A short introduction to artificial intelligence

Daniel Schruhl

ThoughtWorks

A short introduction into the general topic of artificial intelligence. This should help address some aspects of artificial intelligence and define them on a shallow level to give a starting point into this topic.

Motivation

There are a lot of definitions for Artificial Intelligence (AI). Most of them are based on a definition of intelligence which in itself is already difficult to define. A simple approach would be to say that humans solving complex problems (with thoughts) is considered intelligent. So making programs or machines pursue the way humans might solve problems can be considered as AI.

Another aspect of AI is often that programs associated with it are considered intelligent in itself because it is hard to understand how they work. This is mainly due to the fact that they work in ways that do not come to you straight away. That is often also considered as intelligent. But in programming it and actually coming up with the idea of a program that is considered to be an AI, the myth of this intelligence is already debunked and does not pose any intelligence anymore. This illustrates the possible paradoxon in AI.

AI can be used for image recognition, for controllig machines, to play games or to detect fraud. It can be used in nearly any domain and has already found great usage in medicine or commercial scenarios. Using AI can give a company a major advantage against competitors. Companies like Netflix have embraced AI (Gomez-Uribe & Hunt, 2015) and have established a market leading position also backed by AI.

Types of AI

Approaches to implement AI have resulted into two major paradigms: symbolic and sub-symbolic. Symbolic approaches model a problem space with tokens or symbols that are humanly readable. This problem space is then processed by the AI programs. The symbols themselves are therefore manipulated and processed. Because of the symbolic nature the AI programs can be completely understood by humans. These programs are often called expert systems, rules engines, knowledge based AI or knowledge graphs. They were the first paradigms that found usage in the past and are therefore also called Good, Old Fashioned Artificial Intelligence (GOFAI). In theory they try to solve modeled problems in the same abstract way humans think and would solve problems.

The sub-symbolic paradigm also consists of symbols but they are not really human interpretable. The whole idea about this paradigm is to build the parts that make human thoughts possible on a more low level abstraction. It is highly inspired by neurobiology and tries to solve problems by using that abstraction to somewhat model cognitive functions. This paradigm has found a lot of usage and popularity in the recent years.

Symbolic AI

Introspection more useful for coding Easier to debug Easier to explain Easier to control Not so Big Data More useful for explaining people's thought Better for abstract problems

- rule based - logics - SHRDLU - search algorithms, constraints

Sub-symbolic AI

More robust against noise Better performance Less knowledge upfront Easier to scale up Big Data More useful for connecting to neuroscience Better for perceptual problems

- supervised - unsupervised - semi supervised - neural nets, deep learning - reinforcement learning - evolutionary algorithms

Current state of AI and further topics

- neural networks, capsule networks, autoencoders, attention, gans, ... - neuroevolution

Where to follow up

deeplearning book further readings

Glossary

AI Artificial Intelligence. 1

GOFAI Good, Old Fashioned Artificial Intelligence. 1

References

Gomez-Uribe, C. A., & Hunt, N. (2015). The Netflix Recommender System. *ACM Transactions on Management Information Systems*, *6*(4), 1–19.