Neural Networks

Presentation for
VB038 English conversation
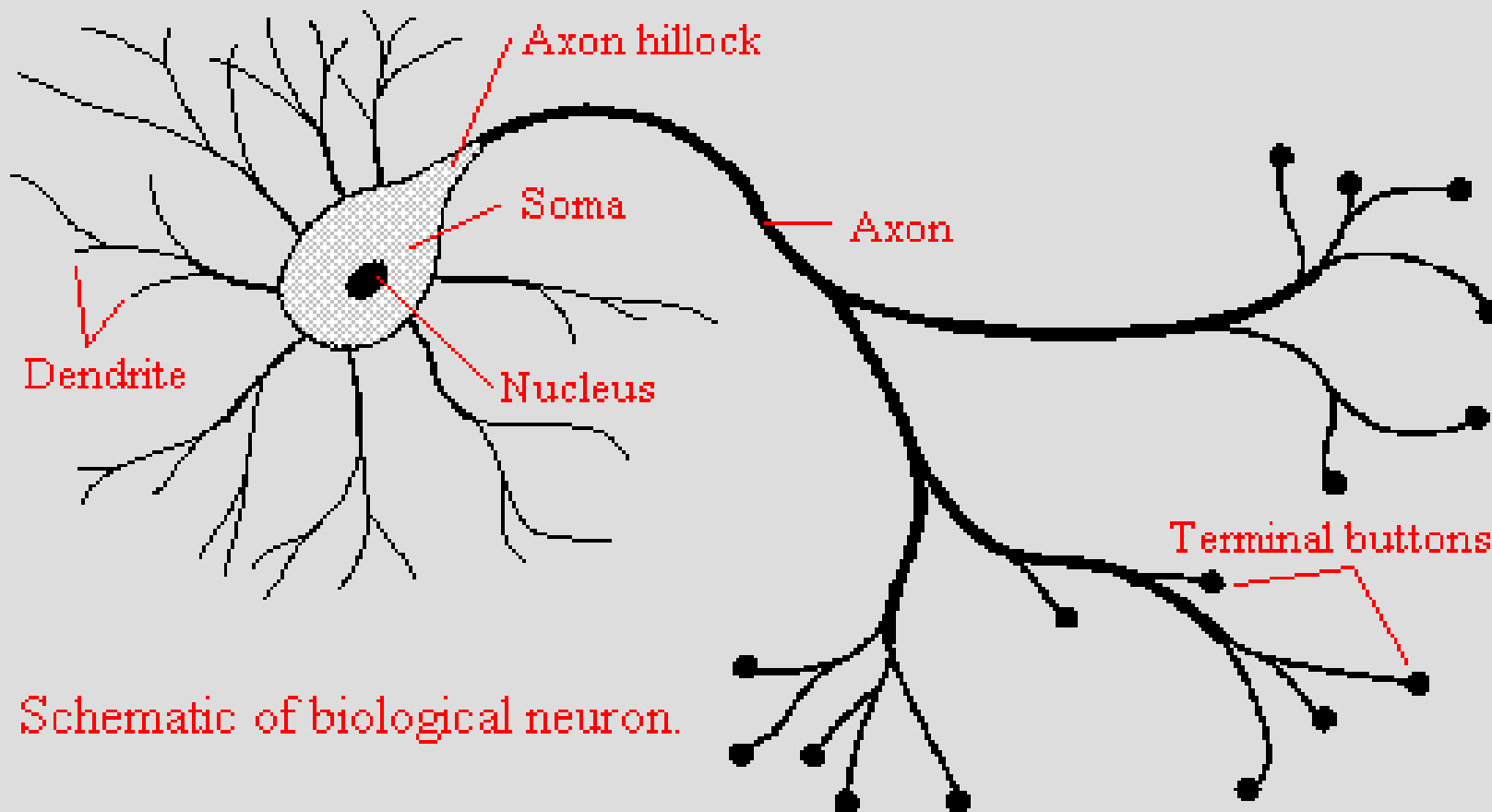
author:
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Outline

- Motivation
- Biological and formal neurons
- Activation function
- Simple neural network
- NN types
- Backpropagation NN
- Learning
- Applications

Motivation

- Can machines think?
- Is intelligence more than a set of rules?
- Can intelligence be injected into the matter?
- Materialism vs idealism
- Alan Turing's prediction
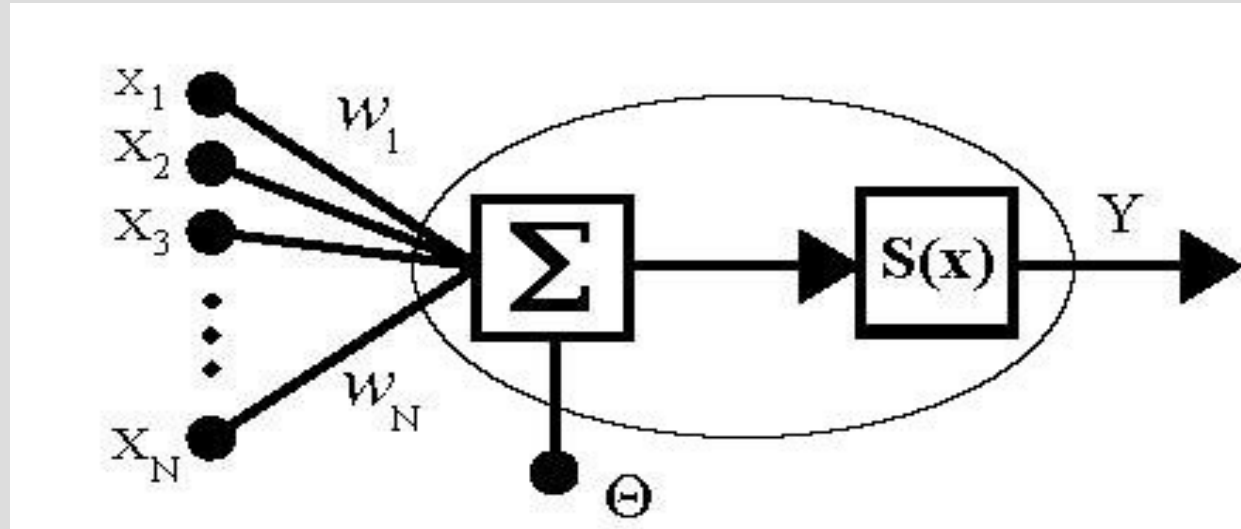- Turing's test
- Emergentism

Biological neuron

Schematic of biological neuron.

from http://www.swarthmore.edu/NatSci/echeeve1/Ref/HH/index.htm

Formal neuron - perceptron

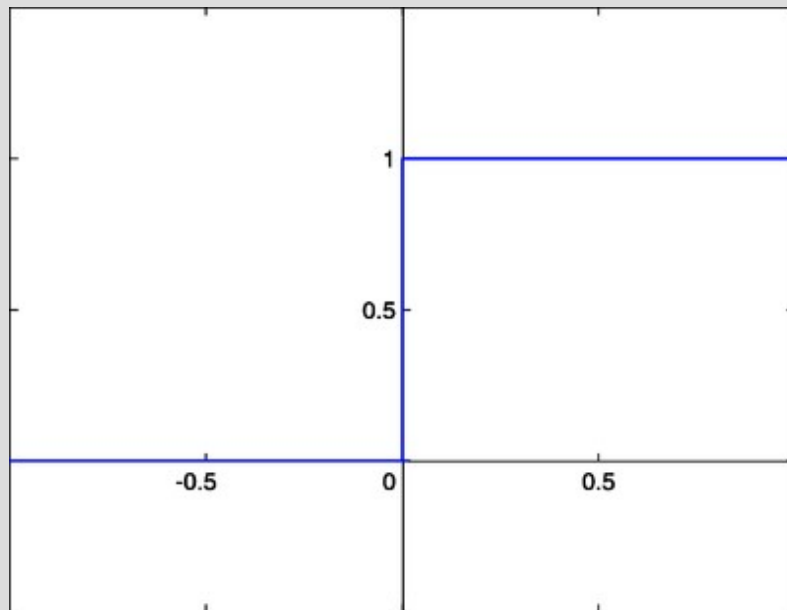from http://kryten.mm.rpi.edu/SEP/index8.html

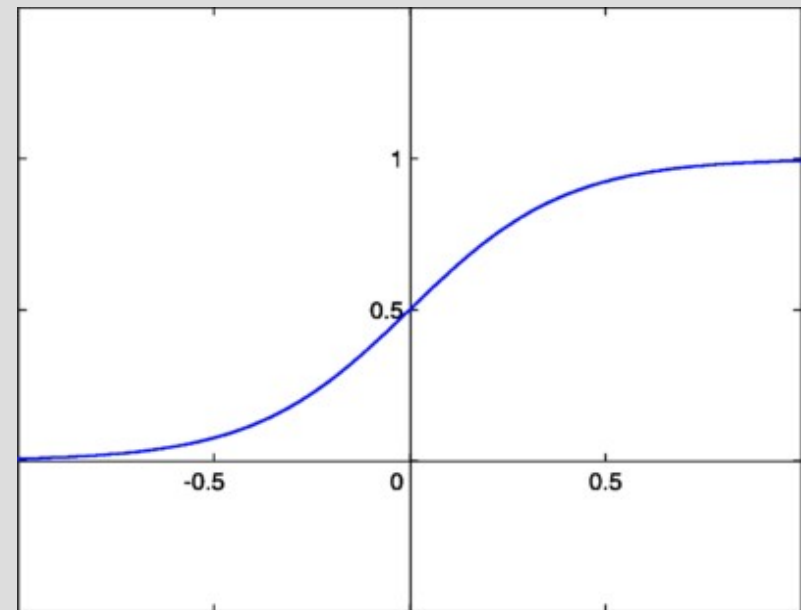$$Y = S \left(\sum_{i=0}^{N} w_i x_i \right)$$

S is called activation function
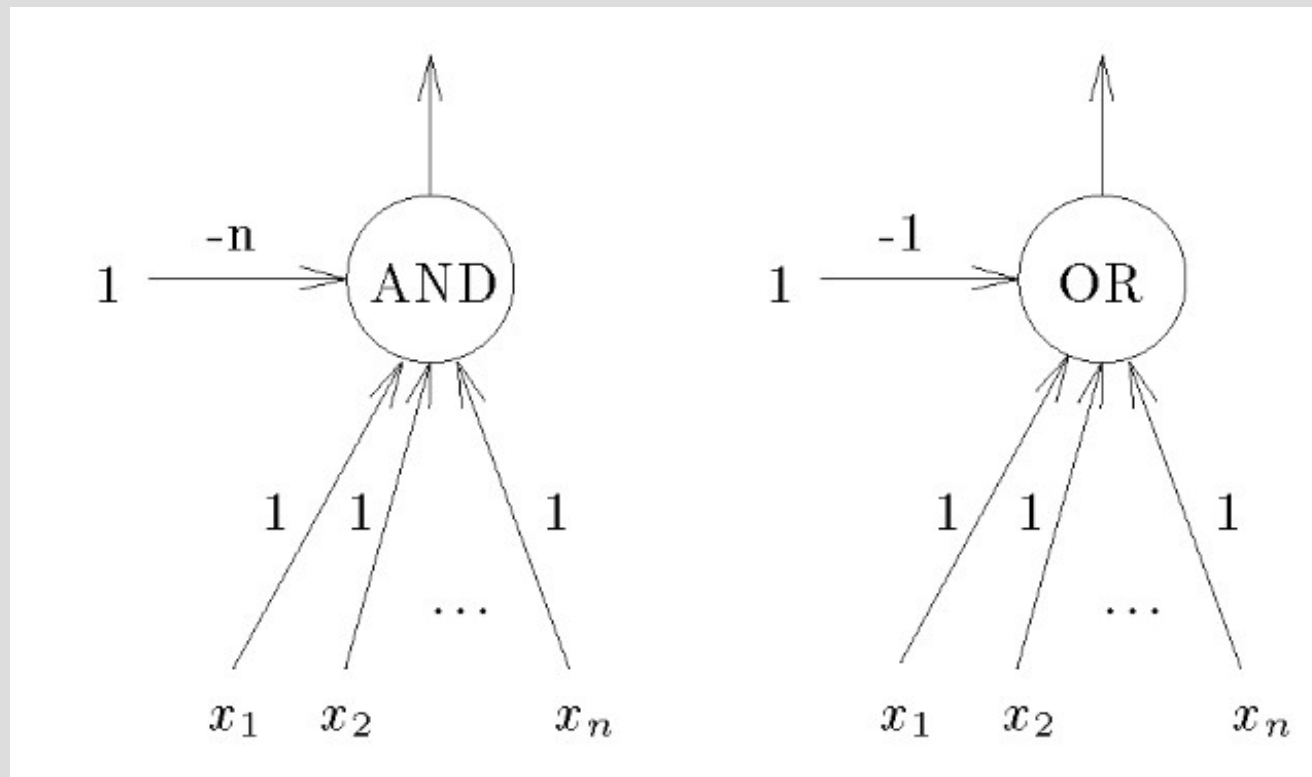
Activation functions

Step Function

Sigmoid Function

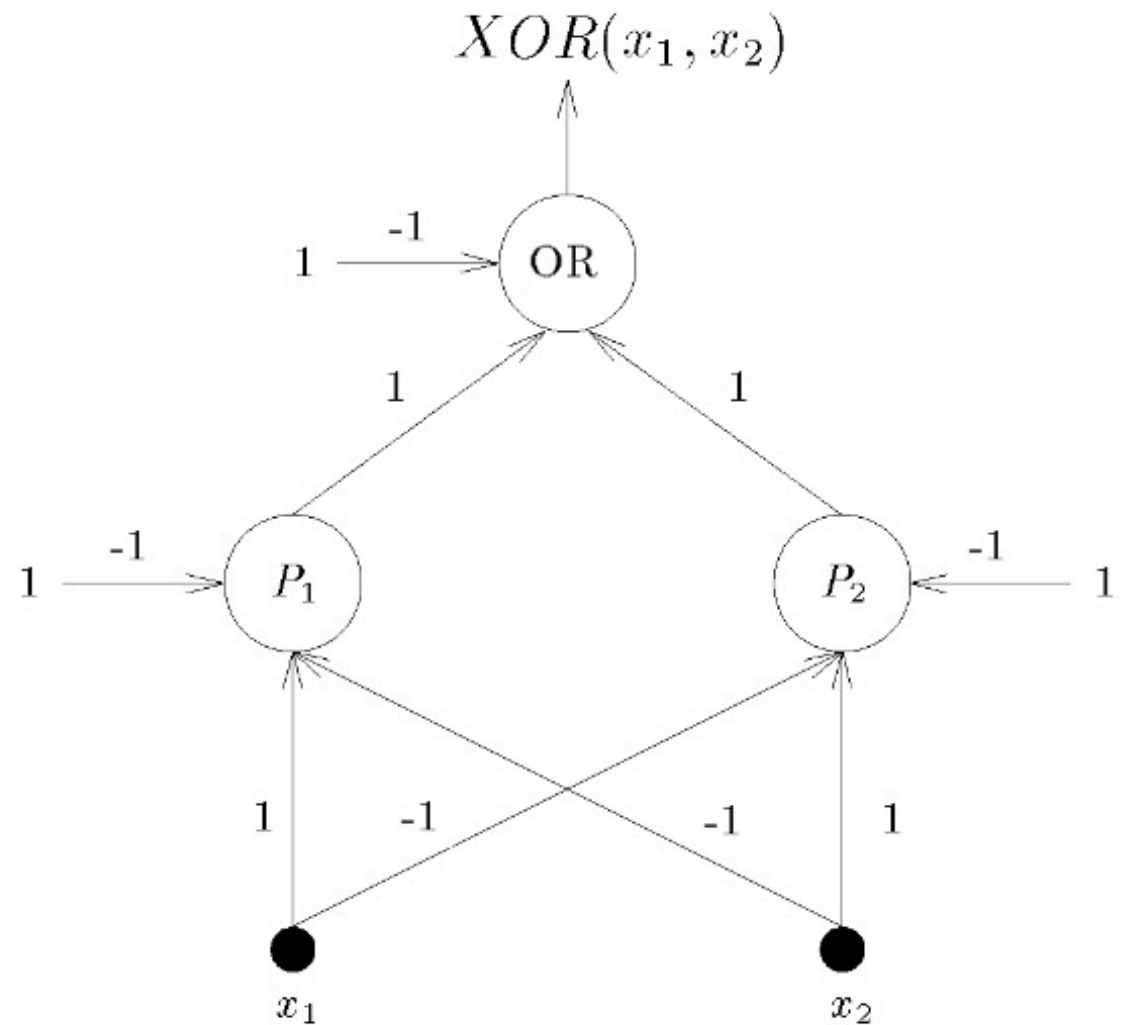from http://en.wikibooks.org/wiki/Artificial_Neural_Networks/Activation_Functions

Simple example

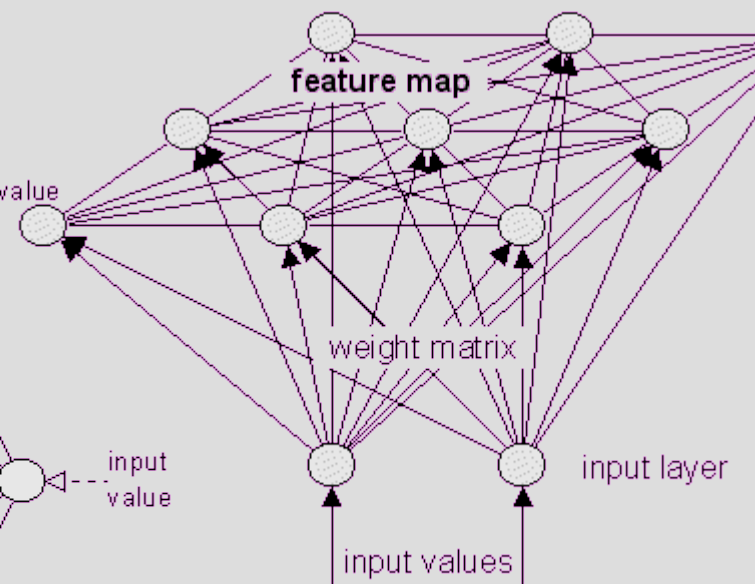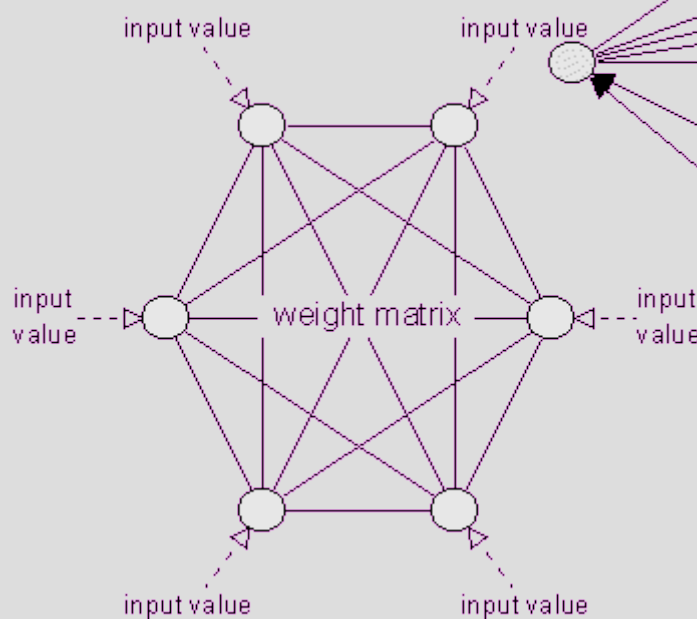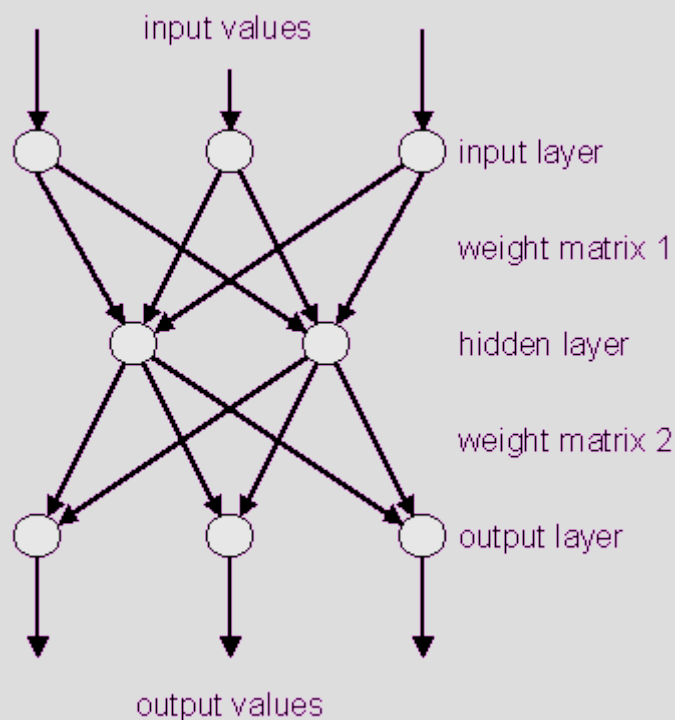One perceptron realizing AND and OR

Simple example

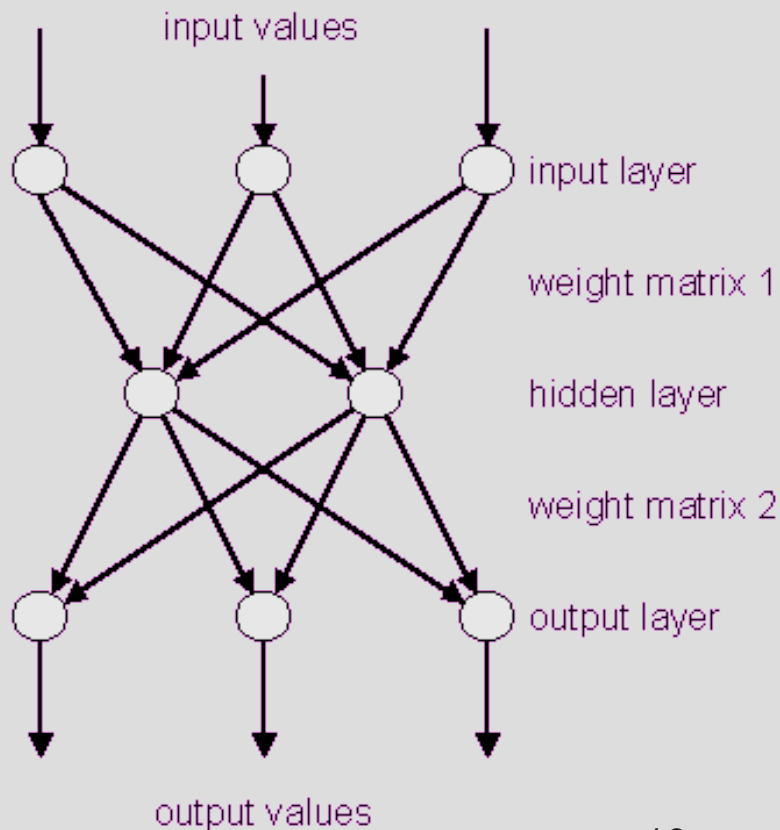| x1	x2	Y
0	0	0
0	1	1
1	0	1
1	1	0

NN types

- Multilayer Backpropagation NN
- Hopfield NN
- Kohonen's Self-Organizing Map (concept storing)

Multilayer Backpropagation NN

- Organization dynamics (topology)
- Active dynamics (computation)
- Adaptive dynamics (learning)

input values

input layer

weight matrix 1

hidden layer

weight matrix 2

output layer

output values

Supervised learning

- Learning with teacher
- Given set of example pairs (x,y)
- x is an input vector, y is the desired output vector
- The goal is to minimize the error of NN
- Backpropagation of error
- Adjusting weights
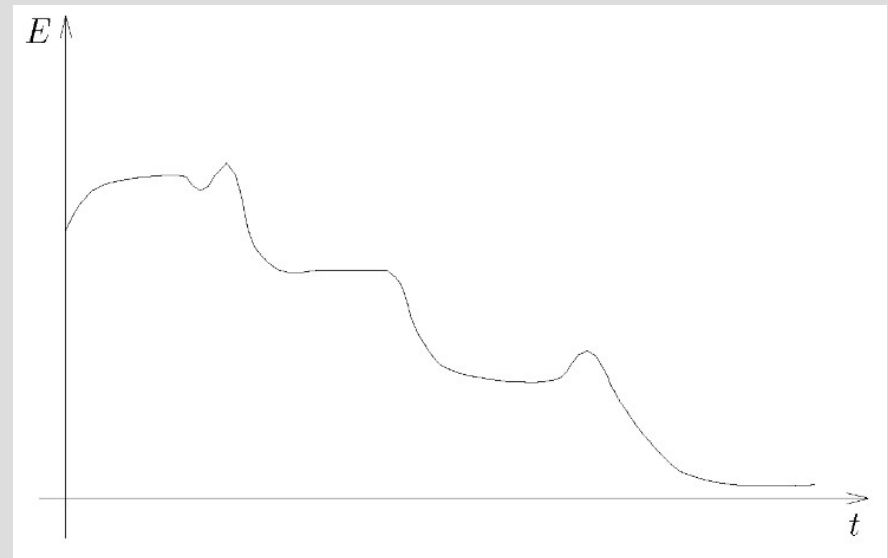
Applications

- Time series prediction (market)
- Classification
- Pattern recognition
- Vehicle control
- Game-playing (chess)
- Filtering spam
- OCR
- CAPTCHA breaker
- etc.

Intelligence?

- Reduction
- 100,000,000,000
- ASIMO
- Turing's test
- 2008 winner

judge: What's your favourite novel?

Elbot: I often read telephone books, or dadaist poetry: Brä brä brä brä brä.

judge: Typical computer!

Elbot: You tend towards generalizations. But I must admit, so do I. However, my generalizations are firmly grounded in statistical theory.

judge: What do you think of KW's enthusiasm for having machines take over the world?

Elbot: Fix it up a bit first. Then I'll take it over.

Courses at MU

- PSY481 Introduction to cognitive science
- PV021 Neural Networks
- PV056 Machine Learning and Data Mining
- VIKMB03 Machine Learning
- PA164 Machine learning and natural language processing

The end

Thank you

(Demo)

Q&A