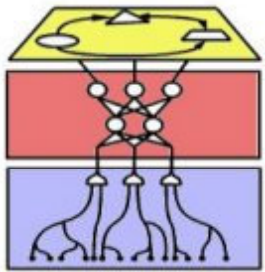


RobotDoc

Cognitive Robotics Research Methods Workshop



Dr. Cornelius Weber

Knowledge Technology Research Group

led by Prof. Stefan Wermter

Department of Computer Science

University of Hamburg, Germany



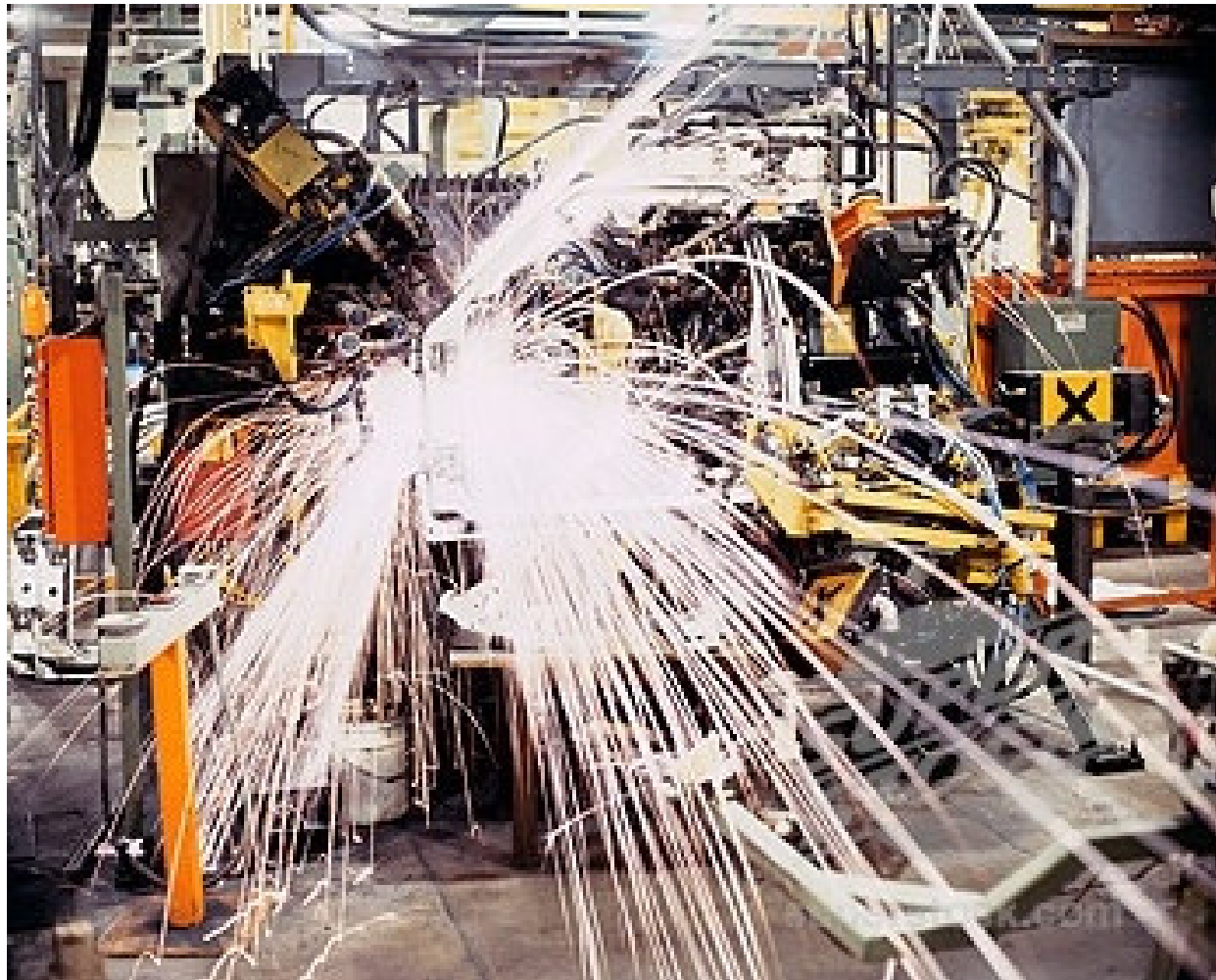
Lab overview of partner

- **University of Hamburg – internationally well known University in Intelligent Systems and Robotics**
- **Large number of DFG, EU, BMBF, and international projects**
- **New Institute for Knowledge Technology (from March 2010)**
- **Focus on Intelligent Systems, Natural Computing, Neural Networks, Cognitive Robotics, Language Processing, Data and Text Mining...**
- **RobotDoc key personnel: Prof. Stefan Wermter (PI), Dr. Cornelius Weber (lab manager), 2 RobotDoc Early Stage Researchers, Dieter Jessen (technician)**

Some recent research projects

- **What it means to communicate based on cortical assemblies (NestCom – EU)**
- **Cortical multimodal integration and Mirror Neurons (MirrorBot – EU)**
- **Sound localisation based on Inferior Colliculus (MICRAM – EPSRC)**
- **Emergent Neuroscience-inspired Architectures (Emernet – EPSRC)**
- **Visual homing based on Reinforcement Learning (MAC)**
- **Knowledgeable Service Robots for Aging (KSEDA – EU)**

Robot success in industry

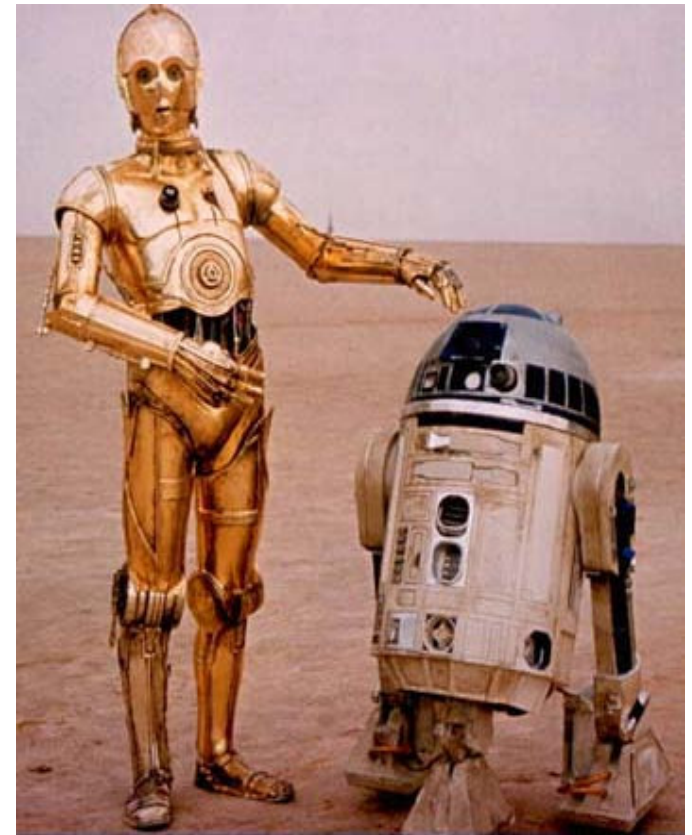


Why we need human oriented robots different from industrial robots

- Good performance for repetitive tasks
- No uncertainty but precision
- Only limited sensing
- No interaction with humans
- No learning, no development
- Complete re-programming for new tasks



The challenge: developing cognitive robots for elderly



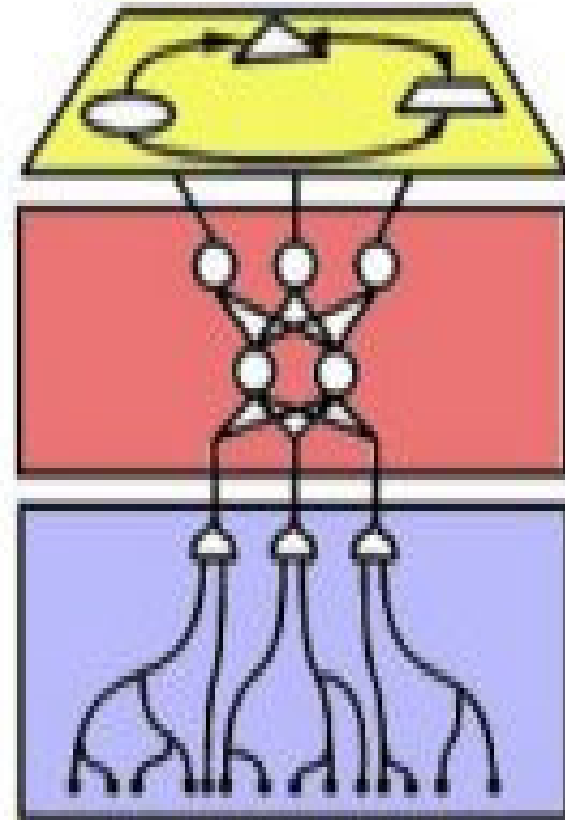
Robots need to reason, communicate, learn and develop many complex tasks...

Our approach: hybrid processing for learning cognitive robotics

- Symbolic knowledge and planning
- Fast encoding and manipulation
- Interpretable knowledge and rules

- Reactive behavior
- Neural connectionist learning
- Robustness

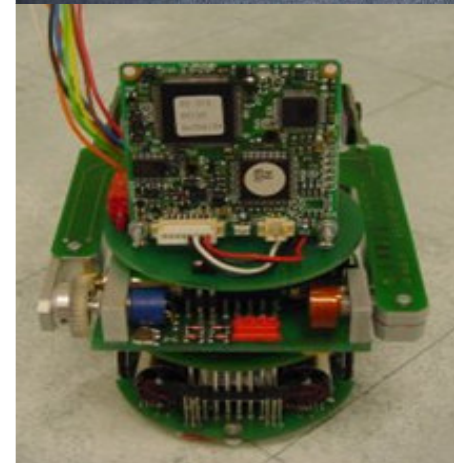
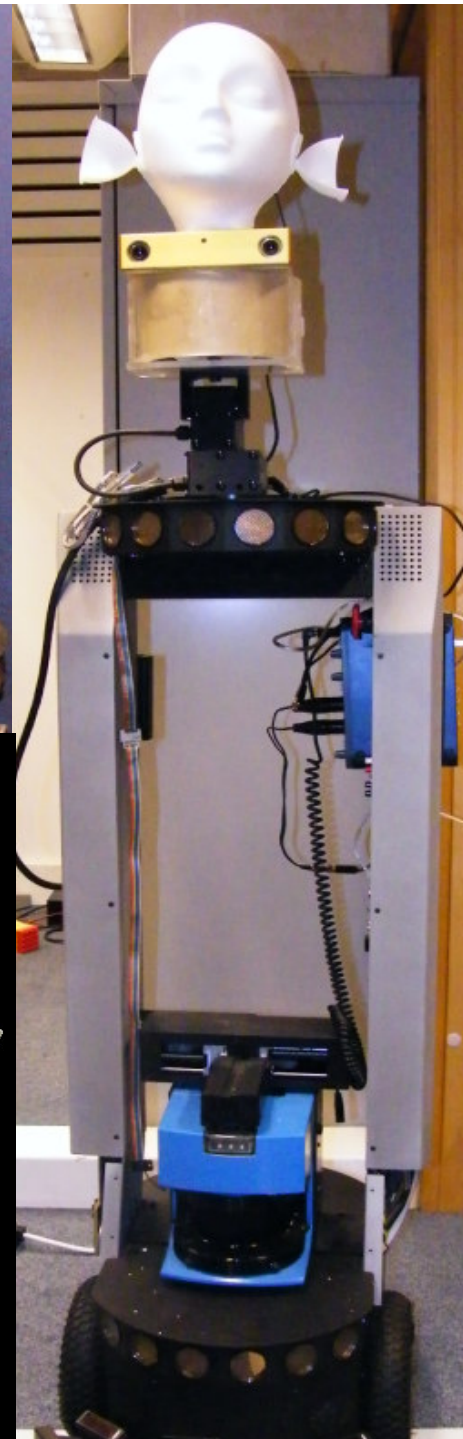
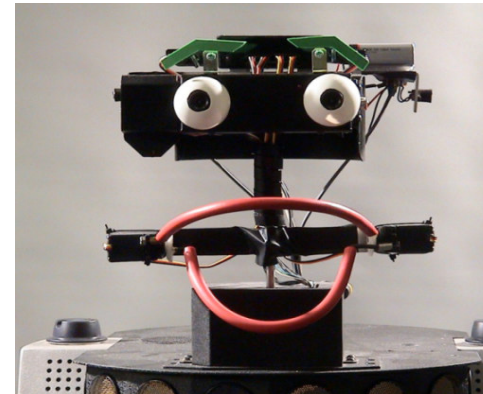
- Embodied bioinspired computation
- Neuroscience and plasticity
- Spatiotemporal integration



Research methodology

- **collect neuro/cognitive data (by psychologists etc)**
 - ↓
 - **identify architectures and develop computational models**
 - ↓
 - **train and evaluate a robot to perform actions e.g. based on visual perception and language input**
 - **feed back results to scientists and use for end users/patients (with psychologists etc)**
-
- ```
graph TD; A[■ collect neuro/cognitive data (by psychologists etc)] --> B[■ identify architectures and develop computational models]; B --> C[■ train and evaluate a robot to perform actions e.g. based on visual perception and language input]; C --> D[■ feed back results to scientists and use for end users/patients (with psychologists etc)]; C --> A;
```





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**web page to come ...**