Application Note

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Capturing Knowledge in Real-Time ICT Systems to Boost Business Performance

Introduction

This application note introduces XBASE Cognitive Mapping Tool, an AI/ICT Platform to develop cognitive networks to cope with a management of a great availability of data and a necessity to dispose of prompt right information, extracted by data.

XBASE Cognitive Mapping Tool allows to develop an intelligent grid, to support and "automate" strategic decision and so, to solve, in real-time, every kind of diagnostic problems. The analysis of data and the timely interpretation of symptoms lead to discover EARLY WARNING, before it's too late. The data fusion lead to a correct and timely "decision making".

Why?

The proposed platform comes from idea that the better strategic decision arise by a prompt availability of target and effective information. A cognitive network helps to reach this goal: it allows to integrate many data source to drive analytics which transform data into useful information to support advanced operational control and strategic decision making. To realize a cognitive network, it is necessary, firstly, capturing Knowledge, transforming data in information and introducing the knowledge in ICT framework and in Real-Time Systems. This is the right way to have a set of target and suitable information by using to take a correct decision, especially in real-time problem.

XBASE Cognitive Mapping Tool allows to develop a cognitive network. It is introduced as a tool for expert systems development, having a role potentially equal to that the data flow diagrams widely used in information systems development. The cognitive map is used to provide feedback to domain expert, merge the Knowledge of multiple experts, synthesize this Knowledge and provide a graphic representation from which the final rule-based is formed. XBASE Tool creates a cognitive network, with expert neurons.

The principles of XBASE Tool are:

1. Ability to acquire, formalize and insert the Knowledge in ICT Systems: to work with a cognitive network, and to automate completely this network, it needs to transfer the Knowledge from humans to information systems, and in particular, to every node of neural network;
2. Ability to infer heterogeneous and complex domain of Knowledge: fusion of heterogeneous data allows to solve every kind of problems, deterministic and not deterministic, textual and numeric.
3. Ability to control processes in Real-Time: the interconnections among neurons allow to reach the fixed target, in real-time. It allows to develop Knowledge-Based Systems, in Real-Time for industrial processes, like environment monitoring.

Description

The proposed method is based on "FuzzyMQC", Fuzzy Matrix of Certainty's Quantification. The Knowledge domain is split in homogeneous Knowledge subdomains. Every Knowledge subdomain will contain one or more "elementary information". An elementary information can be implemented, increased and improved, depending of the necessity.

The principles of XBASE Tool are:

1. every Knowledge's system, although complex, can be decomposed in simple subsystems;
2. the efficiency of the process improve with the increase of the number of the information.

The principle one could be explained in mathematical terms: given a Knowledge's system Ω, one can always find a decomposition in subsystems D_k. Every subsystem D_k is characterized by an elementary information χ, which is characterized by an elementary function $f_c(\delta, \rho)$, where δ represents the list of input, ρ represents the list of output. The function f_c is activated when the input δ takes on an admissible value. This function can be a fuzzy function, an heuristic function, etc. However, indicating with $\otimes$ the generic correlation between an input and an output, f_c is

$$f_c = \delta \otimes \rho$$

So, the elementary information χ depends by the correlation between input and output.

Given a subsystem D_k, a list of input $\Im(\delta)$ the concept can be extended, examining all correlation between the list of input and a list of output $\Re(\rho)$.

So:

$$[\Phi]m,n = \Im(\delta) \otimes \Re(\rho)$$

with $[\Phi]m,n$ system of matrix.
Whereas in a Knowledge system Ω, union of different subsystem D_k, every correlation matrix $[\Phi]m,n$ forms a system correlation matrix. So, there isn't a single activation function, but a set of activation functions.
Starting with the list of input $\Im(\delta)$, through the correlation matrix system, it is obtained the list of output $\Re(\rho)$, and so the results of problems.
So, every subsystem D_k produces a result ρ, and if one considers the more sure results $\Re c(\rho c)$, one can repeat the process, with a new level.
In this way, the number of input, and also of output, at second level is less than at first level. Step by step, if new levels are created (2°, 3°, 4°…), the number of output will reduce and so, one can arrive to a correct and desired synthesis level.
XBASE Tool allows to develop cognitive networks that can be used in both numeric and textual Knowledge domain. It allows to develop Knowledge-Based Systems, in Real-Time for industrial processes, like environment monitoring (Mappa, Salvi and Tagliaferri, 1995).

Advantages and Innovation

XBASE Tool is a flexible platform that helps to take strategic decision and to solve every kind of problem. This is realized in a prompt and automatic way, possibly in real-time, in order to optimize the working time. So, rather then a complex and powerful computation systems, to a better "Problem Solving" approach, one makes use only of a good Knowledge Engineering ability and the right conceptual tools. This tool helps to develop cognitive networks that can be used in both numeric and textual Knowledge domain. In this cognitive network every node is an elementary information, and it forms the Knowledge Base of the examined problem: the interconnections among the nodes allow to fuse different cognitive processes. This tool can be used in differentKnowledge's domain, also in environment monitoring, as in monitoring of wastewater.
The peculiarity of XBASE Tool are:

- Optimization of processing capacity;
- Deterministic and not deterministic approach: when some data aren't available, it is also possible to reach the final goal;
- Detection of solution in a rapid way and quick interception of critical events (EARLY WARNING);
- "Capitalization" of Knowledge and insertion of Knowledge in ICT System to solve problems both in textual and in numeric domains.

Conclusion

For the correct management of the great mine of data that there is at disposal, it needs a tool that allows to dispose in an optimal way the information, extracted by these data. This tool should help to take strategic decision, to solve every kind of problem. This should be realized in a prompt and automatic way, possibly in real-time, in order to optimize the working time.
So, rather then a complex and powerful computation systems, to a better "Problem Solving" approach, one makes use only of a good Knowledge Engineering ability and the right conceptual tools.
In particular, it has been realized a tool, XBASE Cognitive Mapping Tool. XBASE Tool allows to develop intelligent grids that can be used in both numeric and textual Knowledge domain. In this intelligent grid every node is an elementary information, and it forms the Knowledge Base of the examined problem. Every Knowledge Base is homogeneous, and the interconnections among the nodes allow to fuse different cognitive processes. This tool can be used in different Knowledge's domain, also in environment monitoring, as in monitoring of wastewater.

References

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