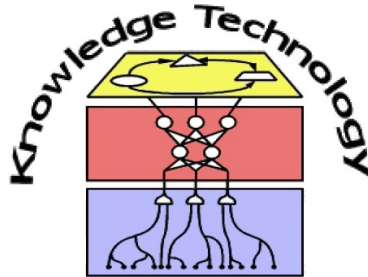


Praktikum Neuronale Netze

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Dept. of Informatics, Knowledge Technology



<http://www.informatik.uni-hamburg.de/WTM/>

<http://www.mincommsy.uni-hamburg.de/>

Who is Who

- Group: Knowledge Technology
 - Research into foundations, representations and applications of intelligent systems
 - Interested in nature-inspired hybrid neural & symbolic representations and learning methods
- Lecturers
 - Cornelius Weber
 - weber@informatik.uni-hamburg.de
 - Office: F-233
 - Prof. Stefan Wermter
 - wermter@informatik.uni-hamburg.de
 - Office: F-230

What is a Praktikum?

- Praktikum in general
 - Not a lecture
 - Practical lessons
 - Work in a team
 - Self-guided exploration under supervision

- Praktikum in detail
 - Preparation toward practical research and programming
 - Topics with a reduced difficulty
 - Main focus: learn how to apply theoretical knowledge

Neural Information Processing

- Information encoding and transmission in neurons
 - Neuronal layers and networks
 - Transformation and interpretation of raw sensory data
 - Reactive behavior
 - Learning and memory
 - Reasoning, planning and decision taking
 - ...
- Central requirement
 - Biological, physical, mathematical and computational sciences combined
 - Mathematical equations transformed into computer programs
 - Abstraction to the level of hypotheses, models and algorithms
 - Simulations with real data

Goal of this Praktikum

- First experiences in neural information processing
 - Get an overview
 - It's not a lecture!
- Some skills in the scientific method
 - Learn some models of neural networks
 - Implement and test these models on data
 - Combine some of the models
 - Present your results in a talk

Support to Reach the Goal

- Guidance and advice
 - Some introductory lectures
 - Literature to get started from the tutor
 - Tutor available for questions

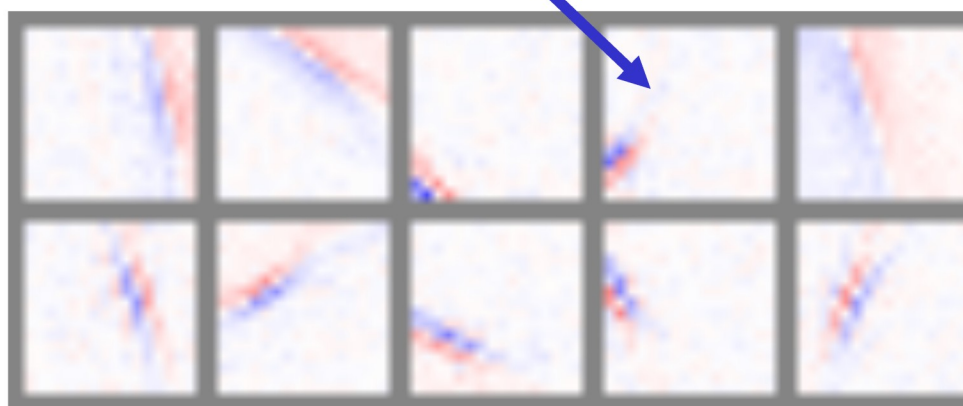
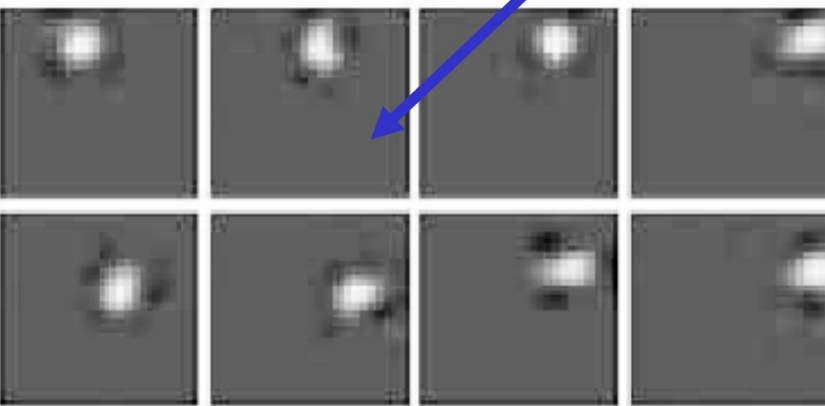
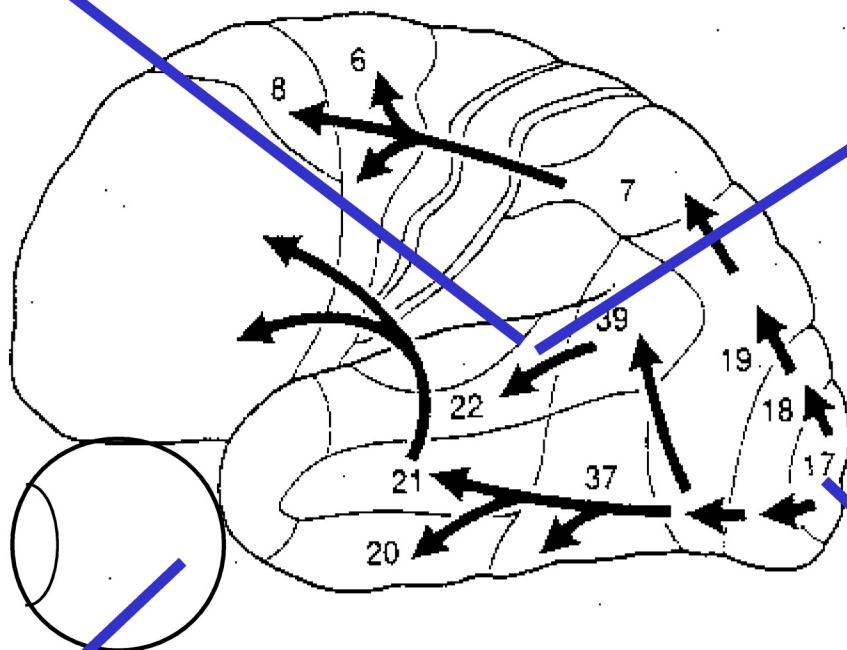
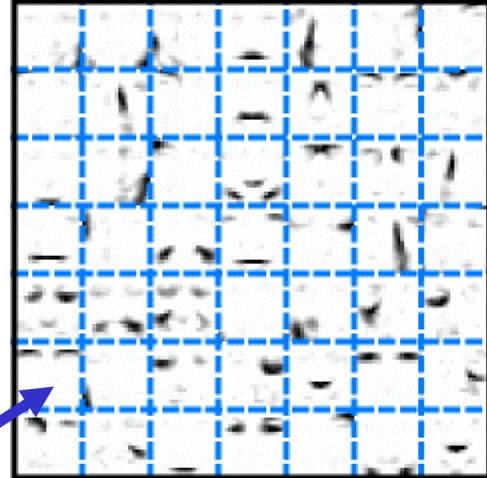
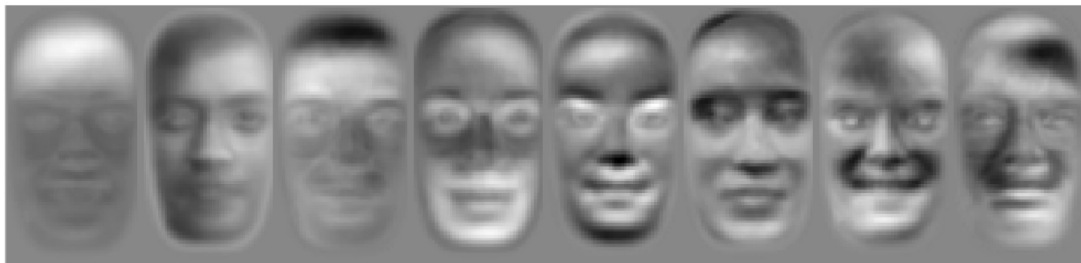
- Feedback from the group
 - Discussions
 - Update on progress
 - Feedback on the presentations

Tasks

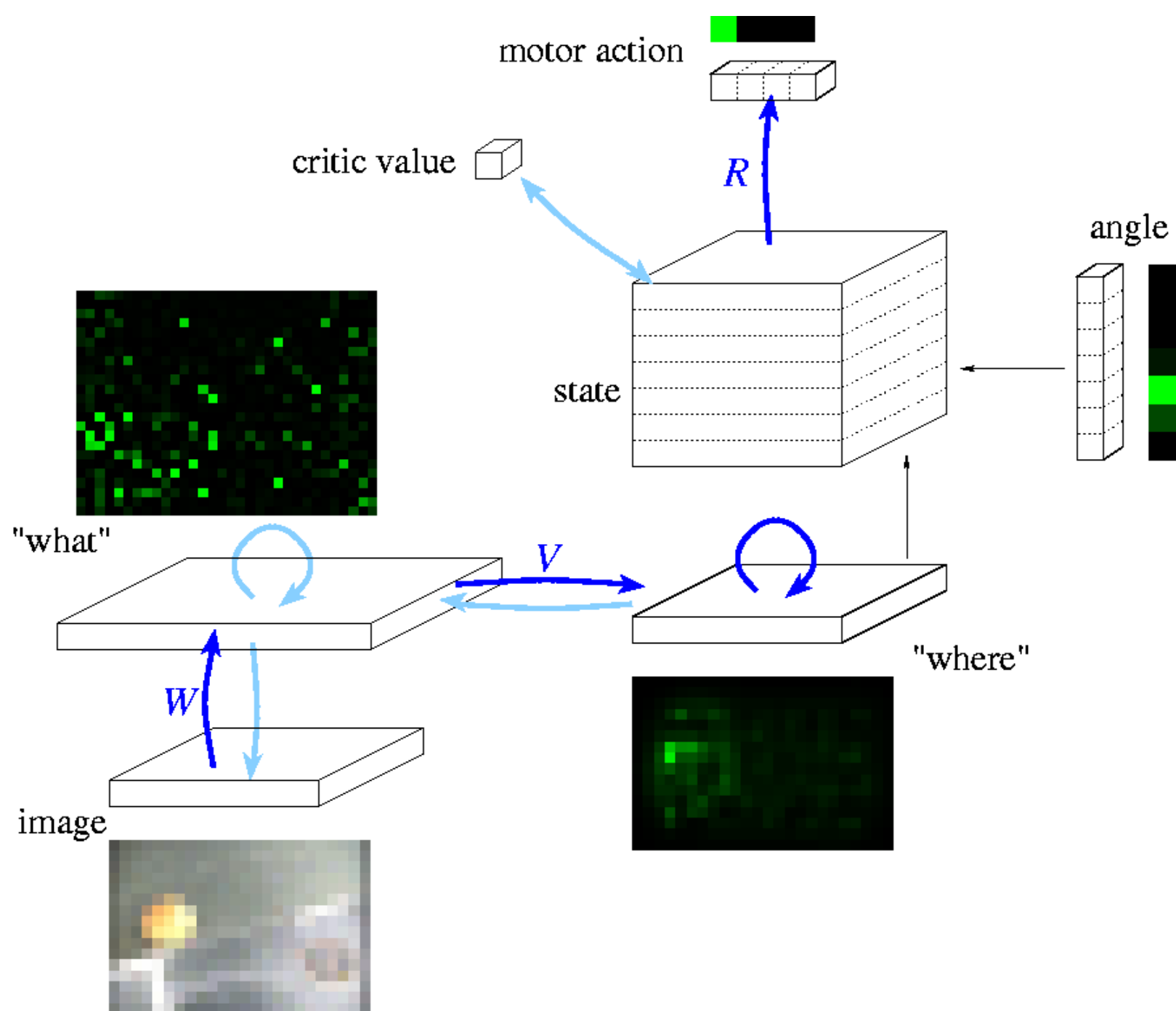
- Implement neural network models
 - Keep each architecture simple
- Elaborate and combine some models
 - Document the program
 - Give a 20 min talk (final presentation); 5-10 min discussion; slide templates recommended
- Participate actively
 - Attend the complete praktikum block
 - Discuss the problems, implementation details, learning progress
 - Maintain the deadlines – stay on track

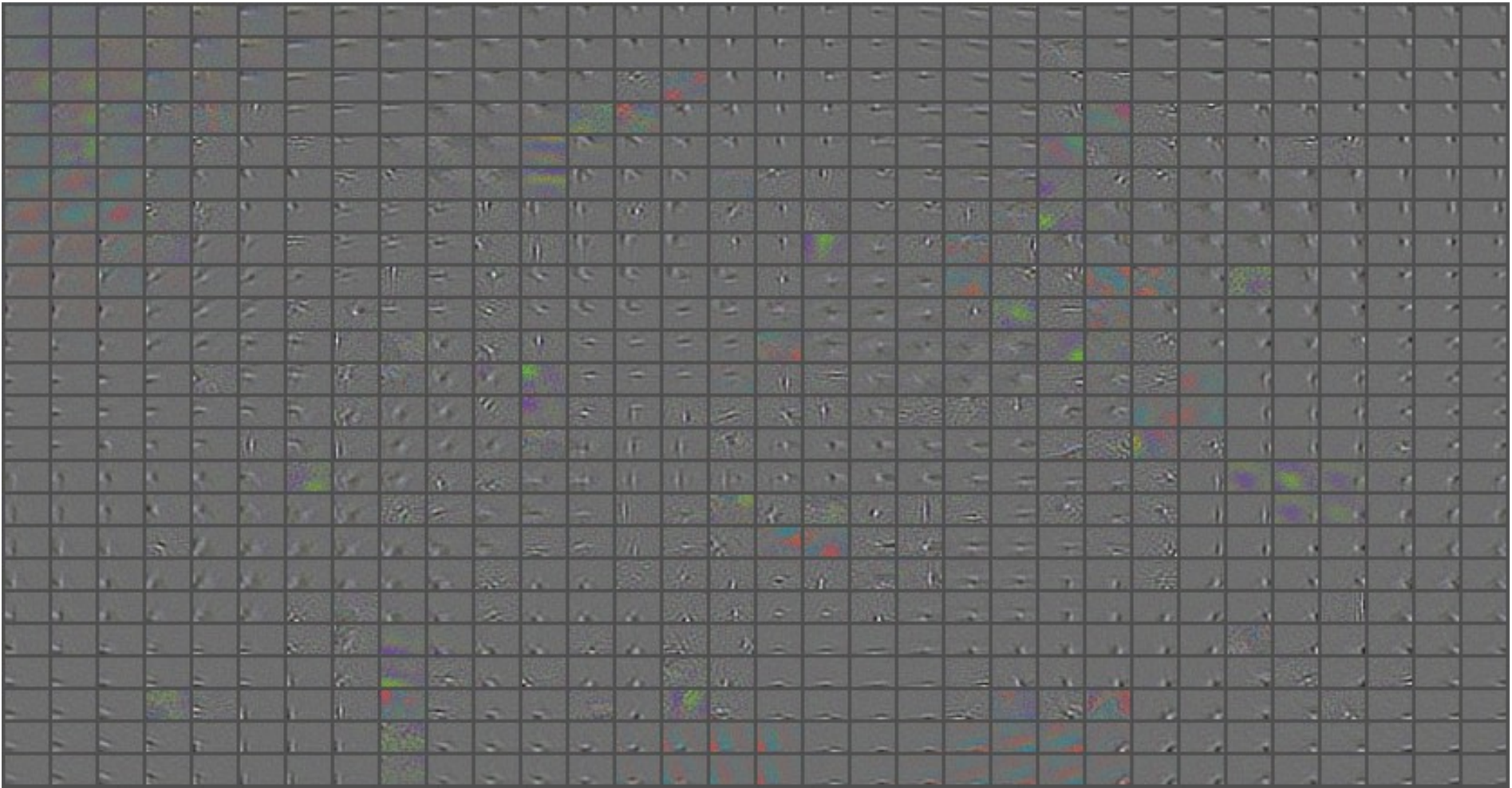
Possible Models

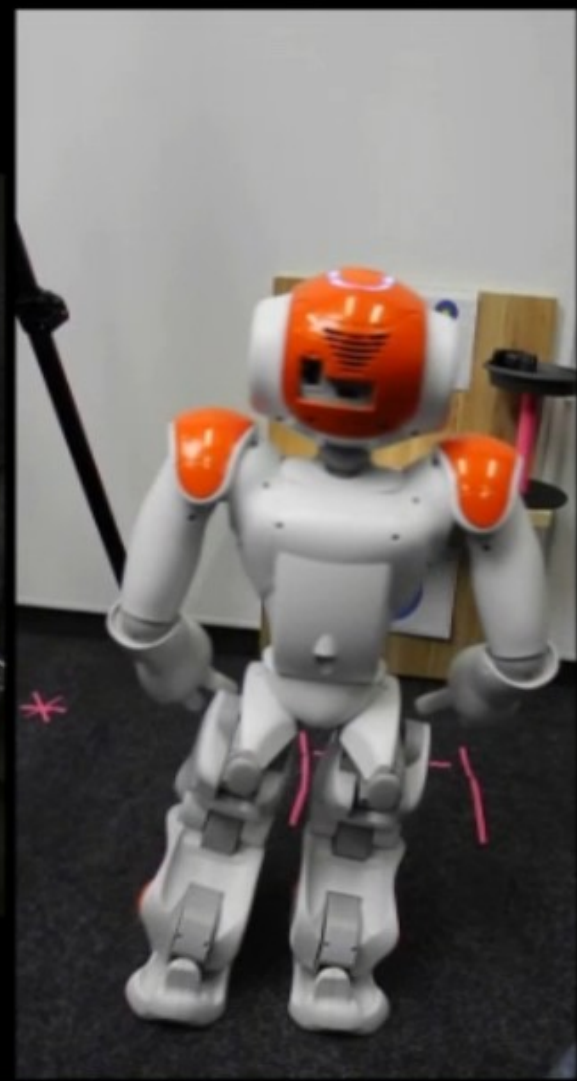
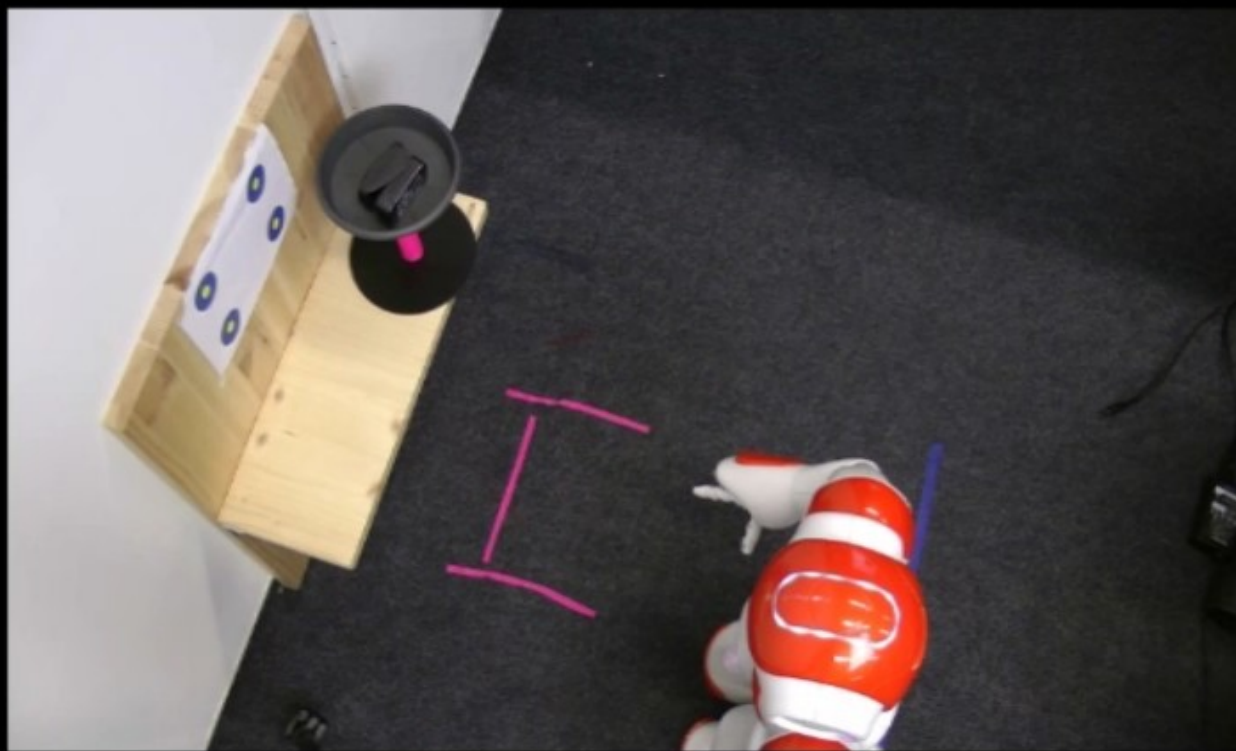
| | Feedforward networks | Recurrent networks |
|-------------------------------|---|--|
| Unsupervised learning | Self-organizing map (SOM), generative models | Hopfield network, Boltzmann machine |
| Supervised learning | Multi-layer perceptron (MLP) | Elman network |
| Reinforcement learning | Actor-critic, SARSA, CACLA | |











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Your next steps

- Choose (a) preferred model(s)
- May form groups of preferably 2 students each
- Join the MIN-CommSy room
- Test your RZ account and software on the WTM machines

- In the next 5 weeks:
 - Implement two network models
(each will be introduced in a mini-tutorial)
 - Read the initial material and possibly search for more
 - Specialise on one model:
 - Implement different variants of networks & find new data

And the further steps

- Before the Christmas break :
 - Discuss initial results and further plans with the group
 - Can form larger groups to combine models
- In the next year:
 - Based on the capabilities of your implemented network, work out an interesting novel problem
 - Read some literature to improve your own model (ask tutor)
 - May use software libraries, V-rep robot simulator, ...
- At the end of the lecture period:
 - Deliver your documented programs
 - Give a final presentation

Milestones and deadlines

- | | | |
|----|--------------|--|
| 1 | Mon, 13. Oct | Introduction; Choice of topics; Python Intro |
| 2 | Mon, 20. Oct | <i>e.g. Multi-layer perceptron</i> |
| 3 | Mon, 27. Oct | |
| 4 | Mon, 3. Nov | |
| 5 | Mon, 10. Nov | <i>e.g. Reinforcement learning</i> |
| 6 | Mon, 17. Nov | |
| 7 | Mon, 24. Nov | |
| 8 | Mon, 1. Dec | Discussion of plan with the group |
| 9 | Mon, 8. Dec | |
| 10 | Mon, 15. Dec | |
| 11 | Mon, 5. Jan | |
| 12 | Mon, 12. Jan | |
| 13 | Mon, 19. Jan | Prepare documentation and slides |
| 14 | Mon, 26. Jan | Presentation & Questions by audience & tutor |

Marks

- 33% Program
 - technical quality: performance/capabilities; extendable/modular programming style
 - user friendliness: installation and usage; clarity of documentation (maximum two pages!)

- 67% Presentation
 - technical quality: thorough, accurate, insightful; answer questions: understanding of the implemented networks
 - presentation clarity and style: slide quality, content, delivery, enthusiasm; adherence to schedule

The End

Thank you for your attention.
Any question?

Please take any printouts with you.

Websites:

- WTM: <http://www.informatik.uni-hamburg.de/WTM/>
- MIN-CommSy: <http://www.mincommsy.uni-hamburg.de/>
membership code: “NNpraktikum“