A few historical (and pre-historical) landmarks in AI

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A few references


From Antiquity to XVI\textsuperscript{th} century

First steps...

- Greek philosophy, but also Chinese, Indian, Arabic, Persian... philosophies.
- Opposition knowledge/opinion, necessity/possibility.
- Inspiration for the philosophers of the Middle-Age.
- Distinction between logics and theologics.
- Ramon Llull (1232-1316): logical machine for argumentation.
- William of Ockham (c.1287-1347): law of parsimony (Ockham’s razor: “shaving away” unnecessary assumptions).
- Imaginary artificial creatures (Galatea, Golem...).
- Machines: pulley, clepsydra...
XVII\textsuperscript{th} and XVIII\textsuperscript{th} centuries

- Slow transition towards the birth of modern logic.
- Link between symbolic manipulation of terms in logic and mathematical calculus: Thomas Hobbes (1588-1679).
- First developments of probabilities:
  - Before 1660: two independent concepts:
    - chance (randomness)
    - probability (attribute of the opinion)
  - Theory of games and chances (without referring to probabilities): Dante, Cardano, Galileo, Pascal, Fermat, Huygens.
  - Towards Bayesian mathematical formulation: Arnault, Leibniz, Bernoulli, Hooper, Montmort, De Moivre, Bayes, Lambert, Laplace.
- Emergence of the first machines and automata (Vaucanson).
- Philosophical advances (Descartes, etc.)
- Votes: Condorcet, Borda.
- Towards reason and rationality,
XIX\textsuperscript{th} Century

- Rise of modern logic.
- F. De Castillon: formal calculus for solving syllogisms.
- J. Gergonne: algebraic methods in mathematics, applied by G. Boole and A. De Morgan for logic, and further developed by E. Schröder, C. S. Peirce, etc.
- L. Carroll: symbolic logic, voting method.
XXth Century

- Birth of computer science, calculability theory, cybernetics (Wiener).
- Early work: G. Frege (quantifiers, predicate logics), Russel, Gödel... (mathematical foundations of logics...).
- Introduction of non-classical logics (multi-valued, modal...).
- Impact in the literature and cinema.
- Alternance of enthusiasm and deception.

1945: John Von Neumann (1903-1957) - bases of computer architecture.

1948: EDVAC (Electronic Discrete Variable Automatic Computer), based on this architecture.

1948: C. Shannon (1916-1957) - “A mathematical theory of communication”.

1948: Norbert Wiener (1894-1964) - “Cybernetics, or Control and Communication in the Animal and the Machine”.


1952-1960: Great (and sometimes unreasonable) enthusiasm
 Marvin Minsky (1927-2016) - AI: *The science of making machines do things that would require intelligence if done by men.*


 John McCarthy (1927-2011) - LISP.
1956: Dartmouth Summer Research Project on Artificial Intelligence
Proposed by John McCarthy, Marvin Minsky, Nathaniel Rochester and Claude Shannon.

We propose that a 2-month, 10-man study of artificial intelligence be carried out during the summer of 1956 at Dartmouth College in Hanover, New Hampshire. 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. An attempt will be made to find how to make machines use language, form abstractions and concepts, solve kinds of problems now reserved for humans, and improve themselves. We think that a significant advance can be made in one or more of these problems if a carefully selected group of scientists work on it together for a summer.
1956 Dartmouth Conference: The Founding Fathers of AI

John MacCarthy
Marvin Minsky
Claude Shannon
Ray Solomonoff
Alan Newell
Herbert Simon
Arthur Samuel
Oliver Selfridge
Nathaniel Rochester
Trenchard More
Symbolic AI

- Representing knowledge using symbols.
- Major role of logics.
- Rules to manipulate symbols.
- Search strategies.
Perceptron and next steps

- Used in computer vision.
- Limits demonstrated by Marvin Minsky and Seymour Papert (1928-2016) in “Perceptrons: an introduction to computational geometry” (e.g. xor can not be modeled).
- Important works in knowledge-based systems: MYCIN (mid 1970s), PROLOG (1972) by Alain Colmerauer and Philippe Roussel...
Expert systems and next steps

- Mostly in the 1980’s.
- Deception: expert systems do not meet all expectations.
- In parallel: Emergence of different communities in AI, with specific scopes, approaches, conferences... (KR, ML, Computer Vision, NLP, Robotics, Decision, Multi-Agents, Cognitive neurosciences...).

- Re-discovery of some features (back-propagation...).
- Deep networks (many layers).
- Convolutional neural networks.
1995-2006

- Difficulty of training.
- Other approaches are developed (SVM, optimization, statistics...).
- Vladimir Vapnik (1936-).
- Development of semantic web and ontologies.
Late 1990’s - Today

- But: more data, more computing resources.
- BigData
- Amazon (94), Google (98), Alibaba (99), Baidu (2000), Facebook (2004), Twitter (2006)...
- Development of Apple, Microsoft, IBM... for data sciences.
- 2011: IBM DeepQA wins Jeopardy!
- 2016: AlphaGo (Google DeepMind). Uses deep learning, Monte-Carlo search, reinforcement learning, plays against himself.
- Huge applications in computer vision.
Inspiration from cognitive functions

1. Receptive functions (acquisition, processing, classification, integration of information).
2. Memory and learning, storing, mining, knowledge inference.
3. Reasoning and computing.
4. Expressive functions, communication.
5. Executive functions for decision making and action.