Marvin Minsky
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Perceptrons versus symbolic computation

- **The Perceptron: A Probabilistic Model for Information Storage and Organization in the Brain**, published in 1958

Source

- The Perceptron: A Probabilistic Model for Information Storage and Organization in the Brain

Understanding brain

- Understanding the capability of higher organisms for perceptual recognition, generalization, recall, and thinking

QA 1

How is information about the physical world sensed, or detected, by the biological system?

QA 2

In what form is information stored, or remembered?

QA 3

How does information contained in storage, or in memory, influence recognition and behavior?

Position I

- Storage of sensory information is in the form of coded representations or images, with some sort of one-to-one mapping between the sensory stimulus and the stored pattern.

Position II

- The tradition of British empiricism hazards the guess that the images of stimuli may never really be recorded at all, and that the central nervous system simply acts as an intricate switching network, where retention takes the form of new connections, or pathways, between centers of activity.

Coded memory theorists

- Position I
- Conclude that recognition of any stimulus involves the matching or systematic comparison of the contents of storage with incoming sensory patterns, in order to determine whether the current stimulus has been seen before, and to determine the appropriate response from the organism

The theorists in the empiricist tradition

- Position II
- Combine the answer to the third question with their answer to the second
- Since the stored information takes the form of new connections, or transmission channels in the nervous system (or the creation of conditions which are functionally equivalent to new connections), it follows that the new stimuli will make use of these new pathways which have been created, automatically activating the appropriate response without requiring any separate process for their recognition or identification.

Position II

- The perceptron is designed to illustrate some of the fundamental properties of intelligent systems in general

Learning

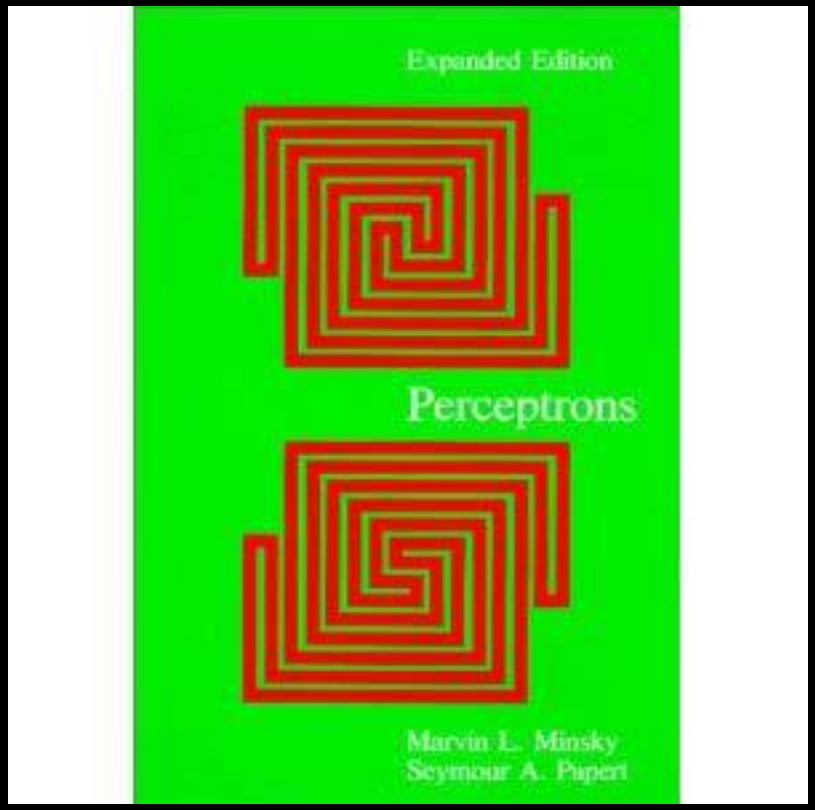
- Ashby (1) and von Neumann (17, 18)
- The problems of how an imperfect neural network, containing many random connections, can be made to perform reliably those functions which might be represented by idealized wiring diagrams.

Symbolic logic

- Unfortunately, the language of symbolic logic and Boolean algebra is less well suited for such investigations.

- Perceptrons: An Introduction to Computational Geometry, Expanded Edition [Paperback] Marvin L. Minsky (Author), Seymour A. Papert (Author)

Amazon.com: Perceptrons: An Introduction to Computational Geometry



- IEEE: Perceptrons: An Introduction to Computational Geometry

- Minsky reviews

Review

- Reviews

- Marvin Minsky - Wikipedia, the free encyclopedia

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- *Perceptrons* - the first systematic study of parallelism in computation - has remained a classical work on threshold automata networks for nearly two decades.

- It marked a historical turn in artificial intelligence, and it is required reading for anyone who wants to understand the connectionist counterrevolution that is going on today.

- Artificial-intelligence research, which for a time concentrated on the programming of Von Neumann computers, is swinging back to the idea that intelligence might emerge from the activity of networks of neuronlike entities.

- Minsky and Papert's book was the first example of a mathematical analysis carried far enough to show the exact limitations of a class of computing machines that could seriously be considered as models of the brain.

- Now the new developments in mathematical tools, the recent interest of physicists in the theory of disordered matter, the new insights into and psychological models of how the brain works, and the evolution of fast computers that can simulate networks of automata have given *Perceptrons* new importance.

- Witnessing the swing of the intellectual pendulum, Minsky and Papert have added a new chapter in which they discuss the current state of parallel computers, review developments since the appearance of the 1972 edition, and identify new research directions related to connectionism.

- They note a central theoretical challenge facing connectionism: the challenge to reach a deeper understanding of how "objects" or "agents" with individuality can emerge in a network.

- Progress in this area would link connectionism with what the authors have called "society theories of mind." Marvin L. Minsky is Donner Professor of Science in MIT's Electrical Engineering and Computer Science Department. Seymour A. Papert is Professor of Media Technology at MIT.

- *Neural Nets and the Brain Model Problem*, Ph.D. dissertation, Princeton University, 1954. The first publication of theories and theorems about learning in neural networks, secondary reinforcement, circulating dynamic storage and synaptic modifications.

- Marvin Lee Minsky was born in New York City to a Jewish family,[1] where he attended The Fieldston School and the Bronx High School of Science.

- He later attended Phillips Academy in Andover, Massachusetts. He served in the US Navy from 1944 to 1945. He holds a BA in Mathematics from Harvard (1950) and a PhD in the same field from Princeton (1954).[2] He has been on the MIT faculty since 1958. In 1959[3] he and John McCarthy founded what is now known as the MIT Computer Science and Artificial Intelligence Laboratory. He is currently the Toshiba Professor of Media Arts and Sciences, and Professor of electrical engineering and computer science.

- Bronx High School of Science
- google map

- Marvin Minsky's Home Page

Exercise I (Last week)
Lines and Hyper-planes

- Draw a line
  - $y=2x-1$
- Draw addition of two lines
  - $f_1(x)=y=2x-1$
  - $f_2(x)=y=-3x+1$
  - $f(x)=f_1(x)+f_2(x)$

Exercise I: Nonlinear functions and Hyper-planes

- Draw a hyper-tangent
  - $y=\tanh(2x-1)$
- Draw addition of two hyper-tangents
  - $f_1(x)=y=\tanh(2x-1)$
  - $f_2(x)=y=\tanh(-3x+1)$
  - $f(x)=f_1(x)+f_2(x)$

Last week
Exercise II: Line fitting

- X=[1 -1 1.5 -1.5 2 -2]
- Y =[1 -3 2 -4 3 -5]
- Find a and b such that y=ax+b well fits paired data in X and Y
- Draw line and points

Exercise II

- x=(-1.8,-1.6,-1.4,-1.2,-0.8,-0.6,-0.4,-0.2,0,0.2,0.4,0.6,0.8,1.0,1.2,1.4,1.6,1.8,2.0)
- y=tanh(2*x-1)
- y=?

Exercise III: One tanh

- x=(-1.8,-1.6,-1.4,-1.2,-0.8,-0.6,-0.4,-0.2,0,0.2,0.4,0.6,0.8,1.0,1.2,1.4,1.6,1.8,2.0)
- y=tanh(2*x-1)
- Find a, b and c such that y=atanh(bx+c) well fits paired data in x and y
- Draw line and points

Exercise IV:

- x=(-1.8,-1.6,-1.4,-1.2,-0.8,-0.6,-0.4,-0.2,0,0.2,0.4,0.6,0.8,1.0,1.2,1.4,1.6,1.8,2.0)
- y=tanh(2*x-1)+tanh(-3*x+1)
- y=?

Exercise V: Two hyper-tangent functions

- x=(-1.8,-1.6,-1.4,-1.2,-0.8,-0.6,-0.4,-0.2,0,0.2,0.4,0.6,0.8,1.0,1.2,1.4,1.6,1.8,2.0)
- y=tanh(2*x-1)+tanh(-3*x+1)
- Find a1, b1, c1,a2, b2, c2 such that y=a1*tanh(b1*x+c1)+a2*tanh(b2*x+c2) well fits paired data in X and Y