Artificial Intelligence Fundamentals

The Foundations & History of Intelligent Machines

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Preface

Computers and People

Human beings undoubtedly are the most sophisticated creature living on this planet. We're the most powerful intellectual machine ever known because we use our own intelligence to make decisions. With our intellect we're able to rule over any other living creature on this mother earth.

Through learning we acquire various skills which are necessary for our survival, and once our survival process is started, we proceed to explore more through our infinite intelligence that has no boundaries and wants more.

We humans don't stop inventing tools because we want to save ourselves time and make ourselves secure and safe. Gradually we began to invent machines that led to the extension of our intellectual brain, memorizing a lot of information and performing multitasking for us.

Taking you down the memory lane, the very first computing machine was invented by Charles Babbage in 1833, and was called Turing-Complete. Since that time the computer has transformed from the Analog era to the Digital Era.

1. Fundamentals of Artificial Intelligence

There are various ways we can define Artificial intelligence (**AI** for short). It depends on the dimensions you want to use.

For example, if we're concerned with *reasoning* and *thought processes*, we can define AI as

"The study of mental faculties through the use of computational models."

(McDermott and Charniak, 1985)

or

"The study of the computations that make it possible to perceive, reason, and act." (Winston, 1992)

But if we're concerned with *behavior* or *human* performance, we can define AI as

"The art of creating machines that perform functions that require intelligence

when performed by people." (Kurzweil, 1990)

or

"Computational Intelligence is the study of the design of intelligent agents." (Poole *et al.*, 1998)

However here is a very simple definition:

AI is the theory and development of computer systems that are able to perform tasks which normally require human intelligence, such as speech recognition, visual perception, decision-making and language translation.

We want machines that thinks like human, so we give them their own intelligence by feeding them a lot of information that simulate the environment very similar to the real world, simply because the machine can process huge volumes of information in a split second.

It seems the ultimate aim of the entire AI computing is to facilitate task performance and make it efficient for us humans so we get an opportunity to become extremely comfortable, or maybe lazy, and depend on machines to decide on our behalf.

Origin of Artificial Intelligence

Artificial Intelligence concept was introduced by **John McCarthy** with the help of **Allen Newell, Marvin Minsky and Herbert A. Simon**. It was in 1955 that McCarthy created the

term "artificial intelligence". He also organized the famous Dartmouth Conference back in Summer 1956. It was in this conference that AI started as a field.

Why Artificial Intelligence?

Now that we know what AI is, a very basic question we should ask is why artificial intelligence? Even though we human have got a supremely powerful computing brain or intellect of our own, why do we require virtual intelligence in the first place?

Well, it all boils down to one word: **Decision Making.** AI was conceptualized because we humans feel that we cannot be present every where, and cannot take decisions remotely without being present at that place. We found this to be very necessary after industrial revolutions and now it has become even more necessary after digital revolutions where we generate information in terabytes.

So it was because of our need for information processing and our need to reach some virtual conclusion that we required a computer machine that can think and act like the human brains, Therefore AI was founded as an academic discipline in 1956.

Since that year AI has experienced countless waves of optimism, followed by loss of huge funds (called an "AI winter") and disappointment. Then follows some new approaches, some success and then renewed funding.

AI research has bee divided into various subfields that most of the time fail to communicate with one another. But in the early twenty-first century ample success was made in the statistical approaches to machine learning. These approaches eclipse all other tools, problems, approaches, and schools of thought.

Types of Artificial Intelligence

There are 4 basic types of Artificial Intelligence.

Weak AI (narrow AI): Non-sentient machine intelligence. This typically focuses on a narrow task called narrow AI.

Strong AI (hypothetical): Sentient machine (a machine with mind and consciousness).

Artificial General Intelligence (AGI) (hypothetical): A machine that is able to apply intelligence to any problem, not just a specific problem. This typically means that the machine is at least as smart as a typical human.

Superintelligence (hypothetical): A machine with artificial intelligence that far surpasses the intelligence of the most gifted and brightest human minds.

Applications of AI

As depicted in **Fig. 1.1**, AI Research mainly focuses on developing intelligent programs that can simulate human intelligence in the field of

1. Learning
2. Reasoning
3. Problem Solving
4. NLP (Natural Language Processing)
5. Perception Building
6. Ability to manipulate and move objects

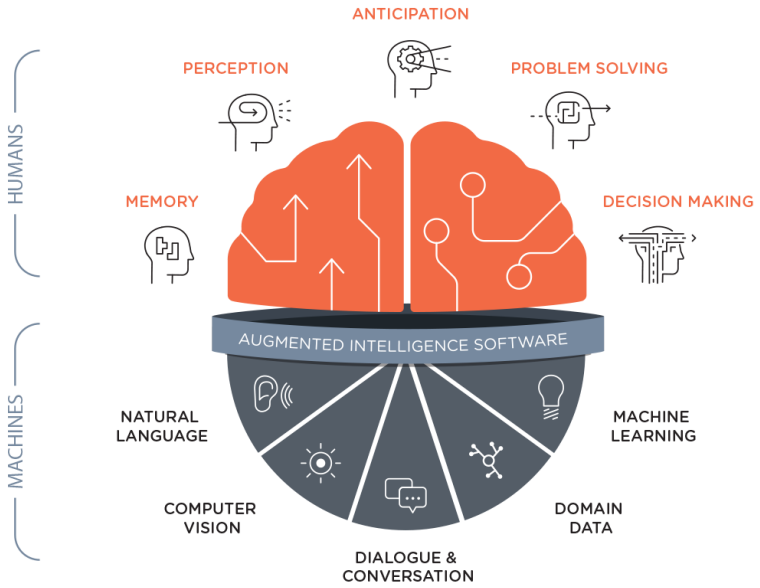

Fig. 1.1: Applications of AI. Image Source: cognitivescale.com

Popular Developer Tools for AI Development

Let's look at some opensource developer tools that has been built by aspiring opensource community. Here's a list of some of the notable ones that are currently utilized in Artificial Intelligence to make machines have their own brains:

1. **OpenAir**: This is a message communication and routing protocol for AI systems. It became popular in the past few years (2006).

2. **OpenCog**: This project is aimed at building an open source AI framework. The OpenCog Prime is the architecture for robot and the virtual embodied cognition which defines a group of interacting components that is designed to build the human-equivalent AGI as an emergent phenomenon of the whole system.

3. **OpenIRIS** : This is the open source version of the IRIS, a semantic that helps users to make a "personal map" across their office-related information objects. The acronym IRIS stands for "**Integrate**. **Relate**. **Infer**. **Share**.". It was developed as part of CALO project. CALO is a very large Artificial Intelligence that is funded by DARPA (the **Defense Advanced Research Projects Agency**) under its program called **Personalized Assistant that Learns**.

4. **RapidMiner**: It is a Data Science platform that came into existence in 2006. It has been put to use mainly in the commercial and business applications, as well as for education, research, training, rapid prototyping, and application development. It supports all the steps of the machine learning process which includes preparation of data, visualization of results, model validation and optimization.