Great Challenge in Building Intelligent Systems – Quo Vadis Intelligent Systems?

Peter Sinčák

Center for Intelligent Technology, TU Košice, Slovakia
Peter.Sincak@tuke.sk

Abstract: The papers deals with the great challenge in building intelligent systems and it is creation of human made systems with ability to learn incrementally. The approach is agent based and speed of learning is very high. The paper presents the concept of the starting project which is now underway in CIT and have ambition to create a strong project proposal towards domain oriented intelligent system with strong ability of incremental learning, knowledge fusion and sharing for its agents. We are preparing a server client approach and community could join and make its own contribution in this project.

Keywords: universal incremental learning system, Agents, knowledge, fusion of knowledge, pattern recognition, neural networks, fuzzy systems, evolutionary systems

1 Introduction

The Human made intelligent system is **a dream** of the mankind and still it is very big problem of its definition and basic concept of this systems. Basically we can state that the industrial revolution around us is underway and AI and related fields are trying to find its position and contribution with aim top bring a new better technology and provide investors higher profit and better conditions for human life and future of humanity.

Generaly we can state that for any proces made by human we need certain amount of Intelligence (even we do not know what it is) but generally we can state that

$$GI = HI + MI \qquad (1)$$

Where **GI** is **G**lobal **I**ntelligence necessary for accomplishing a process, **HI** is **H**uman **I**ntelligence necessary for accomplishing a process and **MI** is **M**achine **I**ntelligence necessary for accomplishing a process. Generally proportion between **HI** and **MI** tells something about the **Autonomity** of the proces. If we do assume that **GI** is always constant **1** then we do scale all the parameters in definition interval <0,1> that means that **HI** and **MI** are between <0,1> we can state that the

Autonomity is high if **HI** is converging to **0** and **MI** is converging to **1**. Based on this assumtion we define **A**utonomity **M**easure of Intelligence **AMI** as follows:

AMI = HI / MI (2)

that means that **AMI** has a definition interval of **<0 , LN)** (LN is large number)**, HI** is between **<0,1>**, **MI** is between **<0,1>**. So based on that AMI describes a 'fully' Autonomous system if **AMI** is **0**. The AMI should be linked to **MIQ** which is very difficult to describe and for sure it MUST be domain oriented. The problem is **'WHO'** will define **HI** and **MI** and I think it must be only made by human or community which define HI and MI by observation of the process. A good example of changing **AMI** is piloting a large plane 20 years back and now. **AMI** is completely **different** and is a nice example how things are changing towards **AMI equal to 0**. Some references to MIQ and Autonomy can be found in [1,2,3]

These ideas and tools are important to implement. There is a strong believe that 4 main stream of technologies will affect this goal and these are: nanotechnology, Information technology, Cognitive technology and Biolotechnology. Convergence of these technologies should be the way how to create an Intelligent System and bring these systems into everyday use.
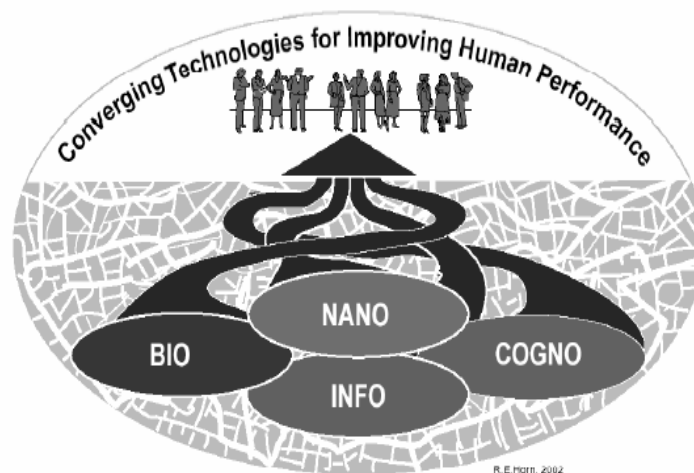
Changing the societal "fabric" towards a new structure
(upper figure by R.E. Horn)

2   Universal Pattern Recognition System

Our lab is setting up a new project for creating a Universal Pattern Recognition System where we want to make an attempt for creating a prototipe which will be able to fulfill basic requirements for conditions as follows:

- Agent based concept with server-client appproach where client is an Agent and server is a 'Master of Agents'. We do not like "full democracy in Agent Systems

- Each Agent will be a source for information which will be stored in 'Masters – knowledge base' (MKB) with fast access technology

- Each Agent will be able to use a common MKB for its own 'life' and activitities

- Conficts will be handled by very care and each conflict will be solved either by human or by preference rule base which is created by human

- Interactive technology is an important part of UPRS

- We will start our project in domain – it will be much easier to handle a specific problems using domain oriented problems.

- The candidates for these domains are related to projects and funding for this UPRS.

There are number of problems in this concept which can be sumarized by the following questions:

1   What kind of Pattern recognition systems for 'real' dicrimination between classes we will use?

2   What kind of feature space we will use and will it be static or dynamical?

3   What kind of answers will the UPRS provide to the user – crisp or fuzzy?

4   What if the user observes the error of UPRS – how will the UPRS create the feedback and 'correction' in this situation?

5   What will be a a form of knowledge databese and what kind of technology will be used for information fusion

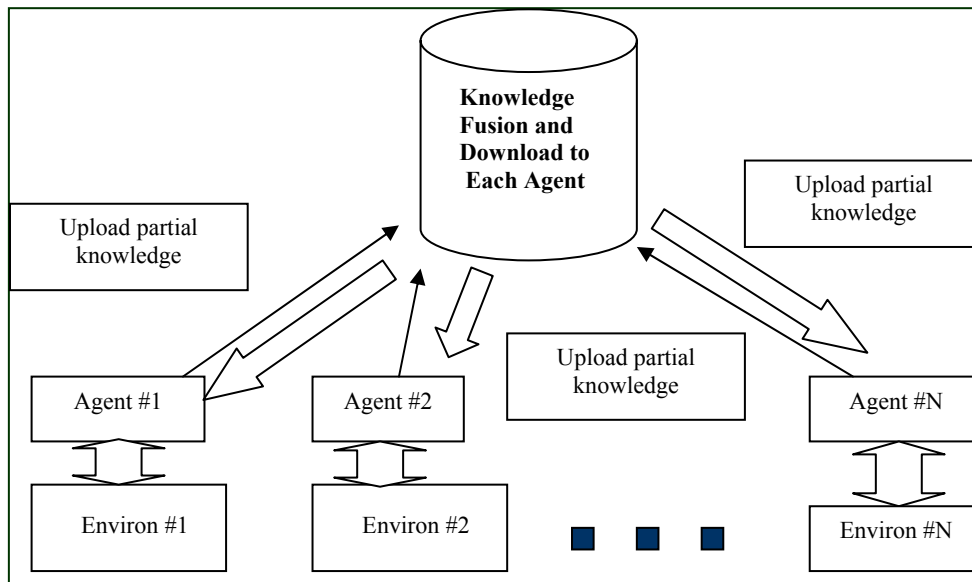6   Can we use Grid related architecture in this research probblem for server concept?

Figure 2

The basic concept of building UPRS

These questions are very dificult and are very domain related. The pilot project is made by MSc. students and it is related to various playing card recognition using simple WEB camera. We will set up a server and put public a client download-able from world/wide and we will ask people show to a client any playing card in front of the WEB camera.

The system will be a pilot system for creating a speed up learning using many agents worldwide. We do hope that we will be able to proof the basic concept of the system and proceed for more domains and more complicated and complex problems.

Conclusions

This short paper gives the basic information about the starting project in the Center for intelligent technologies TU Kosice and recall for some potential collaborators and forming the future consorcia using this concept in various domains and applications.

References

[1]   A. Bodnárová, "Classification Using ART Neural Networks," MSc. Thesis, Technická Univerzita v Košiciach, 2006

[2]   E. Brešťanský, „Utilization of NS in Image Pattern Recognition" MSc. Thesis, Technická Univerzita v Košiciach, 2006

[3]   O. Cordón, F. Gomide, F. Herrera, F. Hoffmann, L. Magdalena, "Ten Years of Genetic Fuzzy Systems: Current Framework and New Trends," Int. Journal Fuzzy Sets and Systems, Vol. 141, pp. 5-31, 2004

[4]   M. W. Craven, J. W. Shavlik, "Visualizing Learning and Computation in Artificial Neural Networks," International Journal on Artificial Intelligence Tools, No. 1, pp. 399-425, 1991

[5]   W. Duch, "Coloring Black Boxes: Visualization of Neural Network Decision," Proc. of International Joint Conference on Neural Networks (IJCNN), Vol. 1, pp. 1735-1740, 2003

[6]   D. Gwaltney, G. Humphreys, "Fuzzy Logic Control of Wind Tunnel Temperature Processes," Proceedings of the Third IEEE Conference on Fuzzy Systems, Vol. 2, No. 3, pp. 825-830, June 1994

[8]   A. V. Huerga, "A Balanced Differential Learning Algorithm in Fuzzy Cognitive Maps," Proceedings of the Sixteenth International Workshop on Qualitative Reasoning, 2002

[9]   R. Jakša, H. Takagi, "Tuning of Image Parameters by Interactive Evolutionary Computation," Proc. of 2003 IEEE International Conference on Systems, Man & Cybernetics (SMC 2003), pp. 492-497, 2003

[10]   R. Jakša, H. Takagi, "Analysis and Evaluation for Interactive Evolutionary Computation-based Image Processing," Proceedings of MPS Symposium, Vol. 2003, No. 2, pp. 243-250, 2003

[11]   Y. Kim, Z. Bien, "Robust Self-Learning Fuzzy Controller Design for a Class of Nonlinear Mimo Systems," Int. Journal Fuzzy Sets and Systems, Vol. 111, No. 2, pp. 117-135, 2000

[12]   B. Kosko, "Fuzzy Cognitive Maps," International Journal of Man–Machine Studies, Vol. 24, No. 1, 1986

[13]   D. Koulouriotis, I. Diakoulaki, D. Emiris, E. Antonidakis, I. A. Kaliakatsco, "Efficiently Modeling and Controlling Complex Dynamic Systems Using Evolutionary Fuzzy Cognitive Maps," International Journal of Computational Cognition, Vol. 1, No. 2, pp. 41-65, 2003

[14]   K. Lang, M. Witbrock, "Learning to Tell Two Spirals Apart," Proc. of the 1988 Connectionist Models Summer School, pp. 52-59, 1989

[15]   C. Lin, Neural Fuzzy Systems: A Neuro–Fuzzy Synergism to Intelligent Systems, Prentice Hall, 1996

[16]   M. Negoita and et al., Computational Intelligence: Engineering of Hybrid Systems. Springer, 2005

[17]   T. Procyk, E. Mamdani, "A Linguistic Self-Organizing Process Controller," Automatica, Vol. 15, No. 1, pp. 15-30, 1979

[18]   P. Sinčák, M. Hric, R. Vaľo, P. Horanský, P. Karel, "Neural Fuzzy

P. Sinčák

Great Challenge in Building Intelligent Systems – Quo Vadis Intelligent Systems?

Classifier Based on MF–ARTMAP," 2nd Euro-International Symposium on Computational Intelligence (E-ISCI 2002), June 2002

[19] P. Sinčák, N. Kopčo, M. Hric, H. Veregin, "MF–ARTMAP to Identify Fuzzy Clusters in Feature Space," IIZUKA 2000, 6th International Conference on Computational Intelligence, October 2000

[20] C. Stylios, P. Groumpos, "Fuzzy Cognitive Maps in Modelling Supervisory Control Systems," Journal of Intelligent & Fuzzy Systems, No. 8, pp. 83-89, 2000