Analyze of the Measuring Performance for Artificially Business Intelligent Systems

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10 July 2007

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Abstract: *This paper analyzes the measuring performance of artificially business intelligent systems. Thousands of persons-years have been devoted to the research and development in the various aspects of artificially intelligent systems. Much progress has been attained. However, there has been no means of evaluating the progress of the field. How can we assess the current state of the science? Most of business intelligent systems are beginning to be deployed commercially. How can a commercial buyer evaluate the advantages and disadvantages of the intelligent candidate and decide which system will perform best for their business application? If constructing a system from existing components, how does one select the one that is most appropriate within the desired business intelligent systems? The ability to measure the capabilities of business intelligent systems or components is more that an exercise in satisfying intellectual or philosophical curiosity. Without measurements and subsequent quantitative evaluation, it is difficult to gauge progress. It is both in a spirit of scientific enquiry and for pragmatic motivations that we embark on the quest for metrics for performance and intelligence of business intelligent systems.*

Keywords: *artificially intelligent systems, analyze of the measuring performance, business intelligent systems, metrics for performance, measurement performance.*

Introduction

The business intelligent systems must be able to utilize a variety of types of information and knowledge about the world in which it functioning. They must be able to model the business domain so that they can perform the supporting intelligent reasoning on different business pieces of knowledge and information. A business intelligent system should be able to have generic models available that guide it as it interacts with the real business world. This is as opposed to non-intelligent systems, where the environment is constrained to fit within the system expectations (limited knowledge about *what is possible*). Although all possible business situations cannot be predicted, the system should be prepared to handle many of them by a sub-store of *commonsense knowledge*.

Intelligent systems use knowledge and different information to perform tasks for the user. Business intelligent systems are artificial intelligent solutions that can be used to automate the decision making process. Rasmussen [4] defines eight steps to the decision-making process, as illustrated in Figure 1.

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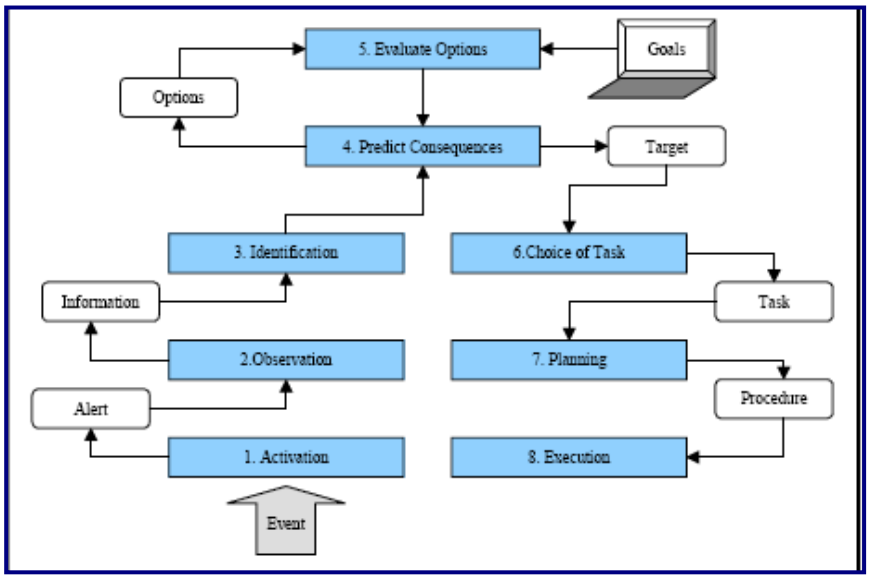

Figure 1: Decision making process

A successful intelligent system typically makes more reliable and more consistent decisions at a lower cost than its human counterparts. Nowadays, applications of business intelligent systems abound from those in discovery of consumer spending patterns to insurance risk assessment, currency price prediction, fraud detection, auditing, managerial accounting, etc. Information and knowledge in business real-life are usually complex and unstructured, even worse they are almost always incomplete, uncertain and susceptible to change. Most research topics focus on building robust intelligent systems that can model and manage information and decisions based on incomplete and uncertain information. It encompasses such areas such as Expert Systems, Fuzzy Expert Systems, Artificial Neural Networks, Genetic Algorithms, Intelligent Web-based Systems, Intelligent Information Systems, Intelligent Tutoring Systems, Hybrid Intelligent Systems, etc It is general accepted that testing of performance pertains to evaluation of the potential and actual capabilities of a these systems to satisfy the expectations of the developer and the users via exploration of its functioning. To be successful in business realistic environments, intelligent systems must identify and implement effective actions in the face of inescapable incompleteness in their knowledge about the world. A business intelligent system should become better at performing its jobs as it learns from its experience. Therefore, one aspect that should be part of the testing and evaluation is the evolution and improvement in the system's functioning. *The system should have an internal measure of success as it performs its job. It can use the measure to evaluate low well a particular approach or strategy worked*. Just as humans build expertise and become more efficient and effective at doing a certain job, the business intelligent system should have some means of improving their performance as well.

Based on this discussion, we try to formulate *an initial set of requirements for testing business intelligent systems*. The tests should be designed to measure or identify at least the following abilities [3]:

✓ to interpret high level, abstract, and vague commands and convert them into a series of

actionable plans;

- ✓ to autonomously make decisions as it is carrying out its plans;
- ✓ to re-plan while executing its plans and adapt to changes in the situation;
- ✓ to register sensed information with its location in the business world and with a priori facts;
- ✓ to fuse facts from multiple sensors, including resolution of conflicts;
- ✓ to handle imperfect information facts from sensors, sensor failure or sensor inadequacy for certain circumstances;
- ✓ to direct its sensors and processing algorithms at finding and identifying specific items or items within a particular class;
- ✓ to focus resources where appropriate;
- ✓ to handle a wide variation in surroundings or objects with which it interacts;
- ✓ to deal with a dynamic environment;
- ✓ to map the environment so that it can perform its job;
- ✓ to update its models of the business world, both for short-term and potentially long-term;
- ✓ to understand generic concepts about the business world that are relevant to its functioning and ability to apply them to concrete situations;
- ✓ to deal with and model symbolic and situational concepts as well as graphical objects and attributes;
- ✓ to work with incomplete and imperfect knowledge by extrapolating, interpolating, or other means;
- ✓ to be able to predict business events in the future or estimate future status;
- ✓ the ability to evaluate its own performance and improve.

Business intelligent systems and the qualitative performance evaluation

As we know, measurement may be defined as the process of determining the value or level, either qualitative or quantitative, of a particular attribute for a particular unit of analysis. We think that the most of the items on the above list allow for a quantitative evaluation, but qualitative domains can play a substantial role in evaluating the performance of business intelligent systems.

How might we do measurements for machines of the virtue that we associate with intelligence? First, we have to encapsulate the notion of what we mean by intelligence. From the above discussion one can see that the following properties are tacitly considered to pertain to intelligent systems:

- ✓ the ability to deal with general and abstract information and knowledge;
- ✓ the ability to infer particular cases from general ones;

- ✓ the ability to deal with incomplete information and knowledge, and assume the lacking components;
- ✓ the ability to construct autonomously the alternate of decisions;
- ✓ the ability to compare these alternatives and chose the best one;
- ✓ the ability to adjust the plans in updated situation and to reschedule and re-plan in updated situations;
- ✓ the ability to chose the set of sensors and to recognize the unexpected as well as the previously unknown phenomena;
- ✓ the ability to cluster, classify ands categorize the acquired information and knowledge;
- ✓ the ability to update, extrapolate and learn;
- ✓ being equipped with storages of supportive knowledge, in particular, commonsense knowledge.

Then we need to find consistent measurements of what we consider to be the characteristics for each item on the above list. We see these characteristics like characteristics of intelligent software performance quality in general, to provide us with goals to strive for in developing business intelligent systems. Ideally, the characteristics of value would be even more than knowledge engineering goals. They would be theoretical constructs in a ”science of artificial”[6] - in this case, the science of Artificial Intelligence, or more specific in the science of knowledge representation.

Intelligence evaluation

Evaluation of intelligence requires our ability to judge the degree of success in an intelligent multiresolutional system working under multiple goals. This means that if a success is defined as producing a generalized representation, the latter can be computed in a very non-intelligent manner especially if one is dealing with a relatively simple situation.

Experts in business problem solving use knowledge that has been already extracted from the texts. How? Now, the existing computer tools of text processing for allow us to address this systematically. Finally, there user might have its vision of the cost-functions of his interest. This vision can be different from the vision of the expert. Usually, the expert will add to the user’s cost function of the intelligent system an additional cost-function that would characterize the time and/or complexity of computations, and eventually the cost of solving business problem. Thus, additional parameters: (w) cost functions, (x) constraints upon all parameters, and (y) cost-functions of solving the business problem. This contains many structural measures. We need to trace back from an externally perceived measure of „success” or intelligence to a structural requirement.

Important properties of the business intelligent systems are their ability to learn from the available pieces of knowledge about the system to be analyzed. This ability is determined by the ability to recognize regularities and irregularities within the available pieces of knowledge. Both regularities and irregularities are transformed afterwards into the new units of information. The spatiotemporal horizons of business intelligent information systems turn out to be critical for

these processes of recognition and learning. Metrics for intelligence are expected to integrate all of these parameters of intelligence in a comprehensive and quantitatively applicable framework. Now, the vector of intelligence $\{VI_{ij}\}$, would allow us even to require particular target vector of intelligence $\{VI_T\}$ and find the mapping $\{VI_T\}\rightarrow\{VI_{ij}\}$ and eventually, to raise an issue of design: how to construct an intelligent system that will provide for a minimum cost (C) mapping: $[\{V_{PT}\}\rightarrow \{VI_{ij}\}] \rightarrow \min C$ where:

$\{VI_{ij}\}$ - vector of intelligence; $\{V_{PT}\}$- a particular target vector of intelligence (which is trying to develop within a system).

In the literature, the following tools for intelligent systems are known as proven theoretical and practical carriers or the properties of intelligence:

- ✓ Using Automata as Generalized Model for Analysis, Design and Control;
- ✓ Applying Multiresolutional (Multigranular) Approach;
- ✓ Reducing Computational Complexity;
- ✓ Dealing with Uncertain by Equipping the System with Knowledge Representation;
- ✓ Learning and Reasoning Upon Knowledge Representation;
- ✓ Using bio-neuro-morphic methodologies;
- ✓ General Properties of Reasoning: -Quantitative as well as qualitative reasoning.

Conclusion

Artificial Intelligence (AI) textbooks and research papers often discuss the big questions, such as "how to reason with uncertainty," "how to reason efficiently", or "how to improve performance through learning." It is more difficult, however, to find descriptions of concrete problems or challenges that are still ambitious and interesting, yet not so open-ended.

The conclusions are the following:

- ✓ humans use their ontology's (the whole system of knowledge representation) to label, categorize, characterize, and compare everything – ever object, every action;
- ✓ humans learns the meaning of some new entity because a label for this thing is put into the knowledge representation system, and eventually into a place in the ontology that relates it to the rest of the human's knowledge;
- ✓ the ontology is usual accessed only as much as needed to make the decision, or to communicate ideas and understand ideas communicated by others;
- ✓ a human knowledge representation system reflects reality to the extent that it helps human to deal with the world external to the human's mind in a way that enables good decisions and accurate predictions;
- ✓ the human experiences depend on actions that have been taken, sensory information that has been absorbed and communications that have been received and understood;
- ✓ the relationship between the ontology and direct experiences of a sensory nature, coupled with activity and what it accomplish is a part of the property called *grounding* which is a

part of the process of symbol grounding;

- ✓ the rational interpretation of things communicated to an individual (or discovered) is affected by and affects that individual's ontology;
- ✓ decisions that lead to a high probability of success in dealing with the external world can only be made in the light of an individual's knowledge-representation system understanding of the facts surroundings the decision;
- ✓ like a human, an intelligent system may have sensors connected to subsystems of sensory processing, and may be able to take certain actions that provide grounding ontology. If it can learn, it can extend its ontology, like humans.

This paper analyzes the performance measuring of artificially business intelligent systems. The goal has been the developing of best practices on metrics for performance and intelligence of business knowledge-based systems. Nowadays, much progress has been attained in the research of various aspects of intelligence of these systems. Our work explains the most important aspects of this progress, and a supplementary vision about this matter. Based on our research work we strongly believe that a comprehensive and quantitatively applicable framework of metrics for intelligence are expected to integrate all of the parameters, and good experimental results will be appear in the future by using of specialized tools.

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