25 Years of interACT: A Success Story for International and Crossdisciplinary Cooperation

Rüdiger Dillmann
interACT: research competence world wide

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interACT – how it all began...

1991: Joint lab of Alex Waibel at University of Karlsruhe and Carnegie Mellon University
interACT – how it all began...

- 2004 official foundation of the international center for Advanced Communication Technologies
- 2004 official signing @ CMU by Presidents Horst Hippler (KIT) and Jared Cohon (CMU)
interACT – how it all began...

- 2007 Hong Kong University of Science and Technology
- 2008 Waseda-University, Tokyo, Japan
interACT – how it all began

- 2010:
  - National Institute of Information and Communications Technology (NICT)
  - University of Southern California
  - Fondazione Istituto Italiano di Tecnologia (IIT)
- 2012 Nara Institute of Science and Technology (NAIST)
interACT’s Mission

Neither Export nor Import, but Collaboration between the Best:

- **Education**
  - Educate Internationally Experienced Scientists
  - Adept to work in International Teams
  - Build Alliances between the Best

- **Research**
  - Develop Advanced Communication Technologies
  - Build Technology that makes Collaboration and Communication Easier
  - Facilitate Joint Projects and Joint Funding
interACT’s tasks

- Summer academies
- Joint projects
- Presidential meetings
- Student and researcher exchange
- Distinguished lectures
interACT Student Exchange

- 2004 – 2016: 160 students supported
- 41 Studien-, 52 Diplom-, 27 Bachelor-, 28 Master-, and 12 PhD Thesis at the partner universities

interACT students D. Telaar and A. Fritz @ HKUST

interACT students St. Gärtner, M. Völker, D. Hazer, S. Greiner, Mount Washington, Pittsburgh

CMU-president Cohon with interACT-students at Universität Karlsruhe, June 2006
interACT Cooperations

- More than 75 permanent cooperations established between professors of the partners

Waseda Associate Director A. Takanishi and interACT student H. Sperr at Waseda-University
interACT Distinguished Lecture Series

- Sharing scientific know-how between partners
- Around 5 distinguished lectures per year

Tom Mitchel, CMU @ KIT, 2005
Randy Bryant, CMU @ KIT, 2013
Dekai Wu, HKUST @ KIT 2007
interACT Summer Academies & Workshops

- Research workshops and academies with cross-institutional and cross-national emphasis
- interACT organised six summer academies in the last 10 years
- Strong support of the international evaluation campaign (IWSLT)
interACT joint Projects and Research

- **CLICS**, interACT-Partners KIT & HKUST & Waseda & NAIST & CMU, Funding 1 Mio€ (2015-2018)
- **EU-BRIDGE**, interACT-Partner KIT & HKUST, Funding 8 Mio€, 1,5 Mio€ (nur KIT) 2012-2015
- **Babel**, interACT-Partner KIT & CMU, Budget 328.000€ (nur KIT), 2012-2014
- **Xperience** interACT-Partner KIT & IIT, Budget 1,6 Mio€ (nur KIT), 2011-2015
- **WALK-MAN**, interACT-Partner KIT& IIT, Budget: 960.000€ (nur KIT), 2013-2017
- **KoroIBot**, interACT-Partner KIT & IIT, 560.000€ (nur KIT), 2013-2016
- **Autonomes Lernen**, (Schwerpunktprogramm, DFG, NSF) (interACT-Partner, KIT & USC), 20.000€ (nur Reisekosten, KIT), 2014-2018
interACT Organisation

- Follows local organizational principles and operates in collaborative manner
- interACT director is Alex Waibel, associate directors at each partner
- interACT offices at all partners
interACT Associate Directors

Each partner appointed an associate director:

- Rüdiger Dillmann, KIT
- Florian Metze, CMU
- Pascale Fung, HKUST
- Atsuo Takanishi, Waseda
- Stefan Schaal, USC
- Guilio Sandini, IIT
- Eiichiro Sumita, NICT
- Satoshi Nakamura, NAIST
….and some of the robots within InterACT
Institute for Anthropomatics and Robotics (IAR) one of the Core Members of InterACT
Robotics is ...

... the science of automatic handling for manufacturing, services, interaction with humans
Anthropomotics is …

… the science of the symbiosis between human and machine
Research Topics

**Machine Intelligence**
- Representations
- Memory Structures
- Machine Learning
- Cognitive Architectures

**Human-Centered Robotics**
- Humanoid and Service Robotics
- Prosthetics and Orthotics
- Medical Robotics
- Sensor-Actuator Networks

**Multimodal Interaction and Communication**
- Speech Processing and Translation
- Robot and Computer Vision
- Biosignal Processing
- Multimodal Perception

**Robot Technologies**
- Mechatronics and Control
- Lightweight Design
- Sensors and Actuators
- Embedded Systems

**Industrial Robotics**
- Manufacturing
- Automation
- Industrial Vision Processing
- Supervision

**Technology Transfer**

*interACT*: The International Center for Advanced Communication Technologies
High Performance Humanoid Technologies (Asfour)

- Mechatronics and Mechano-Informatics
- Grasping and dexterous manipulation
- Learning from human observation
- Wearable robotics
Humanoids and Intelligence Systems (Dillmann/Asfour)

- Programming by Demonstration
- Learning from human observation
- Application in humanoid and service robotics
Humanoids and Intelligence Systems (Dillmann)

Junior Research Group Computer-assisted Surgery (Speidel)

- Surgical Vision
- Intraoperative Sensor/Workflow Analysis
- Context-aware visualization
- Biomechanical Simulation
Vision and Fusion (Beyerer)

- Automated Visual Inspection
  - Deflectometry in Infrared and Visual Spectrum, Ellipsometry
  - Detection and Identification of Surface Defects
  - Underwater Vision

- Human-Machine Interaction
  - Multi-Modal Interaction Methods
  - Interaction Techniques for Augmented Reality

- Semantic World Modeling
  - Open World Modeling for Cognitive Systems
  - Smart Surveillance Systems
  - Semantic Interoperability for Manufacturing Execution Systems

3.3 Range Resolution

Every measurement is assigned a resolution which indicates the smallest value that the measuring method is able to distinguish. For a laser line scanner, the range resolution can be defined as the minimum change of the target height which can be distinguished by the sensor. To determine the range resolution one needs to determine the change in the surface height which induces the minimum allowed change in the position of the laser line on the image, which is in turn equal to the precision of the peak detection algorithm.

Figure 3.1: Rendering an image from the camera view using RSL.
Vision and Fusion (Beyerer)

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Intelligent-Sensor-Actuator System (Hanebeck)

- Extended-Range Telepresence
  - Multi-modal interface
  - Navigation by walking in arbitrary-sized environments
  - Increased degree of immersion

- Self-organizing Sensor-Actuator-Networks

- Stochastic Model-Predictive Control
Intelligent Industrial Robotics (Hein)

- Interaction technologies Industrial and Service Robots

**Sensors**  
(Proximity sensors)

**Aktors**  
(Hard- and Software)

**Interfaces**  
(Integrated multimodal Sensors/Aktors)

**Telemanipulation**  
(AR-based operator assistance)

**Applications**  
(Dismantling of nuclear power plants, release measurement, Control und Programming)
Computer Vision for Human Computer Interaction (Stiefelhagen)

- **Human-Robot Interaction**
  - Person tracking, head and hand tracking, pointing gestures (3D), face recognition

- **Smart environments**
  - Smart crisis control room (work with Fraunhofer IOSB)

- **Videoanalysis & Retrieval, Security, Surveillance**
  - Interactive search in video
  - Recognition of politicians and VIPs
  - Gender, age, head orientation, interest, ...

- **Assistance systems for visually-impaired people**
Interactive Systems (Waibel)

- Automatic Speech Recognition
- Simultaneous Machine Translation
- Translation of Lectures and Speeches
- Multimodal Dialog Systems

Partner Laboratory at Carnegie Mellon University, Pittsburgh, USA
Process Control, Automation and Robotics (Wörn)

Industrial Robotics

Medical Robotics

Algorithms for Robotics

Programming, Interaction, Path planning, Calibration

Modular control architecture for multi-agent systems

Humanoids and Service Robotics

Hands

Tactile Sensors

Micro and Swarm Robotics

Medical Robotics

Industrial Robotics

Algorithms for Robotics

Programming, Interaction, Path planning, Calibration

Modular control architecture for multi-agent systems

Humanoids and Service Robotics

Hands

Tactile Sensors

Micro and Swarm Robotics
Success of InterACT: Bringing the People together...
Thanks for Your Attention