

# The Role of the Artificial Intelligence as a factor of Improving the Quality of Higher Education Teaching

Gancho T. Ganchev

South-West University, Bulgaria

## I. What is Artificial Intelligence?

The current stage of scientific revolution is characterized by the possibility to treat big data and to use software having the capability of artificial intelligence (AI). The coming transition to 5G internet will accelerate this trend as far as the operation of AI requires fast and reliable access to the worldwide net.

We need to emphasize however that the most part of the nowadays systems with AI work with “narrow” AI as opposed to the “wide” AI which is supposed to possess abilities similar to the humans. Nevertheless, many researchers believe that the computers will be intelligent. These expectations are still unrealistic. Though in the future it will be probably possible to work out AI systems, with capabilities analogous to human intelligence, the actual systems in operation are based on simplified learning models and elements of biological intelligence.

The most part of the applied AI software uses reflexological and behavioral learning schemes popularized by Pavlov and Thorndike (see Kosinski and Zaczek- Chrzanowska, 2003) in the beginning of the 20<sup>th</sup> century. These schemes can be characterized rather as mechanical instincts than as AI. Regardless these constraints the potential of the AI in the field of education and business widely recognized. Though the application of the AI in the classroom was relatively limited, the recent developments shows that the situation is changing (see EDUCAUSE 2019). In particular, the AI based systems can be widely used with positive impact on both learners and teachers. The AI can rapidly change the economy and labor market, creating new norms and standards in business and education.

From historical point of view, the evolution of the AI systems can be divided in three types- based on information treatment, logical structures and learning driven. The first stage is also known as neural network

and machine learning. Up to now, the information-based systems are the most successful.

In particular, the AI can be defined as a field of study that seeks to explain and emulate intelligent behavior in terms of computational processes. Some searchers advocate the physical-symbol system hypothesis (see Newell and Simon, 1976). The latter postulates that the intelligence is a functional property of some logical symbol algorithms and that it is completely impartial of any particular physical representation.

Alternative less-symbolic paradigms are neural networks and evolutionary computation (see for example Moriarty, Schultz and Grefenstette, 1999).

The AI may be focused on modeling of exactly how humans actually think, establishing cognitive models of the human reasoning. The second stage consist of focusing on exactly how humans actually act, including models of human behavior (what they do, not how they think). A third level includes demonstrating how ideal agents “should think”, i.e. models of “rational” thought (formal logic), though humans are often emotional, not rational. The fourth type of displaying human behavior includes how ideal agents “should act” and involves modeling of rational actions, but not necessarily formal rational reasoning, i.e., more of a black box/engineering approach (see in more details Welling, 2007).

Modern AI focuses on the last definition. Success is judged by how well the agent performs. Modern methods are also inspired by cognitive and neuroscience (how people think). An agent should strive to “do the right thing”, based on what it can perceive and the actions it can perform. The right action is the one that will cause the agent to be most successful.

To do this we need performance criterion and performance measure. An objective criterion for the success of an agent's behavior maybe utility, profit,

cost and others. The measure is necessary in order to determine the degree of attainment of the desired objective.

The rational agent is in the heart of any AI concept. For each possible percept sequence, a rational agent should select an action that is expected to maximize its performance measure (Boedecker, Burgard and Nebel, 2017), given the evidence provided by the percept sequence and whatever prior knowledge the agent possesses.

## II. Artificial Intelligence and the Socio-Economic Sciences

As we already mentioned, the intelligent agent is in the heart of the AI concept. From an epistemological point of view, the intelligent agent is the necessary starting point of any scientific research. The social sciences, however, and economics in particular, go further- the so-called homo economicus is the building block of economic theory itself. Homo economicus is a kind of embodiment of the broader intelligent agent concept. Neoclassical economics is based on just two main concepts- the principle of methodological individualism and the idea of general equilibrium (see for critique Colander, 2000). The proof that the decentralized exchange between self-interested economic agents converges to simultaneous equilibrium on all markets is the core objective and the main result of the neoclassical research program. Such coordination between rational economic agents' behavior guarantees optimal allocation of resources.

The basic methodological assumption of the classical general equilibrium approach is to derive the macroeconomic behavior of the system from the micro parameters- preferences, utility and profit maximization, endowments, supply conditions and so on. This is a result of the application of the so-called methodological individualism principle, because only the individuals can be treated as agents in a course of subjectively understandable action (Weber, 1922). However, the very way of describing the general equilibrium via a system of simultaneous equations implying interdependence between markets and introducing money as a medium of exchange, allows for an alternative interpretation of the latter, namely as a state determined by the parameters of the system as a whole.

Furthermore, we can critically assess not only the thesis of micro foundations of macro theory, but also

the related approach of the so-called representative agents, being part of virtually all neoclassical models.

The fundamental flaw of this anthropomorphic concept is that it imposes human-like features to collective, impersonal objects. Any representative consumer, for example, as a kind of "collective individual", could be assumed to have non-transitive preferences, as in the case of collective decision making, with unpredictable consequences for utility maximization. The problem of individual preferences aggregation is extremely complex (see Schofield, 1996) and the legitimacy of the representative agent's paradigm casts serious doubts. If we add to the possible non-transitivity of collective preferences the impact of macro variables on micro behavior, we obtain a potentially unpredictable behavior of economic systems.

Whatever the interdependence between micro and macro level in economics, the latter, especially the mainstream economics, is a science based on artificial intelligence in the sense that the theory is founded on artificial human behavior and not on real humans' performance. We observe similar trends in all the other social sciences- political sciences, sociology, social anthropology, philosophy and others.

## III. New Trends in Artificial Intelligence in Education

Given the advancements in the field of AI, the problem of higher education from the point of view of preparing students for lifelong ability to work with dynamic information flows becomes extremely important. It is obvious that education oriented towards building ability to work with AI-based information systems must be grounded on the AI itself since the traditional learning approaches are not capable of resolving this problem. The impact of AI on education is sometimes compared with the invention of electricity.

The artificial intelligence-based learning platforms can be divided into several classes.

The first is the so-called tutoring- these are software platforms with AI also known as Intelligent Tutoring Systems. These platforms include adaptive machine-based tutors who involve students in active dialogue, answering questions and supplying feedback.

The next stage is the well-known Personalized Learning consisting of highly sophisticated platforms using artificial intelligence who select the curriculum, manage the intensity of the educational process including the sequencing of the learning topics, taking into account the individual needs and requirements of the students.

Another form of using the artificial intelligence are the adaptive systems of evaluating students, the so-called Testing. These are learning platforms generating questions, when every subsequent question is a function of the answers to the previous questions. This approach allows for more precise and dynamic evaluation of the level of knowledge and understanding of individual students.

The next stage is the Automating of Tasks. Under such platforms, we have integration of several tasks-assistance and participation assessment, marking of course works, generating test questions, evaluation of knowledge and understanding and others.

Teaching based on platforms using artificial intelligence demonstrates results, which are statistically much better, than traditional methods. The new technologies demonstrate better results especially in the case of the so-called blended learning, consisting of combining of computer systems with traditional education. The blended learning can be defining as “combination of multiple approaches to pedagogy or teaching, e.g. self-paced, collaborative, tutor-supported learning or traditional classroom teaching” (see Trapp, 2006). The application of this approach allows for improving of academic results and diminishing of differences between different groups of learners.

One of the most interesting applications of the artificial intelligence in the field of higher education is the so-called video processing (see Cao, Xu, Qin and Jiang, 2018). There is strong economic interest in applying video-connected systems in classrooms as a way to complement the information collected via social networks and internet of things. As far as the modern technologies make possible to follow the emotions and the concentration of the learners in real time and to use the respective information in support of educators, such parameters of the systems with artificial intelligence as security and protection of the personal space become crucial for education. Similarly, the artificial intelligence platforms are extremely

appropriate in order to collect private information about skills, experience and competence of students from open sources such as social media, learner portfolios, open badges and so on. In the same time, these practices rise ethical and regulatory problems.

Many economists, philosophers and researchers make statements about the possibility for invention of future super wise artificial intelligence platforms that could replace humans in many areas of white-collar activities.

It is however useful to admit, that the most part of the AI machine learning platforms are based on cognitive abilities reproducing the level of biological instincts. Many of the predictions about the future of the artificial intelligence are grounded on the history of the development of machine civilization and on the expectations for the continuity of the so called Moore’s law in the field of computer technology (see for example Fritze, Cheetham, Lato and Syers, 2016) in respect of artificial intelligent systems, not taking into account however the serious differences between the complex forms of accumulation of human knowledge and the more elementary abilities to memorize and treat the information, implicit for the modern computer systems.

Human learning implies many competences and the meta level. In particular, for the human beings it is very important to assess what is the value of the knowledge, how this knowledge is obtained, created and accumulated. How the cognitive abilities, emotions and attention are regulated in the process of education and what is the social and the practical motivation in the process of new knowledge accumulation. As many researchers emphasize, the most part of the existing artificial intelligence platforms do not possess the above mentioned meta cognitive and regulatory capabilities. This means that the education on the basis of the modern artificial intelligence systems needs to be of the type of the blended learning.

#### IV. Conclusions

Modern Artificial Intelligence based teaching methods must be based on Intelligent Agent Behavior-economics, political science, environment, creative professions etc.

This is not however sufficient- we need education adapted to the needs of students and to the growing

information flows, so the solution is the transition to Adaptive E-learning Systems.

Since the AI based platforms are at rather elementary level, the education on the basis of the modern artificial intelligence systems needs to be of the blended learning type.

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