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What is the difference between AI and machine learning

by Nikola Miloševi? - Sunday, September 27, 2020

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Recently an acquaintance of mine sent me the following article AI and ML: Are they one and the same? published by Makeen and asked for my opinion, so I thought I would address the topic as well and expand a little bit on what is written in the article. I believe the article contains a lot of interesting information, so I would recommend you to read it as well.

Where it all started?

If we assume that computer science is a new field, artificial intelligence can be considered both new or old. Artificial intelligence as we know it today started forming after the Second World War with people like Alan Turing, Marvin Minski, or Claude Shannon discussing it. However, people's imagination, myths, and legends involving intelligent machines go much further in the past. Probably one of the first mentions of the intelligent device was in around 950 BC in China, where King Mu of Zhao was presented by mechanical engineer Yan Shi (or artificer) by human-size machine. The article states the following encounter:

> It walked with rapid strides, moving its head up and down, so that anyone would have taken it for a live human being. The artificer touched its chin, and it began singing, perfectly in tune. He touched its hand, and it began posturing, keeping perfect time... As the performance was drawing to an end, the robot winked its eye and made advances to the ladies in attendance, whereupon the king became incensed and would have had Yen Shih (Yan Shi) executed on the spot had not the latter, in mortal fear, instantly taken the robot to pieces to let him see what it really was. And, indeed, it turned out to be only a construction of leather, wood, adhesive and lacquer, variously coloured white, black, red and blue. Examining it closely, the king found all the internal organs complete—liver, gall, heart, lungs, spleen, kidneys, stomach and intestines; and over these again, muscles, bones and limbs with their joints, skin, teeth and hair, all of them artificial... The king tried the effect of taking away the heart, and found that the mouth could no longer speak; he took away the liver and the eyes could no longer see; he took away the kidneys and the legs lost their power of locomotion. The king was delighted.

Even though speaking of 950BC, the article describing this interaction was from 3 century BC. But this is not the only legend. Talos of Crete was a mechanical intelligent machine created by Gods to protect Europa. This Greek myth dates to around 400BC. In Prague, there is a famous legend in the Jewish community that one rabi created a Golem out of the mud in around 1580 and gave him life. The Golem served the purpose to protect the Jewish ghetto and Jewish community in Prague.

However, the main event that shaped artificial intelligence was the Dartmouth Summer Research Project on Artificial Intelligence in 1956. This event is usually considered as the event where artificial intelligence was formulated and where many of still unfulfilled promises were made (mainly about general artificial intelligence being achieved quite soon).

Defining Artificial intelligence

Artificial intelligence is quite a big umbrella term that covers all methods, algorithms, and systems that exhibit some sort of intelligent behavior. And as from this definition can be seen, one can mimic intelligence with coding into the system a set of heuristic rules, expressing some knowledge. So it does not necessarily need to be through any kind of learning, but the knowledge can be built into the program. However, learning is as well one of the areas of artificial intelligence. In my opinion one of the great ways to explain subareas of artificial intelligence is through human senses and capabilities. Humans have a set of senses and capabilities that make them behave intelligently. Artificial intelligence is trying to mimic this and therefore for each human sense or capability, there would be a field in artificial intelligence that would try to find the best way to mimic that capability.
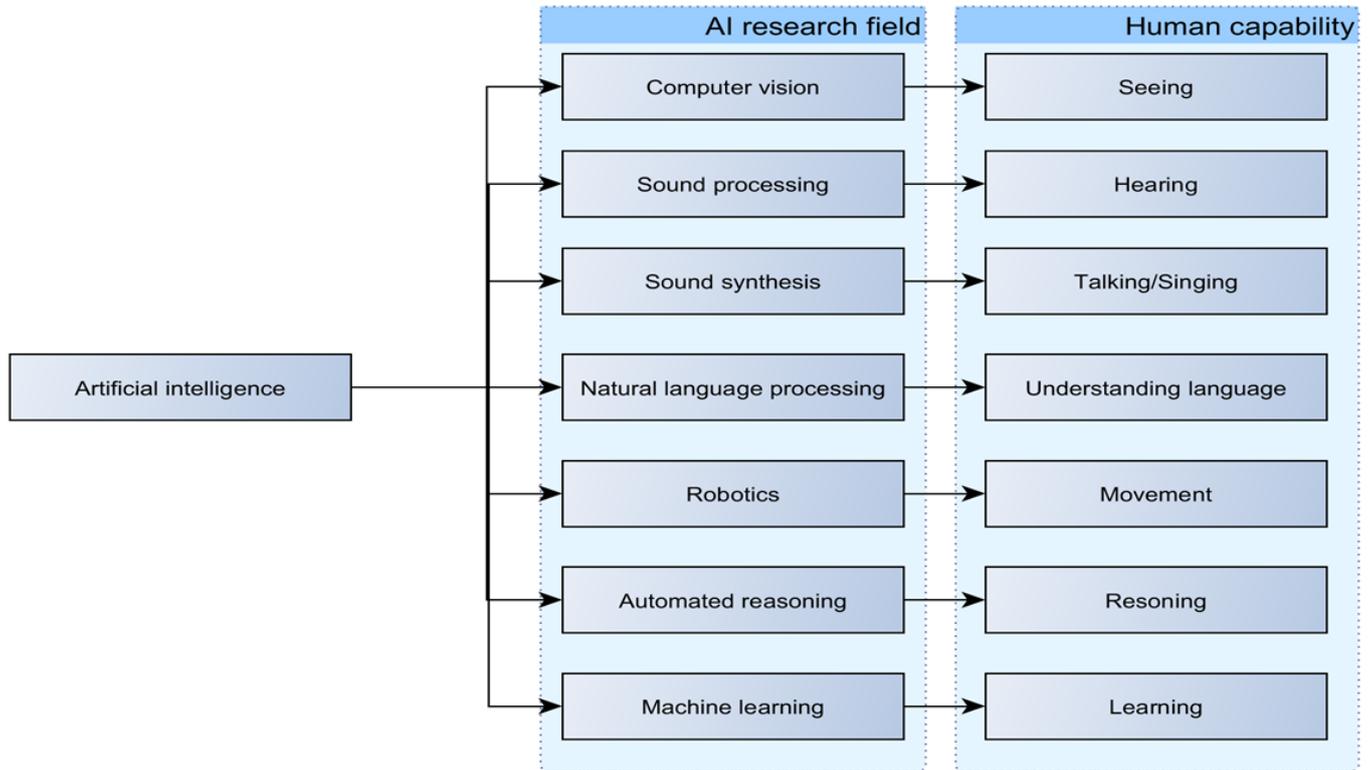
Human capabilities mapped to AI fields

As shown in the picture here, the computer vision field of AI would mimic seeing, sound processing hearing, natural language processing will mimic language understanding, and so on. Machine learning would mimic how humans learn, and as we learn to understand language and recognize object, some of the machine learning concepts played a major role in the development and applications of other areas, such as computer vision, natural language processing, reasoning, and so on.

Types of artificial intelligence

Since artificial intelligence started developing three main types of artificial intelligence came to be considered:

- Narrow AI
- General AI
- Super AI

Today we see the rise of Narrow AI, and all the applications that we can see with various kinds of recommender systems in Amazon, Netflix, Facebook, Google search and semantic networks, virtual assistants, and so on are examples of narrow AI. General AI is a goal for many researchers for decades but is still in the realm of science fiction. This is a kind of artificial intelligence that would not be applied only in a certain area but would be able to adjust its skills through a lifetime as humans do. On the other hand, there is a theory that because of the computing speed, once general AI is achieved, it would not be hard for that AI to move to Super AI, which is AI that would be many times smarter than human and may then decide to rule the world (usually this ends up in some type of Matrix or Terminator scenario).

However, these AI types are again not necessarily bound to learning, although if AI is supposed to adjust and learn new skills over time, here we have learning. However, in the 1970's there were many attempts of creating quite a general expert system with encoded knowledge in some sort of knowledge graph or database. Mostly these attempts were failing because there are gray areas where knowledge can be contradicting in some cases. That is why most systems that are being developed today for these kinds of experiments are based on machine learning with maybe some part of knowledge encoded.

Types of machine learning

Usually, in the field we are talking about 3 kinds of machine learning, based on human intervention in that learning:

- Supervised learning
- Unsupervised learning

- Reinforcement learning

As names say, in supervised learning, we would have labels and show the machine that based on the certain input we would like to see a certain output. In unsupervised learning, we let machines try to find patterns in data on their own. There is semi-supervised learning that combines methods from supervised and unsupervised learning. This is especially useful when we don't have enough data for supervised learning. At the end, reinforcement learning lets agent live in a certain environment with a certain reward and punishment function. This kind of learning is quite literally based on the Pavlovian conditioning of the machines.

Where we are headed

Some people may interchange terms of machine learning and AI, but they are quite a different animal. Machine learning is AI, but AI is not machine learning, but rather way wider field. Nowadays, machine learning plays a bigger and bigger role in many of the other fields and areas of AI, however, each field and area will remain on its own as they would use quite specific tricks and methods for the capability they try to mimic.

If you would like to learn more about AI, I have created a free Udemy course with this topic and you can find it here.

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