The History of Computing and AI

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In what year was the first programmable computer built?

The question is a trick. There are six defensible answers:

Year	Machine
87 BCE	**Antikythera machine**
1642	**Pascaline**
1805	**Jacquard machine**
1837	**Analytical Engine**
1943	**Colossus**
1951	**CSIRAC**

Which one counts depends entirely on what you mean by “programmable” and “computer” — which is the point.

Timeline

Period	Era	What happened
1837		Charles Babbage invents the Analytical Engine. **Ada Lovelace** recognises it is a general purpose calculating machine.
1941–1943		British mathematicians and engineers build the **Bombe** and **Colossus** for cracking codes during World War II.
1950		**Alan Turing** proposes the Turing Test as a goal for artificial intelligence, rather than defining "intelligence".
1956		The **Dartmouth Conference** is held. The proposal coins the term *artificial intelligence*.
1956–1974	**The Golden Era**	Foundational search algorithms and artificial neural networks are invented.
1974–1980	**The first AI winter**	The hype of the golden era did not eventuate. Funding dried up and excitement dwindled.
1980–1987	**The Knowledge Era**	Knowledge-based systems, such as Prolog and expert systems, invented.
1987–1993	**The second AI winter**	The hype of the knowledge era did not eventuate. Funding dried up and excitement dwindled.
1994–now	**The Revival Era**	Intelligent agents, computational power, the Internet, and machine learning.

The Turing Test (1950)

> "The new form of the problem can be described in terms of a game which we call the 'imitation game' "
>
> — Alan Turing, *Computing Machinery and Intelligence*, Mind, LIX(236):433–460, 1950

Turing sidesteps defining intelligence and substitutes a *test* for it. That move — replacing an unanswerable definition with an operational check — is the same instinct as making a hypothesis falsifiable in experimentation[1].

Dartmouth (1956)

The founders present: John McCarthy, Marvin Minsky, Claude Shannon, Ray Solomonoff, Alan Newell, Herbert Simon, Arthur Samuel, Oliver Selfridge, Nathaniel Rochester, Trenchard Moore.

> "We propose that a 2-month, 10-man study of artificial intelligence be carried out during the summer of 1956 at Dartmouth College… The study is to proceed on the basis of the conjecture that every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it."

Two months, ten men. The proposal's confidence is the first data point in the pattern that follows.

Its lasting output was the **divide and conquer model of AI**, splitting the problem into perception, knowledge representation, learning, reasoning and planning.

The Golden Age (1956–1974)

- **Reasoning as search** — Shakey the robot and A*, Hart, Nilsson and Raphael (1968); STRIPS (Stanford Research Institute Problem Solver), Fikes and Nilsson (1971), with its preconditions/postconditions action model.
- **Perceptrons and neural networks** — the single-layer perceptron, Rosenblatt (1958).

[1] courses/comp1100/experimentation.pdf

The first AI winter (1974–1980)

What went wrong — outcomes failed to live up to the hype:

- **Scalability**
- **Commonsense knowledge**
- **Perceptron limitations**
- **Moravec's paradox**

The result: funding dried up, global interest died down, and criticism came from philosophers and cognitive scientists.

The Knowledge Era (1980–1987)

- **Knowledge-based systems** — Prolog (Colmerauer and Roussel, 1972), and formal ontologies.
- **Expert systems** — MYCIN, for diagnosis of blood diseases (Shortliffe, Buchanan and Cohen, 1970s).

The second AI winter (1987–1993)

Same headline, different specifics — outcomes again failed to live up to the hype:

- **Scalability**
- **Maintenance**
- **The qualification problem**
- **Moravec's paradox** *(again)*

The result: funding dried up (DARPA declared AI was "not the next wave"), global interest died down, AI companies went bankrupt.

The revival (1994–present)

- **Intelligent agents and decision theory** — Bayesian networks, Pearl (1988)
- **Computational power** — Moore's law
- **The Internet and big data**
- **Machine learning** — backpropagation in deep neural networks, Rumelhart, Hinton and Williams (1986)

Another AI winter?

This is the real argument of the history. We have been here before:

> "In from three to eight years we will have a machine with the general intelligence of an average human being." — **Marvin Minsky (1970)**

> "Machines will be capable, within twenty years, of doing any work a man can do." — **Herbert Simon (1956)**

> "...the embryo of an electronic computer that [the Navy] expects will be able to walk, talk, see, write, reproduce itself and be conscious of its existence." — **New York Times on the Perceptron (1958)**

> "Artificial intelligence will reach human levels by around 2029." — **Ray Kurzweil (1999)**

> "We will have fully self-driving cars on the road by 2017" — **Elon Musk (2014)**

> "We are now confident we know how to build AGI as we have traditionally understood it" — **Sam Altman (Jan 2024)**

Amara's Law

> We tend to **overestimate** the effect of a technology in the **short run** and **underestimate** the effect in the **long run**.

Which is why the pattern above isn't simply "the predictions were wrong" — the winters came from the short-run overestimate, and the revival from the long-run underestimate.

What are some of the risks?

> "By far the greatest danger of Artificial Intelligence is that people conclude too early that they understand it." — Eliezer Yudkowsky

> "People worry that computers will get too smart and take over the world, but the real problem is that they're too stupid and they've already taken over the world." — Pedro Domingos

> "The beauty of AI and what we can do with it is currently being overshadowed by reckless hype, monotheistic techniques, and absurd deification. Yet, it's not the first time in 65+ years nor it'll be the last one. We haven't learnt a thing." — Dagmar Monett

Representation in computer science

Six people the field's history remembers:

Person	For
Ada Lovelace	The first "computer programmer"; the first person to consider general purpose computers doing more than numerical calculation
Alan Turing	Turing machines, code cracking in World War II, the Turing test, so many other things
Margaret Hamilton	Software engineer at the MIT Instrumentation Lab; developed on-board flight software for NASA's Apollo program; **coined the term "software engineering"**
Grace Hopper	Identified that computer programs can be written in a high-level language and compiled into machine code
Fei-Fei Li	Machine learning researcher; founder of AI4ALL
Timnit Gebru	Research on bias in machine learning models; founder of Black in AI

> CSSE1001 covers overlapping ground from a different angle — see CSSE1001's history of computing[2] for the hardware timeline and the machine-code-to-Python language progression.

[2] courses/csse1001/history-of-computing.pdf