

Thoughts on Artificial Intelligence for Teachers

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Abstract

In this lecture, we approach from a new aspect the sources and the expected development of artificial intelligence. Our starting point is still human creation, which is driven by common sense, the striving for omnipotence of power, and the unlimited nature of the capitalist economy. Artificial intelligence is based on the anthropomorphic model according to the current state of science, i.e., it tries to imitate human thinking and behavior. The basis of human intelligence is the human brain, and the computer for artificial intelligence. People organize themselves into societies according to rules and morality. Common sense contradicts the need to provide machines with such self-organizing ability, and human goals do not require it. This performance tries to explore the difference and possible convergence of the two intelligences. At the same time, it always establishes the superiority and responsibility of man. The unethical, the destruction, is caused by man, the power, even if it is done by machines with intelligence.

Keywords: artificial intelligence, machine learning, human intelligence, formal logic, automated decision-making, danger

*Everything is different
than we think we know:
... then you beat it, sharpen it,
And split it, grind it,
Until it becomes madness or shackles...
Frigyes Karinthy*

1. ARTIFICIAL INTELLIGENCE

The huge fashion of our time – all the media advertises it – is the name Artificial Intelligence¹ (AI). Today, no one knows what this term really means. According to our observation, we come across the creations of the world's largest computer entrepreneurs that have just been released under this name. The Office system, which was previously taught under the name of IT, is increasingly being replaced by new programs that provide more services and are more modern. IT education is a demanding, thorough application of these. Creative entrepreneurs greatly contribute to this by providing a so-called educational version that is provided free of charge. The student and the so-called. The situation is similar to the simplest versions of generative AI techniques, and teachers make their students work on them depending on their imagination. Generative AI² is even capable of evaluating work and creating competition rankings. Peak performance is when tasks are pushed to the limits. This is the other goal of manufacturing companies – in addition to huge business profits – to test and have their creations examined to see how well they will meet business requirements. So newer and newer versions can be born. Instructors take a lot of effort to get acquainted with the applications and try to integrate them into the curriculum, and the students become trained users.

¹ The first artificial intelligence congress was held in Dartmouth in 1956, and the first version of LISP was completed in 1958. Hope was quickly dashed, and it soon became clear that any description of human reasoning was mere logic, and even the moment it started to work on a machine, it became an algorithm, so it was no longer intelligence. An algorithm is not intelligence, but a state sequence or recursor, as we have already discussed. A typical example is the perceptron, which is merely an approximation of an artificial model of the neuron, far from a proven definition. However, there is no reason to despair, as the result – the perceptron model and its variants – is a tool that can be used in many areas: recognition and search algorithms, etc. Source: McCarthy, J., Minsky, M., Rochester, N., Shannon, C.: 'A Proposal for the Dartmouth Summer Research Project on Artificial Intelligence' (1955).

² The results achieved today and the opportunities inherent in them entitle us to the so-called Sustainable Development Program. Generative Artificial Intelligence. Its name and abbreviation are: Artificial Generative Intelligence AGI.

The educational result shows little more than the level of skilled workers. This is a good idea for multi-millionaire software companies, because the human factor is already given when their creations are introduced.

2. QUESTIONS AND REPLIES

Thinking further, if it is at all possible to achieve a higher standard here, it will still be some kind of imitation! Where is the independence, the individual imagination, the idea, the real creative skill? Yet this would be the expectation of higher education. In the field of AI, too, creation should be taught much more, such as intelligent algorithms, sensor control procedures, data reduction solutions, probabilities, statistics, deviation minimization, error detection, security, etc. Teaching similar theoretical issues gives graduates a future.

Let's briefly review the main elements of education that influence and determine expectations at every age.

1. Due to the changes and development of scientific disciplines, subjects are faced with an ever-expanding curriculum. Some examples:
 - non-Euclidean geometries, spaces, quantum logic
 - network science, cybernetics
 - quantum mechanics, particle physics
 - nanotechnology, new materials.
2. The ratio of science and technology has always been a problem, which is as old as the theory-practice debate. With the spread of computers, the proportion of technology is increasing, which means teaching the use of machines and their programs. In addition to computer technology, computer science appeared, and in addition to computing techniques, computer science and cybernetics, the technical version of the system theories, regulation theories, and control theories appeared. The level of IT education³ is limited to technology only, because this material is also large and dynamic, and there is no time for theoretical foundations. I don't even consider it a university-level educational material; it belongs in secondary education. Again, I have to refer to imitation, to serving others, which is much more in line with the intermediate level. To achieve this, the training of appropriate trainers is essential.
3. Since the discovery of the steam engine, we are now part of the fourth industrial revolution⁴. We also call it the digital age. Fundamentally, new creations are breaking into all areas of our lives. Some of the most important technologies and methods are networks, databases, robots, self-driving devices, nanotechnology, plastics, quantum mechanics, energy storage, virtuality, biotechnology, etc. Technologies are renewing themselves so quickly that biological humans can hardly keep up with them anymore. Humanity will be torn apart, there will be cultivators, a few will be creators, and most of them will be those who fall behind. It would be good to recognize who belongs where – who is talented in what⁵ – because 'uniformity' is only possible by lowering the standard. The Hungarians have always been proud of their excellence and their creations. The basic requirement of universities should be excellence, both in teaching and in education, and in the results achieved.
4. The extensive assets have been exhausted. The time devoted to education can no longer be increased. As an intensive mode, the separation of specialties is an option. The **STEM**⁶ solution has been known for a long time, as well as the exploration of the characteristics of **generations**⁷. STEM lies in the discovery of different talents and then their transfer to the appropriate field. Those selected in this way will be much closer to learning about the latest results in the given field and the inclination to actively create in it.
5. To solve it, it is necessary to recognize talent at an early age; that is, we have to return to high school for this, because this age is the unfolding of talent. Prepared teachers are needed, whose training is an important college and university task. Unfortunately, we have to acknowledge that this is a task that will take

³ In Hungary it was created by combining the words information and mathematics by the computer technicians of the Central Statistical Office in the 1960s. This is how the professional journal Information and Electronics was shortened to INFORMATIKA.

⁴ In general, steam, oil, electricity, and finally the computer stamp each industrial revolution.

⁵ Finally, we consider everyone talented again. The task is to find and recognize in what. The task of talent management is to direct the talent in the right direction and to provide appropriate training.

⁶ It is an abbreviation for Science, Technics Engineering, Mathematics. To put it succinctly, Science: the one who observes nature, the Technics: the one who implements, the Engineering: the one who invents, the Mathematics: the one who imagines – each of them presupposes a different talent.

⁷ Generation Z was born at the beginning of the 21st century, who already live in the digital age and grew up on its technology.

several years and will have an impact on the next generation. And then, until then, only the trained work – how to use the creations of others – remains?



The difficulty of problem solving is finding the one who solves it.

Stage 1&2^[K-5] Stage 2&3^[grades 2-8] Stage 3&4^[grades 5-10] Stage 4&5^[grades 11-12]

nrich.maths.org/



livingworld



physicalworld



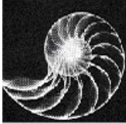
technology



mathematics



STEM +



professional

1. everybody has a talent; the problem is how to find it

2. the effect and the constraint by the Digital world

STEM: differential study

- education program for teachers
- education plan for schools
- program for nursery schools

STEM — people are different

Science: who watch the Nature

Technology: who realize things

Engineering: who find and plan

Mathematics: who imagine

Continuing Professional Development Standard

National Centre for Excellence in the Teaching of Mathematics

Millennium Mathematics Project

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3. FROM THE LAST TO THE PRESENT

Until the middle of the last century, according to the scientific understanding, nature shaped the world:

'We see with the eyes of science,
How the world turned in its cradle,
And how nature with its cunning hand
Transformed the great chaos.'

[Spencer]

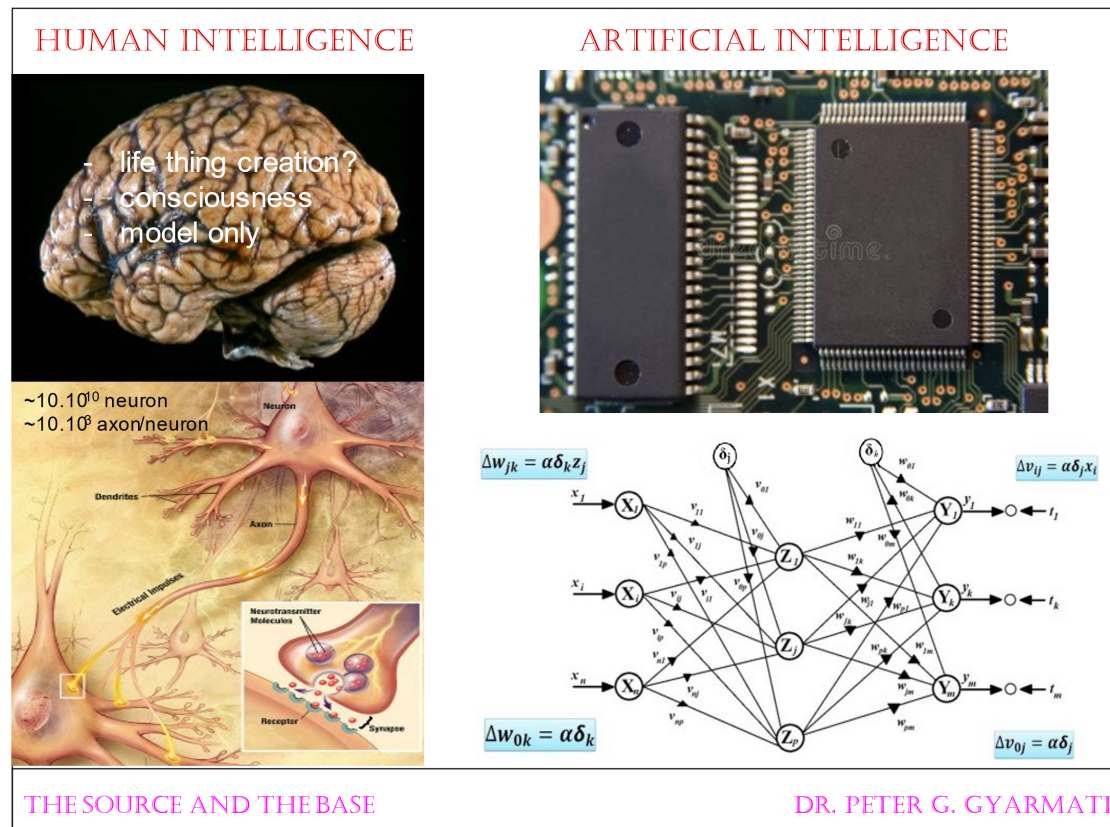
Industrial revolutions gradually transformed this approach, and man-made technical development became more and more dominant in the scientific world. As early as 1954, Szentgyörgyi asked the question at a conference: Will biological man be able to keep up with the technical world of his own creation, or what will happen if he is left behind forever? And this gap⁸ has been growing ever since.

The huge human innovations of recent years seem to justify this process; technology becomes dominant, and science becomes the servant of its needs. This man-made technique has now broken into the innermost world of human consciousness by modeling thinking, intelligence, decision-making, and execution management.

This technique is based on the neuron model created by McCulloch and Pitts and is realized on a computer conceived by Neumann. Its operation is based on the cybernetics formulated by Wiener through the states defined by Turing, which are always possible, but only unprovable finite.

⁸ Lag theory: there is always a lag between the new system and its users during the introduction of a system, which, however, will soon be leveled out. If the development is faster than the equalization, then the lag becomes permanent. Unfortunately, today the lag is measured in generations.

The basic rule states: anything that is formulated accurately and unambiguously enough can be realized on a computer. So we have mapped the task to human language, because we use it to formulate it, so 'sufficient accuracy and clarity' is a linguistic requirement, more precisely, a language or linguistic transition that both man and machine can understand. At the same time, we know that language is a tool of communication between people and, due to its inaccuracy, uniqueness, and ambiguity, it is also a world of tragedies caused by misunderstandings.



So how can we still create usable procedures? Man is inventive and has invented the technique of **testing and experimentation**; accuracy and clarity are not prerequisites for this. We can compare the achieved results with the desired ones, and we leave the decision to the person for now. Modification, correction, and subsequent retry – a new version – is the development process. Artificial intelligence and machine learning in their respective fields contain this opportunity. Moreover, generative and creative systems can also be taught and shaped by the user to suit their own ideas. The effectiveness is doubtful for the time being, but in any case, it is financially very useful for the creators. But are we in the 'experimental phase'!?

4. SUMMARY

In summary, we can clearly see that the interests of AGI producers are well enforced, significant results have been achieved in shape recognition, speech understanding, video and audio techniques, data management, etc. Thousands of processing and storage capacities – the cloud – are available and offered by software manufacturers to users, most of them with subscriptions – this is the billion-dollar profit of the creators – and, as I have already mentioned, educational versions of all this.

The solutions are not without errors; the results can only be applied with competence, attention, and an appropriate level of control, yet there is a huge tendency to introduce **automated decision-making** and to apply it without human intervention in many areas.

Especially those in power and the media do this, and fake news, zero tolerance, and the like are becoming more and more common. With this, they can reach such a level that it becomes impossible to find out the reality, and the deliberation, understanding, and human qualities are excluded. AI technology grows above and dominates the majority of people, even though democracy has a coordinating – never subordinate – structure. We can say that the problem is not with technology, but with the practice of certain people, with power, and the media.

The introduction of more modern techniques – as we have known for a long time – makes human work unnecessary; in reality, it transforms it into an easier, more comfortable activity, requiring more and more adult education, which is also a novelty of secondary and higher education.

Training that monitors development is essential, and any delay can cause generations to lag behind and the degradation of the entire society.

To confirm what was said in the presentation, I would like to mention that my activities in the USA and the UK – even beyond official hours – were about discovering and helping talent. During my working hours, I led the development of the teachers' in-service training program as head of department and research director. In my free time, I organized the development and operation of the Math Circle⁹ and Math Cafe¹⁰ programs based on Hungarian traditions¹¹. The aim of all this was to help schoolchildren from the then Generation Y who were talented in mathematics and information technology. Today, these and other similar programs are nationwide in the USA and England.



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5. SOURCES AND SOME ARTICLES ON THE SUBJECT ARE AVAILABLE ON THE INTERNET:

1. McCarthy, J., Minsky, M., Rochester, N., Shannon, C.: "A Proposal for the Dartmouth Summer Research Project on Artificial Intelligence" (1955).
2. <http://www-formal.stanford.edu/jmc/history/dartmouth/dartmouth.html>. Retrieved 30 August 2007.
3. <https://gyarmati.eu>
4. <https://nrch.maths.org>
5. <https://www.superhuman.ai/c/confirmation>
6. <https://hspublishing.org/JRECS/article/view/133>
7. <http://www.sciencepg.org/article/10.11648/j.ijjis.20221105.11>

⁹ A 'Sunday school' for mathematical thinking for schoolchildren, established by Stanford University teachers.

¹⁰ An initiative of the NRICH natural sciences research group at Cambridge University.

¹¹ Among others, the old and new editions of SICC, as well as the KÖMÁL booklets that are still alive today; and also the Dániel Arany and László Rácz international competitions.

8. <https://hspublishing.org/JRECS/article/view/168>
9. <https://hspublishing.org/JRECS/article/view/283>
10. Gyarmati Peter, G. (2023): Szilánkok. TCC Computer Studio, Wien.
11. <https://gyarmati.eu/publikaciok/MI-1-en.pdf>
12. <https://gyarmati.eu/publikaciok/MI-2-en.pdf>
13. <https://gyarmati.eu/publikaciok/JRECS-168.pdf>
14. <https://gyarmati.eu/publikaciok/JRECS-283.pdf>
15. https://www.kpluszf.com/assets/docs/MI/MI_2024_1_047_Gyarmati_Mezo.pdf
16. Challoner, Jack (2000): The Brain. MacMillan, New York.
17. Neumann, John Von (1965): Selected Papers. KJK, Budapest. 114-115.
18. Pólya George (1963): Mathematical Methods in Natural Sciences. MAA, Stanford.
19. Stanford Encyclopedia of Philosophy: Artificial Intelligence. <https://plato.stanford.edu/archives/fall2022/entries/artificial-intelligence/>
20. Szentgyörgyi Albert (1988): Selected Papers. Gondolat. Budapest.

The figures are some slides from the lecture.

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