Using CommonKADS Method to Build Prototype System in Medical Insurance Fraud Detection

Yao-Hsu Tsai and Chieh-Heng Ko*
Chung Hua University/Hospitality Department, Hsinchu, Taiwan
*Corresponding author, Email: happy4golf2007@gmail.com, chko@chu.edu.tw

Kuo-Chung Lin
Tatung University/ Department of Computer Science and Engineering, Taipei, Taiwan
Email: roberboy@ms34.hinet.net

Abstract—At present, the false claim cases related to insurance fraud emerge endlessly. In respect of frequent fraud cases of social insurance undertaken by government organizations, the inspection procedure usually relies on experts’ experience for verification and experienced personnel in charge of checking. However, due to heavy work load insufficient manpower and lack of experience, the ratio of miscarriages of justice is very high, which leads to improper settlement of claims and the waste of social resources. In this paper, we used rule technology to improve the above inefficiency. We employ a knowledge engineering methodology to analyze problems and construct knowledge models, including the domain schema and rules. We implement the knowledge model along with the existing database applications. The benefits generated by the research are: (1) establishing a knowledge system with expertise reasoning to solve the review problems of massive cases, (2) significantly reducing the large labor cost and consumed time of the existing reviewing system, and (3) improving the application level of traditional database in the expert reasoning system.

Index Terms—Fraud Prevention; Knowledge Engineering; Domain Schema; Government Insurance

I. INTRODUCTION

In order to prevent insurance fraud, Common approach for the introduction of experienced professionals to apply for insurance claim cases to be assessment. There are two bottlenecks in the assessment: First, the required information stored in heterogeneous databases, the query is not easy. Second, the assessment relied on the experienced professionals and specialized domain knowledge is very complex and difficult to transfer the rules into the automated system. In order to solve problems, insurance claims for case assessment. The database will be integrated with related technology and automated knowledge processing capabilities are two important tasks. Mainly to the insurance claims departments to meet the expectations of all levels of personal. In the study will be based on knowledge engineering methodology to meet these needs. Includes used knowledge of methodology CommonKADS [1] to develop the insurance fraud prevention reason system.

Next section, we give an overview of the insurance fraud and knowledge engineering methodology-CommonKADS. After, we describe the analysis and design of the knowledge system in Section III. Section IV, we was evaluation the reason system. Finally, to made conclusions and future study.

II. REVIEW LITERATURE

A. Insurance Fraud Prevention

In this section, we discuss the academic to identify characteristics of the insurance fraud case. Hope to use these characteristics in the development of insurance fraud reasoning system. These characteristics will be reviewed with an experienced expert assess of the rules of the insurance fraud prevention knowledge, for comparison.

The insurance fraud characteristics include: Damage level insufficient information, suspected diagnosis of proof, insured low willingness to cooperate and Cause of the accident unreasonable [2]. Repeatedly claims record, in a special area, Occur at a specific time and claims for late filing [3]. Inconsistent documents of application, high claims payments, certificate of poor reliability, non-cooperation and very familiar with insurance knowledge [4].

Statistical techniques to explore the incidence of fraud cycle [5]. The establish Private Network of Social of control investigative insurance company [6]. This survey describes the range of these moral hazards arising from asymmetric information, especially in claiming behavior, and the steps taken to model the process and enhance detection and deterrence of fraud in its widest sense [7].In automobile insurance fraud prevention studies case, it will assess the results distinguish between two kinds of results, suspected fraud cases and reasonable. Prediction method use Logistic Regression [3] [8]. Want to classification for different levels, use of Fuzzy C-means, Artificial Neural Network and Line Regression [9] [10]
Some scholars in the life insurance claims fraud, the use of game theory to infer information asymmetry caused by fraud factor [12]. Or use the least square method to identify the factors that affect the insurance fraud cases can apply to increase the recognition rate [13].

B. Knowledge Engineering Methodology

When building a knowledge-intensive system, it is appropriate to adopt a comprehensive methodology. The adopted methodology should facilitate the detailed analysis and complete treatment of knowledge-intensive tasks and processes. The CommonKADS methodology is excellent for the above purpose.

The process of CommonKADS actually is developing the six predefined models with each of them focuses on one limited aspect and the combination is a comprehensive view of the whole system. "A model reflects, through detail abstraction, system characteristics in the real world. Each model highlights certain system characteristics and abstracts other ones" [14]. Also, the CommonKADS has a wide application range, effectively integrates the knowledge derived during the program management process knowledge engineering development method of CommonKADS.

III. DESIGN AND IMPLEMENTS

A. Contextual Analysis

In the government insurance process, the expert assess process is most important. Often occurs for many cases of fraud, resulting in significant losses. The experts assess process also the focus of this study. The CommonKADS starts from the contextual analysis which results in three processes: Organization, Task and Agent Models [15]. Firstly, in the analysis of Organization Model, the analysis to the problems and opportunities is required and at the same time, the task and mission of the organization shall be clarified.

The primary process, to comprises a number of tasks, among which List item check, Query for IS (Information System), Assessment, and Re-Assessment are knowledge intensive tasks Fig. 1.

![Flow chart of governmental insurance system](image1)

B. Enhanced System Architecture

The right-hand side in the figure is the current system architecture. In the left-hand side is the enhanced part using rule technology. The auditing personnel access the knowledge based system through the service interface; the knowledge base administrator uses the management interface Fig. 2.

![System architecture enhanced by using rule technology](image2)

C. Class Diagram

The UML provides system architects working on object analysis language for specifying, visualizing, constructing, and documenting the artifacts of software systems, as well as for business modeling [16]. The UML is fact industrial standard of an object-oriented modeling language [17]. We define the concepts and attributes using UML Fig. 3.

![Knowledge agent class diagram](image3)

D. Expressions Relationship

Through the interview with auditing experts and the classification of existing rules and regulations, we summarize the following knowledge items used to in the assessment task. [Figure 4 Example for Rule 1]

Rule 1: Inspection already adjustment of days in hospital.
Rule 2: Inspects the insured to be effective.
Rule 3: Check insured’s date change date.
Rule 4: Inspects insured’s Institution.
Rule 5: Insured’s salary change range.
Rule 6: Check the insurance seniority.
Rule 7: Inspects hospital reliability.
Rule 8: Inspects doctor reliability.

E. Knowledge-Base
The knowledge-base gets the pairs through different generic rules previously defined. A sample instance of the knowledge-base:

```
KNOWLEDGE-BASE insurance-fraud-assessment-base;
USES
Refer to days has been paid-rules FROM
insurance-fraud-assessment-scheme;
Refer to insured effective-rules FROM
insurance-fraud-assessment-scheme;
Check data change-date-rules FROM
insurance-fraud-assessment-scheme;
Check categories of institution-rules FROM
insurance-fraud-assessment-scheme;
Check salary change-range-rules FROM
insurance-fraud-assessment-scheme;
Check the insurance seniority-rules FROM
insurance-fraud-assessment-scheme;
Refer to hospital reliability-rules FROM
insurance-fraud-assessment-scheme;
Refer to doctor reliability-rules FROM
insurance-fraud-assessment-scheme;
EXPRESSIONS
/* refer to days has been paid */
If Application.Claims_Days + Insured.Day_has_been_paid > 180
then Reject else Pass;
/* refer to insured effective */
If Application.Date = Insured.Start_Date < 30 days then reject else pass;
/* refer to data change date */
If Application.Date = Institution.Data_change_date < 30 days then reject else pass;
/* refer to categories of institution */
If Application.Insured_ID inquiry Institution.Categories = 2, 3, 4, 5
then Reject else Pass;
/* refer to salary change range */
If Application.Insured_ID inquiry Institution.Salary_change_range_level > 2
then Reject else Pass;
/* refer to insurance seniority */
If Application.Insured_ID inquires Insured.Years > 12 months then pass else reject;
/* refer to hospital reliability */
If Application.Hospital = Check_list.Problem_hospital then Reject else pass;
/* refer to doctor reliability */
If Application.doctor = Check_list.Problem_doctor then Reject else pass;
```

END KNOWLEDGE-BASE insurance-fraud-assessment-base;

F. Inference Knowledge
Inference Knowledge is the reasoning primitives and the elemental reasoning steps for task resolution [Figure 5]. They are described by specifying the performed function and their input and output [18].

G. Using Rule tool to design Task Knowledge
We implement the design model using the visual rule technology – Visi-Rule [19]. The rule system integrates with the existing database application by using the Prolog-to-database interface; The Pro-data user accesses the rule system through the browser [20]. WIN-PROLOG 4800 [Figure 6] is used for conducting Rule Model construction. In the design model, will apply for the case after the Rule inspection divides into three broad headings.

IV. Evaluation
In this section we describe the implementation of the knowledge model using the visual rule technology, Visi-Rule [19]. For example, to maintain the knowledge base: The resulting code after using the visual interface can be Flex [21] or Prolog [22], which is automatically generated, compiled and ready to run. In the resulting
We are successful in using the rule technology to build up the knowledge-based system. At present, various database systems are used in the application of managing governmental insurance. In the future, the Semantic Web technology is suitable for integrating databases of various formats [24]. And, the knowledge model developed of result to combined data mining technology, to extend the coverage of the knowledge base [23].

VI. CONCLUSIONS

The research subject is government insurance which is different from private insurance. And the developed programming language has not undergone compatibility verification. Because the tool used by this study is the rule language developed by Prolog 4.8 tool of LPA Company, therefore, whether the program code can be applied to other rule tool or semantic network tool is not completely verified functionally.

Modify the reasoning knowledge model combined with mining technology: In the future, the adjustment and weighing of correlation in each important knowledge item of the knowledge reasoning review system of the public insurance application claim cases can be made combined with data mining technology so as to increase the reasoning accuracy.

Reasoning system application combined with ontology and Web technology: The hierarchical construction of ontology is made combined with ontology semantic tool and WEB interface, which can conduct more effective integration and construction for each core knowledge one by one in a more efficient way; At the same time, the development of reasoning system of WEB framework can promote the application of reasoning system through the borderless power of network.

REFERENCES


