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PREFACE

After a series of three events in 1999, 2001, and 2003, gradually evolving to be better than before, the 4th of this conference – *The International Conference on Neural Network and Artificial Intelligence* was held in Brest, Belarus, from 30th May to 1st June 2006 (ICNNAI'2006).

A preparation of a conference is sometimes very dramatic. Let us introduce one episode happened during the selection procedure of the submitted papers. One guy tried to submit three papers. Then those three submissions were all found to be just the results of *cut and paste operations* from the already published papers of other persons in public domain web sites. This is not a citation, but exact copies of other authors' papers. It is far much worse than a *plagiarism* and is totally illegitimate. Fortunately, thanks to our International Program Committee, we avoided this situation of blindly accepting his illegal submissions.

In this special issue, we selected 14 out of 33 papers from our proceedings. This selection was not so easy, partly because of the limited space. We faced a dilemma of how our selection to be a true positive as much as possible while minimizing a possibility to be a false negative selection. Then the editor in chief of the journal unexpectedly had kindly offered us an additional space to publish some of the papers in the one issue advance of this issue, which enabled us to apply a somehow strange and unintelligent but a pragmatic formula *One-author-appears-only-once*.

The papers published in that previous issue were as follows. C. M. Frayn (UK): *"A review of industrial applications of computational intelligence."* M. Adamski and K. Saeed (Poland): *"Heuristic techniques for handwritten signature classification."* K. Madani (France): *"Modular and self-organizing connectionist systems: toward higher level intelligent functions."* N. Kussul, S. Skakun, and O. Kussul (Ukraine): *"Comparative analysis of neural networks and statistical approaches to remote sensing image classification."* N. M. Hewahi (Palestine): *"Soft computing as a solution of time/cost distributor."* I. Turchenko, V. Kochan, and A. Sachenko (Ukraine): *"Simulation modeling of neural control system for coal mine ventilation."* A. Otwagin, and A. Doudkin (Belarus): *"A framework for parallel processing of image dataflow in industrial applications."* Thanks for all these great contributions. Thanks also go to the authors of this issue. Now let us go on to the topics picked up in this special issue.

What is intelligence? Agence France-Presse (AFP) recently reported, *"Deep Fritz, the world's leading chess computer, beat its human counterpart, the Russian world chess champion Vladimir Kramnik, in a six-game encounter. Of the six games, Deep Fritz won two and four ended in draws."* Then, this raises question, "Can we conclude Deep Fritz has a human-like intelligence?"

There have been a fair amount of proposals of "*definitions of life,*" but still we do not have a clear definition as C. Langton, the founder of scientific discipline of *Artificial-Life*, once claimed, *"Every time we succeed in synthetically satisfying the definition of life, the definition is lengthened or changed."* On the other hand, "*Turing test*" has never succeeded in gaining an inch despite of a huge amount of challenges so far.

The conference started with the talk by H. Mühlenbein (Germany). This special issue also starts with his paper. Mühlenbein wrote, *"There is no system in sight which comes near to passing the Turing test."* Mühlenbein contributes to this issue with the paper entitled *"Artificial intelligence and neural networks – the legacy of Alan Turing and John von Neumann."* This article is not a nostalgic history of computer science, but rather a challenge to Artificial Intelligence community, as the author starts the article with *the von Neumann's doubts that creating artificial intelligence will be possible with teacher-based-learning*, since our concern is more or less on creating artificial intelligence by learning. He shows a couple of still open issues or unsolved problems. For example, he introduced McCarthy's idea of designing human or animal like intelligence starting with an appropriate mental structure instead of a sheet of blank paper like Turing, as a problem which nobody seems working at this moment. Refer to the paper for more in detail. Just one thing we might add here is a variation of Turing's imitation game with *an intelligent guy who pretends to be ignorant versus an ignorant who thinks himself is intelligent.*

Is current ANN technology actually being used in industry? You will find a positive answer if you take a look at a few examples presented in the conference. The first one is an application to aerospace industry: *"Prediction of fatigue crack growth process via artificial neural network technique,"* by K. N. Nechval, N. A. Nechval, I. Bausova, D. Skiltere, and V. F. Strelchonok (Latvia). Authors wrote in their abstract, *"Failure analysis and prevention are important to all of the engineering disciplines, especially for the aerospace industry. Aircraft accidents are remembered by the public because of the unusually high loss of life and broad extent of damage."* Yes, indeed. The authors went on, *"The artificial neural network technique for the data processing of on-line fatigue crack growth monitoring is proposed after analyzing the general technique for fatigue crack growth data."* After a well-organized survey, authors further wrote, *"The feasibility of this model was verified by some examples. It makes up the inadequacy of data processing for current technique and on-line monitoring. Hence it has definite realistic meaning for engineering application."*

Does money make you happier? *"Does being happier in the first place allow you to earn more money later, maybe by way of greater creativity or energy? Or does some other factor produce both money and happiness?"* asks psychologist R. E. Lucas of Michigan State University. Recent United Nation's report also wrote, *"The world's richest 2% own more than half of global wealth, while half the world's population owns only 1 %."* Have they struggled to become that super-rich? We guess not. Some times we know, *"When Doing Nothing Is Better."* (The headline of an article of New York Times on 16 December 2006.)

The next paper is *"Industrial applications of computational intelligence,"* by C. M. Frayn (UK). The topic is data analysis for financial applications. He poses the question, *"Are data mining methods learning real knowledge that depends on human trading behavior, or are they merely learning to predict patterns in arbitrary time series?*" The author also mentioned about, *"No free lunch vs. random investment instead of using artificial intelligent."* What is the point? Well, read the paper. The author also explores *a root optimization when we must salt in order for the road not to freeze* – much more complicated and practical variant of the *Traveling Salesperson Problem.*

Yet another example of applications to industry is rather a big scaled one. Still it is on a stage of seeking a possibility though. The paper is, *"Simulation modeling of interplanetary shocks arrival time prediction on historical data set,"* by V. Turchenko, V. Demchuk, and A.Sachenko (Ukraine). According to the paper, high energy particles and solar wind from the planetary space to the earth which are called *interplanetary shocks* influence on spacecrafts, satellites, radio communication, radars, etc, and among others, on human health. The paper proposes a technique to predict a future arrival of these shocks from the data obtained by the NASA's spacecraft.

Can ANN monitor human health in hospital in the same way as monitoring machines in industry? K. Madani, M. Voiry, V. Amarger, N. Kanaoui, A. Chohra, and F. Houbre (France) try this challenging riddle by attempting to diagnose auditory pathway of real human as well as to diagnose defects of high-tech optical device by using soft computing techniques including ANN and Fuzzy logic. The paper entitles *"Computer aided diagnosis using soft-computing techniques and image's issued representation: application to biomedical and industrial fields."*

How does ANN learn? According to a recent report in Reuters *"P. Hof and E. Van der Gucht of the Department of Neuroscience at Mount Sinai School of Medicine in New York studied the brains of humpback whales and discovered a type of cell called a spindle neuron in the cortex, in areas comparable to where they are seen in humans and great apes."* Or Reuters also reported *"Researchers at the Los Alamos National Laboratory in New Mexico said they trained honeybees to stick out their proboscis – the tube they use to feed on nectar – when they smell explosives in anything from cars and roadside bombs to belts similar to those used by suicide bombers."* Then why not we approach to ANN more biologically?

J. J. Mariage (France) gives a consideration from such aspect in his paper *"Holistic self-reprogramming of neural networks: Between self-organization and self-observation."* Citing G. Edeleman, as *"Brain develops by a Darwinian selection process that takes place at the neuron groups' level instead of the individual neuron…"* the author wrote, *"Our main research concern is to model and simulate the dynamic character of learning structures and processes, and their evolution…"* Paper reviews essential properties observed in the development of encoding structures in nature.

How did bats learn to fly back to their home? AFP recently reported, *"Princeton University batologists*

used radio telemetry aboard a small aircraft to track big brown bats that were released 20 kilo-meters north of their home." D. A. Bendersky, and J. M. Santos (Argentina) start their paper *"Learning from the environment with a universal reinforcement function,"* with the description *"... environment affects not only how animals perform particular tasks, but also what skills an animal will develop during its life."* Then paper describes how a robot learns skills like avoiding obstacles, finding a hole in the wall to pass it, traversing a corridor, etc.

Can a machine walk like a human? According to the recent report by AFP, *"The first walking android will make its debut within two to three years, said So Byung-Rok at the Korea Institute of Industrial Technology, quoted as saying, 'We are now working to improve the motion and upgrade intelligence so that next-generation androids can walk like a human, engage in more sophisticated conversations and have a wider range of facial expressions.' "* So, designing human-like walking machine seems to be still not so easy task. The paper *"A modular neuro-controller for a sensor – Driven reactive behavior of biologically inspired walking machines,"* by P. Manoonpong, F. Pasemann, and H. Roth (Germany) challenges this topic.

A new structure of ANN still awaits to be found. R. E. Hiromoto, and M. Manic (US) in their paper *"Information-based algorithmic design of a neural network classifier,"* propose a totally innovative structure of ANN which has never appeared in the literatures, as far as we know. Proposed network is made up of two layers. To simply put, the first layer performs an orthogonal search while the next layer performs a rotational search which reduces the search space. The author wrote, *"In cases where the patterns are sparsely distributed, the computational search time for the initial space can be dramatically reduced."*

Can a swan in a snow lake or a crow in the dark sky be recognized? We now look at another more specific application – *pattern recognition*. We have three papers here. Firstly, *"Handwritten script and word recognition – A view-based approach,"* by M. Tabedzki and K. Saeed (Poland). The authors apply their already successful established method of recognizing *who-spoke-what-words,* to *what-is-written* by means of what authors call a *View-based method,* also successfully.

The next one is *"The defect and project rules inspection on PCB layout image,"* by A. Doudkin, and A. Inyutin (Belarus). A proposal by using image processing to find on a *printed-circuit-board* defects such as unexpected pin-holes or absence or displacement of elements which are supposed to be printed, though it seems not yet to have applied to a real manufacturing stage.

R. Sadykhov, and D. V. Lamovsky (Belarus) contribute with their paper *"Estimation of the cross correlation based optical flow for video surveillance."* In the topic of computer vision, how each point of an image moves from one scene to the next, *e.g.,* to which direction with what velocity, is an important issue and is called *Optical Flow*. The paper proposes a method using cross correlation to determine how similar are two consecutive optical flows, which, author wrote, is robust but computationally expensive, and proposition is to use a parallel processing, though it is just a simulation at this moment. We hope it will be a good challenge if we can recognize a movement of a swan in a lake covered with snow, or a crow flying in a dark sky.

Can ANN detect network intrusion after learning? The final topic of this issue is network intrusion detection. Here we have two papers which could give us a good debate. The one is optimistic while the other pessimistic. *"Neural network approaches for intrusion detection and recognition," by* V. Golovko, and L. Vaitsekhovich (Belarus) is the former. Authors propose a network intrusion system by combining a *principal component analysis neural network* to reduce the dimension of input data and a *multilayer perceptron* to detect attacks from normal transactions. The target is KDD-cup-99 dataset, which has been, and still is going to be, a frequently used common benchmark for evaluation of intrusion detection techniques.

A. Imada (Belarus) claims an opposite insight in his paper *"How many parachutists will be necessary to find a needle in a pastoral – Who is a lucky one?"* The paper might make someone fell from the chair. The reason to be shocked with might be somewhat of a negative attitude of the paper. That is, author suggests there is no panacea to detect intrusions in a real sense, claiming some of the reports of success were due to prescribing a placebo like a powder of sugar, if not at all. The author further claims, "Real dangerous outliers are not the ones whom we can easily classify, but those who hide behind normal transactions. Hence, it is more like a search for a needle in a haystack.

Can a needle in a haystack be reached by an intelligent search? Finding a needle in a haystack seemed to play a role of a *hidden topic* of this conference. While this is one of the main topics of above mentioned

paper by Imada, Mariage also denotes in his paper, *"… This avoids the needle in a haystack problem and enables natural selection to run across the hills and valleys of a varied landscape to find basins of attractors, where it is easy to fall."* Although Imada shows some examples of failure to find a needle efficiently, both Mühlenbein and Hiromoto suggest a hint of a possibility of an approach to a needle more efficiently than a random approach. Mühlenbein wrote, *"The problem of the exponential explosion has been solved in the 80's. For singly connected Bayesian networks, exact inference is possible in one sweep of Pearl's belief propagation algorithm."* Hiromoto and Manic wrote, *"Random treatment of problem solutions has proved to provide a convenient approach in surveying landscapes for optimization problems where the solutions space is vast and appears to follows no predetermined schedule or route."* Then went on to write, *"It can also be used as a preconditioning search algorithm regardless of the dimensionality of the search space,"* which would be a great advantage if we are to try this algorithm to find a needle.

Or, as old Turkish saying goes, *"Would it be difficult like digging a well with a needle?"*

Hope you enjoy reading.