The History of Machine Learning

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Gabriel Wagner
(sorted by letter count)
Some people and events that almost certainly played a role in the development of machine learning

Eleftherios Filippakis
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The foundation
The foundation

Posterior probability

\[ p(A|B) = \frac{p(B|A)p(A)}{p(B)} \]

Likelihood

Prior probability

- 1812 - Bayes Theorem
The foundation

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- 1913 - Markov Chains
The foundation

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- 1913 - Markov Chains
- 1949 - A little bit of Hebb’s rule
Alan Turing

I propose to consider the question, “Can machines think?”
The Bombe Machine

- Emulated human reasoning
- Decrypt german secret messages
- Tackling the enigma machine
- Similarity to machine learning
1950
Turing Learning Machine

- Learn and become artificially intelligent
- Foreshadowed genetic algorithms
1957

Perceptron

- Frank Rosenblatt
- Image recognition for the Navy
- One of the first Neural networks
“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 1958
Is Machine Learning a lie?
Abandon ship!

~ the ‘A.I. Winter’
1966-1990s
1954

Cold War Machine Translation target:
Instant translation of Russian documents and scientific reports.
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"The spirit is willing but the flesh is weak."
Translated into:
"The vodka is good but the meat is rotten."
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DARPA to fund:
"mission-oriented direct research, rather than basic undirected research."
1954

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1966

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1969

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1973

Sir James Lighthill report:
Utter failure of AI to achieve its "grandiose objectives."
continually occurred also in computer recognition of human speech or
Expert Systems

Lisp Machines, XCON
VAX 9000

‘70s - ‘80s

- LISP - the A.I. Language
- Decision making
- Huge profits

But(ter)

- Tons of “if-then” rules
- Costly maintenance
- No learning capability
5th Gen Computers
The prophecy from 1982 by M.I.T.I Japan

- Ideal A.I. Platform
- Massively Parallel Computing
- Distributed Computing
- Human-like Reasoning
New era of computing

- Multi Core CPUs & GPUs
- Deep Learning Frameworks
- Big Data
- And many more buzzwords...
Semi-Supervised Learning

Why Semi-Supervised Learning? - Obtaining labels are time consuming and expensive.
- Uses both labelled and unlabelled data.
- Large amount of unlabelled data and small amount of labelled data.

Assumptions Used:
- Smoothness Assumption
- Clustering Assumption
Active Learning

- A special case of Supervised Learning
- Active Learning chooses a subset of unlabelled to be labelled using querying strategies
- Uses Rules or an expert (e.g., human annotator) to label data.
Querying Strategies

- Querying in Batch
- Multi Instance Active Learning
- Multi-Task Active Learning
- Question raises about Noisy Data and Expert?
Google Brain (2011)

- Research on Deep Learning by Google started in 2011
- Devised a new software that can create detailed images from small pixelated images.
- Google Brain achieved this by a combination of two neural networks, firstly the Conditional Network (CNN) and a Prior Network (Pixel CNN)
Deep Face (2015)

- A leap in face recognition with accuracy level of 97.35%.
- Step 1 - Face Detection using HOG (Histogram of Oriented Gradients)
- Step 2 - Posing and Projecting faces (Face Landmark Estimation)
- Step 3 - Encoding Faces
- Step 4 - Finding the person’s name from the encoding (Using a linear SVM classifier), but also other classification
Where is Machine Learning Headed?

- Cloud-Hosted Intelligence.
- Virtual and Augmented Reality.
- Use of location based services to capture data.
Thank you for listening..
Discussion Points

1. In the presentation we heard a little about government funded A.I. research for e.g. military applications. Today there are big companies like Google and Facebook making a lot of progress. How is the direction of A.I. research affected by where the funding is coming from?

2. Was the A.I. winter inevitable or could there have been a completely different evolution during that time? Where would we be today if the interest had been higher? Is there any risk for a new "winter"?

3. What do you think is the best way forward today: building A.I.s for specific applications or trying to have a sort of “fundamental research” for A.I.? Which are the pros and cons with each?
Literature

- Timeline of Machine Learning
- Alan Turing and the Development of AI
- Funding a revolution: government support for computing research
- The Lighthill report
- From Theories to Queries: Active Learning in Practice
- DeepFace: Closing the Gap to Human-Level Performance in Face Verification
Pictures

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