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Electronic money laundering and data mining methods in investigating money laundering prevention

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Abstract

Money laundering is the process by which criminals, illegal nature of their illicit earnings from the perspective of regulatory agencies conceal.in this process, money laundering always new and different methods are usedTools such as electronic banking and payment cards, including tools is attractive to money launderers.Viewing profile data mining solution that valuable but hidden in mass volume of financial transactions, gives valuable information related to this criminal process loses.Method of classification and clustering are algorithms that use a variety of common methods to detect and combat money laundering.

Keywords: Money laundering, money laundering, electronic, data mining

Introduction:

Today, with the development of new information and communication technologies such as the Internet, all aspects of human life is change and transformation Economic and financial aspects of the change are not affected And using various tools based on computer science and communications technology and network-based services, facilities and opportunities are varied and customers financial institutions put at the disposal of the authorities.There are a variety of tools, such as electronic banking, electronic money, payment cards, etc. In general, traditional banking has changed very serious
in the meantime, along with various benefits such as speed, efficiency, security, application diversity, anonymity and the use of these tools, there are also faced with challenges Because it has brought the characteristics of these new instruments, a new approach to criminal activity becomes attractive.
Including money laundering, organized crime is due to the complex nature and expertise of those involved in this process, the facilities and opportunities to take the most advantage of these new tools.
As considered to the facts of this crime, including drug trafficking, drug trafficking, embezzlement, bribery and human trafficking should be More than ever, the need to combat this type of crime appears to be a new era for all countries Given the above, the international community and many countries have prompted numerous laws to fight money laundering in order to identify and prevent the organized crime carried out.But the use of new technologies in the process of the crime, use of a new method and software is necessary.Today, with the development of communication infrastructure between various institutions, such as the detection of various transactions easily and simply and only reflect on human resources not applicable And smart software system for implementing policies to combat money laundering in financial institutions becomes inevitable.Article ahead with plans to introduce the issue of money laundering and processes, though brief, will introduce strategies that data mining techniques to detect suspicious transactions related to payment cards to apply This article has been compiled four main sections
And in the first part of the process of money laundering and the characteristics and economic impacts have been addressed The second part of the new process in relation to money laundering as money laundering, mail and express in different ways the documents mentioned The following introduction of electronic methods of money laundering, anti-money laundering system in the context of what has been a
The following section introduces the concept of data mining and a variety of methods and practices covered At the end of the proposed methods using data mining techniques to detect money laundering activities have been expressed.As will be mentioned in future Due to higher and more effective access to financial institutions monitor transactions for suspicious transactions of their customers, including methods for detecting and combating money laundering is key The main emphasis in this paper on these issues will be key in the fight against money laundering.

Money Laundering

Washing the proceeds of crime by banks or financial institutions for offenders is a major success US federal agency stated that more than 300 million dollars annually worldwide money laundering is done.Between 40 and 80 million dollars of this amount is carried out by drug trafficking in the United States.FATF to combat money laundering, which is estimated at 85 million dollars annually from drug trafficking to money laundering United Nations Office on Drugs and Crime said in its report that in 2009 money-laundering the proceeds of criminal activities was about 1.6 trillion $(The Financial Action Task Force,2014).According to the Preamble goes on to define money laundering, characteristics and its effects are discussed:

The definition of money laundering

Several definitions have been proposed in the literature on money laundering For example, Genzman defines money laundering:"Adding a wholesale financial transactions in order to promote the proceeds of illegal activities in order to disguise the nature, source of income and control partners"(Veernndra,

M.Sai,2014)In other words, money laundering process by which criminals or organized groups to resort to the origin and nature of crime has changed mine And it will make formal economy(Department of Education Bank Melli Iran, 1391)

Characteristics of Money Laundering

money laundering is Secondary offense

To commit this crime should be another crime such as drug trafficking, abduction, sale of human organs and…. happened.Secondary nature of the crime makes the public conscience is not aroused so much against it.

Money laundering is organized crime

The crime of money laundering authorities, faced with the virtual organization that Include The different levels of organization of simple agents (eg, retail drugs), by skilled people and educated people and professionals With the arrest of an offender others simply continue to work and work for their law enforcement problem.

Money laundering is transnational crime

Secondary offense of money laundering carried out by the Organization necessarily included in a specific geographical area or in border sovereignty of a country does not happen.Organized crime and money laundering for help to cross the border and for the perpetrators of this crime, the global village will be meaningful.

Money laundering is crime experts

The nature of this crime is to make the proceeds of crime must be clean, decent organizations such as banks and banking specialists, law offices and auditing may be used Without the help of professionals, missing the dirty money proceeds of crime is not possible This characteristic is also another problem that impede the fight against money laundering ،(Department of Education National Bank of Iran, 1391)

Economic effects of money laundering

disruption and instability in the economy

Those who attempted money laundering are not looking to profit from their illicit funds are invested,
But their purpose is the maintenance of funds and earnings So they place their funds in activities that are profitable for the country, do not invest, But only to lose investments made for refunding illegal
In other words, the money launderers resort Country to wash their own dirty funds After washing it quickly out of their country.In fact, this orientation is not real money demand But due to the short-term interests of money launderers And as soon as these parts will lose their property for money laundering They removed their assets from the sector And this is a great loss to the sector and the overall economy.

Deterioration of the financial market.

Money laundering operations insert of a lot of money into the financial market.That The entry of this sources can not be controlled and subject to known factors On the other hand a certain time to do a huge amount of money and other illegal activities, suddenly out of the market.That The influence of motion without notice, or unreasonable , suddenly entry or exit of sources , troubled financial market And reduces the efficiency of the economy The money-laundering operations in an open economy that can result in the entry and exit of a country's resources without regard to the economic activities of the country, and negatively affect the exchange rate Which leads to clutter the external sector of the economy, followed by imbalances in the domestic economy.

Reduction in government revenue

One of the harmful effects of money laundering, reducing government revenue that indirectly hurt to those who faithfully pay their taxes, In addition, by money laundering, tax collection becomes difficult.

Reduction of government control over economic policies

In some developing countries, the power of the illegal income, undermine the authority of the state And as a result of government control over economic policy is low In fact, sometimes the high volume of accumulated assets based on the proceeds of money laundering, market or even small economies is constrained.The unpredictable nature of money laundering, governments always to achieve the proper and effective policies, is difficult.

Shift investments and capital outflows from the country

Money laundering, causing a shift in short-term investment in the service sector What has negative effects on long-term government economic policy and planning For short-term investments at the macro level because of its instability and high output power, irreparable damage to the structure of the economy On the other hand, income from drug trafficking and other criminal activities, not necessarily where it is produced or washing, not investment. The investments were transferred mainly to developed countries, especially the western countries

The destruction of the private sector.

The process of money laundering operations can be economic activities of the private sector to act within the law is difficult.Criminals to legitimate their criminal operations, established firms are apparently justified Due to the many benefits that can be obtained from criminal activities can affect the price of goods.Consequently, the prices of their goods is less than the cost of other firms.Furthermore, these firms have strong financial backing to attract more financial resources for them And led to the exclusion of other economic enterprises are allowed Finally, these criminal enterprises, have the leadership of other firms And have disturbed the Economic activities of private sector (Department of Education Bank Melli Iran, 1391)

criminals are always looking for "a new type of detergent which allows for cleaner laundry" . They have been quick to exploit each new method of financial transfer.In the 1980s and 1990s wire transfers became a popular method for moving money in both the legal and illegal sectors. By 2000 we may see the same situation with e-money. The abuse of e-money by money launderers may become a significant problem in the future because e-money systems will be attractive to money launderers for two reasons: transactions may become untraceable; and

transactions are incredibly mobile.

Untraceability

The use of e-money systems will mean fewer face-to-face financial transactions. The anonymity of e-money will make "knowing your customer" much more difficult.E-money systems also allow the parties to the transaction to deal with each other directly, without the assistance of a regulated financial institution. Thus, there may not be a traditional audit trail.

Mobility

Hypothetically, e-money could come from anywhere in the world, and be sent anywhere in the world. Thus, e-money systems may offer instantaneous transfer of funds over a network that, in effect, is not subject to any jurisdictional restrictions. (Solicitor General Canada,1998)

With the introduction of the definition of electronic money laundering procedures and methods of review:

Electronic money laundering

Electronic money laundering is the process of legalization of illicit income and proceeds of criminal activity using the services of cyberspace To make use of these facilities to their incomes legal form And use it as a tool for illegal transfer of funds (Miralayi, 1392).

E-Money Laundering steps:

Stage electronic placement

The first step in money laundering, is physical release of cash Traditionally, replacement money in safe banks or financial institutions is done Or that may be smuggled outside the country of cash to deposit in an account to be transferred Or to buy goods at high prices taken Such as works of art, aircraft, precious metals and gems that can be sold later But in The e-Money Laundering for placement stage, the money launder can be easily and using electronic money by smart card, can exchange of his criminal earnings This money can be used to purchase foreign currencies or precious commodities used Until it was again sold And thus the electronic money is used to replace dirty money .With this feature, the money launder does not need to pay illegal money, or any other transaction will be face to face It can easily his criminal earnings in the form of electronic money from the border pass Or the purchase of luxury goods and foreign currencies Thus, the main advantage of this type of e-Money Laundering than traditional methods is removal and concealment of identity face to face transactions In this method did not prove to be true whether or not the individual identities provided Therefore, this step is electronically less risk than traditional methods Even some argue there is no need to take this step in electronic money laundering.

Electronic layering

In this step requires complex layers of financial transactions to make the gap between income and evade the inspections is dirty from the source Always for a money launder speed, distance between legitimate and illegitimate money and anonymity is important All these features can be provided by online financial services At this stage, the offender tries to separate the money from its original source.He can easily do this by transferring money through accounts in different banks for the purchase of physical goods for resale If people are allowed to have an Internet account Without having to provide their real identity documents, this step can be done easier.

Electronic integration

The final step in the laundering of money that has arisen out of the way seem contrary to the law Traditionally, integration may be caused by several methods.Methods such as investing money in foreign financial institutions to secure loans legal form, ‹The use of front companies Or create sales receipts or Forging receipts of goods sold across borders.It is clear that these mechanisms are very high risk But money laundering is to pay by mail a simple way to create a coating that is apparently provide services, such as Internet service providers, opening a bank account.Money launder is not even required to provide service On the contrary, he will use the company as a cover As it assumes that the services provided in return for payments, these funds have in fact criminal origin And the second phase has passed (Miralayi, 1392)

Electronic money laundering methods

Money laundering through electronic banking is done in two ways: direct and indirect.In the direct method money launder by direct relationship with their financial institution By providing identity in a way that is easy to hide its real intention to do money laundering operations.The direct method is that one money launder using digital signature technology and the Internet will connect directly with the financial institution And without a physical presence in the bank account By providing a false identity and even without attracted the attention of someone and forging a digital signature do the steps of money

laundering.Money launder concealment method can directly through commercial structures, improper use of legal trade, the use of false identity documents, misuse of legal authorities and international issues of anonymity and the anonymity of points in space virtual reach his goals Without transactions reported as suspicious transactions.Another method used in electronic money laundering is indirect method.
In this method, a direct relationship with financial institutions avoided.The aim of this relationship is that the transaction is not reported as a suspicious transaction Electronic money laundering is often done using indirect methods Because in this method the work faster developed Without the authorities' attention drawn to the fact that the money of illegal origin and illegally obtained.Business areas mainly affected or threatened are electronic money laundering include commercial banks, credit institutions, post offices, international trade, stock brokers, investment companies, insurance companies and electronic banking .(HABIBZADEH, 1390).

Electronic money laundering methods in banking
The ways in which a money launder through the banking unsafe channels could do his illegal actions are

Online banking
When account holder transfers his existing through ATM, mobile phones and other electronic payment services can be said online banking Electronic money laundering threatens online banking by three methods
Opening an account without the customer's identity using the Internet
Domestic and international regulations, banks will have to report of any suspicious transactions
The money launderers also can simply evade such restrictions.The opportunity to money launder through online banking facilities that will be provided to them For example money launder by opening online accounts with a number of companies that have an Internet banking account, and without adequate regulation and supervision use electronic payment systems The most important point for money launder is that Internet banking client authentication Internet banking because it is difficult to determine the identity of the customer and the information recorded and reported suspicious transactions.
The features of Internet banking as well as expanding the use of pre-paid cards such as credit cards, enables money launderers simply transfer electronic money from one card to another Sometimes, money launderers from hackers buy identity fabricated at a low price To be able to use these identities to open accounts at the bank's website Or whether they had attempted to set up a website Using it to access detailed information about users Then pre-paid cards or smart cards in the name of the service that is supposed to be demand Dirty money in the account to deposit In fact, money launderers in this way to seduce their users and to obtain simply their information of smart cards transferred dirty money to their accounts and to carry out money-laundering operations.
The use of encryption and digital signature technology.
The most important technologies in money and electronic banking functions for the correct implementation of functions and raising the safety factor is encryption technology and digital signature
n summary, the function of encryption technology is that content is converted to a form unintelligible and incomprehensible And for this it is necessary to return to the initial state of the decoding process run
It is obvious that this technology is the only manufacturer and quitter and sending and receiving content with the ability to do it.According to the description it is clear that if the money is electronically encrypted content will be inaudible And only the recipient that is unclear is part of the world can be decrypted with the full implementation of relevant programs to be aware of it Thus, such a level of confidentiality and anonymity is provided for these exchanges That anyone can post amount from anywhere in the world to another without anyone to be aware of its content.
Use of the perpetrators of money laundering:

Sometimes, money launderers to carry out the process of money laundering use people who are the money laundering agents Natural or legal persons that appear in the image of the law on money laundering . In fact, these agents help to cover some sort of criminal activity.

Internet Gambling:
Internet gambling or betting process so that the criminals will open an account on the Web website
Then The dirty money to the extent that they are tokens are sent to the respective casino account of the website And then they bet money on it.This method of using credit cards, checks, wire transfers and especially electronic money easily done, (HABIBZADEH, 1390).

Computer Games Online
Another relatively new method has been created to launder money is virtual money laundering
In this way, the perpetrators use computer games online that are multi-step web-based Internet sites for money laundering In some of these games, players can pay the money to prepare traditional punishment
And so, with pay the right to enter into the game.And by winning in different stages, more money was awarded as a reward Players can transfer money to other players Or by use of virtual money obtained to buy or sell goods or services In this way it is possible to make money online, or vice versa the traditional money And moved to other accounts Sometimes, instead of virtual money, the player is given a debit card By which it can withdraw money from the ATM machine.

Pre-paid cards
This card as a means of electronic payment, can be in the form of credit cards to purchase for Internet services For example, the person could commit a crime, the amount of money gained And then bought a lot of phone cards or the internet card Then sells The cards purchased to the purchase price or a lower price than buying in the market And the proceeds deposited to his account And thus the dirty money is washed Or someone who has dirty money buys The volume of Internet services from a service provider
And then sell to shops or newsstands with printing the Internet cards ,at lower price And the money is deposited into his account In this case, if someone asked him about the origin of the money Says monies earned through buying and selling While this is not And he thereby eases the process of money laundering And their identification is difficult

Online auctions
Companies that have electronic auction and set up websites by the function of the electronic auction, have bank accounts The seller introduces goods through this web site Buyer after choosing the product, the company paid the money to the account The seller sends the goods to the buyer If the buyer has received the goods and confirms that the order, the company will deposit the money into the seller's account In this case, money launderers can use this tool to money laundering.Thus, the specification of an apparently expensive goods for sale on the website are displayed And someone else buys it as a formal Buyer And receipt of goods to be announced Thus, by one of the perpetrators of money laundering dirty money to be transferred to other perpetrator

Mobile Banking
This payment method is the same as internet banking Payment instructions by voice or text message is issued When the payment order is issued with mobile phones Phone number and serial number of the device is registered with the users Money launder can pay via text messages or voice an unregistered cell phones to transfer money from different accounts to use.In fact, if the technology is combined with identity theft and bank account provide Suitable environment for concealing identity and money transfer.
Thus, mobile banking as a way to launder money criminals will be exploited.

Electronic Buying and selling precious metals

E-commerce and buying and selling of precious metals and bars in the world by some Internet websites is possible Buyer or seller before any action should be to sign up to an e-mail account assigned to him.
To register the name and other identification, e-mail address be included in an electronic form and sent to the website Consultants preparing and using fake identities and forged addresses is possible
Some websites need to assign an electronic account with no identity.This agreement provides the possibility of impersonation or identity Usually a user after the registration of e-account and allocation of the Web site can try to buy and sell precious metals to other members who like him were registered
The user can register on the site with a different name In this way, using it both as a buyer and as a seller's role Some of the providers of such services, continue the process of forging identity during the process of shifting money from the buyer's account to the seller's account And no one will know the identity of the buyer and seller.And their bank account number will remain hidden The electronic stock market, precious metals potentially become a means of money laundering (HABIBZADEH, 1390).

Framework of anti-money laundering

According to what was said the establishment of a Anti-Money Laundering system of credit institutions is essential Anti-money laundering systems by applying some rules or statistical tools and artificial intelligence profiles of some hidden but valuable mass of data base reveals These systems use of artificial intelligence and intelligent agents In order to exploit DM techniques efficiently, they need to be integrated in a framework for detecting ML. A DM framework is normally consisted of four layers corresponding to four levels of mining: transaction, account, institution and multi-institution. The most basic level is transactions. In this level, transaction records are extracted for an investigation. However, they provide a few analytical contexts because they do not constitute links to accounts or other data. In the second level, multiple transactions are associated with specific accounts. Aggregation of transaction with individual accounts gives a general view of these accounts on their financial activity. This view shows the degree of association between various accounts based on frequencies of their transactions. At the institution level, the same customer (business or individual) may have multiple accounts. A consolidation of these accounts may show that an institution maybe in ML suspicious and may involve multiple accounts related to different individuals. The last level investigates the ML involving multiple corporations, organizations and customers.(Veernndra,2014)
However, these systems have their weaknesses and limitations.Canhoto and Backhouse In the case of failure of anti-money laundering systems have been discussed and stated four reasons for this:
First, money laundering depends not only a special treatment Secondly, could range from a variety of factors including the person guilty of money laundering to encompass complex organizational factors.
Third Money Laundering continuously is expanding and growing Fourth various institutions to combat money laundering have a small number of data elements. (Duman And Buykkaya ,2008).
And each institution for legal, strategic and operational reasons does not exchange of information easily with others (Duman And Buykkaya, 2008).
Although the above factors in the failure of anti-money laundering systems, it seems effective Another point that should be considered is Today, the constant monitoring of the various transactions relating to accounts and cards, and extraction suspected is of important factors in diagnosis and prevention of money laundering But observation and measurement suspected cases of mass data in databases of banks and financial institutions need to use new methods of data mining and software tools to date, more than ever exhibit To this end, we will continue to introduce the concept of data mining

Data Mining

Data mining is a process of knowledge and information among a group that can be hidden in massive amounts of data to identify and use them to solve various problems Technologies such as statistics,

artificial intelligence, data mining, database, form the theoretical basis Due to the large amounts of data in databases, data mining has many applications in financial affairs. (Hojatoleslami, 1392).

Definition of Data Mining

Bose and Mahapatra data mining have defined process to identify interesting patterns in the data base that can be used in decision-making.Turban et al have defined the data mining process for identification of useful information and knowledge from large data bases seek uses of statistical methods, mathematics, artificial intelligence and machine learning Fraley et al claim that the aim of data mining is obtaining implicit useful information and data is stored in large repositories (M Issyk, 1391).Data Mining is a process that consists of applying data analysis and discovery algorithms that, under acceptable computational efficiency limitations, produce a particular enumeration of patterns (or models) over the data" Another , sort of pseudo definition; "The induction of understandable models and patterns from databases. In other words, we initially have a large (possibly infinite) collection of possible models (patterns) and (finite) data. Data Mining should result in those models that describe the data best, the models that fit (part of the data). (Ozer,2008)

Data mining in banking.

The high volume of data on banks and financial institutions are aggregated and collected that are regarded as a strategic investment.Updated technologies related to data collection and storage provides the opportunity for banks to be able to store and analyze large data.Although the use of data mining methods in the field of banking compared to other areas due to the nature and sensitivity of the data in this area has been slower However, the data mining methods are most appropriate and the best tools for predicting, estimating and decision-making to help IT managers Application of data mining in banking include risk assessment, relationship marketing, segmentation of customers, improve customer value, customer retention and increase customer loyalty, customer validation and fraud detection can be named(Hojatoleslami, 1392).

methods of data mining

As mentioned in the previous sections Data mining is a process between a group using technologies such as statistics, database and artificial intelligence to detect hidden patterns in large volumes of data.It is necessary to remember that Although different sources and international instruments such as the FATF's Forty Recommendations to combat money laundering cases, have been mentioned such as accurate identification of customers receiving the cards, limiting the uptake and non-issuance of the name refers cards But monitor and report suspicious transactions related to the types of cards is considered One of the key in the fight against money laundering Among the suspected cases will be mentioned below

It seems not reasonable in terms of economic and commercial transactions

Cash deposit with high volume, which was not acceptable.

It was not harmonized with the deposit account

How suddenly be transformed so that account history(Department of Education National Bank of Iran, 1391)

Thus, the three examples of anti-money laundering procedures that data mining methods to the use of technology, statistics, databases and artificial intelligence to identify suspected cases of the audit is mentioned.

The proposed method by Duman And Buykkaya

In the way that Duman And Buykkaya suggests in (Duman And Buykkaya, 2008) as the framework for anti-money laundering system The two phases are called data mining to detect money laundering

Descriptive analysis phase and prediction data phase Descriptive and predictive data mining techniques were used for these phases in the first phase anomaly detection algorithms are used to reduce the search

list.This will cause that instead of investigating all cases the customer / transaction where normal behavior is removed from the list and reduces the search space.In the second phase prediction algorithms are used

To overcome the problem of creating a set of training data which they suggest that the data obtained from the first phase to be in possession of a human expert staff Specify the test data to be used at a later stage

In (Hojatoleslami , 1392) descriptive and predictive data mining functions are studied target of Descriptive performance is finding patterns in data that is interpreted by man Performance of predictive used to predict future behavior of variables The forecast is applying multivariate prediction or a field in a database or other unknown variables to predict future values of interest The descriptive functions include Summary , sequence discovery, clustering, association rules and, predictive functions include prediction, regression, time series, estimation and classification In terms of machine learning there are two types of learning: supervised and unsupervised learning In Predictive data mining some known cases is necessary

Then, using this examples is created a training data set where definition of Relationship of class members are trained by data mining algorithms.In other words, learning is done under the supervision of well-known products It is not necessary in descriptive data mining training data set so called Unsupervised learning In the case of money laundering cases as money laundering are detected very little to create a training data set The predictive data mining algorithms can not be used directly So in a way that Duman And Buykkaya suggest that the two phases using data mining is used to detect money laundering.

The first phase-descriptive analysis data

This Research be in relation to suspected cases in the transaction, the account or customer level to be done

Duman and Buykkaya have proposed to identify the customer in their approach without losing any content, consider customer level as representative of the layers of transactions, accounts and customers

The solution begins with determining what are suspected:What kind of customer behavior must be suspected?There is really no clear answer to this question.So there are Two property to judge whether a behavior is suspect or not 1-type customer 2. historical customer behavior Therefore, anti-money laundering system for the detection of money laundering should be applied to the above factors to be used

Customer peer groups as basic law parts defined by clustering algorithms Whatever method is used to determine the variables that are important to determine the peer groups Peer groups should be able to recognize the validity of methods of money laundering In the way of Duman and Buykkaya proposed clustering methods for the determination of variables like the following is preferred:

The number of accounts opened

The number of closed accounts

Number of accounts that have been closed or open via the Internet

The number of debit and credit card transactions

The amount and number of transactions via the Internet

Electronic transmission of input or output

Total and average electronic transfer

Then, for the second factor, the deviation from the average of the past period such as six months past have suggested using the formula (1):

$$\text{Deviation}=(x-\mu)/\sigma \qquad (1)$$

μ= The average of the past six months

σ=standard Deviation of values s in six months

x= the value in the last month

It is assumed that summation of these variables is n and the resulting number of clusters is k

In this case, some customers to the center of the cluster are closer and some furtherCustomer distance from the cluster center is defined as follows:

CD=(VD) Summation of variable distance (2)
In this state the distance of variable k(VD) is The absolute difference between the value of a customer from the center of the cluster k.Then another variable as customer abnormality index (CAI) can be defined as follows:
The customers are divided by the average amount of distance customer cluster.
customers who CAI close to 1 are known as normal Customers who have a big difference with a value of 1 can be considered as candidates suspected customers After determining the customers who have a high anomaly index, identifying the origin of this anomaly would be desirable.For this purpose, we can determine scale distributions of k (VCK) by formula(3)
VCMK=VDK/CD (3)
Then specify the variables that are more distributed scale can be a great help detect money laundering experts A list of clients who obtained an algorithm fetus can be as basic tools to identify customers who anomaly index is greater than the threshold used for the detection of money laundering If the threshold is too low increases the number of customers that must be explored.The list can be obtained from this type of threshold used to start the next phase
predictive analytics, data Phase
As mentioned above, the difficulty of predictive data mining is that very few cases are known as money laundering This makes the resulting list for the establishment of a training data set is not enough So by putting the list of the experts, they can quickly decide which of customers with high anomaly index
Using this method, a set of training data to derive Prediction suspected cases.Thus, after reviewing the inspectors suspected cases detected And after the introduction of the relevant authorities, and the characteristics of the customer data are used as training data to predict future cases (Duman And Buykkaya, 2008).

The proposed method by Bajoria
In another method, which uses data mining to detect money laundering is proposed by Bajvrya (Bajoria, 2010) real data derived from the data bank and consists of "anonymized" information about real clients (both people and companies) and the relationship among these clients. The data is stored in SQL as a relational database in binary form. In this project the Researcher uses a
graph query representation to provide an effective visualization of complex patterns A node in the query graph is an entity that the user is searching for, e.g. a person or a company and a connecting edge implies a relation between two entities. The nodes have defining attributes and the edges have types.For example, a "person" node can have attributes like: First Name, Last Name, Position, Passport Number and so on. Similarly, an edge between a "person" node and a "company" node may have the type "Founder"
implying that the person is a founder of the company. The purpose of attributes is to help the user specify details of a pattern they are looking for. In such a setting, we want to find sub graphs that match a user-defined query pattern.Types of graphs used in this method include
• Graph with a single node



Figure 1 Graph with a single node

In this example, the user is looking for a pattern of people who satisfy the attributes specified for "person" node A. These attributes may be the person's title, location, country of origin and so on. This node could even be a company where the attributes
would be different. In this case, our application will query the database for people who match this pattern in terms of the attributes alone, irrespective of their relation with other data.
• Graph with a single relation and two nodes

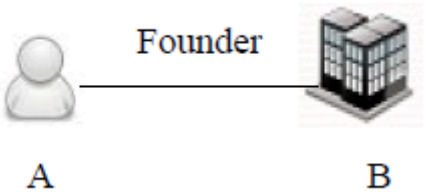


Figure 2 Graph with a single relation and two nodes

In this example, the user is looking for a pattern where a person has founded a company. Similar to above case, the user may further specify the attributes for the two nodes which will further provide more relevant results. In this case, his application will query the database for a person-company pair which matches this pattern in terms of the attributes and the relationship "Founder".

• Graph with a several nodes and relations

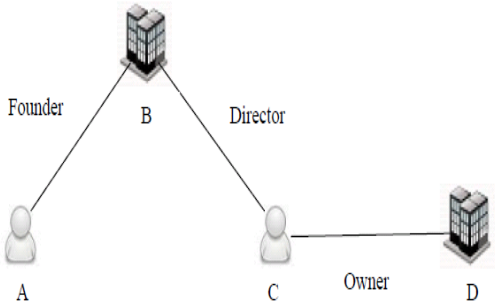


Figure 3

In the case of detection of money laundering, however, it seems appropriate to use the standard SQL But if there was no real compliance SQL Will not be able to estimate an appropriate response.On the other hand if several are available in SQL compliance It is appropriate that function automatically by a valuation, are graded.In some cases, existing compliance issues may be the best solution may not display. In this method, the degree of compliance issues is available.

Launching system

The application data is stored on a server application and processing of the user interface is performed on the client side coding On the server side is done using the PHP language Bajoria to develop its proposed system is used of Apache http server The system software user interface has done with Adobe Flash Builder IDE using Action Script and XML language and Flex library The software can run on the Web browser and do not need to install any software so that Bajoria mentions this software is tested with browsers like Internet Explorer, Google Chrome and Mozila Firefox Adobe Flash Builder software must be installed in the browser to be able to use this software The relationship between the server and the browser via http service is done in Flex.

As mentioned, the purpose of this application is seeking entities, for example comply with the following graph (Figure 4)

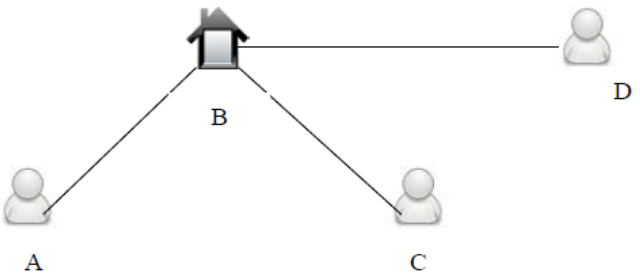


Figure 4

It supports all the bilateral relationship in the graph database search and after the integration of communication, items are presented to the user.

Inaccuracy in the data

If the data that have been collected in the database may be incomplete patterns were found for the requested items are not very accurate and appropriate Methods of data treatment, most statistical methods to determine the hidden characters and their relationships, appropriate methods will be considered to determine the appropriate output And the proper implementation of these procedures are necessary.

Viewing patterns have been found

Such limitations described in this method, displays the results in the form of tables As Bajoria mentions due to time constraints this software was not able to display the results in graphical and visual mode,.

For better performance, this method seems to be effective the following points Having regard to the relevant databases by cards are constantly changing The criteria should be reported to a particular database is updated continuously Methods of learning which will support the management would be useful.Different users may have different relationships to extract data from the database based on their content Therefore, it is appropriate that the system allows different users to suit different user scenarios, models do raids.As may be required for some graphs with different compliance issues in SQL achieved

The use of a function for the grading and classification of the valuation results would be very useful to display to users (Bajoria, 2010).

Mentioned methods can be used to detect suspicious transfer customer account balances through various payment cards Thus the graph consisting of 3 groups as the "customer" and "card" and "Account" in the simplest case defined The edges of "having" between the customer and the account node and edge "communication" between nodes and edges accounts and cards "having" between the client node and card linked to each other. (Figure 5)

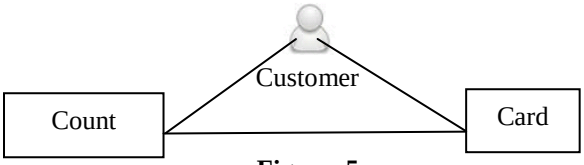


Figure. 5

The client node can be characters such as name, occupation, identification, such as father's name, ID number, place of issue, address, phone number defined For Account node can be defined features such as history, people have the right to withdraw from the account, the ceiling and the withdrawal At same mode for card node can be defined characteristics such as the deposit or withdrawal limits, the number

of authorized withdrawals from the card at certain time periods, such as periods daily, monthly and yearly and more This simple graph can be connected to other graghs by transfer to / from edges By The definition of this basic group by using the software framework proposed by Bajoria, can discover transfer between different cards and different customer and accounts

The method proposed by Gao et al.

Another method by Gao et al. (Gao and Wang, 2009) stated that a software agent is used to identify money laundering cases, the details of which are discussed below

Before applying multi-agent technology into the AML solution, we need to decompose the process of AML into several autonomous stages, in which each agent is delegated a particular task to exhibit its goal-oriented and reactive behavior, and to cooperate with other agents to pursue their goals. The process of AML usually consists of the phases of data collecting, ML risk monitoring, behavior diagnosing, and suspicious activity reporting (see Figure 6)



.Figure .6

Data collecting involves internal and external data collection. ML monitoring is composed of client profile assessment (complying with FATF's customer identification) and a transaction risk measurement. Accordingly, the taxonomy of intelligent agents required for AML is outlined in Figure7, in which several intelligent agent classes are applied to provide a set of AML functionalities for existing financial institutions. The requirements of the stages of the AML process (as outlined in Figure 6) are clearly evident in the categories of agents specified in the taxonomy of Figure 7

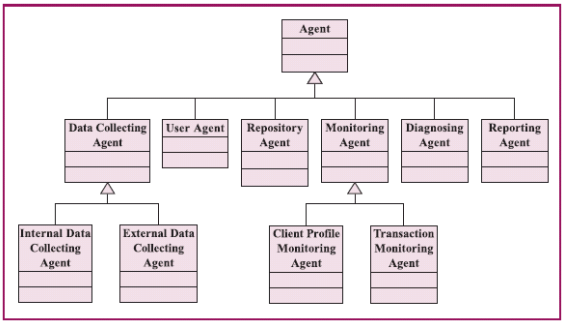


Figure 7

For example, the Data Collecting Agent is specialized into an internal data collecting agent and an External Data Collecting agent

Multi-agent system architecture

The value of any AML solution has to be based on its ability to uncover suspicious financial activities by identifying the specific individuals or organizations that may be involved However, given the complex nature of ML prevention controls, an automated solution cannot attach suspicion to any activity detected – it can only detect activity worthy of analyst interpretation. Human ML expertise is required to

determine if that activity is suspicious and worthy of reporting. Therefore, the optimum way to implement ML prevention controls is as a synthesis of human expertise and automated intelligence. In this research, the automated system performs the detection work, raising alerts for transactions deemed suspicious (in terms of the suspicious activity report) to the humans concerned. The human analysts perform investigations into the cases that are raised.

Gao and colleagues have expressed two ways to develop anti-money laundering processes:

reengineer existing banking systems to support AML functions

develop an independent AML system to link with the existing applications through which all client and transaction data would pass during its lifecycle

Gao et al., For the following reason have chosen the second approach for their system

First, their proposed AML solution can capture the data from the banking system without any interruption to normal banking operations. Second, their proposed AML solution is a stand-alone system. It can integrate flexibly to any banking legacy systems. Third,reengineering an existing banking system to support AML functions is a too complex,time-consuming, and costly.

The framework developed by Gao et al. Suggest that using multiple factors in the Figure 8 In which a set of intelligent agents are employed To a set of tasks to provide anti-money laundering in electronic transactions

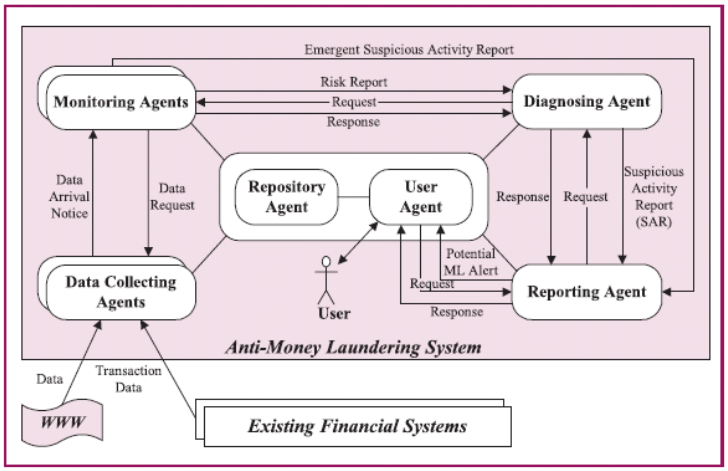


Figure 8

The agents are distributed in the departments of banks involved in AML; they communicate with each other through the Internet. All of these agents work autonomously and collaboratively in the multi-agent environment. Each agent focuses on its particular task such as data collecting, monitoring, diagnosing, and reporting without inventions from outside. By drawing on other agents' knowledge and capabilities, agents can overcome their inherent bounds of intelligence and work collaboratively to pursue their goals.The behavior of an agent is based on an internal model of the agent consisting of a knowledge base, operational facilities, and a correspondence between the external application domains. Generally, development of an agent considers an agent knowledge base, its operational facilities and its external interface. Knowledge is required by each agent to perform its internal and external activities. It consists of knowledge for particular tasks, resource status information, information about other agents, and the like. The operational facilities execute different functions and provide collaboration with other agents; they are the central control and action part of an agent. A dynamic rule engine is usually an important operational facility, which provides a means for applying simple,dynamic-rules-based reasoning to emergence of new facts in the agent's world and for using this reasoning capability to decide what the agent should do next.

The external interface envelops an agent and provides access to it via a well-defined interface, and it is also the primary conduit for communication between agents.

The User Agent acts as an effective bridge between the user and the computer. It can make the human-computer interface more intuitive and encourage types of interactions that might be difficult to evoke with a conventional interface. In their system, this agent enables users to view the current state of the financial transactions and ML monitoring, diagnosing, and reporting processes and allows them to convey their own judgments, opinions, and arguments relative to ML detection to the rest of the bank. The agent also enables the corresponding users to issue requests to the other agents in the system.

The Repository Agent plays an important role in our approach. Although there is no need for centralized storage of all knowledge regarding AML, there could be one consistent knowledge repository that maintains and integrates all information related to the monitoring and analysis tasks. In this way, the various agents that make up the system can exchange knowledge regarding entities involved and deal with ML in a collaborative manner. In our approach, the Repository Agent may contain and manage several kind of information, e.g. real time banking transaction data for monitoring, risk reports for further diagnosing, reports for suspicious activities that have been detected, etc. Such shared information about banking transactions and suspicious activities may form an important base for agents' collaboration in banking AML.

The Data Collecting Agents enable the system to collect data internally and externally. In particular, the Internal Data Collecting Agent is in charge of acquiring real-time data from existing banking systems for the client profile assessment, transaction risk measurement, and further behavior diagnosis and reporting. Several kinds of data related to possible ML schemes are required for ML prevention controls, such as client profiles, financial transaction details, account reference data, client reference data, historical statistics, etc.On the other hand, the External Data Collecting Agent retrieves open data from ML watchdog agencies, national government, and other authorities. The data includes international standards, official thresholds, watch list, legislations, etc.Two kinds of Monitoring Agents include Client Profile Monitoring Agent and Transaction Monitoring Agent, are proposed in our system to monitor potential ML schemes on a client-by-client, transaction-by-transaction basis. Both agents comply with the global-accepted core policy for effective ML controls – KYC (KnowYourCustomer). The Client Profile Monitoring Agent is to assess a wide variety of detailed information relating to the client's account, typically collected at the time that the account is opened. The agent provides a single view of the client profile incorporating all of the various financial relationships that the account has an affiliation with. The types of analytical activities that are part of the agent client profiling processes include, but are not limited to: watch list name screening, high risk country alerting, financial source or channels, business relationship,and political affiliation. Each client is classified into different risk profiles. And based on the client risk classification, the agent determines the frequency and the intensity of monitoring.The Transaction Monitoring Agent is to identify transactions that pose the greatest risk for potential ML activities. Transaction determined to be of a higher risk can vary from organization to organization based on their product-type lines and types of business. For instance, the risk associated with transactions from a bank would be different from those associated with an insurance agency or a securities firm. In general, the transaction risk behavior include, but are not limited to (Menon and Kuman, 2005): rapid movement of funds in or out of the account, sudden activity into a previously dormant account, frequent changes to an account, recurring transactions, hidden account relations, offsetting trades, settlement and/or standing instructions of an account, the movement of funds without a corresponding trade, and the deposit of excess collateral into an account Normally, if a questionable client profile or an unusual transaction is captured by the Monitoring Agents, a risk report will be issued and sent to the Diagnosing Agent for further investigation. However, an emergent suspicious activity report (SAR) could be issued to be reported to the user for instant action. When receiving the risk reports from Monitoring Agents, the Diagnosing Agent will start its diagnosing process to investigate the complex behavior that is commonly

associated with ML schemes. This agent may conduct analysis on risk reports from Monitoring Agents and request any additional information if necessary to examine the cases. The agent allows financial institutions to detect wrongdoing by finding suspicious patterns of behavior that may be hidden behind large volumes of financial data

When the Diagnosing Agent identifies unusual or suspicious behavior, a suspicious activity report (SAR) will be automatically produced and sent to the Reporting Agent. Figure 8 shows a screenshot of a SAR. Then the Reporting Agent will present and communicate a potential ML alert to the appropriate compliance personnel through the User Agent for case management investigation and action. Alternatively the Reporting Agent will automate or take a specific course of action, for example, interfering with standard operations to block a particular suspicious transaction. Cases for investigation are filtered and prioritized based on the severity of the alert. The Reporting Agent is able to support the business process to assist with suspicious case investigation. It does this by providing evidence of client activity and information, ensuring the case officer has all of the relevant customer intelligence at hand. If necessary, additional information is requested from Diagnosing Agent. This allows them to make a fact based decision and it also demonstrates regulatory due diligence in the process. The Reporting Agent also facilitates combining the automatically generated alerts with suspect manual reports, to build the case for investigation. The reporting facilities within the Reporting Agent provide a complete tracking system and audit trail for managing actions in response to detected events or suspicious behavior. Such comprehensive reporting allows the financial institutions to demonstrate compliance to the AML rules and adherence to the regulatory requirements.Moreover, the Monitoring Agents run scheduled scans for all accounts and transactions by using the data-mining techniques (property of agent's proactivity). The Monitoring Agents will monitor the complex suspicious customer activity and rank the customers according to degree of suspicion of ML. After the unknown patterns are understood, they are sent to the Diagnosing Agent to identify suspicious events that build over time, and to separate them from everyday events and transactions in order to target the offending behavior. In addition, when the previous unknown complex ML schemes become known ML schemes, they will be stored in the Repository Agent for future monitoring and diagnosing. (Gao and et al,2009)

Conclusion

The complex nature of the process of money laundering and the features it has brought to identify and deal with organized crime and the international financial institutions should be top priority in the meantime, better monitoring of large transactions in the database, financial institutions, reveals need to use software tools and up to date So that Gao et al. (Gao and Wang, 2009) argue There are intelligent agents that automatically and by using the science of artificial intelligence, statistics and data mining to search and detect suspicious transactions in high volume deals with financial data, the current anti-money laundering system is imperative and necessary,Data mining with different techniques and methods and appropriate software, is a good alternative in the detection of money laundering and suspicious transactions data mining with Descriptive and predictive functions shall discovery to suspicious transactions of mass data What have been discussed to this point leads us today in our country that the development of electronic banking is passing through its early stages And tools such as payment cards as debit cards are widely available to the public, customers of financial institutions

As well as there is the money laundering risk in this type of banking and its tools It is essential that law enforcement officials of financial institutions in combating money laundering in addition to the traditional and basic strategies to deal with it such as carefully and thoroughly uninstall customers authentication when a variety of banking services, use new and effective strategy such as a Intelligent software in order to discover and deal with organized crime, money laundering operation.As mentioned in the previous section can be used to deploy software systems to date and the use of intelligent agents as efficiently detect the crime of money laundering in this paper, have mentioned three methods of data mining

methods using technology disciplines such as statistics, database and artificial intelligence to detect money laundering the expression of Recommended seems useful that these methods must be integrated Thus, the algorithm be mentioned in the first method can be used in the design of monitoring system proposed by Gao et al.And the model that is mentioned in second method can be used in designe of reservoir or reporting agent of of Gao et al method .Of course, these proposals offer may be special cases of proposals collection that Using different techniques and data mining techniques to detect money laundering activities has been expressed Which provides prepared the ground for further research in this area.

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