

An Electronic Market Space Architecture Based On Intelligent Agents And Data Mining Technologies

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This paper presents an overview of current trends in electronic Business (E-Business), and discusses how an enterprise can use the Electronic Market space based on intelligent agents and data mining techniques to its strategic advantage. We define an agency as a multi-agent system created by integrating agents, selected from a library of reusable agents that have formed a federation. A federation of agents comprises of a set of registered agents, witch are themselves complete knowledge-based system [1].

Keywords: multi-agent system, e-business, data mining, artificial neural networks

Introduction

Over the last two decades, electronic format has become the dominant medium for information storage. With an increasing number of organizations embracing electronic commerce, this trend will continue to grow. Currently, the amount of information in the world is estimated to double every 20 months, while the size and number of databases are increasing at a still faster rate. As a result of escalating volume of data, human domain experts are no longer adequate for making timely and accurate data analysis. [1] Using the new data mining techniques it can be discovered new patterns that offer new path analysis, new association rules, and new classification and clusters rules. As we can see, data mining techniques offer new perspectives in the analysis of data warehouses and retrieval data.

2. The research objective

The research tries to show the relation between the intelligent agents and data mining techniques. This relation can make the agents to make their job much faster and much better then ever before. The high level of efficiency comes from the big number of knowledge that is process. In this paper will be used 2 types of agents: first will process the results of data mining techniques and the second will use the information offered by the first category of agents.

3. Infrastructural requirements of Logistic Applications - Data Interchange and Security

To realize an appropriate framework for e-

business, some important elements must be used to have an Electronic Market space safe and secure. One of the most important is Electronic data Interchange witch is used to conduct online business-to-business commerce using Value Added Network (VANs). Many electronic transactions use EDI standards and services. EDI is so popular because his software transforms the file of mainframe financial into regular forms that can be process much easier.

To secure the Internet, the protocol architecture of IP includes an Authentication Header (AH) witch provides authenticity and integrity using the message-digest algorithm (MD5) [3] and Encapsulating Security Payload (ESP) [1] witch provides confidentiality using the Data Encryption Standard (DES) algorithm [7]. A number of session-layer protocols have been proposed within the Internet Engineering Task Force (IETF) to support distribution ok keys for use with almost any TCP/IP application. The most significant of these are the Simple Key Exchange Protocol (SKEP), Photuris and the Internet Security Association Key Management Protocol (ISAKMP) [4].

Because every day more and more companies develop their business over the internet, a new standard security was assessed. This standard was established by a consortium of over 300 companies and organizations dedicated to promoting Internet business. The new protocol is Secure HTTP (S-HTTP) and has as objective to provide confidentiality, authentication, and data integrity for the e-

business participants.

Data mining involves many phases and each one is very important for the quality of the final results. The most used are data cleaning, transaction identification, data integration and transformation and pattern discovery. Every phase is made using a big number of mathematical algorithms and statistical models. The final goal of data mining is not just to collect and manage data; it is also to analyze and to discover unknown patterns that exist in the datasets.

4. Intelligent agents and data mining in logistic applications

An agent is anything that can be viewed as perceiving its environment through sensors and acting upon that environment through effectors. A generic agent is diagrammed in Figure 1 [9].

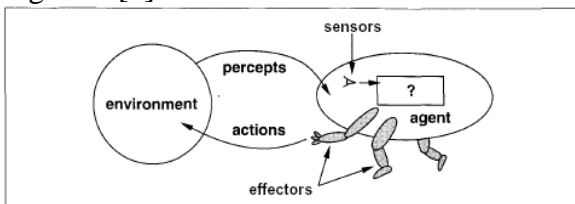


Fig. 1 Agents interact with environments through sensors and effectors.

A **rational agent** is one that does the things like a human being. It percepts all the things from his environment, analyzed them and based on this, it makes the best decision. A question is “how do we measure the efficiency of an agent?” Well it is very hard to make an agent to evaluate his performances. That’s why, the man is the one who establish a standard of what it means to be successful in an environment and use it to measure the performance of agents.

Agents in the Electronic Marketplace are useful because then can adapt to every situation that can appear. Some of their jobs can be: to make contact and to establish connection (this action is based on several rules assessed by the one who create the agent), to negotiate and facilitate interaction (action made also based on some criterions and rules), to disseminate information to wide audience or automatically target information to those interested (for this action, an agent must to know the details of every person), integrate information from heterogeneous

sources (these are the most complex agents because they have to adapt to every media type, to recognize it, to process it and to transform it into the wanted data type.), automate behavior and regulate transactions for efficient business interactions (this action is very complicated because in many cases, it can appear situations like never before; here the agent must to make the decision using only his accumulated experience).

5. Agents for e-business, data mining techniques and system architecture

Most companies use the internet to obtain the information and to create their business. Making e-commerce on this virtual space becomes a very difficult job. To succeed in their business they must have access to information, information that is obtained from many datasets, databases, and data warehouses. Using such a big data volume, the electronic system must transform it into coherent information that can be used by the company. The semantics of the data may conflict across multiple sources and the data may be of certain quality, and the reliability of the source may be questionable. For this reason, for an complex e-business is more amenable to use cooperating intelligent agent.

In the middle of the system there is an executive agent that has the role to facilitate the communication between agents. It has also the role to evaluate the performances of other agents and to accept or to reject the registration of an agent in to the agency.

6. Case study of an agent based delivery system using data mining

For this case study we will use an agency-based architecture and adapted to the current vision of the prototypical Electronic Market space concept. The architecture developed here is designed to take advantage of the extensive World Wide Web network using data mining techniques. The particularity of this architecture is that it uses intelligent agents dedicated to the specific actions of e-business and other intelligent agents that will try to extract the knowledge from databases and to offer quality data mining results.

In Figure 2 is designed an electronic system

for a large important institution warehouse for food, clothing and pharmaceutical supplies. The system goal is to eliminate the crisis situation that can appear. Using agencies with intelligent agents, the system must be able to take necessary corrective action in time. The agent's objectives are to monitor the system, inform logisticians and decisions makers and trigger alternative plans to take care of a fatal situation.

As we can see in figure above, data mining techniques offer results, which will be used by the agents. In many cases, the results offered by data mining agent can be considered knowledge. The agents will work more quickly and efficiently if they will use knowledge instead of simple information. Architecture for Web usage data mining is represented in Figure 3 [6].

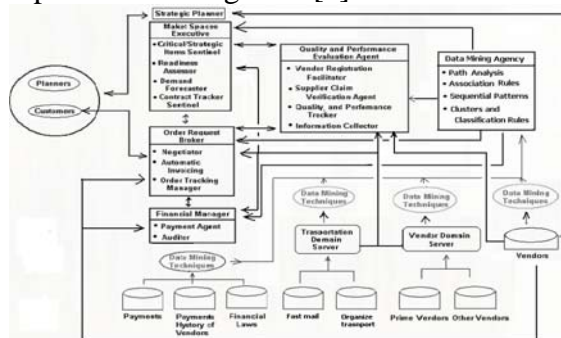


Fig. 2 Detailed Architecture for the prototypical Electronic Market space

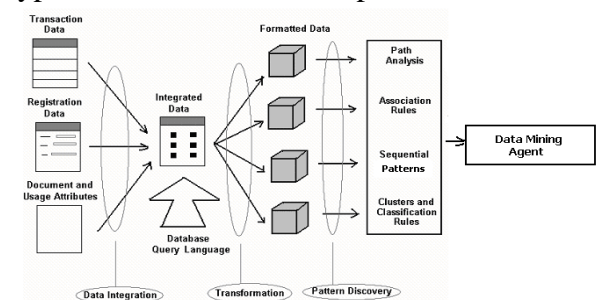


Fig. 3 Architecture for Web Usage Data Mining

In this architecture each agency is a multi-layer agent with a specific goal and functional role in the market space. Therefore each can be considered as a collection of cooperating autonomous agents with particular expertise. A remarkable thing in Figure 2 is the correlation between data mining agent and other agents. The data mining agent use data that are already integrated. There are

several actions that must to be made before the information gets to the data mining agent. These actions are: data cleaning, data integration, transformation and pattern discovery.

Market space Executive – It ensures that probable crisis situations are detected early and avoided by taking suitable action. Useful patterns discovered by data mining will be path analysis and clusters and classification rules to avoid crisis situations. This kind of situations from the past are analyzed and classified from different viewpoints. Data mining techniques for this agency are very important because they help agents to identified easier and better fatal situations. This agency includes: **strategic planner** (allows the user to provide domain knowledge, define long term plans and objectives of the system, define rules and constraints, identify critical items and situations that need to be monitored, define the cause-effect relationships, establish rules and course of action for the sentinels), **sentinel to track critical /strategic items** (consists of a group of daemons witch continuously monitor the state of market space), **readiness assessor sentinel** (ensures that strategic plans can be fulfilled by the resources), **demand forecasting manager** (breaks down plans into resources and material that need to be provided. It also builds the contract term necessary to maintain the inventory) and **sentinel tracking contract terms** (is a daemon the monitors the system to alert against any deviation from the contracts).

Data mining Agency – has an agent for each task. His objectives are: to find *path analysis*, *association rules*, *sequential patterns* and *clusters and classification rules* that could create a whole new vision of the data interpretation. Data mining agency communicates with all the other agents and offers a very good data quality. This agency will have to deal with a huge number of information. That's why his agents must to be able to extract that knowledge that can be useful for other agents.

Order request broker - It ensures that transactions run without interruptions and takes corrective action to undo any inconsis-

tency. Patterns discovered by data mining that will be useful for this agency are: association rules, clusters and classification rules. The association rules will help agents to make transactions run in any circumstances, finding any possibility to take them to the end. The clusters and classification rules will help the agents making them work less time. An agent now must deal only with one transaction that represents the most significant transaction from a cluster. The others from that cluster will be treated in the same mode, but the agent will not do the same steps for them, doing just minimum number of actions. This will save a lot of time and work. This agency includes: **negotiator** (provides optimized broker-supplier mapping), **automatic invoicing** (receives supplies and requests payment), **and order tracking manager** (takes over the contract after negotiations have been completed by the negotiator). **Financial manager** – this agency removes the need for invoices to be prepared and approved. Clusters and classification rules will help agents from this agency to correlate the type of payments with organizations and with their mode to do e-business. Another advantage for agents from this agency of using data mining tools is that they can easily find fraud cases. For example if a transaction or a payment is not included in a classification type, it can be point out and analyzed closer. This agency includes: **payment agent** (when the automatic invoicing agent acknowledges the receipt of merchandise corresponding to a particular contract, funds are automatically transferred to the supplier account and records of the financial transaction are sent to the auditor) and **auditor** (records of all the financial transactions and performs audits). **Quality and performance evaluation agent** – provides directory services and tracks performance of the vendors. It tracks the measure of the level of confidence in different suppliers – based on previous history, verifies supplier claims and obtains referrals. Path analysis, association rules and clusters and classification rules can be use for this agency. Path analysis is useful to find new ways to analyze a vendor that can reveal new

information about him. Association rules offer a detailed view of vendor activities and see if these are as they should be (legally, ethically, etc.). This agency includes: **vendor registration facilitator** (enables new vendors to make their services available to the client; established the connection between the vendor and the customer), **supplier claim verification agent** (includes the verification of supplier authenticity by obtaining and checking the references), **quality and performance tracker** (extracts information and update the knowledge stored in the supplier).

8. Conclusions

Using in the Electronic Market space architecture based on intelligent agents and data mining technologies increases productivity by allowing processes to be done much faster and with more efficiency. New architectures are projected every day. If today is only the beginning, in few years they will be able to support larger and more complex applications for e-business.

In the presented architecture, the great advantage is that the integrated data mining agent is like a “bridge” between databases and the other agents. This confers a high flexibility level of the system because it has the possibility to choose from a big number of combinations that can bring to the right decision.

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