# A survey on the detection of frauds

Une approche consensuelle de classification pour la decection de fraudes

You Jiang

Supervisor: Zahia Guessoum

Université Pierre et Marie Curie
Juin 2017

# Contents

# Introduction

With the development of technologies and the large use of online payment or transaction of money, the sécurity become a subject important today. Recently, the fraud becomes a problem witch causes a billion of dollars loss every year, So that the detection of the fraud becomes really important. Many scientist make their effort to study the major type of fraud and look for solutions. the frauds can be divided into these domains, credit card fraud, telecommunication frauds, assurance frauds and computer intrusion fraud. In this report we try to resume the most commune frauds, and some techniques of the detection. [1]. [2].

# Chapter 1

# The Frauds

## 1.1 Definitions

Fraud is an abuse of the information or action of the credit card or insurances. The definition given by the association of certified fraud examiners (ACFE) is: the use of one's occupation for personal enrichment through the deliberate misuse or misapplication of the employing organisation's resources or assets (ACFE, 2002). Almost all technological system that involves money and services can be compromised by fraudulent act; for example the credit card, telecommunication, health care insurance, automobile insurance and online auction system(Almeida, 2009).
In law, fraud is deliberate deception to secure unfair or unlawful gain, or to deprive a victim of a legal right. (Wikipedia: fraud)

## 1.2 Fraud in general

Fraud can be considered as a conficence trick. A confidence trick (synonyms include confidence game, confidence scheme, ripoff, scam and stratagem) is an attempt to defraud a person or group after first gaining their confidence, used in the classical sense of trust. Confidence tricks exploit characteristics of the human psyche such as dishonesty, vanity, compassion, credulity, irresponsibility, naïveté and greed. (Wikipedia: confidence trick)

- Business-related
  Billing, Cramming,Disability Drug / Pharmaceutical, Email, Employment, Fixing, Impersonation, Intellectual, property, Internet, Job, Long firm ,Odometer, Phone Quackery / Health care, Racketeering, Return, Slamming, Telemarketing
- Family-related
  Marriage , Paternity
- Financial-related
  Advance-fee (Lottery scam), Bank, Bankruptcy, Chargeback, Cheque, Credit, card, Forex, Insurance, Mortgage, Securities, Tax
- Government-related
  Electoral, Medicare, Visa, Welfare
- Other types
  Affinity, fraud, Charity, Confidence, trick, Counterfeiting, Faked death, Forgery, Hoax, Impersonation, Mail and wire (honest services) ,Scientific, Spyware, White-collar, crime

## 1.3 Fraud in finacial fields

Almost any technological system that involves money and services can be compromised by fraueulent acts, for example credicard system, telecommunication system, health care insurance system, etc (Almeida et al, 2008). In this section we introduce four major finacil frauds mentioned in the works of (Abdallah et al., 2016) [1]

### 1.3.1 Credit card frauds

As a result of the growing usage of credit card, fraudsters try to find more opportunities to commit frauds that can cause huge losses to cardholders and banks(sherly and Nedunchezhian, 2010).[3]
Credit card fraud is a major type of fraud happended in the dailylife. It's called Offline fraud if the physical card is stolen, and called Online fraud if it is caused by online information leaks.(laleh and azgomi, 2009)[4]

There is another classification for credit card fraud, types into two types, application fraud and behavioural fraud(Delamaire et al., 2009)[5]. The classification is based on fraudster's strategy on committing fraud.application fraud occurs when a fraudster enter wrong information into the application form to get a new card. Then , the fraudster may use this card to make some purchase without the intention to pay.(Bolton and Hand, 2002)[6]. The second is called behavioural fraud, the fraudster obtain the real cardholder information to make some online purchase(Bolton and Hand, 2002)[6].

Patidar and Shama, 2011[7] proposed another credit card fraud categorisation. it divided the fraud into 3 major type: traditional card related frauds, merchant ralated frauds and internet frauds.

### 1.3.2 Telecommunication frauds

Telecommunication fraud is a problem that has grown dramatically over past 10 years. the Fixed line fraud is committed against telephone companies this as fraudster gain access to switchboard. mobile fraud is unauthorised use, tampering or manipulation of a fraud in both types of telecommunication is to gain services and calls by illegal ways.
the telecommunication fraud is grouped into four categories: contractual fraud, hacking fraud, technical fraud, procedural fraud.

### 1.3.3 Insurance frauds

- Healthcare insurance frauds
  Healthcare system are working to support people with low income to pay he high costs of healthcare. The healthcare system is complex and confusing to most people. It consists of many rules and regulations. The most common known healthcare fraud types are: phantom claims, Duplicate claims, Bill padding, etc.

- Automobile insurance frauds
  An automobile inssurance system is similar to healthcare insurance system, but between the different services provider and the insured.Staged vehicle fraud and rental care fraud are considered the most prevalent fraudulent behaviour in this area.

### 1.3.4 Computer intrusion frauds

Actually, the computer virus could be used to control a personal computer and access or manipulate the information illegally. The traditional way may be asking or threatening the user to pay ransom to unlock

his illegally encrypted files.

### 1.3.5 Online auction frauds

An online auction is one of the most popular profit internet business models, because online auction activities are not constrained by time or physical store locations. The internet Complaint Center reported that online auction is one of the top two most dangerous internet crimes in recent years, (Chang and Chang, 2012)[8]. It classified the fraud into six categories: non-delivery of goods, mis-representation of the items, triangulation, fee stacking, Selling of black-market good, multiple bidding and shill bidding.
Dong et al(2009) [9] classified the types of online auction fraud based on time periods into three categories: pre-auction, in-auction and post-auction.
Chang and Chang(2014)[10] categorised online auction fraud according to fraudster attitudes into fours types: aggressive, Classic, Luxury and low-profiled.

# Chapter 2

# The fraud prevention and detection systems

## 2.1 Fraud prevention system

Fraud prevention system is the first layer of protection to secure the technological systems against fraud()[1]. It try to stop fraud from occurring in the first place. The first mechanism restrict, suppress, destruct, destroy, control, remove, or prevent the occurrence of cyber-attacks, in computer systems, networks, or data, including using encryption algorithm in scramble data. The other one is firewall.(Oppliger, 1997;Magalla , 2013)[] This layer is note always efficient and strong(Belo and Vieira, 2011) []

## 2.2 Fraud detection system

Fraud detection system is the next layer of protection. It tries to discover and identify fraudulent activities as they enter the systems and report them to a system administrator(Behadad et al., 2012). the computerized and automated FDS was invented to avoid these complicated and time consuming manual fraud audit techniques , to raise the effectiveness of detection.However the FDS capabilities were limited because the detection depends on predefined rules that are stated by experts(Li et al., 2008).
In the recent years, FDSs integrate an amount of data ming methods to the effective fraud detection(Akhilomen,2013. Koh and Tan, 2005. Guo and Li, 2008; Ogwueleka, 2011. Desai and DeshMukh, 2013.Saravanan et al; 2014).Data ming involves statistical, mathematical, artificial intellingence and machine learning techniques to extract and identify useful information and subsequent knowledge from large databases.[1]. Data ming methodes consist of six main categories which are Classification, Clustering, regression Outlier detetion, Visualization and Prediction(Edelstein, 1997:; Noor et al. 2015)

### 2.2.1 Anomaly based fraud detection

Anomaly or outlier detection approch is used by FDS and it relies on behavioral profiling methods where it models each individual's behavioural pattern, monitoring it for any deviation from the norm(Jyothsna and Rama Prasad, 2011). Anomal based FDS are adopted by numerous authors in different fraud areas(Ghosh and Reilly, 1994; Dorronsoro et al. 1997; Taniguchi et al. 1998; Brause et al., 1999). Anomaly vased FDs havve the potential to detect novel fraud, therefor, it is mostly used by the FDS literature(Sun et al., 2006). This method can be further categorized in to three types; supervised, semi-supervised and supercvised amnamaly detection(Akhilpmen,2013).

- Supervised
  Supervised learning techinques require a data set that has been labeled as fraud and non fraud. The major advantage of this approach is that the output is meaningful to human.however, due to the large volume of dataset, it is sometime difficlt to label all the data.

Examples:Classification algorithmes(neural network, k-nearest neighbors, treses, logistic regression, Naive-Bayes and support vector machine), Regression algorithme(linear regression, simple regression and logistic regression)

- Semi-Supervised
  Semi-supervised learning lies between supervised and unsupervised leaning since it involves a small number of labeld=ed samples and a large number of unlabelled samples and a large number of unlabelled samples.

- Unsupervised
  Unsupervised learning techniques detect fraudulent in an un labelled test data set under the assumption that majority of the instrances in the data set is nonfraud. the main benifit of using unsupervised approach is that it does not rely on accurate identification for label data which is often in short supply or non- existent(Bolton and Hand, 2001)[6].
  Exemples: Clustering algorithms (K-means techniques.), Dimensional reduction algorithms(Principal component Analysis)

### 2.2.2 Misuse based fraud detection

In misuse detection approach, fraudument behaviors are firs defined by using fraudsters signatures, and then other behaviors are defined as normal behaviors. this approac adopted by FDS utilises urle-based, statistics, or a corresponding heuristic methods to reveal the happening of specific suspicious transaction(Hand and Crowder, 2012). the difficulty is that it is not possible to detect all different kinds o frauds because it only looks for known patterns of misuse(Wei et al., 2012).

### 2.2.3 Hybrid of misuse and anomaly detection

Some researchers have been proposing a hybrid approach in which anomaly detection and misuse detection models are combined to get optimum results(Kundu et al., 2006: Sherly and Nedunchezhian, 2010; Sasirekha, 2012). this is deu to that misuse detetgion's incapability to detect novel fraud; meanwhile, anaomaly detekction suffers from the lack of generalisation capability and presence of high false alarm rates(Mul and Kulkarni, 2014). However, accoding to the literature, anomaly based FDSs is the most commonly used approach(Sun et al., 2006; Akhilmen,2013)

## 2.3 The techniques of the detection of frauds in different areas

### 2.3.1 Detection of the credit card fraud

Here are five major type of detection of frauds, introduced in the survey (Neha et al., 2014)[11].

- A fusion approach using dempster shafer theory and Bayesian Learning
  These system combine three approaches rule based filter, Dempster-Shafer adder and Bayesian learner. It detects based on combination of current as well as past behaviour together have recorded a profile for every card holder [2]. It has high accuracy, it redudes false alarms and imporoves detection rate and also applicable in E commerce But it is very expensive and its processing Speed is also low. (Neha Sethi et al., 2014)[]

- Blast-Saaha Hybridization
  It as two analyser as name is profile analyser and deviation analyser. The first detect unusual data sequence and the second compare these data in the fraud database. The alarm raises when the decision maker gives the result that the transaction is fraud.

- Hidden Markov Model
  Hidden markov model is a finite set of states haveing a probability distribution, every state is

associated with a probability distribution. Transitions ampngs these states atre administeted by a set of probabilites called transition probablility[11] . HMM categorizes the card holder's profile as low, medium and high spending based on their spending behavior in terms of amount. Amount of each incoming transaction is then matched with card owner's category[12].

- Fuzzy Darwinian Detection
  Fuzzy Darwinian Detection is an evolutionary-Fuzzt system detects based on fuzzy logic rules which using Generic programing evolving fuzzy logic rules. It comprises fuzzy expert system and a Genetic Programming search algorithm together. It has a high accuracy and it is highly expensive.[12].

- Bayesian and Neural Network
  This approach is an automatic fraud detection system.

### 2.3.2 Detection of telecommmunication fraud

Anomaly base fraud detection is usually used tfor telecommunication FDS. the subscribers extrated profile based on her CDR(number of calls ,call duation, call type) are used to detect abnormal behaviours.(Farvares and Sepehri, 2011)
This approach relise on a comparaision of recent and long term behavior histories derived from the toll ticket data. If there is a significant change in the pattern, the alarms will be triggered(Held et al.,2001)

### 2.3.3 Detection of healthcare and automobile insurence fraud

Raw data for helthcare fraud ddtection came mostly from in surance clasims, general practitioners data; or clinical-instance data(Liu and Vasarhelyi, 2013).

### 2.3.4 Detection of auction fraud

Aleem and AnwiBoasako 2011 resume three detection schemes: Feedback anomaly detection schemes, data mining schemes and agents based-trust management schemes.

Feedback anomaly detection schemes uses a reputation system which is an available countermeasure for buyers to evaluate a sellers credit. The mechanism is scoring the reputation of the trader by accumulating the feedbacks from trading partners. Feedback scheme has been used extensivemy in the past for online auction fraud detection, but it is easy to be manipulate and create fake overrated reputations(chau et al.,2006; Chang et Change, 2011; Aleem and Antwi-Boasiako, 2011).
Data mining Schemes are widely used now to detect online auction fraud. Generally, online auction FDS procedure consists of two basic steps:(1)construct features which extract user profiles and transaction histories of of suspended accounts in order to discriminate between legitimate trader and fraudster; Then, buld a detection model based on theses constructed features(Chang and Chang 2012 [8], Chang and Lee, 2012 Chau et al. 2016)

Agent based-trust management schemes handle trust and identity problem by using multiple interacting intelligent agents. (Ba et al, 2003; Jaiswal et al, 2004,; Wang et al. 2004).

# Conclusion

Fraud detection is a complex domain: we may find that a fraud detection system is prone to fail, has a low accuracy rate, or gives many false alarms. It is extremely difficulty for electronic commerce system to handle fraud problem forcing them to incur heavy losses. [1]

# Bibliography


[1] Anazida Ainal Aisha Abdallah, Mohd Aizaini Maarof. Fraud detection system: A survey. *Journal of Network and Computer Applications*, 68(2016):90–113, 2016.

[2] Priya J Rana. A survey on Fraud Detection Techniques in Ecommerce. *International Jornal of computer Appplications*, 113(14):0975–8887, March, 2015.

[3] Nedunchezhian sherly. Boat adaptive creit card fraud deteciton system. 2010.

[4] azgomi laleh. A taxonomy of Frauds and fraud detection techniques. 2009.

[5] Hussin Pointon John Delamaire, LindaAbdou. Credit card fraud and dertection techniques: a review . 2009.

[6] Hand Bolton. Statistical fraud detection: a review . 2002.

[7] Shama Patidar. Credit card fraud detection using neuron network. 2011.

[8] Chang Chang. An effective early fraud detection method for online auction. 2012.

[9] shatz sol M. Xu Haiping dong, fei. Combateing online in-auction fraud clues , techniques and challenges . 2009.

[10] Chang Chang. Analysis of fraudulent behavior strategies in online auctions for detecting latent fraudsters . 2014.

[11] Anju Gera Neha Sethi. A Revived Survey of Various Credit Card Fraud Detection Techniques. *International Journal of Computer Science and Mobile Computing*, 3(4):780–791, April 2014.

[12] Dr. R. C. Thool Avinash Ingole. Credit Card Fraud Detection Using Hidden Markov Model and Its Performance. *International Journal of Advanced Research in Computer Science and Software Engineering*, 3(6), June 2013.