THE COMPUTATIONAL THINKING AND ARTIFICIAL INTELLIGENCE DUALITY

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ABSTRACT: Artificial intelligence (AI) is a new, general-purpose technology that will impact most, if not all, aspects of both our society and our personal everyday life. AI technology has enabled applications such as speech interfaces, vision- based object recognition, and machine translation. It is clear that AI technology will play a central role for most aspects of our professional and private lives, as well as society at large. The single most important competence to achieve this will most likely be computational thinking (CT): solving problems using concepts and techniques from computer science in such a way that computers can assist (Wing 2006).

AI and CT can actually be seen as duals with respect to problem- solving by computers and humans. AI is about providing computers with the ability to think like humans, while computational thinking is about improving the problem- solving capability of humans by leveraging the way a computer "thinks" when it solves problems.

Keywords: Artificial intelligence(AI), technology, computer science, Computational thinking (CT).

INTRODUCTION

Currently, most of the attention is focused on machine learning, while knowledge representation and reasoning were the focus in the 1980s and 1990s, often in the form of expert systems. The next big step is likely the combination and integration of reasoning and learning, maybe in a similar manner as we humans do it with type, separate but somehow connected systems (Kahneman 2011). System I is the fast, automatic, and opaque system for perception and intuition with very limited introspection, which shares many similarities with data-d riven machine learning approaches. System II is the slow, deliberate, and explicit system for analytical thinking and planning with a high degree of introspection, which corresponds roughly to formal, symbolic reasoning- based approaches.

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CT captures this general skill of solving problems in a way that computers can assist (Wing 2011). For computers to help us, we have to be better at understanding how a computer solves problems. Thus, CT is to a large extent about learning to understand how a computer "thinks" when it solves a problem.

When you solve problems with a computer, it is often about describing to the computer what should be done, rather than doing it yourself. Programs are descriptions of how to solve something that a computer understands. Traditionally, humans have to describe every step of the process in great detail. AI actually reduces this by enabling the computer to fill in some of the details.

CT is becoming a general basic skill (Wing 2006). We also need to teach about AI and how AI can be applied to different fields and problems. To do this well, you need to understand both the domain and the technology sufficiently well to make the right design choices or procure the right solutions. This leads to a challenge for all those school systems where subjects are taught independently. In the same way that AI breaks down the silos in organizations, AI requires

different ways of teaching in school. Instead of treating each subject independently, there is a need to study both the subject matter and the AI tools and techniques used to help solve the subject matter problems.

DISCUSSION

We can now compare AI to the main CT activities.

AI tries to avoid step-b y- step instructions through either declarative programming, such as logic programming, in which an engine interprets declarative programs, stating what should be done and figuring out how to achieve this, or through machine learning, which could also be called programming by example, in which a large set of examples together with an objective function are used to define what the program should do.

Breaking down problems into smaller problems, or to divide and conquer, is a classical problem-s olving technique used, for example, in AI to provide dynamic programming solutions to optimization problems or as part of reinforcement learning. It can be questioned whether the computer really breaks down the problem itself, but in reinforcement learning the computer has the choice about what parts of the state space to explore, providing some freedom to select how to break down a problem.

Abstraction is an area where AI- based approaches have had mixed success. On one hand, it could be argued that all approaches to representation learning are doing exactly this (Bengio, Courville, and Vincent 2013). On the other hand, the abstractions found are usually much more limited than the type of abstractions we humans create.

Designing algorithms to solve specific problems is an important part of CT. One way of characterizing AI, at least some parts, such as reinforcement learning and planning, is as a form of automated programming.

Some people even define AI as solving problems without being explicitly programmed (Brynjolfsson and Mitchell 2017).

The focus of traditional computer science, and CT, is to develop algorithms and programs that describe how to solve specific classes of problems with some guarantees. This usually involves understanding the problem in detail and then developing step- by- step instructions that allow a computer to solve problem instances repeatedly and with great precision.

The focus of modern AI is to develop algorithms and programs that can extract, or learn, general models or programs, from data where the problem is not really well defined. It is very hard to specify precisely what a cat or chair looks like, but it is relatively straightforward to create large collections of images with and without cats or chairs. The same is true for natural language.

By developing methods that do not require detailed specifications but rather can extract the underlying phenomenon from positive and negative examples, we increase the range of problems that can be addressed by computers. This is also significant for the skills required to leverage these techniques.

By studying AI and CT, we will learn more about both thinking and human intelligence, how to effectively solve problems with computers, and most importantly, how we humans can solve large scale complex problems together with AI. In consideration of the major challenges humanity is facing, such as providing everyone on the planet with food, energy, sustenance, and belonging in a long- term sustainable manner for both the climate and ourselves, this is absolutely essential.

REFERENCES :

1. Bengio, Yoshua, Aaron Courville, and Pascal Vincent. 2013. “Representation Learning: A Review and New Perspectives.” IEEE Transactions on Pattern Analysis and Machine Intelligence 35 (8): 1798– 1828.
2. Brynjolfsson, Erik, and Andrew McAfee. 2017. “The Business of Artificial Intelligence.” Harvard Business Review, 1– 20.

3. Brynjolfsson, Erik, and Tom Mitchell. 2017. “What Can Machine Learning Do?
4. Workforce Implications.” Science 358 (6370): 1530– 1534.
5. J. M. Wing. Computational thinking. CACM 49(3):33-35, 2006.
6. www.digitalpromise.org
7. www.unite.ai