# Decision Support System for Taking Actions to Staffs Using Cased Based Reasoning

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## Abstract

*A decision support system a case-base of previously taken actions and a record of previous taking action processes can assist Administrators in deciding and solving problem cases of staffs in new cases. This system suggests the framework of a Decision Support System adopting Case-Based Reasoning approach; which can support decision makers in management as well as Administration for staffs working in International Non-Government Organizations (INGOs).Case-based reasoning solves problems by retrieving and applying solution to previous problems. Many applied case-based reasoning systems have been developed to capture experiential knowledge in order to aid future decision making. For helping the Administrative Department in INGOs, this system proposed a Decision Support System (DSS). This DSS will be the type of knowledge driven DSS and make use of CBR, specifically Cased Based Reasoning method. This system is implemented by using JAVA programming. This system will be able to reduce the amount of time to assess the situation and will have more extra time to concentrate on the other important departmental issues. This system will support to the Administrative Department.*

## 1. Introduction

Administration department has to handle various complicated issues. It is a challenging job to reduce a number of cases in the staff working in International Non-Government Organizations (INGOs). An administrator will be definitely need of advice and help to make a decision on the staff affairs. It is very difficult for an administrator to make all the staffs be aware of the rule and regulation. On the other hand it is necessary to take the good performance of a member of the staff who breaks the rule and regulation. Most of the cases are difficult and time consuming for Administrative Department in INGOs. Because the staffs working not only in INGOs but also in government organizations need to be well-trained and have to obey rules issued by Administration.

In case-based reasoning (CBR) systems, expertise is embodied in a library of past cases, rather than being encoded in classical rules. Each case typically contains a description of the problem, plus a solution and/or the outcome. To solve a current problem; the problem is matched against the cases in the case base, and similar cases are retrieved. The cases are used to suggest a solution which is reused and tested for success. If necessary, the solution is then revised. Finally the current problem and the final solution are retained as part of a new case.

Case-based reasoning is liked by many people because they feel happier with examples rather than conclusions separated from their context. A case library can also be a powerful corporate resource, allowing everyone in an organization to tap into the corporate case library when handling a new problem. A new problem is solved by finding a similar past case, and reusing it in the new problem situation. Another important difference is that CBR also is an approach to incremental, sustained learning, since a new experience is retained each time a problem has been solved, making it immediately available for future.

CBR allows the case-base to be developed incrementally, while maintenance of the case library is relatively easy and can be carried out by domain experts. The case-based reasoning is based on the observation that when the user solves a problem he often bases the solution on one that worked for a similar problem in the past.

So, case-based reasoned solves new problems by adapting solutions that were used to solve old problems or by remembering a previous similar situation and by reusing information and knowledge of that situation**.**

### 1.1 Related Work

CBR has generated significant research interest and has been successfully applied to a wide range of problem domains for decades. Typical applications

are diagnostic systems, for instance, CASCADE addressed solving problems with the operating system VMS. More recently, Alstom have deployed CBR technology, in conjunction with data mining of past fault data, to support diagnosis of system error messages form the on-board computers which control all the train electronics. Decision support, classification and e-commerce are other problem domains that have been successfully tackled using CBR. A CBR-based Decision Support System framework for Construction Supply Chain Risk Management is the project to support decision makers in preventive as well as interceptive construction supply chain risk management**.** The whole process of CBR system is based on case representation.The case representation for preventive risk management should cover the important features of the project so that risks relevant to the current project can be covered in the retrieved cases and various alternatives to minimize the probability of risk events can be suggested[3].

FM-Ultranet is a medical CBR project to detect malformations and abnormalities of foetus through ultrasonographical examinations. The diagnosis uses attributes derived from scans of the mother's uterus, and identifies abnormal organs and extremities. Cases are arranged in a hierarchical and object oriented structure. The attributes consists of anatomical features, medical history and general domain knowledge. Similarity between attributes are mathematically calculated or compared through a look up table, depending on the attribute type. Reports of the system's findings are generated when the detection (CBR) process is completed [6].

The diabetes management project is presented to provide intelligent decision support to people with Type 1 diabetes on insulin pump therapy, CBR was used because: (a) existing guidelines for managing diabetes are general and must be tailored to individual patient needs; (b) physical and lifestyle factors combine to influence blood glucose levels; and (c) CBR has been successfully applied to the management of other long-term medical conditions[5]. Thus, CBR is the central reasoning modality, and future integrations will be of the master-slave variety, with CBR playing the leading role.

## 2. Theory Background

### 2.1 Case-Based Reasoning

The CBR paradigm covers a range of different methods for organizing, retrieving, utilizing and indexing the knowledge retained in past cases. Cases may be kept as concrete experiences, or a set of similar cases may form a generalized case. Cases may be stored as separate knowledge units or split up into subunits and distributed within the knowledge structure. Cases may be indexed by a prefixed or open vocabulary, and within a flat or hierarchical index structure. The solution from a previous case may be directly applied to the present problem, or modified according to differences between the two cases. The matching of cases, adaptation of solutions, and learning from an experience may be guided and supported by a deep model of general domain knowledge, by more shallow and compiled knowledge, or be based on an apparent, syntactic similarity only. CBR methods may be purely self-contained and automatic, or they may interact heavily with the user for support and guidance of its choices. Some CBR method assume a rather large amount of widely distributed cases in its case base, while others are based on a more limited set of typical ones. Past cases may be retrieved and evaluated sequentially or in parallel.

### 2.2 CBR process

All case-based reasoning methods have in common the following processes:

1. RETRIEVE the most similar case or cases,
2. REUSE the information and knowledge in that case to solve the problem,
3. REVISE the proposed solution,
4. RETAIN the parts of this experience to be useful for future problem solving.

A new problem is solved by *retrieving* one or more previously experienced cases, *reusing* the case in one way or another, *revising* the solution based on reusing a previous case, and *retaining* the new experience by incorporating it into the existing knowledge-base (case-base). The four processes each involve a number of more specific steps, which will be described in the task model. In figure 1, this cycle is illustrated.

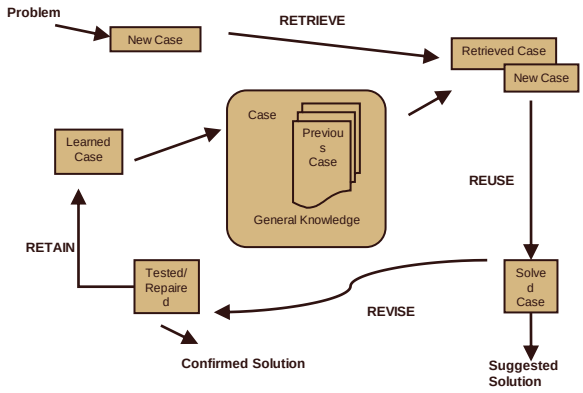


**Figure 1. CBR Cycle**

An initial description of a problem (top of the figure) defines a new case. This new case is used to RETRIEVE a case from the collection of previous cases. The retrieved case is combined with the new case - through REUSE - into a solved case, i.e. a proposed solution to the initial problem. Through the REVISE process this solution is tested for success, e.g. by being applied to the real world environment or evaluated by a teacher, and repaired if failed. During RETAIN, useful experience is retained for future reuse, and the case base is updated by a new learned case, or by modification of some existing cases.

### 2.3 Uses of CBR

Case based reasoning first appeared in commercial tools in the early 1990's and since then has been sued to create numerous applications in a wide range of domains:

Diagnosis: case-based diagnosis systems try to retrieve past cases whose symptom lists are similar in nature to that of the new case and suggest diagnoses based on the best matching retrieved cases.

Help Desk: case-based diagnostic systems are used in the customer service area dealing with handling problems with a product or service.

Assessment: case-based systems are used to determine values for variables by comparing it to the known value of something similar. Assessment tasks are quite common in the finance and marketing domains.

Decision support: in decision making, when faced with a complex problem, people often look for analogous problems for possible solutions. CBR systems have been developed to support in this problem retrieval process (often at the level of document retrieval) to find relevant similar problems. CBR is particularly good at querying structured, modular and non-homogenous documents.

Design: Systems to support human designers in architectural and industrial design have been developed. These systems assist the user in only one part of the design process, that of retrieving past cases, and would need to be combined with other forms of reasoning to support the full design process.

## 3. System Overview

This system stores the old cases of staffs problem information in case database. The user can save new case with their corresponding successful solution into the case database.

This system decides four types of Action:

(1) Dismission
(2) First Warning
(3) Extract Salary
(4) Verbal Warning.

## 4. System Flow

### 4.1Case Retrieval

The stored cases from case database are retrieved by using Nearest Neighbor Retrieval approach. This approach involves the assessment of similarity between stored cases and the new input case, based on matching a weighted sum of features. The biggest problem there is to determine the weights of the features.

### 4.2 Case Reuse

Reusing the retrieved case solution in the context of the new case focuses on: identifying the differences between the retrieved and the current case; and identifying the past of a retrieved case which can be transferred to the new case**.**

### 4.3 Case Revision

Evaluate the case solution generated by reuse. Otherwise repair the case solution using domain specific knowledge. Check the solution of new case by using Nearest Neighbor Algorithm.

### 4.4 Case Retainment

The new solution is stored after being accepted decision by taking the most similarity from the old cases and confirmed.

## 5. Decision Making using CBR

In this system, when staff breaks some rules and regulations issued by the Administration and need to take actions upon these staffs, the system will accept the problem descriptions from the staff and then matches with similar old case or cases from the case database. If an exactly match case is found in the case database, the decision will be made exactly like the matched case. If there is no exactly match case in the case database, this system will check the decision by using Nearest Neighbor Algorithm.

The procedure of this algorithm is as follows:
For each feature in the input case, find the corresponding feature in the stored case, compare two values to each other and compute the degree of match. And then multiply by a coefficient representing the importance of features to match. Add a result to match to derive an average match score. This number represents the degree of match of the old input case. A case can be chosen by choosing the item the threshold.

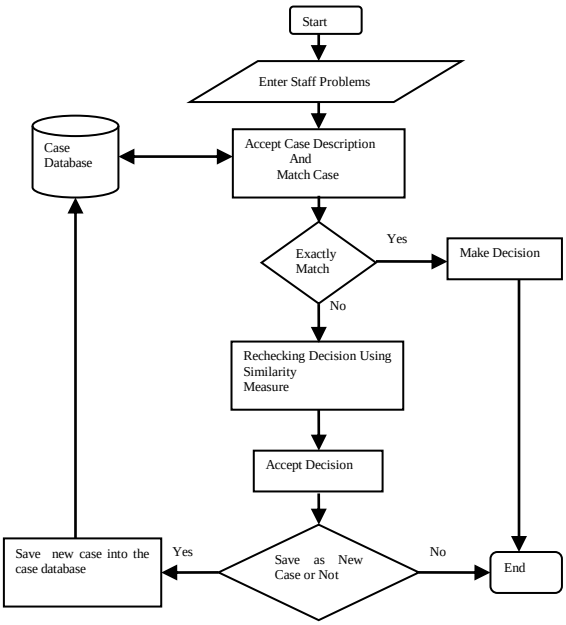


**Figure 2. Decision Making Process**

And then the decision will be accepted from the most similar case from the case database by using the Nearest Neighbor Algorithm. If the administrator wants to save as a new case, the case can be saved into the case database and useful for future decision making.

**Sample New Problem**

Feature 1(Leave) Taking leave beyond the limited acceptance
Feature 2(Having no flexibility in works) No
Feature 3(Abuse) No
Feature 4(Mis-use) Making wrong use of office equipment personally
Feature 5(Bribing) No
Feature 6(Failing) To follow up the assigned tasks

Nearest Neighbor Algorithm is used to calculate the main distance. The main distance equation is:

$$S(I,R) = \frac{\sum_{i=1}^{n} w_i * Sim(f_i^I, f_i^R)}{\sum_{i=1}^{n} w_i}$$

where: $w_i$ is the importance weighting of the feature I,
Sim( ) is the similarity function
$f_i^I \; f_i^R$ are the values for feature $f_i$ in the input and retrieved cases respectively,
N is the number of attributes in each case

This similarity function is defined as follows:
if feature $f_i$ is numeric
0 if feature $f_i$ is symbolic and $f_1^I \neq f_1^R$
1 if feature $f_i$ is symbolic and $f_1^I = f_1^R$.

There is no exactly match case found in the case database, so it calculates the similarities by using the above equation. And it will accept the decision from the old case which has the most similarity.

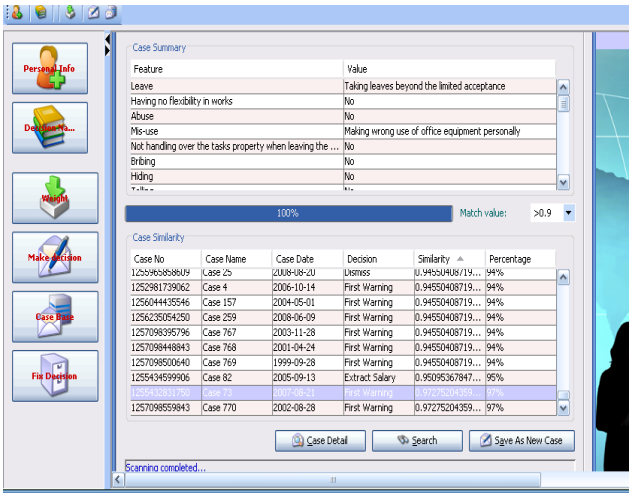


**Figure 3.Nearest Neighbor Retrieval**

Therefore, the decision for the new case will be First Warning. This new case can be retained in the case base after being confirmed its decision and checking with fixed rules.

## 6. Conclusion

This proposed system will give many advantages to the International Non-Government Organizations (INGOs) by organizing with reasonable facts and systematic decision support system so that there will be no dispute for the decision for taking action. Main advantage is that having a computerized decision to take action to staffs there will be no personal bias so the staffs will be more willing to accept the actions taken by the administration department for the INGOs. It is also easy to keep track of the history of the staffs and do not need to review the personal file of the staffs. And then it reduces the amount of violations on rule and regulation by the staffs and so it reduces taking the dismiss actions to staffs. Most Decision Support System use Data Mining Technology and AI approach techniques. In this system, CBR techniques are used because it can well support the requirements of the organization.

## 7. References


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