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Messages from the AI engine room

Happy birthday, AI!

Artificial intelligence celebrates its 65th birthday - time to congratulate

By Kristian Kersting

Artificial intelligence, or AI for short, is celebrating its 65th birthday: from June to August 1956, U.S. scientists John McCarthy, Marvin Minsky, Nathaniel Rochester and Claude Shannon organized the "Dartmouth Summer Research Project on Artificial Intelligence" at Dartmouth College in New Hampshire, which is considered the birth of AI. The premise of the four Americans still underlies all of today’s AI research: every aspect of intelligence, not just the ability to learn, can be described so precisely that a computer can simulate it.

Already back in 1956 there was the discussion whether computers could match the brain's performance with the help of artificial neural networks. Today, learning such networks, now with layered structures that are reminiscent of the brain's three-dimensional connectivity (hence deep learning), has led to many breakthroughs — most recently in a core problem of biology: predicting the three-dimensional folding of proteins. For Elizabeth Blackburn, winner of the Nobel Prize in Physiology or Medicine in 2009, this is revolutionary because it will allow us to gain a deeper understanding of genome sequences.

Back to Claude Shannon. He is also considered the father of the digital age but resisted the hype (and its consequences) about his information theory that he founded. In a 1956 article with the meaningful title "The Bandwagon," he compared the hype to a band wagon surrounded and accompanied by enthusiastic, but not always knowledgeable followers. The timeliness of his criticism becomes clear if you just cleverly replace some key words such as "information theory" by "deep learning", "cybernetics" by "digitization" or "decoder" by "artificial neural network" in the article, which already Krisha Mehta, Charles Frye and Toby Walsh noticed. I am actually amazed how well his experiences back in 1956 match my experiences today. Here is my result:

Deep learning has, in the last few years, become something of a scientific bandwagon. Starting as a technical tool for the computer vision engineer, it has received an extraordinary amount of publicity in the popular as well as the scientific press. In part, this has been due to connections with such fashionable fields as computing machines, cybernetics, and automation; and in part, to the novelty of its subject matter. As a consequence, it has perhaps been ballooned to an importance beyond its actual accomplishments. Our fellow scientists in many different fields, attracted by the fanfare and by the new avenues opened to scientific analysis, are using these ideas in their own problems. Applications are being made to biology, psychology, linguistics, fundamental physics, economics, the theory of organization, and many

others. In short, deep learning is currently partaking of a somewhat heady draught of general popularity.

Although this wave of popularity is certainly pleasant and exciting for those of us working in the field, it carries at the same time an element of danger. While we feel that deep learning is indeed a valuable tool in providing fundamental insights into the nature of perception and will continue to grow in importance, it is certainly no panacea for AI or, a fortiori, for anyone else. Seldom do more than a few of nature's secrets give way at one time. It will be all too easy for our somewhat artificial prosperity to collapse overnight when it is realized that the use of a few exciting words like depth, attention, embedding, do not solve all our problems.

What can be done to inject a note of moderation in this situation? In the first place, workers in other fields should realize that the basic results of the subject are aimed in a very specific direction, a direction that is not necessarily relevant to such fields as psychology, economics, and other social sciences. Indeed, the hard core of deep learning is, essentially, a branch of statistics, a strictly predictive system. A thorough understanding of the mathematical foundation and its statistical application is surely a prerequisite to other applications. I personally believe that many of the concepts of deep learning will prove useful in these other fields-and, indeed, some results are already quite promising-but the establishing of such applications is not a trivial matter of translating words to a new domain, but rather the slow tedious process of hypothesis and experimental verification. If, for example, the human being acts in some situations like a neural network, this is an experimental and not a mathematical fact, and as such must be tested under a wide variety of experimental situations.

Shannon concludes with calling upon us, again adapted by me: *Only by maintaining a thoroughly scientific attitude can we achieve real progress in AI and consolidate our present position.*

Yes, we should celebrate "65 years of AI" with a big party, preferably even with band(-wagon). Happy birthday, KI!

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