EURON meeting 2004
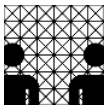
2003 Summer School

Multimodal Human-Robot Interaction
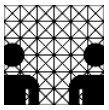
8-12 September 2003

Topics

- **Agenda and Summary**

- **Courses**

  - **Real-Time Computer Vision for Human Interfaces**

  - **Building Spoken Dialogue Systems for Embodied Agents**

  - **Human-Robot Interaction for Psychological Enrichment**

  - **Computer Haptics and Applications**

- **Directions and Open Questions**

  `tams-www.informatik.uni-hamburg.de/lehre/ss2003/euron_summer_school/`

Agenda

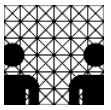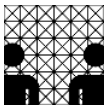|	Monday	Tuesday	Wednesday	Thursday	Friday
9	Welcome / Overview	Real-Time Computer Vision for Human Interfaces	Building Spoken Dialogue Systems for Embodied Agents	Interaction with Pet Robots	Computer Haptics and Applications
10	Real-Time Computer Vision for Human Interfaces				
11					
12					
13	Real-Time Computer Vision for Human Interfaces	Building Spoken Dialogue Systems for Embodied Agents	Building Spoken Dialogue Systems for Embodied Agents	Interaction with Pet Robots	Computer Haptics and Applications
14					
15				Excursion	
16					
17					Discussions

Summary

- Topic: new user-centered multimodal interaction principles

- 5 days

- Lectures + Lab-sessions / practical demonstrations
  PCs (Windows / Linux)

- 24 participants
  Sweden, Germany, Italy, Spain, Portugal, Romania and Switzerland

- positive feedback
 Combination of: theory, practice and applications
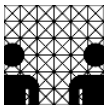
Real-Time Computer Vision for Human Interfaces

- Prof. Yoshio Matsumoto
  Nara Institute of Science and Technology

- 1. *Face measurement systems and its applications*

  - classical gaze tracking techniques: head mounted device
                                            electro-oculography
                                            scleral coils...

  - contactless methods (vision processing)
    model fitting / templates / correlation

  - gaze → attention → gesture recognition

- +lab: using a C++ framework to build a face tracking system

Real-Time Computer Vision for Human Interfaces

- 2. *System integration*

- 2.1 *Application to human interfaces*

  – robot interfaces with eye movement and gaze

  – examples: intelligent wheelchair
      receptionist robot "AKSA"

- 2.2 *Application to human modeling*

- +lab: building a paint program

  – mouse-free

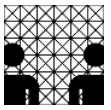 – controlled by gaze and eye-blinking only
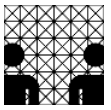
Building Spoken Dialogue Systems for Embodied Agents

- Dr. Johan Bos
  Division of Informatics, University of Edinburgh

- 1. *Automatic speech recognition for communication with robots*

  - modeling specific dialog applications

  - use of linguistic grammars

  - domain specific tuning of language models

  - building representations from the speech recognizer

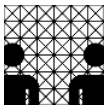 - example: "NUANCE" speech recognizer
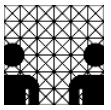
Building Spoken Dialogue Systems for Embodied Agents

- 2. *Computational semantics and inference*

  - natural language semantics – the interpretation

  - logical inference

  - first-order reasoning tools in human machine dialogue

  - example: "CURT" system

- 3. *Dialogue management and system building*

  - information-state approach to dialogue modeling

  - communication of the components (speech recognition, semantic interpretation, speech synthesis...) using an open agent architecture: "DIPPER"

Human-Robot Interaction for Psychological Enrichment

- Dr. Takanori Shibata
  AIST

- *Pet robots for physical interaction*

    – mental effects of robots

    – cat robot, seal robot "PARO"

    – use of robots at pediatric wards and elderly institutions

    – subjective evaluation of robots
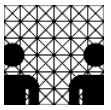   ⇒ measure the feedback   e.g. with "face scale"

Computer Haptics and Applications

- Prof. Cagatay Basdogan
  College of Engineering, Koc University

- 1. *Computer haptics and applications*

  - fundamentals: human perception,   device types,
    haptic interaction,   haptic rendering / texturing

  - applications: medical training,   collaborative engineering,
    haptic visualization, tangible interfaces

- 2. *From 2-D images to 3-D tangible models:*
  Reconstruction and Visualization of Martian Rocks

  - algorithms for   3-D Integration of data, visualization and
    haptic stimuli generation

Computer Haptics and Applications

- 3. *Simulation of surgical procedures in virtual environments*

    - case-study: modeling of internal organs and their physically-based characteristics

- Haptic device: SensAble Phantom Desktop
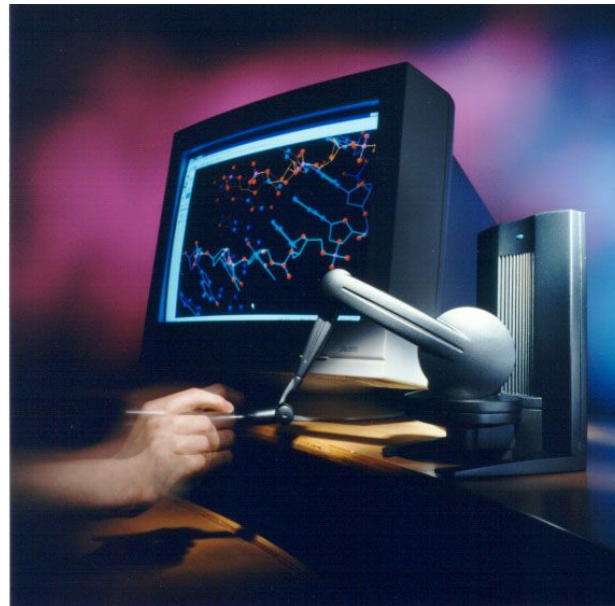
Directions

- **Task of Integration to build the *Interaction Loop***

    - Matsumoto: vision processing   → feature extraction
        - → application / interaction
        - → feedback

    - Bos: speech recognition   → semantics
        - → dialog modeling
        - → speech synthesis

- **Integration within *domains***

- **Integration of *different modalities***

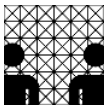   - merge input streams   use speech + vision for recognition task

Complex systems

Intelligent Service Robot

- **Cameras**
  - omnivision
  - stereo
  - hand
- **Laser Range Finder**
- **Microphone(s)**
- **Force / Torque**
  - arm
  - hand
- **Gyro**
- **Position**
  - platform
  - arm
  - hand
  - pan tilt unit
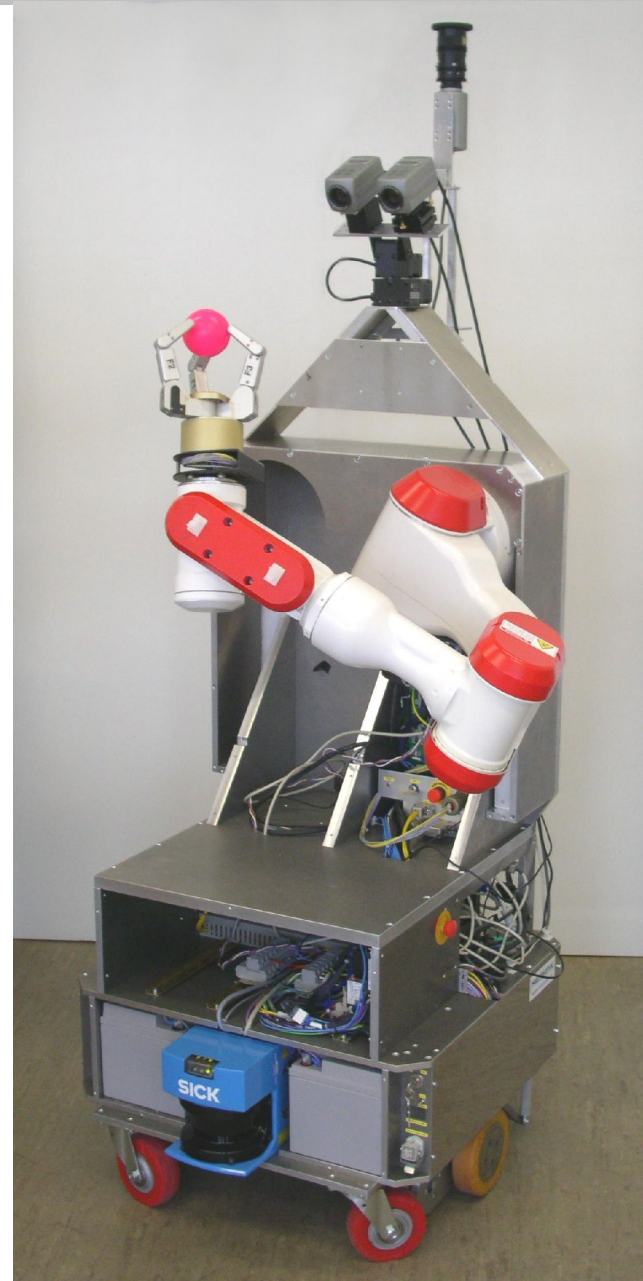
- **Platform**
  Neobotix MP-L655
- **Arm**
  Mitsubishi PA10-6C
- **Hand**
  Barrett BH8-262
- **Pan tilt unit**
- **Speaker**
- **Face...**

Directions

- **Complex System Design**

  - Involves a wide range of research areas within computer science: both *software and hardware* related!

  - keywords   distributed systems
    embedded system design
    hardware/software codesign

  - several   input streams ⇔ modalities
    (pre-) processing elements
    tasks - with a hierarchic, dynamic order
    output modalities