THE EVOLUTION OF ARTIFICIAL INTELLIGENCE TO PREDICT THE PRICE MOVEMENTS OF SHARES

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The article provides an analysis of the historical development of artificial intelligence systems, applied to predict the price movements of the stock market. Such systems gradually acquired special characteristics, which eventually made it possible to apply these systems to the stock market. And this process is considered in this article.

What is artificial intelligence?

Forecasting abilities of artificial intelligence used in the stock market are determined primarily by defining the term "Artificial Intelligence".

The term "intelligence" is derived from the Latin "intellectus" which means the mind, intellect, intellectual capacity of a man. Accordingly, "Artificial Intelligence" (AI) is usually interpreted as an ability of mechanical systems to perform certain functions of human intelligence, for example, take the best decisions on the basis of previous experience and analysis of external influences. Mechanical systems, based on this concept, are known as artificial intelligence (AIS). This is particularly true of the systems based on the principles of learning, self-organization and evolution, with minimal human intervention.

The precise definition of AI requires an answer to the question: to which extent should machine actions be different from the embedded algorithms, so they can be considered truly "intellectual"? Despite the fact that the term "Artificial Intelligence" was recognized as early as 1956, the exact answer to this question does not yet exist. It is explained by a large number of difficulties that the researchers in this field faced. As an interdisciplinary area, AI raises problems far beyond the traditional informatics, which is usually related to AIS. It turned out that the creation of machines simulating human activity requires certain knowledge of the processes underlying the functioning of human psyche, still not fully understood. Therefore, even the best scientists in the field of artificial intelligence can not offer a precise definition of what mechanical systems can be considered intellectual.

This ambiguity of the conceptual foundations of artificial intelligence is reflected in a large variety of AIS, created in the course of their evolution.

The historical stages in the evolution of AIS used in the stock market

The first ideas of creating artificial intelligence were announced in the Middle Ages. In the XIV century there were attempts of creating machines to solve problems on the basis of universal classification concepts. These ideas found support among many well-known scientists such as G. Leibniz and R. Descartes. Some time later, their works led to the systems, known as artificial intelligence systems today.

40-ies.: Formation of AI as a distinct scientific field

Full-scale development of AI as a branch of science became possible only after the creation of computers in the late 40-ies. The new hardware enabled the implementation of the systems that could actually be assigned to the artificial intelligence systems. By that time in the field of Human Sciences the basic concepts of brain and the human psyche functioning had been formed. Through implementing programmable and mathematical codes, these concepts created a new class of information systems, later named AIS.

The appearance of AIS in the form of mathematical programs dates back to 1943, when U. Makkaloh and W. Pitts, relying on discoveries in the field of neurobiology and psychophysiology, proposed a mathematical model of the neuron and formulated the basic provisions

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of the theory of artificial intelligence. In 1948, N. Wiener, repeating the ideas of Sechenov and Bekhterev on the adaptability of all living things through feedback, brought the property of adaptability to the AIS. N. Wiener also gave the name to the new direction - "neurocybernetics". And in 1949, D.O. Hebb realized the ideas of adaptive learning through changing power relations between the simultaneously active neurons.

The theories of Makkalloh-Pitts, Wiener and Hebb attracted a great interest to artificial intelligence. Since the late 40-ies the growing number of scientists rushed to the audacious goal - building computer systems that can monitor environmental conditions and modify their behavior using feedback, i.e., behave like living organisms.

50-60-ies.: The division of AI into two competing directions

The first appearance of the term "Artificial Intelligence" took place in 1956 at the seminar with the same name in Stanford University (USA), the term itself was proposed by an American scientist J. McCarthy. Shortly after, the artificial intelligence was recognized as an independent branch of science. And almost immediately in the field of AI the researches were divided into two directions - the logical direction and neurocybernetics.

The main idea of the logical direction was that only the study the mechanisms of the conscious algorithms is able to provide the basis for constructing the AIS. It was assumed that all or almost all the tasks, requiring intellectual solution, can be solved by constructing a logical sequence. The practical implementation of this approach became Boolean algebra and its logical operators, first of all, the operator IF ("if").

Neurocybernetic approach was focused on modeling the internal structure of the brain. Its supporters believed that if thinking was provided by the brain, any artificially intelligent device must have a way to reproduce the structure. Therefore, the nucleus of neurocybernetics became the mathematical interpretation of the nervous system activities and the hardware simulation of structures similar to the structure of the brain - the elements, similar to neurons and their associations in the functioning systems, called neural networks.

50's and 60's were under the clear dominance of neurocybernetic direction. A major impetus to the development of neurocybernetics was given by an American neurophysiology F. Rosenblatt, who offered in 1958 his own neural network model - a perceptron. It was an attempt to create a system that simulates the work of the human eye and its interaction with the brain. Rosenblatt's perceptron remained the highest achievement of cybernetic approach for a long period of time. Initially regarded with great enthusiasm, in the next decade perceptron was subjected to intense attack by the major scientific authorities. And as a result of stiff criticism of M. Minsky and S. Papert in the late 60's, the major research of neural networks was stopped for the following decade. The main claim was that the perceptron was able to solve only a simple task, but for more complex, indeed "intellectual" tasks, it was unsuitable. This gave rise to conclusions that perceptron, in principle, could not be assigned to the AIS. Slightly getting ahead, we can see that already in the 80's it became clear - the failure of cybernetics in the 50-60-ies took place because of software and hardware restrictions - weak memory and low speed of computers. And, in fact, it was not exactly the perceptron suggested by Rosenblatt that was being criticized. Later, M. Minsky even apologized publicly for his criticism of the perceptron and joined the supporters of the cybernetic direction. There were some other reasons for this: the logical direction of artificial intelligence faced the same problems, which neurocybernetics was accused of.

70-ies.: The dominance of the logical direction

In the 70-ies, the research in neurocybernetics decreased, as the first results had fallen short of expectations. The main efforts of the researchers were sent to the logical direction of artificial intelligence.

In 1963 - 1970 logical direction got largely developed, owing to the methods of mathematical logic, in 1973, within the logical direction the famous programming language Prologue was created. But by the mid 70's it was found that the classical logical models are clearly not enough to build rich and practically usable intelligent systems. Therefore, the difficulties with the implementation of human thinking through the clas-

sical Boolean logic were resolved through the concept of fuzzy logic, which added more flexibility to the logical approach. After the fundamental works of L. Zadeh the term ''fuzzy'' became a key word of AI.

A significant breakthrough in the practical application of the AIS, established within the logical direction, occurred in the mid 70-ies, when in order to replace the search for a universal algorithm of thinking, the idea came to model the specific knowledge of professional experts. Intelligent programs were supplied with high-quality knowledge of the subject area, which were used to limit the ways of searching for solutions. The development of this direction led to expert systems creation. Expert systems constituted a computer program, replacing the man in a single narrow area. Since the late 70-ies in the United States first commercial expert systems started to appear, suggesting wide recognition of their practical abilities.

Despite the apparent dominance of the logical direction, researche in field of neurocybernetics also took place. In 1974 doctoral dissertation of P. Verbosa described an algorithm for back propagation of errors in detail, and in 1976 von Malsburg and Vilshou first published the work on self-maps, showing self-neural networks. At that time these developments did not attract serious attention, but in the 80's when they were noticed, it caused a real breakthrough in neurocybernetics.

80-th years: The neurocybernetics resurgence

By the early 80-ies AIS based on a logical approach not only demonstrated the possibility of solving a number of important tasks, but also gave rise to doubts that they are supposed to be the main models of artificial intelligence. Numerous discussions held on this subject in academic circles led to the strengthening of neurocybernetic direction again. Its revival also contributed to the significant progress in the field of microelectronics and computer technology. But the emergence of a transputer - parallel computers with many processors in the mid 80's in Japan, allowed to remove the hardware constraints on neurocybernetics development.

In 80-ies neurocybernetics was marked by numerous theoretical and mathematical developments. In 1982, the publication of Kohonen appeared, dedicated to a new class of neural systems - self-neural networks, and Hopfild proposed a mathematical model of associative memory of neural network. In the 1985-86, the appearance of effective learning algorithm - the algorithm of back propagation of errors, became a breakthrough in the practical application of neural networks. In the late 80's a lot of attention was paid to the evolutionary modeling of AIS - genetic algorithms, reproducing the processes of natural selection in nature. Evolutionary modeling was used to train neural networks and select the optimal architecture. In 1988 the introduction by Brumhedom and Loue of the so-called RBF-networks was the last to date major discovery in the field of neural networks.

Since the mid 80's large-scale commercialization in the field of neurocybernetics has started, which means their public acceptance. The research in the area of logical direction continued, but they were few and not very productive.

Major discoveries in the field neurocybernetics in 80-ies, coupled with the rapid development of microelectronics and computer technology led to the AIS, which were able to predict the price movements of stock market shares. Thanks to the universal computerization, at that time, the infrastructure of the stock market was actively developing, what facilitated the application of the AIS considerably.

Because of the complexity of neural networks they did not immediately go beyond the purely scientific application, but the wave of interest in this area among the practitioners of stock market has accelerated the process of their practical use. Over time, the level of confidence to new technologies in business area increased and in the early 90-ies regular media reports on using neural networks in different companies, banks, corporate institutions of the United States, Japan and Europe appeared. Moreover, forecasting time series in financial markets was considered to be one of the most promising applications of neural networks.

In the late 80's - early 90-ies specialized Neural programs focused on forecasting the stock prices appeared. The most popular models of neural networks were multilayer perceptron, Neural networks of Hopfild, Hamming, Kohonen and fuzzy Neural networks.

The real revolution in the application of neural networks to predict stock prices should be considered the beginning of the 90's - the time of mass distribution of personal computers. So, wide possibilities of using neural networks in the stock market not only by large institutional investors, but also by anyone who had a personal computer appared. As a result, there emerged a special market of neural networks to predict the price of shares targeted at the mass buyer. And such programs became immediately very popular among private traders.

After a rather serious way of evolutionary development, neural networks of the stock market acquired the characteristics distinguishing them from other mathematical methods used in the stock market. Thus, today, AIS certainly can be considered the most promising direction of forecasting stock prices. But it must be noted that the AIS also have a number of features that put very serious constraints to their effective work in the conditions of strong dynamics of the stock market. Correction of these deficiencies in the further evolution of the AIS could allow such systems to claim the leading position among the tools of forecasting used in the stock market.

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