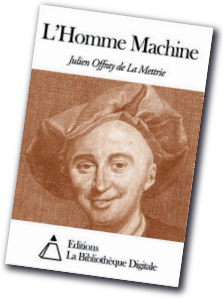
HOW AI SYSTEMS HAVE EVOLVED

You encounter Artificial Intelligence in many places today: in the media, in school, and in your daily environment. But did you know that the ideas behind it are already many years old? Or what developments have led to its breakthrough?

You have just retraced the chronological development of AI systems using the Bandolinos. It is crazy to think that the ideas underlying modern AI systems have been around for so many years, isn't it? But good ideas alone often are not enough. It also always requires the right technical capabilities. Here, the development of computer processing power plays a significant role. The timeline on the playing field shows you the most important milestones in the development of AI systems.

On the following pages, we have summarized everything important about the milestones in the development of modern AI systems for you again. You can either read through all the events or select those that particularly interest you based on the timeline.

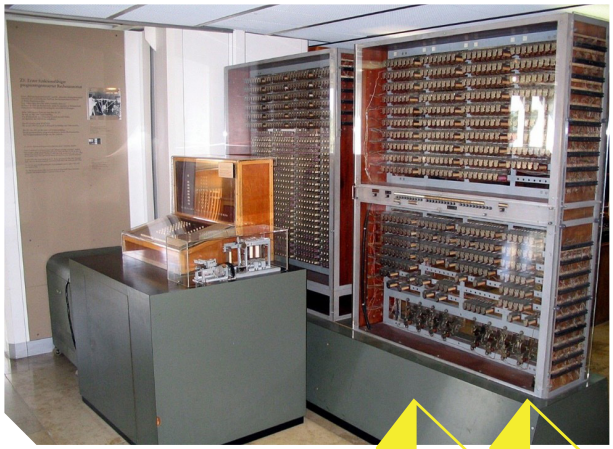
08 ONCE UPON A TIME...



1748

Who came up with the idea of building intelligent machines? In any case, sources dating back to 1748 already discuss this.

The idea of constructing machines capable of exhibiting intelligent behavior in some way is very old. An early source for such ideas is the work **„L'Homme Machine" (Man, a Machine)** by the Frenchman Julien Offray de La Mettrie from 1748, but even in antiquity, philosophers were already pondering how to replicate humans as artificial machines. Technically, of course, this was not yet possible!

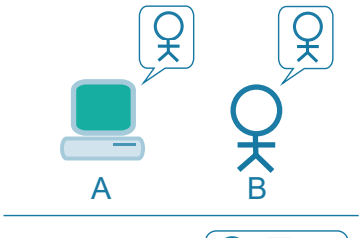


1941

Konrad Zuse develops the first functional digital computer, the ZUSE Z3. It is capable of performing two arithmetic operations per second, measured as 2 FLOPS.

The Zuse Z3 is considered the world's **first functional digital computer** and was primarily constructed by **Konrad Zuse** in Berlin starting in 1938, with its introduction in 1941. Unfortunately, the machine was destroyed in a bombing raid on December 21, 1943. The Z3 occupied an entire room and was capable of performing two floating-point operations per second (FLOPS).

08 ONCE UPON A TIME...



1950

Alan Turing designs the Turing Test, which can assess whether a machine possesses intelligence similar to that of a human.

The Turing Test is just one of many groundbreaking ideas from the British computer science pioneer Alan Turing. Developed in 1950, this test aims to evaluate whether a machine can think comparably to a human. The responses of a machine in dialogue with a human are evaluated. **If the human cannot distinguish the machine from another human, then the machine has passed the test** and possesses artificial intelligence.

1956

The term Artificial Intelligence is used for the first time.

The term Artificial Intelligence was coined in 1956 during a **research conference at Dartmouth, USA**. Many prominent scientists gathered there to explore how machines could be made intelligent. For

"Artificial Intelligence"

example, the discussion included how machines could use language. Initially, the participants thought that this problem could be solved within a few weeks. However, it turned out to be incorrect: To this day, there are many open questions in the field of Artificial Intelligence research.

08 ONCE UPON A TIME...

```
ELIZA >
HI, I'M ELIZA.
WHAT DO YOU
WANT TO TALK ABOUT ?
```

1966

A chatbot is capable of engaging in dialogues with humans in natural language.

The chatbot **Eliza** must have seemed like a sensation in 1966: a machine capable of having meaningful conversations with a person in a chat! However, Eliza's abilities were still relatively limited. The sentences entered by humans were searched for **keywords** contained in Eliza's dictionary. These keywords were linked to specific response sentences from the dictionary, which Eliza then produced. If no suitable keywords were found, Eliza responded with general phrases like **„I don't understand that, let's talk about something else!"**

1976

The expert system MYCIN assists doctors in diagnosing and treating blood infection diseases.

```
Patient's name:  MARCUS BLOICE

Sex:  MALE

Age:  30
------- culture-1 -------

From what site was specimen CULTURE-1 taken?  ?
Must be one of: blood


From what site was specimen CULTURE-1 taken?  BLOOD

How many days ago was this culture (CULTURE-1) obtained?  ?
Must be a number


How many days ago was this culture (CULTURE-1) obtained?  3
------ organism-1 -------
```

In medicine, Artificial Intelligence is already being used in several areas and is a great support for doctors. It analyzes X-ray images, collects patient data, and can make predictions about the course of the disease. However, the first expert systems in medicine emerged many years ago. MYCIN, in 1976, was already able to assist in diagnosing blood infection diseases and made suggestions for therapy. These systems, however, did not use large datasets like today, from which they learned certain relationships; instead, they were knowledge catalogs with a multitude of **facts and rules** on how to deal with them.

08 ONCE UPON A TIME...

1981

The first PC by IBM is introduced to the market, and computers begin to be used more frequently in offices. The processor used achieves 50 kilo-FLOPS.

The late 1970s saw the advent of so-called Personal Computers (PCs), marking a milestone in the development and proliferation of computers. The Intel 8088 processor developed in 1981 had **significant computing power for the time**. Since then, the basic architecture has changed little, so one could say it's the great-great-grandfather of the processors used in PCs today

1992

The first self-driving car drives on the road in Germany.

When you think of self-driving cars, you might immediately think of Google and other big companies. However, the first autonomous car was actually developed in Germany back in 1992. Using **camera sensors**, this car observed its surroundings and made a prediction for the driving situation in the next second, which was then compared with the actual situation. The car could learn from the differences. If there were already self-driving cars in 1992, why are we still behind the wheel? This **technology was very expensive and took up so much space that nothing else could fit in these delivery vans**. Moreover, the car could not handle all difficult traffic situations yet. This still applies to autonomous vehicles today. They still cannot do without human assistance and especially without GPS.

08 ONCE UPON A TIME...

1997

The AI system Deep Blue defeats the reigning world chess champion.

If you can play chess, you might know that it is not so easy to be really good at it. Nevertheless, computers managed to **beat the then-world chess champion Garry Kasparov** as early as 1997. How is that possible? Well, they can simply remember much more than we can and **quickly calculate which moves are particularly promising** for winning!

2000-2008

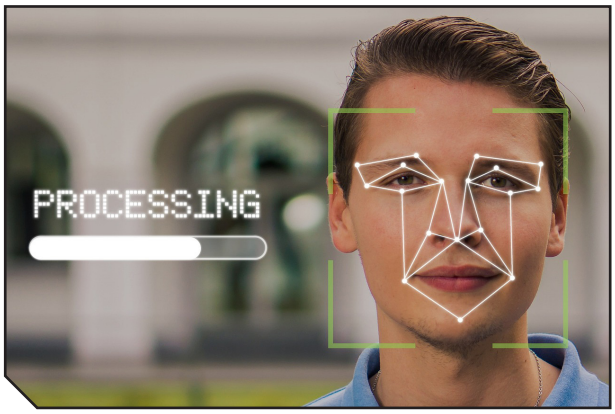
By now, desktop PCs are becoming ubiquitous in every household. With 6 GigaFLOPS, Pentium 4 processors are already quite fast.

With the **spread of the internet** and **computers becoming increasingly affordable**, they are finding their way into many households. The speed of Pentium processors contributes to the fact that now even more complex applications can be implemented at home on one's own computer.

08 ONCE UPON A TIME...

2001

Facial recognition becomes possible in real-time videos for the first time. Since then, a lot has happened: Instagram filters adapt precisely to your face, and at airports, a camera checks if you resemble your ID. This is possible thanks to very accurate sensors and increasingly better cameras, whose data is then analyzed by AI algorithms.



Certainly, you have noticed various **filters for videos and pictures** in different apps on your smartphone. Some of them explicitly use facial recognition. Also, at the airport, electronic images on your ID are automatically checked during security screening. This is mainly possible because **more accurate sensors** (for digital image capture) provide precise data, which can then be analyzed by AI algorithms.

2014

With smartphones, we all now carry pretty fast mini-computers in our pockets. The Samsung Galaxy S5 achieves 142 GigaFLOPS.

By observing the development of smartphones, you can clearly see how the computing power of computers has increased and simultaneously occupies less space. For example, the AI system DeepBlue, which was the first to defeat a chess world champion, was installed in a separate room on a huge computer. Current smartphones have approximately the same computing power - it just fits in your pocket now! The built-in processors are **about 20 times faster than those from 10 years prior.**

08 ONCE UPON A TIME...

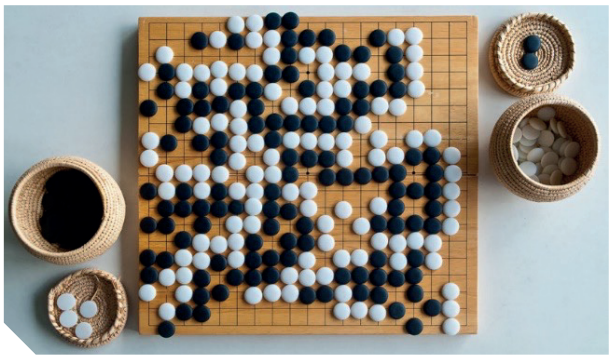
2015

The Amazon Echo with the intelligent assistant Alexa is released.

„Alexa, turn on the lights!“ You have probably seen people talking to Alexa in movies or on TV, maybe you even have such an intelligent assistant standing in your kitchen at home. Yet, these devices have only been around for about five years, and their development was made possible by artificial intelligence. Only through constantly learning can the device understand our commands so well. It **analyzes our language and usage preferences**, allowing it to better respond to us over time.

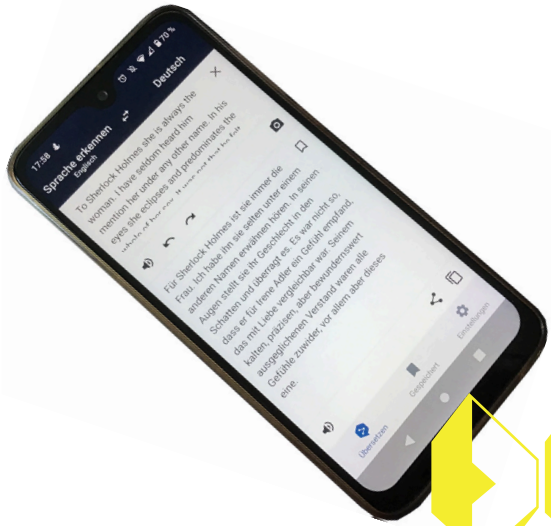
2016

The AI system AlphaGo defeats the European champion in the board game GO with a score of 5:0.



The Chinese board game GO is one of the most complex strategy games in the world. Therefore, it was long considered unsolvable for computers. This changed in 2016 with AlphaGo. The AI system learned a strategy through **countless game sessions against itself** within 36 hours, enabling it to defeat the European champion. And all this, even though it only knew the rules of the game and then simply tried them out.

08 ONCE UPON A TIME...



2017

The translation service DeepL, which accomplishes translations using AI algorithms, is launched.

How nice would it be if you did not have to painstakingly translate your texts yourself in language class, but instead have a machine do it for you? Actually, since 2017, with the translation service DeepL, this is quite possible. The software understands and translates a large portion of the sentences correctly, utilizing AI algorithms: **words are evaluated in their context**, and based on that, the best possible translation in the target language is determined. All of this is possible because one can represent the connections and relationships of words as on a large map, and these are similar in different languages. **So, a word and its translation are located at similar positions on the map**.

2018

Beware of fake videos! The FakeApp enables the exchange of faces in videos using AI methods. Creating such Deepfakes requires super-fast specialized processors – otherwise, the video creation takes too long.

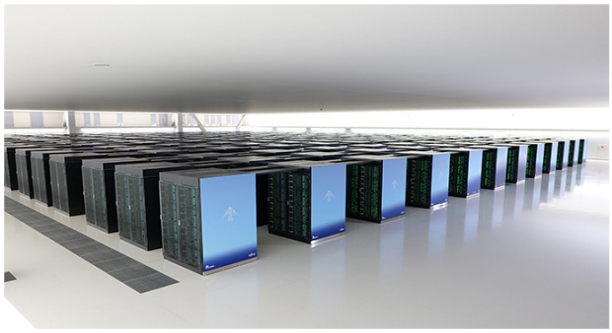
You might have seen a video on YouTube or TikTok where a deceased person was perfectly integrated. Or you may have seen videos of politicians where you were not sure if they actually said what was shown. Deepfakes make it **difficult to trust image and sound materials**. To create these in an acceptable time frame, the development of **specialized processors** was necessary. These are built into current graphics cards, so even with suitable smartphones, such Deepfakes can be created without problems.

08 ONCE UPON A TIME...

2020

The supercomputer Fugaku is commissioned in Japan, operating at 442 PetaFLOPS. Such computers are particularly suitable for handling Big Data, i.e., huge amounts of data. Storing and analyzing such data requires very large storage capacities. For AI systems, these data collections are very useful as they use data to learn specific behaviors (such as recognizing faces).

The size of modern supercomputers is indeed impressive. Most of these machines are housed in **large halls** with their own power supply. But even room-sized computers already have very impressive computing power. Comparing them to the beginnings of the Zuse Z3 makes the development particularly clear.



To illustrate the scale, consider this comparison: If the performance of the Z3 (2 FLOPS) corresponds to one meter, then a modern supercomputer (442 quadrillion FLOPS = 442,000,000,000,000,000) would stretch **from here to the nearest star Proxima Centauri**, which is over four light-years away. Such „computing monsters“ are needed more than ever today. For example, complex calculations are necessary to assess the consequences of climate change. The more computing power available, the more accurate the predictions. However, all of this comes at a high price: Modern supercomputers **generate a lot of heat and consume a lot of energy** themselves.

SOURCES

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