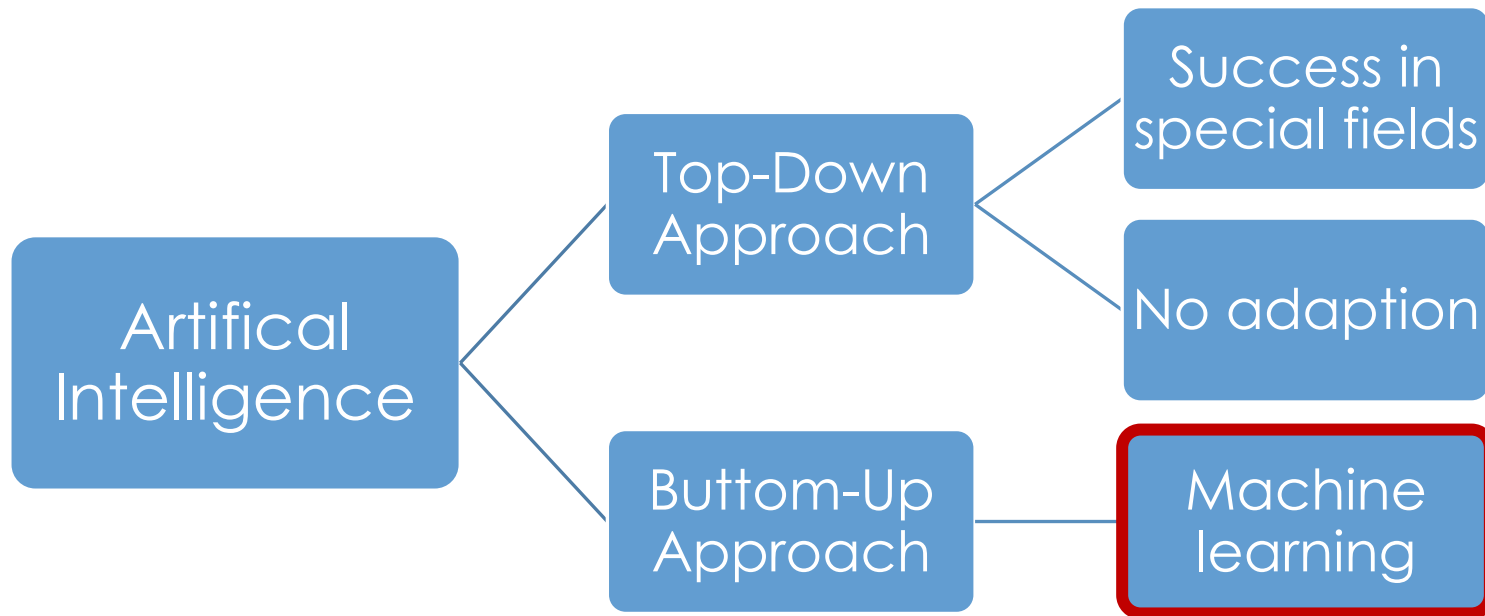17.11.2014

(artificial) Neural Networks

1

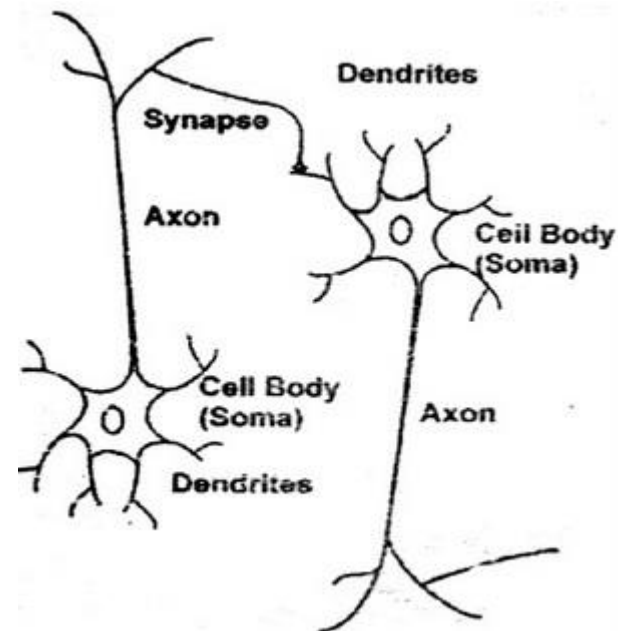# Content

- State of the Art
- Artificial neuron
- Networks
- Learning
- Application

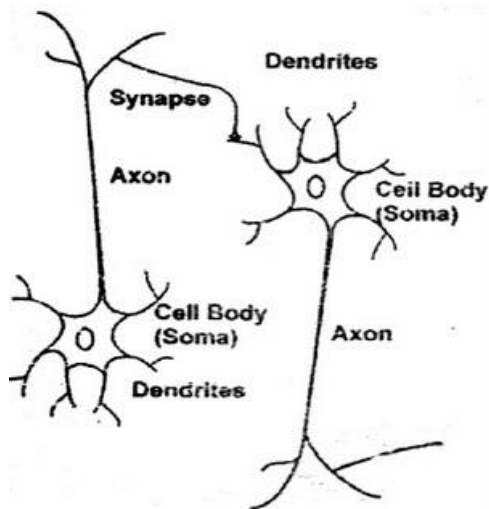# State of the Art

```
Artifical Intelligence
 ├── Top-Down Approach
 │     ├── Success in special fields
 │     └── No adaption
 └── Buttom-Up Approach
       └── Machine learning
```

Neurons

- Build our central nervous system
- Crucial for learning, thinking etc

Artifical Neurons

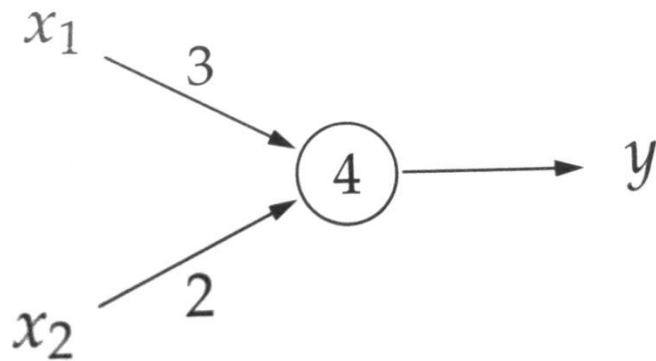**Biological neuron**   **Perceptrom**
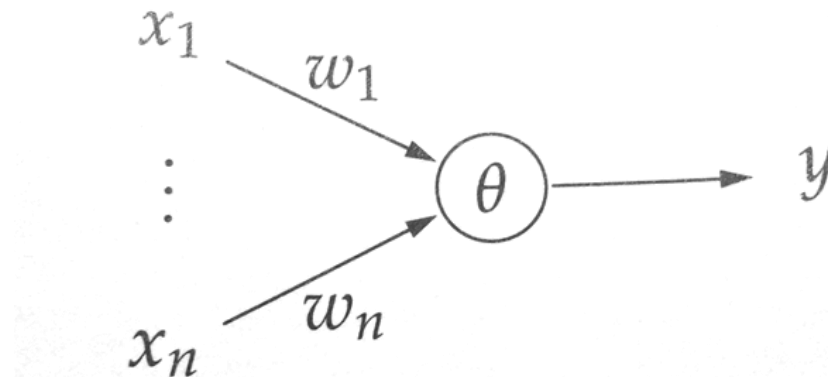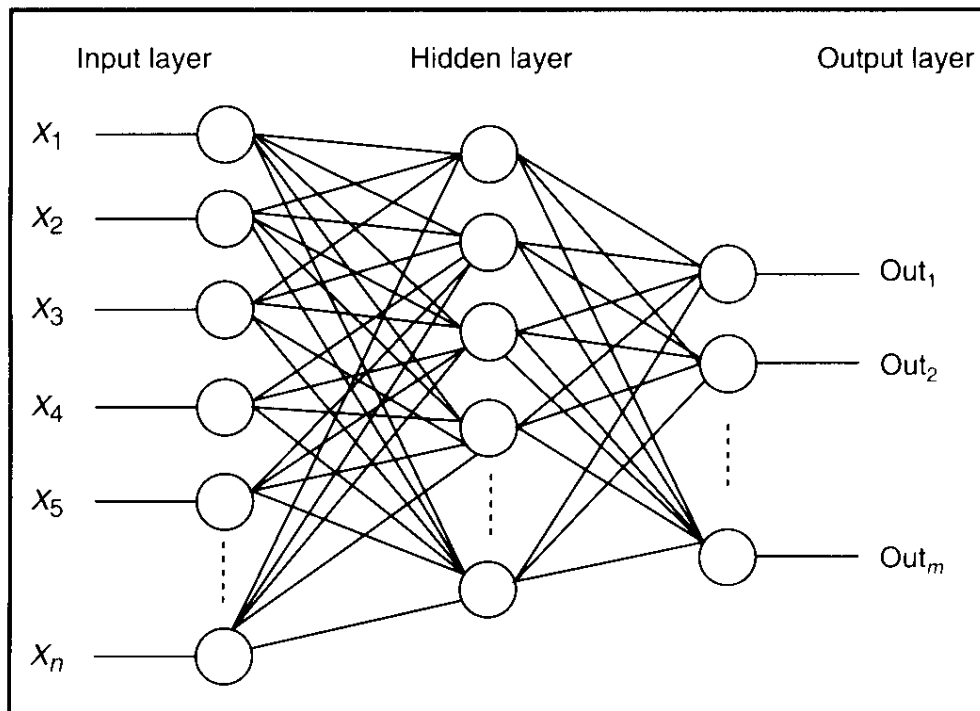
Example

- (A ∧ B)

x₁	x₂	3x₁ + 2x₂	y
0	0	0	0
1	0	3	0
0	1	2	0
1	1	5	1

Networks of Neurons

- More power
- Basic neural network

Learning

- Testing and learning is main objective
- Test data (input)
- Foreward-propagation (calculation output)
- Comparison to desired outcome
- Improvement/changes (but how?)

# How does the network adapt?

- Delete or create connections

- **Change weights**

- Change threshold

- Delete or create neurons

Learning with Neural Networks

- Unsupervised Learning
- Reinforced learning
- Supervised learning
  - offline-/batch learning
  - online

Applications

- Finding structures, analysing data
  - Financial forecast
  - Image processing
- Science
- Robotics
  - Decision making
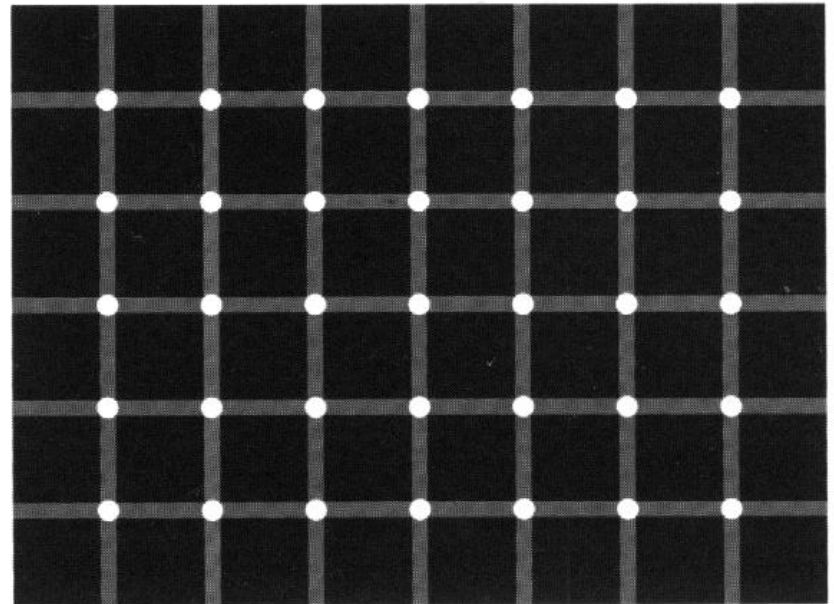
Why use Neural Networks?

- Can learn
- Powerful tool for approximation (salesman problem)
- Fast
- Little programming
- Detect complex structures