Chapter VI
Design of Cognitive Machines

INTRODUCTION

This chapter is concerned with the design of cognitive machines. These machines and their models were chosen in order to increase and to improve:

i. The degree of cognition of the organization,
ii. the capability of the organization for information processing and management, and
iii. the ability of the organization to make decisions.

Therefore Chapter VI introduces the design of cognitive machines with capabilities to carry out complex cognitive tasks in organizations - and in particular the task of decision-making which involves representation and organization of knowledge via concept identification and categorization along with the manipulation of perceptions (or percepts), concepts, and mental models. The ability of these machines to manipulate a percept provides them with higher levels of information-processing than other symbolic-processing machines; and according to the theory of levels of processing in cognition (Reed, 1988), these machines can mimic (even through simple models) cognitive processes of humans (Nobre, 2005). Percepts and thus concepts (along with mental models) are described by words, propositions and sentences of natural language (Zadeh, 2001).
A GENERAL STRUCTURE OF INFORMATION-PROCESSING MACHINES

An outline of the cognitive machine structure is sketched in the Figure 6.1. This structure is adapted from the information-processing system approach presented in (Bernstein, et al. 1997; and Newell and Simon, 1972). In summary, such machines operate like:

1. Stimuli from the environment are modified and transformed by the sensory system into neural activity signals. These signals are called sensations.
2. The perceptual system maps such sensations into new structures and representations of perceptual amodal-symbols. Viewed as a process, perception organizes sensations into patterns, and furthermore, it uses knowledge stored in memory to recognize those patterns. It gives meaning to sensations through perceptions of depth, distance, motion, light, etc.
3. The processor receives and manipulates perceptual amodal-symbols. It consists of a process of reasoning which uses the knowledge stored in memory to make decisions. Its output decisions are represented by the same structure of amodal-symbols given by the perception block.
4. The memory stores knowledge in the form of mental models described by concepts, categories and clusters of propositions.
5. The response block transforms amodal-symbols to a new structure compatible with the environment requirements. This block can also include task execution and actuation on the environment.
6. The process of attention acts on the perception, decision-making and response processes. Attention provides perception with the selection of specific parts of stimuli and sensations when recognizing patterns and storing them into memory for further manipulation in decision-making and response.

A FRAMEWORK OF COGNITIVE MACHINES

This subsection introduces a framework of cognitive machines, and most importantly, it contributes by relating the functioning of such a framework with the processes of cognition.

This framework is tailored from the general structure of the information-processing system illustrated in the Figure 6.1. Its processes and functioning are designed according to the principles of fuzzy logic and fuzzy control (Lee, C.C. 1990; Mamdani, 1974; Nobre, 1997; Wang, 1994; and Zadeh, 1968 and 1973), computing with words (Zadeh, 1996a) and computation of perceptions (Zadeh, 1999 and 2001). Such
Related Content

The Dawning of Computational Psychoanalysis: A Proposal for Some First Elementary Formalization Attempts
Giuseppe Iurato (2014). International Journal of Cognitive Informatics and Natural Intelligence (pp. 50-82).
www.igi-global.com/article/the-dawning-of-computational-psychoanalysis/133296?camid=4v1a

A Computational Cognitive Model of the Brain
Zhiwei Shi, Hong Hu and Zhongzhi Shi (2010). Discoveries and Breakthroughs in Cognitive Informatics and Natural Intelligence (pp. 1-17).
www.igi-global.com/chapter/computational-cognitive-model-brain/39256?camid=4v1a

A Global Process for Model-Driven Approaches in User Interface Design
www.igi-global.com/chapter/global-process-model-driven-approaches/66276?camid=4v1a
Textual Affect Sensing and Affective Communication
*International Journal of Cognitive Informatics and Natural Intelligence* (pp. 81-102).
[www.igi-global.com/article/textual-affect-sensing-affective-communication/75452?camid=4v1a](www.igi-global.com/article/textual-affect-sensing-affective-communication/75452?camid=4v1a)