The Actual Limits of Decision Support Systems and Knowledge Based Systems in Supporting Business Decision Processes

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Abstract

This paper presents actual limits of DSS and KBS in supporting business decisions processes. After a brief review of DSS and KBS limits we propose a solution that consist in information semantically integration with the use of ontology and inference engine in a contextualized web browser. We finish the paper by presenting some detailed conclusions and with some proposal of future research work.

Keywords: decision-making, DSS, KBS, ontology, inference engine, OWL

INTRODUCTION

Technologically speaking, the IT solution is represented by decision support systems (DSS) integration with intelligent technologies. Such systems offer users flexible tools to analyze important data sets. A system to assist decision should be simple, robust, easy to control, adaptive, comprehensive, and easy to communicate with.[3, p.2] Queries needed to assist decision making examine / explore current and historical data, identify trends and create aggregate useful data to assist decision making. On-Line Analytical Processing (OLAP) [1, pp.65-74] and data mining [2, p.12] are tools to assist decision-making ad hoc queries.

Artificial intelligence provides theory and techniques to assist decision-making process in the sense identified by the authors C.W. Holsapple and A.B. Whinston. The reasoning was identified as a critical issue in relation to decision making. It is the base for received information evaluation. Perception and thought have been recognized as critical elements of decision making.

J. McCarthy[5, p.12] says that no human intelligence will be reached by various algorithms to reduce the complexity of a problem. The more formalized common sense, the more logical methods will be developed, as was the case of physics and mathematics.

Better decisions means improving information provided. We tried in this paper to outline that the knowledge of acting from the decision models must be implemented to improve information, to actually provide better information to the user. Using decision models for problem-solving task proved to be a failure in the past. It concluded in very static models, non-adaptive ones, with no utility for the user because they captured a kind of model that impose performing an action by the decision maker in the form of transferring knowledge from the model to human being.

Certainly the methods, techniques and tools for data analysis and knowledge extraction are from many areas of research (artificial intelligence, mathematics and statistics, psychology and cognotics) and the application field is important. Researchers' concerns are oriented towards the unification of these methods; therefore the subject of any research in this area of computer-based modeling is interdisciplinary.

Implementation of functionalities offered by IT in developing decision models always resulted in a systemic approach to decision-making process so that solutions are hybrid forms of technology to solve a function, not necessarily decisions.

Generally speaking in developing computer-based models choosing a representation technique is realized conforming to the balance between data and knowledge detained in making decisions. If there is much more knowledge then inferring rules is the solution. If there is much more data the solution is represented by data mining techniques. If data is labeled the solution are supervised leaning algorithms. If data is not labeled the solution is represented by unsupervised learning algorithms. Usually data and knowledge are insufficient and becomes necessary using data to extract relationships in order to discover knowledge or to use knowledge in order ti improve relationships between data structures.

DSS LIMITS

Operational research models aren't perfect, estimation statistical model aren't perfect either unless they work with bid data sets. Risk's models evaluation found solution in fuzzy models. Every method, technique or algorithm has limits because its uses depend on decision problem's context. DSS are more a philosophy and not actually a technology. Their role is o assist decision-maker in order to solve the structured part of the decisions' problems. DSS are problem oriented and uses: analytical models, databases, decision-making reasoning and interactive functionalities in order to assist solving semi-structured decisions. Meanwhile Business Intelligence concept evolved we can say that, for the moment, DSS have tools for analyzing big data sets, performance management, dashboards, and scorecards.

DSS evolving is due to hardware and software evolution. So many technical personal assistants leaded to continuous evolving of the decision maker's possibility to develop its own decisions models. Developing integrated systems leaded to possibility to use big data sets in analyses undertaken by decision-makers. It remains one single problem: semantics. The decision-maker is not concerned with the actual name of data structures, he/she seeks some information and although this information is available this integrated and all performed systems are not capable to provide because of technical integration limits.

KBS LIMITS

Without treating in details Knowledge based Systems limits we can say from the start that the first limit is imposed by still not finding commercial uses of AI (in the sense of business processes assisting). Software developers are not oriented to AI techniques. They know only one thing: good AI means automation; clearly AI has to be applied in manufacturing and intelligent robots. Expertise and domain problems are small and depend on context: here AI doesn't have what to offer. Clearly they approach the semantic problem starting from data structures classifying problem, they build metamodels for every interrelated system. KBS don't have the possibility to learn because they don't work on big data sets. Without learning nobody can talk about an actual intelligent system. KBS aren't capable to adapt which is another important characteristic for intelligent purpose of a system.

DECISIONS MAKERS' ACTUAL NEEDS

Decision makers often need one interface with all information sources. They seek information in a logical order of solving the decision problem. Every decision-maker has its own logical order. Decision maker seek information and evaluates it like: much, less, improbable, possible. Visualization is also important. Case studies are also important. Similarity cases are of importance. Information alert or some suggestions offering in seeking information are also valuable.

These decision-makers come from different business area, different countries, different government policies, different management approaches. So…from the informatics point of view which is the actual problem that needs a solution? It seems that the actual problem remains integration not of the systems but of information. So…we might say that semantic web efforts must concern business software developers. We discuss in the following the solution proposed by the present article in improving decision-making process.

ONTOLOGY, INFERENCES RULES AND QUERING

On the bases this is our solution. We propose extracting ontologies for different sources of data in OWL formats, firing rules that belongs and are specified and edited by decision maker in the moment of making decisions and after that extracting from the improved ontology information needed. We developed this solution during the PhD program when we are trying to propose a solution to improve techniques for business decisions modeling. So in the following we present shortly the results of our solution.

A. Technologies used

We used relational databases, unstructured data files, ontology, and inference engine. Due to software actual limits we used no more than 6 tools in order to demonstrate our idea.

B. Results

We imagined a scenario in which the decision makers would need information from active markets (unstructured data files), information from internal systems (relational databases) and after that he/she would be capable to edit a decision rule that would have to attach new values to actual instances of the ontology.

CONCLUSIONS

There is no need for a common representation standard for data. End-users may label data as they due with photos; they organize information by creating links. So no more standardization is needed. OWL is sufficient to manage ontologies. There is a need of tools: editing tools, web browser tools that can interfere with internal systems.

There is no need to discover new reasoning techniques. The only way in which people solve problems is IF…THEN….ELSE controls. But these controls must be user-oriented, must be specified by decision-makers and not by software developers.

Rules separation from data level offers the possibility to adapt for a system and permits scalability and heterogeneity. Rules based management systems have specifications that constraint data.
Numerical factors integration with qualitative factors must be realized depending on the structuring level and on the context dependencies. If numerical factors might be identified then economical models might be applied. If the factors are qualitative and their appreciation depends on context and is realized by the decision-maker the decision models must be specified by the decision maker.

Starting from the definition of knowledge level proposed by A. Newell, from the decision-making phases discussed by H. Simon and from the literature existent in the field of developing knowledge-based systems we treat in the following the concept of knowledge. Anyhow, in our opinion a piece of knowledge or for some reason knowledge seen as atomic structure must: be a symbol part from an ontology that describes its existence, to participate in making logical inferences and to improve the original ontology of which it initially belongs.

Organizations develop physical-logical models or information system starting from a function approach, a process approach or a domain approach. Either is the methodology chosen for developing and implementing information systems the difficulties arise from information organization and integration limits. Every participant in the development process has a different view on system's model depending on the expertise of every participant. The end-user wants a system oriented on its needs, the developer wants a system oriented on its developing methodology, and the implementation team wants a system adequate to available psychical architecture.

Although the place where rules specification is above the data level, on the abstractions levels the situation is the other way around. The values specified by rules are part of a piece of knowledge and the most abstract element which defines data is the class's vocabulary from which data comes.

A knowledge piece is characterized by instances of the object classes and by rules of reasoning that access this piece of knowledge. Instances don't necessarily belong to classes' views of the system. Often they belong to the classes from the conceptual domain. Relationships are complex and depend on system views' organization and on semantic equivalences between views. Specifying pieces of knowledge can not be undertaken on the data level or on ontology level.

Accounting has its own methods of synthesizing data. In actual decision support systems this information is described in deposits. Information is used by decision models. The logic of using information in reasoning process is not offered to the decision-maker and data organization structure doesn't permit knowledge acquisition.

From our experience in modeling decisions during the PhD program and two research grant programs that we manage we observed that all the literature related to decision modeling refers to analytical models usually based on mathematics or expert systems models based on the so called knowledge captured from experts. In fact, in practice these models are not used. Every idea, philosophy or technology proves its usefulness by using it in practice. But we can not say that the analytical models or expert systems models are used in practice because these models have an embedded form of knowledge hidden in some sort of technology. In our opinion, for the decision-makers use some models it is necessary that they can specify the constraints, the inferring chains of rules without knowing the intrinsic part of the metamodel.

Humans recognize, classify and evaluate messages in order to perceive and to attach meaning. This would have to be a method to organize concepts to represent some sort of meaning and this kind of methods use semantic technologies models.

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