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WILL THE ARTIFICIAL INTELLIGENCE HELP US?

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Abstract.. *Discussed what can help us (humanity) artificial intelligence. The unification of artificial neural networks and decision-making expert systems based on the logic has discussed. The integration of formed (human) concepts of the system of fuzzy logic and artificial neural networks, allowed us to understand what is happening in the problem-solving process of neural network. The human brain is MEGA processor, therefore, all the efforts of researchers should be focused on the development of MEGA processor systems of new generation. Noted that for the implement intelligent system similar to the human brain, it is necessary to ensure her connection with the outside world and the ability of self-study.*

Key words*: neural networks, expert systems, megaprocessor systems.*

1 Introduction

The theme of this publication: the ways of development the artificial intelligence and a bit on what we are to expect from it in the nearest future. Over time humans have more or less figured out how to deal with hard manual labor. As a result various mechanisms and appliances have appeared. Gradually, the mankind gets rid of not qualified manual work.

The price to pay for this is a sedentary lifestyle, the absence of physical workload, and as a result a lot of health issues. At present the world many is trying to abandon already and from intense intellectual work. Even not so much intellectual, but rather simply require to think about. Arguing that the need and of it get rid. Up till now, it has been possible to get rid of the monotonous (and therefore exhausting), moderately challenging intellectual work. Too, with help different of machines and gadgets. However at many, there is a temptation to go further and liberate humanity from was intellectual work at forever. Better even not to reflect than us have to sacrifice in this case. The fact is that many people wants to get rid of work completely and dedicate himself to only for various games and entertainment. Therefore, there is such a strong interest in artificial intelligence systems, which actually originated from the simple desire to play chess with the computer. Intrigued by this idea, talented humans created quite a lot of useful things, what nowadays is interpreted as a breakthrough on a path to progress. Though, perhaps, it's not a breakthrough but rather a breakaway. They had to figure out how the human being thinks, how one ought to think in principle, and how to teach the machine to do the same. Indeed, how does a human being get to know the world? The key element of the cerebral cortex is neurons, which are cells with a paradoxical reaction to irritation. Weak irritation makes them enraged whereas strong irritation leaves them almost indifferent. A strong response of one neuron subdues its neighbors. It is interesting that the human being is paradoxical in the same degree. Powerful noise doesn't prevent you from falling asleep whereas a word said in whisper while you sleep would make you wake up in fright. The extreme shock is capable to immobilize human and other beings, suppressing them desire and ability to escape.

The cerebral cortex is a multi-storey building, where the top looks like a service floor, i.e. a huge bunch of "cables" each of which connects neurons to one another. Any external disturbance that comes to the brain via these "cables", causes alarm among neurons. This alarm can be increased or reduced additionally by chemical components injected into the blood. Hence, emerge centers of ex-

citation recognized as reflections of various patterns. When these visual imagery partially coincide (on 60-70%) with imagery previously stored in the human memory, happens them identification.

The mechanism of motor reaction goes off. It is no wonder that people want to create some artificial mechanism acting in a similar way. The idea of the device with the ability to recognize the input images is the idea of perception, neurocomputer and neural network.

At first, the man had decided to take away the ability of higher powers to predict future, realizing that each sequence of operations and actions can be interpreted as a computation. And then he wanted to create something in his own likeness.

The fact is that the early successes of developers of the artificial intelligence have lowered the demands to its level. Nowadays, the main feature of the artificial intelligence is considered to be the ability to find solutions independently. Hence, *the natural intelligence has become an important, but only a special case of the intellect in general* [1]. Each set of interacting agents having the ability to perceive and respond to the environment changes may be regarded as the intelligent system. The result of this interaction can be considered as a solution of the problem (or even realization of some actions).

2 The appearance of the perceptron, neurocomputer and neural network

It all started with Frank Rosenblatt's Perceptron Mark I, which recognized with some errors the letters of the alphabet as early as 1960 [2].

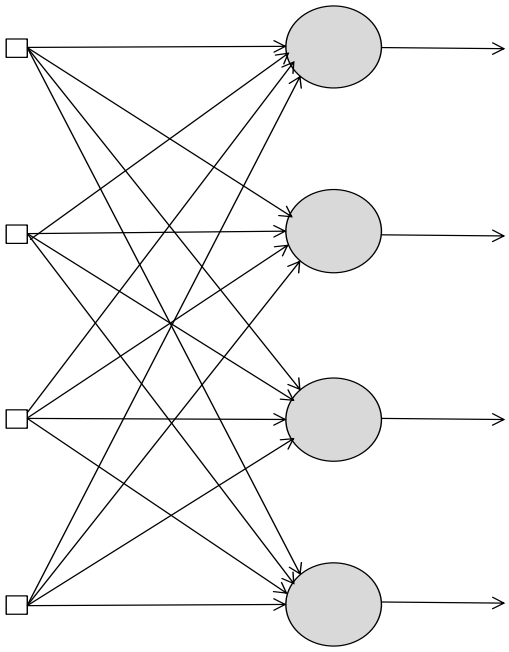

Fig. 1 - The simple perceptron

As usual for science, ten years later, M. Minsky, who had been a schoolmate of Rosenblatt, strongly criticized the capacities of the perceptron, which led to delay in the development of neurocomputers (Fig.2,3) in the following decades [3]. But later, people still decided to use the perceptron as intended, because nothing else had occurred to them. The neural network is the web composed of neurons, which we have to teach. It is necessary to give it several tasks with solutions and adjust network settings so that the network would be able to generate these solutions independently. Though there are networks that do not require training. But there is a lot of the problems with trained networks too. If the tests show that the number of errors decreases after training, then it means we got lucky, the training is successful. But when the number of errors grows, the network just remembers all that it was told during the training, and really learned nothing (the politically-correct term for it is overtraining). Then the network is considered as untutorable and it should be rejected.

There is another reason. When the network is rather powerful, it is capable of providing its own solution, which the experimentalists did not expect. The network violates their view of the world in this case. Such cleverness is discouraged and this excessively smart network is rejected too. The rational response to this situation is to increase the quantity and quality of training tasks to keep the stability of the world view. The hypothesis "*of necessary development* (*www.csd.univer.kharkov.ua/content/files/cat16/zarajenie_razumom.pdf*)": *Expanding intelligent system requires a greater amount of the basic knowledge to prevent the destruction of the current world view.* Human beings demonstrate the same thing: if the student after studies answers "perfectly well" looking honestly in your eyes, but can't solve any problem on this subject, then the experienced teacher knows that the person in front of him is "untutorable". But sometimes the examiners make a mistake and take such student for "untutorable" if he suggests other continuations and variants hidden from the examiner.

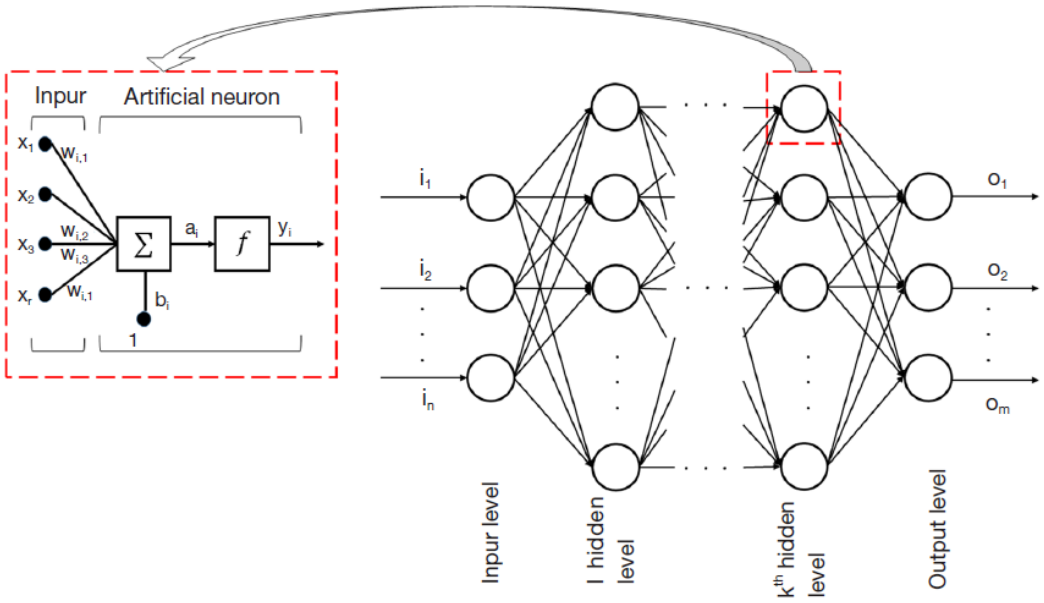

Fig. 2 - Artificial neuron and network

($x_1,\ldots,x_n$ - input signals coming from other neurons; $w_1,\ldots,w_n$ - synaptic weights of a neuron; b - the threshold value (threshold); y - the output of the neuron; $f = \varphi(v)$ - activation function)

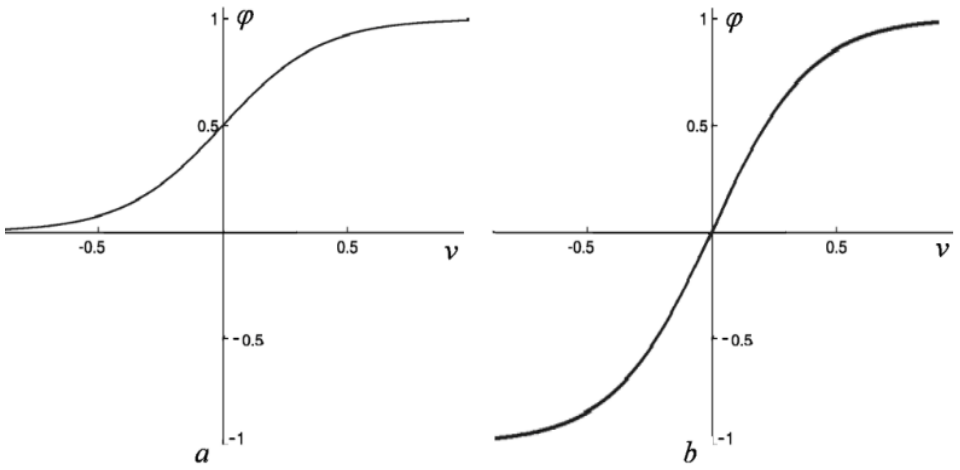

Fig. 3 - Type of the activates

The examiner may be a prisoner of stereotypes imposed by the training program or simply might not be adequately equipped to deal with discussion about new approaches to possible solutions of the problem. But now even the highly advanced neural networks cannot match the human intelligence in the slightest degree.

In addition, M. Minsky was right in some way because a neurocomputer with the insufficient number of neurons is not capable of solving a specific class of problems. This is a lower limit. But there is an upper limit. An excessively extended neural network can produce an undesirable result. Such a computer will revise results all the time, get snarled in its output and will turn out to be completely useless (the loss of the solution uniqueness).The same can be observed on human beings. The intellectual who is instructed to solve a simple problem, will torment the problem originators with doubts and arguments, so all simple tasks should be entrusted to "the men of action", not burdened with extensive education and intellectual abilities.

All investigators have been aware of the difficulty to understand how neural web produces knowledge. But as always, people need a result. Only enthusiastic mathematicians wish to go deeply into the needless details. Indeed, customers need a device that can do something useful, but they are too busy to investigate how it works. It is sufficient for them to obtain the user's manual. Enthusiastic people, who are not aware of what is happening in the "black box", i.e. neurocomputer, have made a lot of such devices by using the methods of selection and sorting. These neural networks learned that what their stubborn creators required, but for the rest neither the first nor the second were fit. Such is the apotheosis of empiricism.

3 Continuation of the history of the artificial intelligence development

So, Allen Newell [4,5], after a late fascination with chess, has created a program (1954), based on the methods of Claude Shannon [6], which produced a long line of followers. However, the mathematical logic, which had been developed long ago by efforts of Friedrich Ludwig Gottlob Frege and his contemporaries, was not put into practice, which is not surprising. Games seemed to be more interesting. However, a method suitable for solving the problem of creating chess programs without the use of a correct mathematical formalism, was proposed by a real inventor – Alan Turing [7]. The efforts by the RAND Corporation employees John Shaw and Herbert Simon, supported by de Groot and his colleagues, resulted in the development of the IPL language (1956), the predecessor of the LISP computer programming language, which was created by John McCarthy (1960).Incidentally, LISP (LIst Processing Language) [8,9] is based on a system of Lambda calculus formulated for the first time by Alonzo Church [10]. The use of formal mathematical logic to represent and execute computer programs, proposed by John Alan Robinson (1965) proved to be revolutionary [11].

1. Two expressions $P(a)$ and $P(c) \Rightarrow G(d)$;
2. $P(c) \Rightarrow G(d)$ can be replaced $\sim P(c) \vee G(d)$;
3. When the unification of the variables $a \to c$;
4. Using the procedure of resolution $P(a \to c) \vee \sim P(c) \vee G(d)$;
5. Remove tautology $P(c) \vee \sim P(c)$;
6. Get the third expression $G(d)$.

Based on this method, albeit with a number of differences, Alain Kolmerauer [12] developed in 1971 the PROLOG language which uses the first-order predicate logic. By the way, the Resolution method was applied earlier by young mathematician Jacques Herbrand. Thus, in the early 70s, the programming languages for artificial intelligence had been created (LISP, Prologue, PLANNER, REDUCE etc., oriented towards various tasks).

Using the artificial intelligence programming languages based on mathematics, one can review the entire solution of the task and correct it, if necessary. Such systems are referred to as expert systems. Of course, this is different from the neural systems, where one can not understand what's going on inside the "black box" – , i.e. neurocomputer. At that time, the logic programming expert

systems possessed one essential shortage – they operated with only two logic values "true" and "false". Sadly, that's just not the way life works.

4 Historical association of artificial neural networks and expert systems of decision making on the basis of logic

It was necessary to go to the structure of fuzzy concepts. Therefore, the theory of fuzzy sets and fuzzy logic, proposed to the mankind by Lotfi Zadeh in 1965 [13], turns out to be very useful. For example

$$A \cap B \quad \mu_{A\cap B}(x) = \min(\mu_A(x), \mu_B(x));$$
$$A \cup B \quad \mu_{A\cup B}(x) = \max(\mu_A(x), \mu_B(x));$$

where $\mu(x)$ - show belonging to this type.

In 1993, Bart Kosko [14] proved the important theorem that any mathematical system can be approximated by fuzzy logic. The integration of fuzzy logic concepts, formulated by mathematicians, with artificial neural networks was initially performed by J.-S. Roger Jang from the Taiwan University (the neuro-fuzzy system refers to combinations of artificial neural networks and fuzzy logic) [15]. This allowed us to understand what is happening within the neural network while solving the task. Thus, a *historic unification of artificial neural networks and decision-making expert systems based on the logic has happened.*

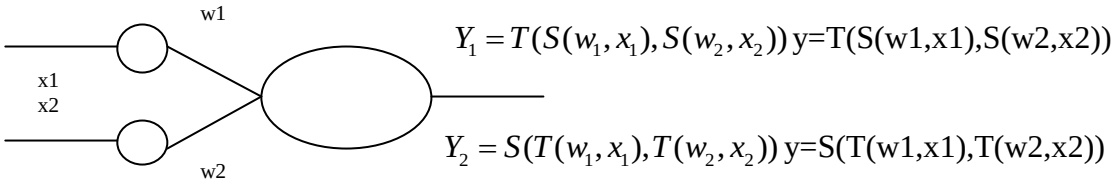

Fig.4 - Fuzzy neurons, where $T(w_1, x_1) = \min(w_1, x_1)$, $S(w_1, x_1) = \max(w_1, x_1)$

5 The problem of learning and prospects

The human beings fill their databases and knowledge bases during all their his life. However, when we want to create an artificial intelligent system and going to fill data and knowledge bases, that's when the problems arise. At first, a human being possesses a set of knowledge that he believes to be known by default. All this knowledge should be spoon-fed and explained to the artificial intelligent system. Secondly, databases should be filled by experts and their job should be highly paid for. Third, the time necessary for database filling, checking and rechecking is rather considerable. All this is somewhat disappointing.

But, already today neural networks allow us to establish the reasons for the poor performance of car engines, a neurocomputers allow to identify the similarity of different objects and processes. Expert systems provide pilots warning function and give its recommendations to action. These systems assist aircraft pilots, train drivers, crews of ships and car drivers, but the final decision is usually left up to the person. Thus in the short term, we can look forward to the development of artificial intelligence, efficiency and work speed of which will be comparable with the human brain.

6 Conclusions

The rate of human decision-making often far exceeds processing speed data of modern artificial neural networks and expert systems (especially for mode multi-task). Here the matter is likely that the human brain is MEGA processor. Simultaneous processing by this huge number of processes accelerates the decision-making.

Therefore, it's obvious that, all the efforts of researchers should be focused on the development of MEGA processor systems of new generation. A Multi-processor system should possess an individual memory for each processor and a shared memory, as an analogue of libraries in the human society.

The Supercomputer Tianhe-2 located in National Supercomputer Center in Guangzhou demonstrates performance of 33.86 petaflops (almost 34 quadrillion (thousand trillion) floating point operations per second). In Britain, the Cray XC40TM, one of the fastest supercomputers in the world, will be launched soon. It has 480,000 cores, 2 million gigabytes of memory and can store up to 17 million gigabytes of data. At its peak, it is able to make 16,000 trillion calculations per second. The best achievement of IBM is the neuro-synaptic processor True North – 16 million digital neurons and 4 billion synapses. But it is still not enough ...

To create the artificial intelligent system, it is necessary to provide its connection to the outside world and the ability to self-learn. For example, as the IBM company is developing the interactive artificial intelligence system based on the Watson supercomputer that has access to the technologies of the cloud system Watson Developer Cloud. Besides, developers, while examining the intelligent systems, have realized the benefits of the network structure, each element of which has

- independent access to external data and general information;
- internal memory, in addition to libraries;
- sufficient autonomy.

Besides, tend to use the their synergy.

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Будет ли искусственный интеллект нам помогать?

Аннотация. Обсуждается чем может нам (человечеству) помочь искусственный интеллект. Рассмотрено важное объединение систем на основе нейронных сетей и экспертных систем на базе математической логики. Объединение сформированных (человеком) понятий системы нечеткой логики с искусственными нейронными сетями позволило понять, что происходит в процессе решения задачи нейронной сетью. Так как человеческий интеллект это мегапроцессорная система, то подчеркнуто, что основные усилия следует направить на создание мегапроцессорных систем новых поколений. Отмечено, что для реализации интеллектуальной системы, аналогичной мозгу человека, необходимо обеспечить ее связь с внешним миром и возможность самообучения.

Ключевые слова: нейронные сети, экспертные системы, мегапроцессорные системы.

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Буде штучний інтелект нам допомагати?

Анотація. Обговорюється чім може нам (людству) допомогти штучний інтелект. Розглянуто важливе об'єднання систем на основі нейронних мереж і експертних систем на базі математичної логіки. Об'єднання сформованих (людиною) понять системи нечіткої логіки з штучними нейронними мережами дозволило зрозуміти, що відбувається в процесі рішення задачі нейронною мережею. Так як людський інтелект це мегапроцесорна система, то підкреслено, що основні зусилля слід спрямувати на створення мегапроцесорних систем нових поколінь. Відзначено, що для реалізації інтелектуальної системи, що аналогічна мозку людини, необхідно забезпечити її зв'язок із зовнішнім світом і можливість самонавчання.

Ключові слова: нейронні мережі, експертні системи, мегапроцесорні системи.