



Advantages of Neuronal Systems

- adaptive
- extremely parallel → fast
- fault-tolerant
- robust to uncertain and incomplete data
- intelligent (whatever that means)
- low power

An example of where we aim

- Robots



vs.



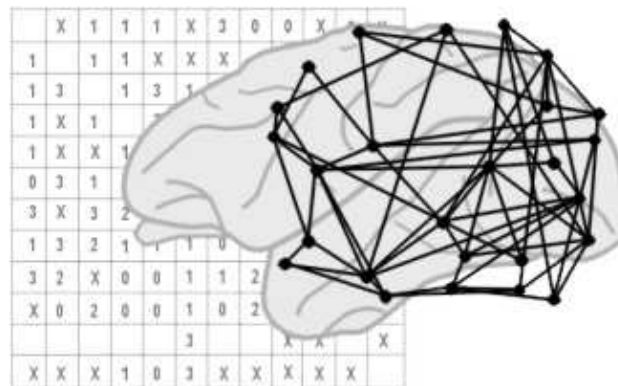
- Intelligent machines

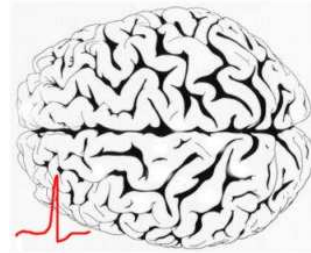
Computational/Theoretical Neuroscience

“Reverse engineering the brain”

- Study how the brain works
- Model brain functions
- Simulate brain functions

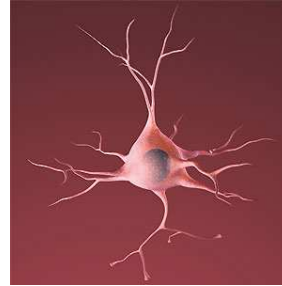
Researchers from many fields work on neuroscience questions, from philosophy to computer science.





- You will gain a basic understanding of neuronal information processing in the brain.
- You will become familiar with models of neuronal information processing.
- You will become familiar with biologically inspired information processing systems.
- You will become familiar with tools for analyzing complex systems.
- You will simulate simple models in MATLABTM.
- You will work with neuro-simulation tools.

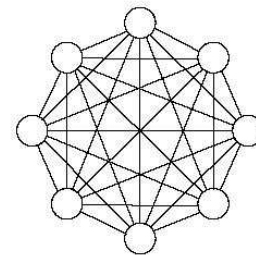
- Brain basics: neurons, synapses, organization.



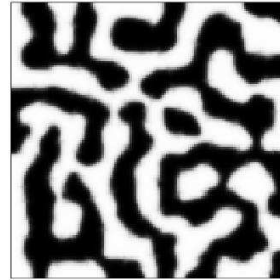
- Simple learning rules. (Application: ICA)



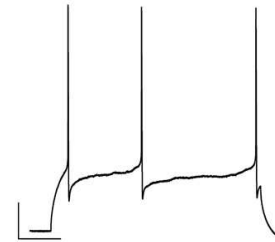
- Computation in recurrent networks. (Application: ESN)



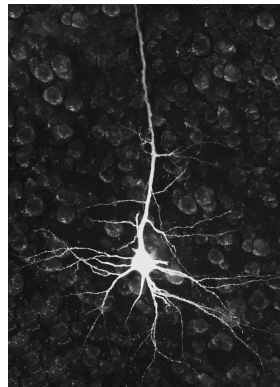
- Self organization: Map formation in visual cortex. (Application: SOM)



- Spiking neuron Models.



- Detailed neuron models.

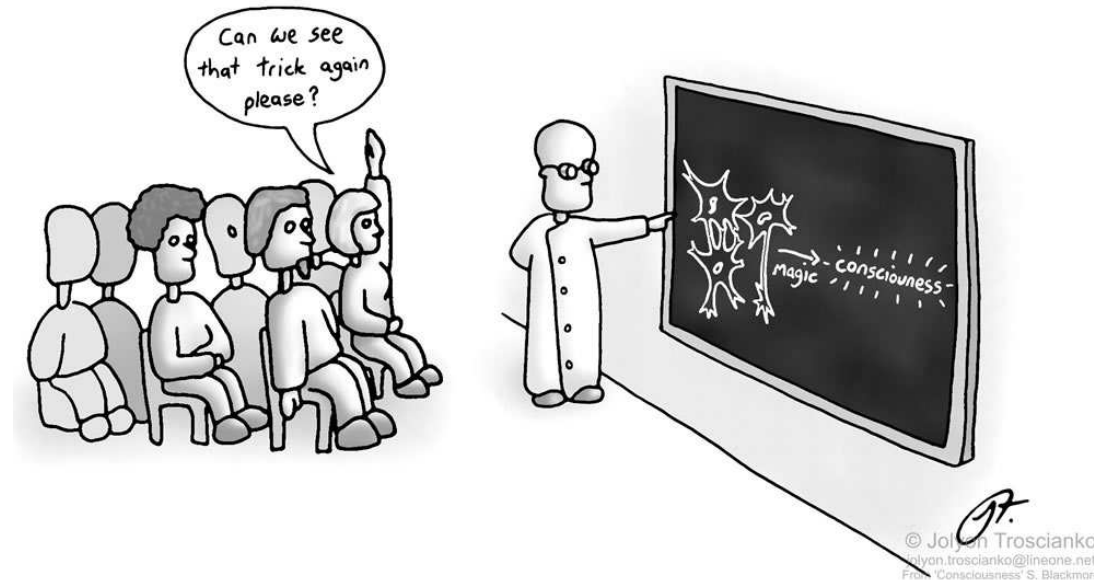


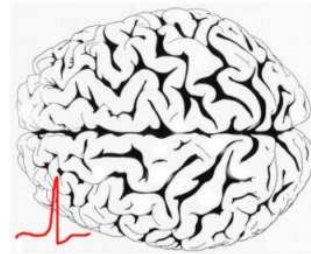
- Spike based learning.



- Reinforcement Learning in the brain.

- Models of how the brain works.





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