Credit Card Fraud Detection Based on the Transaction by Using Ontology Fraud Detection Algorithm

R. Dharmarajan[1] V.Sangeetha[2]
[1]Assistant Professor [2]Research Scholar
[1,2]Department of Computer Science
[1,2]Thanthai Hans Roever College, Perambalur-621212, Tamil Nadu

Abstract— Credit card fraud is rising significantly with the growth of recent technology and the global superhighways of communication. Credit card costs consumers and the financial company billions of dollars annually. The swindler continuously attempts to find new plan and procedure to commit illegal actions. Hence, fraud detection systems have become necessary for banks and financial institution, to reduce their losses. The most common techniques used to make the fraud detection model. Incidentally, detection and prevention of credit card frauds are one of the vital problems in the digital world that need exact transactions analysis. One method for detecting fraud is to check for suspicious changes in user behavior. This paper provides an inventive fraud detection method, build upon ontology and ontology instance similarity. Ontology is broadly used to facilitate knowledge distribution and reuse. Thus, several personality ontologies can be simply used to present user actions. By calculating the similarity of ontology instances, we can decide whether an account is defrauded. This technique short the data model cost and makes the system very adaptive to many applications.

Key words: Credit Card Fraud, Fraud detection, Types of fraud, Ontology, Ontology algorithm

I. INTRODUCTION

Nowadays with the widening of credit cards along with online transactions, it is a significant problem for financial institutions in their attempt to prevent credit card fraud activities. There are a number of sundry methods for fraud can occur with any type of credit products such as tax evasion, illegal dealing of commodities, acquisition of loans via false information, money transfer under the head of fake business transactions, the donation to fake charity organizations, etc [1]. This research addresses this problem by proposing an ontology-based algorithm for doubtful credit card transaction detection. The ontology consists of domain knowledge and a set of rules that together compose an expert system. The native reasoning support in ontology is used to deduce new knowledge from the predefined rules about suspicious transactions [1].

II. CREDIT CARD FRAUD

Credit card fraud detection is the process of monitoring the behavior of the customers‟ transaction level through a period of time [2].

A. Types of Credit Card Fraud:

- The first type which is the most common is the application fraud. The individual will falsify an application to acquire a credit card. The individual will give false information about his/her financial status in order to receive a credit card.
- The second type is assumed identity. Assuming someone's identity has been in the long-run form for credit card fraud. The individual will falsify a name with a temporary address.

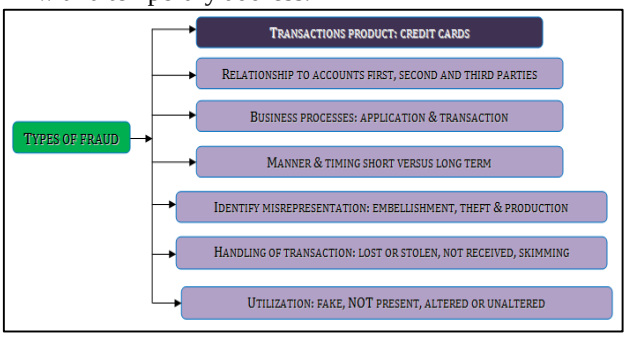

Fig. 1: Types of fraud

- The third type is financial fraud which happens when an individual wishes to gain more credit than he/she currently has. They will apply for a credit card under their own name, but the information regarding their financial status will be false.
- The fourth is skimming technology. Magnetic card skimming is a small handheld device with the sole purpose of collecting and storing the information on any credit card.
- The fifth type is never received issue. This type of credit card fraud involves the theft of the card while still in transit [2].

B. Credit Fraud Detection Ontology

As mentioned above, the findings of research process are encapsulated into a knowledge base also known as ontology. This is a repository of information which uses formal mathematical notations [3]. The followings are various challenges in credit card fraud detection,

- Non availability of real data set
- Unbalanced data set
- Size of the dataset
- Determining the appropriate evaluation parameters
- Dynamic behavior of fraudster

The conceptualization of information into a formal mathematical representation allows the ontology to be queried and suppose a response. The ontology includes the various techniques and their properties that can be used to detect credit fraud. More details about ontologies can be found in following section [3].

III. ONTOLOGY

Ontology is widely defined as "a specification of a conceptualization". Conceptualization refers to the "abstract,

simplified view of the world". A specific real-world domain can be represented at a higher level of abstraction using ontologies. Therefore ontology can be seen as a formal representation of concepts along with their relationships [4]. It can express semantics in a much richer way than other representation models. Ontologies consist of classes, their instances and properties between these instances. They also use logic languages like first order logic or description logic to formalize axioms and increase their expressiveness. They are widely used in the area of Semantic Web to express meaning.

1	*Individuals*	Individuals also known as instances. It can be seen as the objects of the conceptualized domain.
2	*Classes*	The classes of ontology are the "sets that contain individuals". A class 'c' consists of formal mathematical statements which describe the conditions which an individual needs to satisfy for being member of 'c'. Similar to object oriented programming. A class may have a number of subclasses.
3	*Properties*	The properties are simply the relations between two individuals.

Table 1: Classes, Properties and Individuals of Ontology

Ontologies are content theories about the classes of individuals, properties of individuals, and relations between individuals that are possible in a specified domain of knowledge. They define the terms for describing our knowledge about the domain. An ontology of a domain is beneficial in establishing a common vocabulary for the describing the domain of interest. This is important for unification and sharing of knowledge about the domain and connecting with other domains [5].

In reality, there is no common formal definition of what ontology is. However, most approaches share a few core items such as: concepts, a hierarchical IS-A-relation, and further relations. For the sake of generality, we do not discuss more specific features like constraints, functions, or axioms in this paper; instead we formalize the core in the following way:

Definition: Ontology is a tuple

O = (C, is_a, R, σ) where

C is a set whose elements are called concepts, is_a is a partial order on C C (i. e., a binary relation is_a ⊆ C X C which is reflexive, transitive, and anti symmetric),

R is a set whose elements are called relation names (or relations for short),

σ : R → C $^{+}$ is a function which assigns to each relation name its arity [6].

In the last years, several languages have been developed to describe ontologies. Also, the number of environments and tools for building ontologies has grown exponentially. These tools are aimed at providing support for the ontology development process and for the subsequent ontology usage [7].

A. Ontology Algorithm

Generally, every concept in ontology has its explicit definition which is sufficiently detailed to capture the semantics of the domain. In our paper, four kinds of elementary factors are used to distinguish a concept within an ontology and they are concept name (N), property (P), instance (I), and relation (R). Since N, P, I are features related only with the concept, and R are features related the concept with another one, these four kinds of features can be classified as two kinds: intension for local information and extension for global information [8].

Definition 1: Intension of a concept c is defined as a tuple $InTc := (n_c, P_c, I_c)$, which describes the essence features of the concept, where

- n_c is a name of the concept c . Every concept has only one distinctive name.
- P_c is a set of properties related with the concept.
- I_c is a set of instances associated with the concept.

Definition 2: Extension of a concept c is defined as $ExT_c := R_c$, which profiles the structural property of the concept by its relations with other concepts, i.e. determines situation of the concept in the whole ontology, where

R_c is a set of relations that related the concept with other concepts in the ontology [8].

Definition 3: An ontology with k concepts is modeled as a tuple $OM := (V_c, OntoInT_{Vc}\ OntoExT_{Vc})$, where $C=\{c_i | 1 \le i \le k\}$ is concept set of the ontology, and c_i is one concept in the ontology, such that:

V_c { $vci|vci$ =i,$1 \le i \le k$} is a set of sequence number of concept. Where $v\ ci$ denotes that the ith concept in the ontology is ranked with a sequence number of i ;

$OntoInT_{Vc} = \{ vci , Ttype, xci>\}$ is a set of intensional features of the ontology, where $1 \le i \le k$, $Type = \{'N','P','I'\}$ and $\{ vci , Ttype, xci>\} =$

$$\begin{cases} < v_{c_i}, 'N', n_{c_i} > & \text{if } Type='N' \\ < v_{c_i}, 'P', p_{c_i} > \ p_{c_i} \in P_{c_i} & \text{if } Type='P' \\ < v_{c_i}, 'I', i_{c_i} > \ i_{c_i} \in I_{c_i} & \text{if } Type='I' \end{cases}$$

$OntoExT_{Vc} = \{< vci|vci , Type, r_{ij} >\}$ is a set of extensional features of the ontology, Where $1 \le i \le k$, $Type ='R'$, $r_{ij} \in$ Rci and , < vci , vci ,' R', r_{ij} > represents that there exists a relationship from concept c_i to concept c_j .

Definition 4: An overall feature set of an ontology F_0 is defined as a combination of the intensional features set $OntoInT_{Vc}$ and the extensional features set $OntoExT_{Vc}$, that is, $F_O = OntoInT_{Vc} \cup OntoExT_{Vc}$

Definition 5: Mapping function $M: Vc->V'_c$ is defined as a mapping from one ontology O_1 to another ontology O_2, in which V_C is the sequence number set in O_1, and V'_C is the sequence number set in O_2 [8].

As defined in Definition5, a mapping is a correspondence relationship between the taxonomies of two given ontologies. It states that any of concepts in O_1 should have a corresponding concept in O_2, and two different concepts in O_1 may correspond to the same concept in O_2.

IV. GENERAL VIEW OF CREDIT CARD FRAUD DETECTION BY USING ONTOLOGY SYSTEM

In ontology algorithm, every user's transaction behavior and then storage in the system, during abnormality detection only those transactions from registered history of transactions are selected to perform computations which are highly similar to entry transactions [9].

In the first place data of transactions performed by the person carrying it out (whether credit card owner or any other person) are stored based on ontology graph. Data

applied for storage in such ontology graph are those which are influential in detection process.

Generally data stored in graph data structure for every entry transaction falls into four categories.

Data which are similar in all transactions, data in term of amount of transaction, data in connection with transaction location occurrence, data related to quantity of performed transactions by user in a specific time interval [10].

Another task which Make Ontology unit fulfils is *pre-processing* operation on every entry transaction so that there would be no conflict between data stored in each graph during processing operation on transactions. In the next stage there is a comparing unit called *Compare Unit* which its main task is receiving the ontology graph created in the previous stage and then matching it with current patterns in Pattern DB. In fact, the principle of the framework is this part that regarding data graph received from new entry transactions, the data graph stored in history select those users behavior mode resembling the graph and according to output data of the matching process the chief mission of outlier is defined.

In Pattern Data Base both legal and fraudulent acts graphs are stored. Using such method provides the system with three significant benefits. The first one is that computational overload to fraud detection operation would drop due to getting only similar patterns involved despite of all present ones in patterns part. The next benefit is real-time detection of entry transactions in case of resembling those fraudulent transactions already stored. And the last one is that with respect to the similar patterns to a specific entry transaction being applied for detection process, fulfilling offline fraud detection is feasible as well.

The next unit is *Calculation Unit* which its chief task mission is performing main computations on entry transaction data and transactions stored in similar behaviour patterns stored in patterns bank and how a transaction is labelled as fraudulent by discovering [10].

After finishing the computations, if entry transaction is identified as an outlier data graph pattern of analysis unit does not store it. The other unit is *Decision Unit* which categorizes the entry transaction according to finished computations by Calculation Unit consequently entry transactions are either performed or prevented. Offline transactions tagged as fraudulent would be issued alert [10]. The following figure general system architecture for fraud detection system,

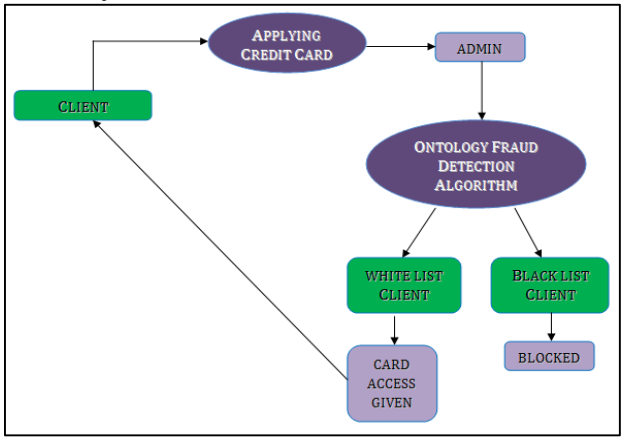

Fig. 2: System architecture diagram for Fraud Detection

V. Conclusion

These days one of the biggest threats to commercial institutes is fraud in credit cards. Understanding of fraud mechanism for fighting back its effects is subsequently a necessarily salient task. This paper explains the approach to credit card fraud detection Using Ontology system by monitoring individual transactions. Detecting such abnormalities credit cards operations by exploiting a concept called ontology. It is a very efficient approach through which low computational overload and less storage for managing credit cards transactions data are required and data mining is utilized for abnormalities detection.

Reference

[1] Linda Delamaire (UK), Hussein Abdou (UK), John Pointon (UK) "Credit card fraud and detection techniques: a review:" Banks and Bank Systems, Volume 4, Issue 2, 2009.

[2] Manjunath K.V, Patharaju S.D"Data Mining for Fraud Detection" ijarcsse, Volume 5, Issue 8, August 2015, ISSN: 2277 128X.

[3] Quratulain Rajput, Nida Sadaf Khan, Asma Larik & Sajjad Haider "Ontology Based Expert-System for Suspicious Transactions Detection" Computer and Information Science; Vol. 7, No. 1; 2014, ISSN 1913-8989 E-ISSN 1913-8997.

[4] T. Gruber, "What is an Ontology?," Stanford University, [Online]. Available: http://www-ksl.stanford.edu/kst/what-is-an-ontology.html. [Accessed 6 April 2013].

[5] C. Martinez-Cruz, I. J. Blanco and M. A. Vila, "Ontologies versus relational databases: are they so different? A comparison," Artificial Intelligence Review, pp. 271-290, 2012.

[6] Chandrasekaran B., J. R. Josephson, and V. R. Benjamins. What are ontologies, and why do we need them? IEEE Intelligent Systems, 14(1):20–26, 1999.

[7] M. Horridge, "A Practical Guide To Building OWL Ontologies Using Protègè 4 and CO-ODE Tools, Edition 1.3," The University of Manchester, 2011.

[8] Junli Wang, Zhijun Ding, Changjun Jiang "GAOM: Genetic Algorithm based Ontology Matching " Proceedings of the 2006 IEEE Asia-Pacific Conference on Services Computing (APSCC'06),0-7695-2751-5/06 $20.00 © 2006.

[9] Ali Ahmadian Ramaki, Reza Asgari, Mehregan Mahdavi, Reza Ebrahimi Atani "Ontology-Based Credit Card Fraud Detection"https://www.researchgate.net/publication/293327022, Conference Paper • October 2012.

[10] Ali Ahmadian Ramaki, Reza Asgari ,Reza Ebrahimi Atani "CREDIT CARD FRAUD DETECTION BASED ON ONTOLOGY GRAPH" International Journal of Security, Privacy and Trust Management (IJSPTM), Vol. 1, No 5, October 2012.

