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Messages from the AI engine room

To the moon and back again

A CERN for Artificial Intelligence could find the fundamental laws of intelligent behavior - a moonshot project with broad impact

By Kristian Kersting

On May 12, 1941, Konrad Zuse, then 30 years old, laid the foundation for today's digitization in Germany: He presented the "Z3" he had developed and built, the forerunner of the world's first digital computer. The vision and drive for research of the native Berliner were enormous: He wanted to develop nothing less than a "mechanical" brain.

Today, 80 years later, Artificial Intelligence (AI) is one of the most spectacular and complicated sciences, and Paul Ziemak, the Secretary General of the Christian Democratic Union (CDU), cites Zuse, who died in 1995, as a shining example of his dream that "Germany and Europe will once again become the places to be of inventors and thinkers from around the world." This requires a moonshot project, an ambitious and groundbreaking undertaking. Let's go for it!

"Moonshot": The term goes back to U.S. President John F. Kennedy's famous announcement at the beginning of the 1960s that he would send a man to the moon by the end of the decade. Many things qualify as moonshot projects — the sustainable and resource-friendly design of processes in industry and business as well as the fight against cancer and climate catastrophe, or the search for answers to the ultimate questions of humanity: Where do we come from and where are we going?

AI can help. AI systems can already help monitor the ecosystems of our plant, predict droughts or measure the impact of extreme weather conditions. They can be part of early warning systems for (a)biotic plant stress due to diseases, drought or even too much water. They can calculate optimal nutrient and fertilizer use to increase yields in an environmentally friendly way for a growing population. They help us to understand and decide how much energy we need, where and when. The performance of AI systems is currently doubling within a few months. This is made possible by new algorithms and models, specialized hardware and more computing power.

The "primordial soup," the generic term that describes the hypothetical set of conditions as well as organic and inorganic substances present on the Earth, from which some have assumed that the first living systems evolved — the primordial soup of current "digital brains" is, surprisingly, computer games. The dream of creating games that are visually indistinguishable from reality led to the development of graphics cards. Nowadays they also accelerate AI. If a classic computer needs perhaps three to four minutes to create a solution plan for intelligent behavior from a small data set, it may take only a few seconds when using

a graphics card. In deep learning, a particularly effective but often energy-intensive method of machine learning, weeks can shrink to days or even minutes.

Of course, this speed-up effects the carbon footprint of deep learning: Current estimates say that 190,000 kWh (kilowatt hour) alone are needed to train the 175 billion connections of the GPT-3 language model — probably the most eloquent AI model in the world. This is roughly equivalent to the energy required for a car to travel 700,000 kilometers, once from Earth to the Moon and back. Fortunately, most AI methods use only a fraction of energy when solving real-world problems, only very few AI groups have the infrastructure at all to train GPT-3 like models, and once trained GPT-3 can be reused for many tasks. Otherwise, AI would not be the climate protector it can be, but truly a climate killer.

But beyond its practical benefits in almost all areas of life and work, AI can also help solve central problems of theoretical philosophy: the questions about the meaning and purpose of reality and all being. Ever since humans developed self-awareness and language, they have puzzled over the self and the world, over the nature of space and time. For the first time in the history of mankind we can come closer to the answers to these questions — due to technical progress.

Germany and Europe must now start to search for the fundamental laws of intelligent behavior and share the results publicly. The model for this moonshot project could be the CERN in Geneva, one of the world's largest and most renowned centers for fundamental physics research. Since 1954, CERN has brought together scientists from around the world to search for the fundamental laws of the universe. The institute is a major driver of technical developments that are now used in medicine or computer technology, and even though the Higgs particle is arguably the most important discovery to date — the World Wide Web is another CERN invention that changed the world! All these achievements justify the annual energy consumption of about 1,200,000,000 kWh — equivalent to 6315 trips to the moon by car, and back again.

A "European Organization for AI Research" comparable to CERN would be tantamount to a flight to the moon: bringing deep learning and reasoning together — "fusing" them in physical terms — and in turn making AI more energy-efficient. Keep in mind, the size and complexity of today's AI models is still a long way from the estimated 100 trillion connections of the human brain. And 20 watts are enough for the human brain to perform its entire reasoning and learning.

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