will affect the *Dam* *Water Level,* which are *Sg. Pahang, Sg. Soi, Sg. Pekan* and *Sg. Gambang.* The attributes of Dam Water Level and all the four rivers will contribute to the opening and closing the spillway gate*.* From an interview conducted in Departmentof Irrigation and Drainage, Kuantan, the expert said that *Sg. Pahang* and *Sg. Pekan* are the **most important** attributes and the attributes are **twice** the value of other attributes. The target for each case is either Open or Close gate.

Table 2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Case** | **Dam Water Level** | **Sg. Pahang** | **Sg. Soi** | **Sg. Pekan** | **Sg. Gambang** | **Gate** |
| 1 | 29.26 | 11.06 | 30.40 | 15.99 | 23.00 | Open |
| 2 | 28.99 | 13.09 | 29.01 | 17.09 | 20.99 | Close |
| 3 | 29.50 | 12.89 | 20.99 | 21.99 | 21.09 | Close |
| 4 | 27.01 | 10.11 | 27.89 | 11.09 | 19.22 | Open |
| 5 |  |  |  |  |  | Close |

**CBR Cycle**

1. First Cycle – **Retrieve**

Cases which have similar attributes with the Table1 information has been **selected** from the general knowledge. 4 similar cases with same attributes and decision has been chosen in Table 2.

2. Second Cycle – **Reuse**

The second cycle will suggest decision/solution to the problem by **using** the 4 cases in Table 2 and find which of these cases very similar to our problem.

a) First step is to find the maximum value and minimum value for each attributes.

Example attribute1 (Dam Water Level)

|  |
| --- |
| 29.26\_\_\_\_\_\_\_\_\_\_\_ |
| 28.99\_\_\_\_\_\_\_\_\_\_\_ |
| 29.5 🡨 Maximum |
| 27.01 🡨 Minimum |

Repeat the step to the remaining attributes (attribute2,attribute3,attribute4,attribute5)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Case** | **Dam Water Level** | **Sg. Pahang** | **Sg. Soi** | **Sg. Pekan** | **Sg. Gambang** | **Gate** |
| 1 | 29.26 | 11.06 | 30.40 | 15.99 | 23.00 | Open |
| 2 | 28.99 | 13.09 | 29.01 | 17.09 | 20.99 | Close |
| 3 | 29.50 | 12.89 | 20.99 | 21.99 | 21.09 | Close |
| 4 | 27.01 | 10.11 | 27.89 | 11.09 | 19.22 | Open |
| 5 |  |  |  |  |  | Close |

b) Second step is to find the local similarity for each attributes, this can be calculated using below formula

LS (LocalSimilarity) =

Where, a is the problem value for the attributes

b is the case value for the attributes

max is the maximum value (as example) of the attributes

min is the minimum value (as example) of the attributes

Example attribute1 (Dam Water Level) for Case 1

LS(attribute1-Case1) =

Repeat the step to the remaining attributes (attribute2,attribute3,attribute4,attribute5)

LS(attribute2-Case1) =

LS(attribute3-Case1) =

LS(attribute4-Case1) =

LS(attribute5-Case1) =

c) Third step is to find the Global Similarity for the Case 1. It can be calculated using this formula

GS (GlobalSimilarity) = \*

Where w is the weight of the attributes

LS is the local similarity

i is the iteration

p is the number of attributes

Example for Case1

GS(Case1) = \*(()+)+)+)+))

Because mentioned in the problem, *Sg. Pahang(attribute2)* and *Sg. Pekan(attribute4)* are the most important attributes and have twice the value than the other. In these attributes, the weight for w2 and w4 is two and the rest is one.

So the value for each w can be inserted as below. Then calculate the GS(Case1) using the local similarity value you have been calculated above in step b).

GS(Case1) = \*(()+)+)+)+))

This will get you the Global Similarity value for Case1.

d) **REPEAT step a) to c) for each other case** (Case2, Case3, Case4)

f) The final step is to compare GS(Case1), GS(Case2), GS(Case3), GS(Case4) and GS(Case5) which has the highest similarity with our problem. GS which has the value nearest to 1 then the other cases have the highest similarity

Example

GSExampleCase1 = 0.256

GSExampleCase2 = 0.690

GSExampleCase3 = 0.8669 🡨 have highest similarity then the rest

g) After we select the case that have highest similarity, the decision/solution eg. Gate (open or close) for the selected case will be used as the solution for our problem.

Example

ExampleCase3

Att1, Att2, Att3, Att4, Att5 Gate

x.xx x.xx x.xx x.xx x.xx **Open**

The decision/solution **Open** is selected which solved our problem whether to open or close the gate.

3. Third Cycle – **Revise**

In order to match the solution of our problem, some revision maybe required to adjust the solution accordingly. But in our problem the Gate decision/solution only have two value Open or Close, and the value can be extracted from previous case without any modification and revision. (See slide for details on how the revision works)

4. Forth Cycle – **Retain**

Our problem with the new proposed solution will be stored as the new knowledge in the general knowledge database for future use. Any arising problem with similar attributes with our current problem will retrieve 5 cases an addition from previous cases with the new solution we just generate.