Optimizing E-Business Using Learning-Based Systems

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Abstract. The main element of profit-bringing in the business, so in the e-business too, is the client; therefore increasing the financial efficiency can be achieved by optimizing the components that stimulate him to allocate more money for the business products and services. This article aims to propose a technical frame, an orientation and a development analysis in terms of learning-based systems. Using ontology, learning-based system will have as purpose understanding user preferences and correctly predicting them by starting from a minimal knowledge accumulation, so that the interest rate reached by this information to be larger. Learning-based system will work with web platform, so that the generated decisions to be implemented dynamically, rapidly and automatically.

Keywords: Learning-based Systems, E-Business, Ontology, Optimize.

1 Introduction

The purpose of any physical or legal entity is to have performance, meaning long-term profitability. Profitability is the most important defining element. There are no economic arguments for a business to continue operations when, constantly, costs are higher than income. This main element is not exclusive, meaning that it should be taken into consideration the idea of finding a competitive model to comply with all applicable rules and possibly anticipate them.

Growing and maintaining profitability is achieved through continuous optimization of the factors that make the business. Thus, the online component used to improve performance, whether applies in parallel with a traditional business, whether is seen as a self-contained element.

Comparing the two businesses, the classical and the online one, the latter may have a higher success rate, due to how it can be extended: a large number of potential customers readily available at low cost, high financial returns which leads to performance for customers and automatically, for business.

Among the most profitable companies in the world, made by Fortune magazine in 2011 [1], Google (activity carried out exclusively online) is positioned in 19th place. This shows that the environment is an optimal climate for business development. Moreover, there is international support in this regard: attention in this area (there is a strong tendency to support consistent online environment by all the major internation-

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al companies), the incentive legislative base, context for research, special funds (including European Union funds [2]).

Optimization can take place only if it is known the state of the online business, meaning if an internal audit is made in order to classify the system and to find vulnerabilities (those elements that can be improved). Knowledge will be dynamic because the business has dynamic elements that require repetitive analysis, knowledge cycles on a certain period of time.

Current economic environment revealed that only business entities which had a very well structured internal system could maintain a positive rate of return so as not to leave the market.

Dynamic and important continuous changes in society presented interest in conducting analyzes on specific situations related to development and business continuity in various fields. So, a question to be asked would be what is the logic behind the fact that two businesses having the same profile, same development opportunities and recognition, influenced by the same factors have different returns? The answer comes after a detailed study on every internal process and on the correlation between different processes within the business.

The current economic environment highlighted the non-consistency of business and the fact that many of them could not cope with the economic environment, while others had a considerable profit.

Analyzing the internal processes of the successful companies of today revealed features that distinguish them in the competition:

- Automation of internal processes;
- Using an evolving knowledge base [3];
- Implementation of decisions in a short period;
- Decision analysis in multiple phases in order to detect non-profitable decisions before they cause major adverse effects;
- Use a predictive system to provide to the customers an environment that he expects to have involuntarily, but is not aware of that.

This article aims to propose methods that increase efficiency by optimizing components regarding the interaction with the users. Thus, we propose an ontology structure and directions for developing a learning-based system algorithm, in order to achieve an environment in which online business operates so that the degree of satisfaction on users to be maximal. This is done only by advanced knowledge on the customers, such as their preferences in time, the learning-based system being responsible on the predictive proposals.

2 Ontology and Learning-Based Systems

The word ontology was introduced in computer science as a way to assign meaning to certain things, in order to support intelligent systems in perceiving knowledge similar to how humans do it. It expands the acceptance mainly used in philosophy, namely "the study of Being or Existence" [4].

Given the high amount and complexity of data, ontology helps on the homogenization and almost total elimination of chaotic and dispersed nature of the data [5]. Multiple sources make difficult to understand and link data so, using this concept, it can be grouped, prioritized and give the possibility to create between it bonds of sense, form and understanding. So, looking at the logic behind this concept, we can admit that ontology is one of the most efficient ways to represent complex and detailed knowledge [6].

The existence of large amounts of data affects the final result in the creation of ontology. As more details are, the senses will be more complex, but the end result will have a higher level of completeness.

The difference between ontology and learning-based systems is on complexity. If ontology groups certain knowledge and defines relations between them by giving a human understanding on information, the learning-based system includes that feature that completes ontology with the ability to make decisions with reduced involvement of individuals and to engage dynamic data set.

Introducing the learning-based system concept shows that there is a continuous effort to achieve systems that improve their performance through experience, so-called "learning" activity performed by a learning agent being similar to the learning done by the human subject.

Some systems based on the technology of learning-based systems tend to eliminate the need for human intuition in the analysis of data, while others adopt a collaborative approach between man and machine. Human intuition cannot be completely removed since the system designer must specify the logic on the representation of the data and what mechanism will be used for their search. Learning systems resemble with an attempt to automate parts of a scientific method.

The learning-based systems refers to changes in systems that perform various tasks related to artificial intelligence, tasks involving recognition, diagnosis, planning, forecasting, which cannot be completely defined only through examples, but by specifying input data and expected results. Results are derived on the assumption that there is some input, without having a well defined input-output function, but only by approximating implicit relations. Often, correlations and connections are "hidden" behind the huge quantities of data, but using the learning-based systems technology this information can be extracted.

Often, systems are designed not to function effectively in the environment that they are used because some features of the working model could not be clearly defined at the time of their creation, but the learning-based systems methods are used on supporting them. Information diversifies and generates new knowledge flows, which would require replication of artificial intelligence systems, but since this is not a practical solution, it is expected that the learning-based systems technology would successfully cope with these situations.

Automatic learning presumes identifying and implementing more efficient ways to represent information in order to facilitate search, reorganization, change and awarding a plurality of multidirectional relationships. Choosing how to qualify such knowledge refers on the general conception of how to solve the problem and on the data features which are used to work.

Learning should lead on getting enough "rules" so as to allow solving problems in a wider area than under which the learning was done. That learning must improve the performance of a system not only by resolving the same set of problems, but also by solving some new problems.
The possibility of implementing a learning algorithm and generally using learning for designing intelligent systems implies generalization of the solving methods obtained to cover a large number of possible instances and at the same time maintaining a sufficient specialization so as to correctly identify the accepted courts.

3 Analysis on Building a Learning-Based System

Specialized learning systems contain a minimal basis and, in addition, they have features closely related to the domain to be used. Learning systems in electronic business will include the features that define the knowledge used routinely in online business. In this regard, we classify all the information that a business can have as follows:

- Management knowledge, related to internal mechanisms;
- Knowledge about knowledge related to working with certain types of information;
- Knowledge about customers;
- Knowledge of different.

The purpose of this article is to show a way to increase e-business efficiency by optimizing the component related to the client.

E-business, as well as classic business, is built around customers, as they are the ones that give directions for development. The client can be any person or entity. Potential customers of e-business are generically called visitors so we will refer to them in terms of specifics they have.

The bridge of interaction with the clients is the technical platform. It receives and provides information, dependent or not. This dependence is given by the complexity of the technical platform meaning all of its subcomponents. As the system's ability to process information coming from the client is greater, the yield - from all points of view - may increase. Thus, an efficient system is one that is dynamic and makes use of the advantage received by the visitor (user) in order to obtain from him a higher income on the long run.

Having a pragmatic approach, we can say that optimizing the component that keeps the user interaction can be achieved by implementing a learning system and providing ontology for aggregating knowledge from different sources.

Learning-based systems should provide two minimal functions:

- Automatically find relevant business information: e-business works with a huge number of information, as part of internal processes or as part of output for clients. Reducing this information is imperative and the result is to provide to the visitors personalized content, meaning potential income bringing content. The chances of a visitor to become a customer decrease with the amount of irrelevant business information provided.

- Prediction: preferential positioning over the competition is made by obtaining exclusive knowledge with a high degree of accuracy and detail. The result of knowledge processing will be providing functionalities in accordance with future needs.

The proposed ontology will structure the knowledge with what an e-business is working with, oriented on the consumer. So, the goal would be identifying and predicting the customer's needs in order to get at the end his satisfaction [7]. Top-level element will be the user and from him will be created sub levels containing user-specific elements of detail in order to obtain meanings.

The learning system will use structured knowledge based on the defined ontology, will process and issue options that will be dynamically integrated or will be subject to supervision and human decisions.

This paper aims not to research on how to obtain the data coming from different databases, libraries or other sources [8], but to show the processing and use logic, starting from the idea that knowledge is available in specific databases - owned or external, complete or incomplete and will be managed using specific technologies of extraction.

A very important aspect to note on the ontology to be created is that all data, regardless of the usefulness in time, will be saved for future processing. Data will be chronologically ordered, having an historical character.

Ontology will group and use the following data types, aggregated in classes:

1. Personal Data Class

Positioned on the topmost level, the data in this category should be as relevant and accurate so as to uniquely identify a particular consumer. This condition is not mandatory but is a goal, the ideal situation.

Class components will include: Identification number, Name, Physical address, E-mail address, Telephone number, Income and other information useful to describe in a more complex way the user.

Also in this class we will include personal preferences and occupations related to the user such as Occupation, Styles and Hobbies - items included in subclass Preferences.

Within this class will be stored Person-to-Person relationships that could help identify the person and increase the level of detail. In other words, based on the relationships, we will be able to identify a user, indirectly, even if we will not have data on it.

2. Data on Online Accessing Activity

We will monitor the online activities developed around the customer [9], that type of interaction between them and the entities present in the web. We will want to know all aspects related to Web browsing, and that part of a web page that had the highest activity or what was the time spent on a page related to the content offered (content classification can indicate the level of interest on the visitor reported on the assumed interest calculated level - for each content offered will calculate an index that shows which should be the time spent on the page so as to conclude the level of interest).

Class components will include: Unified Resource Locator - URL, Date, File, Technical details (connection type, time spent, operating system, location).

3. Data on Commercial Activity

If there was an e-commerce activity that the user has made in online environment, the details of this should highlight any issue that may be taken into account in the learning system.

Class components include details obtained from accessing class and in addition: Purchased Product, Amount, Date, Price, Method of payment.

4. Data on Used Services

Certain online products do not have an interface accessible using a Web browser, so identifying how the client interacts with such services will be part of a distinct category.

Class components will include: Technical Details, Product Details, Reports - its frequency of use in relation to other services, Used Technologies.

5. Data for Offline Activity

This category will include all knowledge about the user from traditional media and beyond: mobile phones (position, specific information - call, messages), physical locations accessed.

This class will have a large number of components, depending on the number and homogeneity of data. Among all types of data described above we will define a multi-directional relationship in order to provide meaning to knowledge, so that all these classes together with the links between them to form a homogeneous entity, specific to ontology with the ability to improve and self develop.

Having defined ontology and data structure, the next step is to analyze and get those specifications and directions needed to integrate the knowledge presented in the learning system. This article aims to propose an interim methodology, as part of the final objective - creating a complex algorithm, generally used, based on which the learning system will operate in optimal conditions, meaning to attend all business decisions within e-business; this will bring a significant efficiency increase.

Fundamentals of the proposed methodology are based on principles supported by the following statements: "No information will be thrown" and "All data is valuable at one moment in time ". Data contained in the defined classes will be grouped according to their relevance and importance in the algorithm. It will be processed and, according to the results obtained, will be used by the application in generating solutions. Whether after multiple iterations we can or cannot get a trend or a rule to be used and combined with other types of data, it will still be stored so that the possible future links found to be integrated.

In Fig. 1 it is shown the way data is processed, organized, grouped, how the classes are populated and the relationships between them – the ontology.

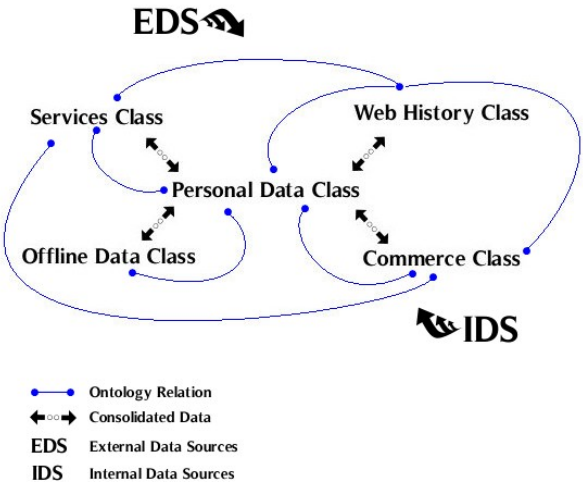

Fig. 1. Proposed Ontology Structure

For a successful integration of data from the ontology in the learning system features it should be taken into account the following aspects:

Process 1. Will be processed the data and relationships contained in Personal Data class. The purpose of this process is to position and identify the user as completely and accurately as possible, so, the learning potential in this category is relatively reduced. The nature of this class allows the learning system to validate information and attach knowledge from other unused classes until that point. Incomplete data which cannot be attached to a feature from Personal Data class will be stored and later trained to obtain additional knowledge.

That class includes subclass Preferences and the result will get the complete user profile and will lead to preferences classification according to their importance.

Process 2. In this process, we will aggregate all the knowledge and existing relationships in order to provide optimal user interface, by taking into account not only technical aspects but also elements of content.

For each web entity accessed it will be extracted some defining elements such as content offered, its quality relative to other similar environments and will be included in an algorithm, which in turn will issue elements that characterize the client profile. The engineering of the algorithm will result in more analytical details about the connection between time spent on a site, the user's interest rate, real quality and perceived quality of content, accessing period [10].

Commercial information from Acquisitions class processed by the learning system will result in products and types of services framed in a certain margin based on quantity purchased and other specific interest result of this class. It will be taken into account the user income and certain exceptions that he was willing to do because of his high interest on that product.

The outcome will result in multiple filters applied to the content offered by e-business having as objective consolidating user profile and online preferences, so as to provide him services having a conversion into acquisitions rate above medium.

As information is more attractive and relevant to the specific user profile, profitability rate is even higher. Providing useless data exponentially lowers interest and perception of the user that this e-business may satisfy his needs. The goal is not to only offer elements that give interest to it, but also to propose new solutions that could be considered by him interesting. The system features based on learning must therefore imperatively include predictions. The user capacity is limited in saying what he might be interested in for the future, but can be eased by offering possibilities. Learning-based system will process all information received and will propose solutions, with a high converting rate - the user to become customer.

Process 3. Profile will be completed using knowledge from ontology that is related to the offline environment. It will be watched the physical activity of the user and we will try structuring it. Given the heterogeneous nature of this data, it will be used for refining and detailing optional prior information.

The described processes will be integrated in a cycle that hould be followed in the algorithm. The logc is presented in Fig. 2.

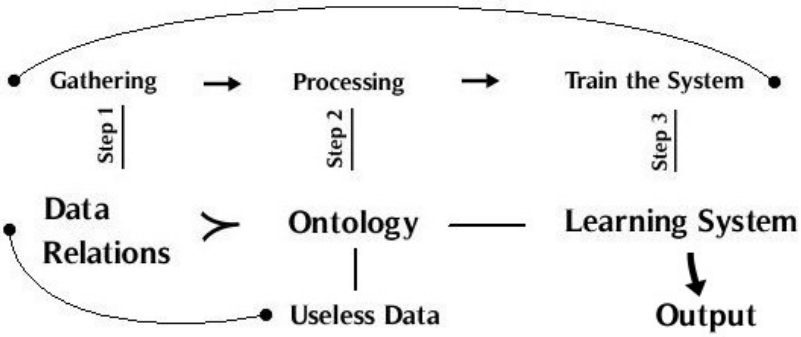

Fig. 2. The Logic of The Platform Based on Learning Systems and Ontology

4 Conclusions

Learning-based systems can complete the meaning of the ontology by optimizing existing relationships and establishing new ones; the result can contain some new meanings, revolutionary ones, which will contribute on making visible progress of the business in question.

The amount of existing and then structured information in the ontology is essential in obtaining more refined, detailed and realistic results. Training sets which will apply the learning system algorithm will process and generate solutions to complex and qualitative data in direct proportion to the data quality. The result is in most cases accomplished by taking decisions so the more the solution is customer oriented and

offers him guidance on what he wants and helps him to find certain needs, the more e-business will be successful.

The Web platform of the business must be constantly synchronized with the learning system because certain decisions need to be taken instantly, automatically, by using results directly from the system.

Analyzing the significant progress on the learning systems, on the methods of intelligent data collection and on the technologies that allow collecting, storing, processing and using a huge amount of data, it can be concluded that the tendency is to maximize information role on the decision-making in any type of business, especially within the e-businesses.

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