

ARTIFICIAL INTELLIGENCE IN DECISION-MAKING

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Abstract

Decision-making is a complex process that involves data that is derived based on set of rules. Conventional computer programs that executes the rules structurally, limits the decision-making process. In addition, the computer (or machine) itself does not have power to think and formulate the rules by itself (based on experience). This paper presents the potential use of Artificial Intelligence (AI) techniques in management, specifically in decision-making. AI is a science that tries to emulate human "technology" onto a computer or machine. AI contributes to a highly complex decision making procedure exhibits from a set of predefined rules. Some of AI techniques can learn patterns, mapping, optimizing and interprets fuzziness. Several of these techniques are discussed based on its function (potentials) and contribution to decision-making process.

1.0 Introduction

Artificial Intelligence or AI is a study that tries to emulate human intelligence into a machine or computer. AI can be best describes as a study that tries to make computer do things where human did better (Rich, 1985). Basically AI involves several disciplines or study such as linguistics, psychology, philosophy, electrical engineering, computer science, management and management science. These disciplines of study act as the root for AI's tree. AI itself can be divided into several branches, which are natural language processing, intelligent tutor, computer vision, expert systems, machine learning, automatic programming, robotics, game playing and speech understanding.

Each of these branches has its own important role in today's world. Intelligent Tutor for example plays an important role in education development (*for further readings see* Clancey, 1981; Clancey, 1886; Brosilovsky *et al.*, 1997). It provides and alternative method of teaching that can help to improve the current teaching and learning processes. Intelligent tutor can be programmed to act as a teacher or instructor in specific domain area. It can teach students at any level of understanding and provides the course materials that suitable with a particular student. It has been successfully implemented in various courses such as PAT (PUMP Algebra Tutor) for algebra (Ritter, 1997) and ADIS (An Animates Data Structure Intelligent Tutoring System) for data structure (Warendorf and Tan, 1997). In addition, natural language processing is proposed as an intelligent interface for intelligent tutor (Fadzilah *et al.*, 2000).

Another branch of AI, that is expert system is one of the well-known techniques in various fields. Expert system is a computer program that emulates human expert decision-making ability (Giarratano and Riley, 1998). In management, expert system can be programmed with certain rules or knowledge to solve problems and provides an advisory comment. It also helps naïve user to use or operates things such as computers, electrical devices and etc. Expert system in medical applications for example, assist doctors and medical practitioners to diagnose and advice them for a specific therapy (*for further readings see* Szolovits *et al.*, 1988; Coiera, 1997).

In business and economic, AI techniques such as expert system and neural network offers qualitative methods for the formal analysis of system's qualitative aspects (Zahedi, 1993). Quantitative methods such as statistics and mathematics represent the systems with an algorithm. An algorithm is a step-wise set of rules that used to produce the desired solution or response. However, a pure quantitative systems is rarely find as many business and economic structures do not fit into mathematical functions. Therefore, AI techniques need to be utilized as qualitative methods to overcome the limitation of quantitative analysis.

This paper discusses the potentials of AI techniques in management, specifically in decision-making. The role and contribution of AI in decision-making is also discussed.

2.0 Potentials Aspects of AI

“Artificial Intelligence” is a term that inherits from human intelligence. AI however, is not just a term but also act as behaviour. The intelligent aspects of AI include; the ability to learn from experience, learn and provide meaning for fuzzy data, quick response to a new situation, able to use the knowledge, reasons and manipulate the environment. These aspects of intelligence produced a dynamic AI that can be implemented in almost all kind of applications that previously, mainly depended on human intelligence.

The lack of human experts to manage a business for example, limits the decision-making processes. Usually, an authority to make decision in a company is belongs to the CEO or manager. If this people are out from office, all decision needs to be suspended. Some of the authority to make decision is usually given to their assistance. However, their decision-making ability is limited to several problems domain. Other problems domain may require other authority. In addition some of the steps taken to solve problems and making decision may not include. This is because one’s that do not conscious of his steps in what he does probably won’t be able to explain the tasks to some else (Eisenhart, 2001).

Decision support systems (DSS) are computer-based support system that focuses on semi-structured and unstructured decision problems helps management decision makers to deal with semi-structured problems. This conventional computing method does assist users to make decision. However, conventional computing applied quantitative method rather than qualitative. As most applications involve qualitative aspects of the problems, the decision-making processes by conventional computing may not be very helpful. In addition AI computing perform symbolic reasoning using the knowledge from the knowledge bases. This could overcome the weakness of step-by-step rule execution which is usually non symbolic, that performs by conventional computer. Figure 1 shows the process in AI computing which involve a request from user and feedback based on the knowledge domain.

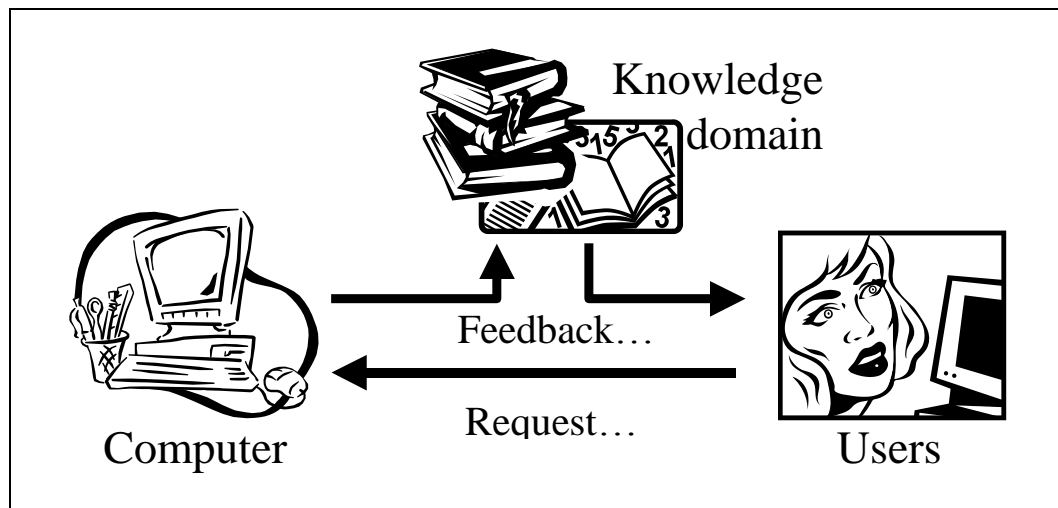


Figure 1: AI Computing

3.0 AI to Improve Decision Making

A salesman who was in travel carried along his assignments to send some goods from City A to City F (see figure 2). His assignment due in 24 hours. Therefore, his first task is to identify the shortest path so that he can deliver the goods in time. There are a few choices:

- City A → City B → City C → City D → City E → City F = 46 miles
- City A → City B → City F = 33 miles
- City A → City C → City D → City E → City F = 43 miles
- City A → City D → City E → City F = 33 miles
- City A → City E → City F = 28 miles
- City A → City F = 35 miles

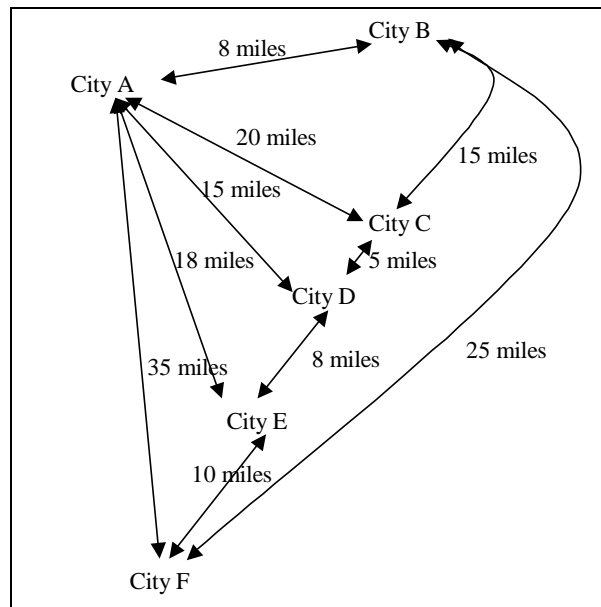


Figure 2: Traveling Salesman

By looking at the distance the salesman might probably choose to travel from City A to City E and City F. Totally, he has to travel for only 28 miles. Basically, his decision would not just based on the how many miles he has to travel, but also other heuristics issues such as how many city he may passed through and was the root in a good condition. If he has to passed through to many city he probably get stuck in traffic jam and if the road condition is really bad the probability he meet an accident is high. His vehicle and the goods might damage.

The question is, how to find the best path for the salesman. In AI this problems required an optimization technique such as Genetic Algorithm that uses Darwin's basic principles of survival of the fittest, mutation, and crossbreeding to create solutions for problems (Dhar and Stein, 1997). For managers, Genetic Algorithm helps to reduced time and costs as the goods could be deliver in time to their costumer. It also assist mangers to prepare a better plan and schedule for their production.

Using the same knowledge, Neural Networks could be trained to recognize and learn the roots and the heuristics patterns. When the managers come across the same problems again he could use the trained nets to provide a solution. Expert system could also be use to generates response based on predefined IF-THEN rules. The expert system is equipped with others' knowledge or experience that describe the problems in great details. It also use the heuristic method to narrow down the problems until it reach the conclusion. Some problems might be hard to solve as its deals with incompleteness and fuzzy data. Therefore, a fuzzy interpretation rules such as Fuzzy Logic need to be employed in conjunction with Expert System. Fuzzy Logic deals with ambiguity of data effectively and provides a better interpretation to the problems.

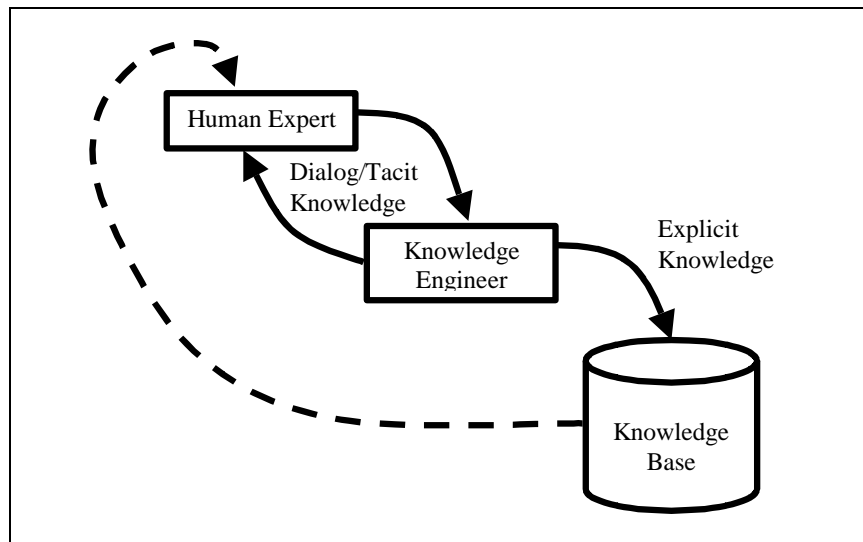


Figure 3: The process knowledge gathering in Expert System

4.0 Conclusion

Artificial Intelligence is one of the promising techniques implemented in system and hardware development. For widespread use of AI, Lith (1996) describes that we need to:

- Clarify what AI technology is, and what can be accomplished with it;
- Provide ways for it to be used in “normal” applications;
- Make sure that there are sufficient practitioners available to build useful applications.

AI contributes to a highly decision-making process that uses domain knowledge to plan the future. AI has overcome the limitation of conventional computing methods by producing a number of branches that specialize in a specific problem domain. To enhance the AI’s ability, some of the techniques could be combine to form a hybrid system which utilize the problem solving ability of each techniques. To strengthen the validity of AI research and improve its intelligent behaviour, the reintegration in AI research is very important (Sowa, 1991). This effort required collaboration between AI researchers to form a bigger research group that combines technical skills, theory and practice. In addition, the reintegration of AI research should also involve non-AI specialist such as managers, businessman, doctors, consultants and etc. to achieve a better understanding between those fields. Therefore, a better decision-making system could be produce as the source of knowledge is directly available.

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