The Department of Informatics at TUC

Prof. Dr. Jürgen Dix

Department of Informatics, Clausthal University of Technology

6th February 2008
1 Computational Intelligence Group
2 Computer Graphics Group
3 Hardware Design and Robotics Group
4 Computer Systems Group
5 Software Systems Engineering Group
6 Business Information Technology Group
7 Databases and Information Systems Group
8 Distributed Systems Group
9 Human-Centered Information Systems
Development of the Department

- Founded in 1982.
- 1985–2006: Diploma in Informatik (Inf)
- 1998–2006: Diploma in Wirtschaftsinformatik (Wi-Inf)
- 1998–2008: Diploma in Informationstechnik (IT)  
  (jointly with other institutes in the Faculty)

**Professorial Staff**
- 2003: 5 (3 C4, 2 C3) Average age > 60
- 2003-2005: Retirement of 4 professors
- 2007: 11 (5 W3, 4 W2, 2 W1) plus 2 apl. Prof, 2 vacancies
- Future: 2 more planned: e.g. Grid Computing.

**Scientific Staff**
- Regular positions: 19
- Project positions: 14
- Scholars: 4
Diploma, Bachelor and Master Studies

Faculty of Mathematics, CS and Mechanical Engineering
(Math/CS: each 1 "Institut", plus 10 smaller "Institute")

ca. 500 students in total
(of 3000 at TUC)

Since WS 06/07: BSc. Inf/Wi-Inf
WS 07/08: MSc. Inf + M.Sc. Wi-Inf
WS 08/09: (planned) MSc IT

Number of graduations in CS (diploma):
Research Areas and Synergies

Computer Engineering
- Hardware design and robotics (Kemnitz)
- Computer Systems (Richter)

Human-Centered Computing
- Neural systems (Reuter)
- Multimedia (Zachmann)
- Computer Graphics (Hormann)
- Human Centered Information Systems (N.N.)

Information Systems
- Database Systems (Hartmann)
- CSCW & Cooperation Systems (Pinkwart)

Complex Distributed and Embedded Systems
- Embedded Systems (Siemers)
- Software Systems Engineering (Rausch)
- Distributed Systems (N.N.)

Foundations of Computer Science
- Artificial Intelligence and Logic (Dix)
- Machine Learning and Theoretical CS (Hammer)

Information Systems
- Database Systems (Hartmann)
- CSCW & Cooperation Systems (Pinkwart)

Human-Centered Computing
- Neural systems (Reuter)
- Multimedia (Zachmann)
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Scientific Activities

- Publications,
- Conference/Workshop organisation,
- Memberships (PC, Editorial Boards),
- Projects, and
- Bachelor/Master/Diploma/PhD theses

can be found under
http://www.in.tu-clausthal.de/forschung
Computational Intelligence Group

Members: B. Arnonkijpanich, T. Behrens, S. Berens, S. Birkenfeld, N. Bulling
J. C. Acosta Guadarrama, S. Harneit, A. Hasenfuss, Dr. W. Jamroga, P. Novak

Research Areas:
- Computational logic: Knowledge representation and deduction.
- Multi-agent systems: specifying and programming, logics of agency.
- Data Mining: Information extraction, representation, visualization.
- Interdisciplinary Applications in medicine, bioinformatics and control.

Key Collaborations:
- V. S. Subrahmanian (US)  T. Eiter (AT)
- V. Neagoe (IT)  G. Dimirovski (TR)
- M. Biehl (NL)  A. Sperduti (IT)
- G. Simari (AR)  I. Niemelä (FI)
- M. Jamshidi (US)  G. Lee (US)
- P. Tino (GB)  M. Cottrell (FR)

Website: http://cig.in.tu-clausthal.de
Agent Contest

- Server-platform for testing and evaluating MAS
- Collaborating agents (to achieve the overall goal)

Model checking MAS

- using intermediate models for MAS
- employing ASP to solve model checking problem

Extensions of Modal Logics

- by coalition formation, strategies, plausibilities
- by imperfect information, elements of game theory

Programming MAS

- Workshop series (PROMAS, since 2003)
- Books on Languages, Systems and Tools for MAS
- From declarative BDI to implementing MAS
Prototype-based data mining

- (fuzzy-)clustering, relevance learning, visualization
- any-time, single-pass, parallel realizations

Machine learning for structures

- recursive models
- kernel methods
- neuro-symbolic integration

Biomedical applications

- mass spectrometric data
- clinical proteomics
- medical image analysis

Learning Theory

- theory of online learning
- worst case generalization bounds
- analysis of model capacity
Neural Based Demining Methods

BPP-Nets for non-destructive detection, localization and classification of

- anti-personal mines with commercial metal detectors
- underground pipes and cables with multi-sensorial equipments

Neural Based Predictive Controllers

SOM-BPP-net-combinations predicting

- operational states
- physiological parameters
- robotic strategies
Computer Graphics Group

Prof. Dr. K. Hormann

Prof. Dr. G. Zachmann

Members: D. Mohr, F. Ponchio, R. Weller, T. Winkler

Research Areas:

- Geometry Processing: subdivision, point clouds, surface reconstruction
- Visualization: immersive and interactive visualization of CFD data
- Virtual Reality: interaction in virtual environments, virtual prototyping
- Computer Vision: model-based hand tracking
- Simulation and Animation: collision detection, efficient geometric algorithms, compression
- Rendering: GPU-assisted rendering

Key Collaborations:

M. S. Floater (University of Oslo, NO)
C. Gotsman (Technion, IL)
N. Dyn (Tel Aviv University, IL)
M. Tarini (Universita dell’Insubria, IT)

Meyer auf der Heide (University Paderborn, DE)
Strasser (University Tübingen, DE)
M. A. Sabin (University of Cambridge, GB)

Website: http://cg.in.tu-clausthal.de
Surface Reconstruction

- from point clouds to surfaces
- free-viewpoint video using depth cameras

Generalized Barycentric Coordinates

- efficient interpolation
- warping of images and shapes

Subdivision

- polynomial reproduction
- non-linear geometric schemes

Dynamic Geometry

- simulation and animation sequences
- interactive visualization
Point Cloud Representation
- point clouds as model description
- definition via implicit functions using weighted least squares

Probabilistic Collision Detection
- Bounding volume hierarchies with likelihood
- Combinatorial likelihood estimation

Camera-based Hand Tracking
- Markerless tracking of 27 DOFs
- Model-based approach

Kinetic Collision Detection
- Collision detection of graphical models
- Arbitrary animated deformations
- Event-based approach transforms continuous into discrete problem
Natural Hand Interaction in VEs

- Model interactions between virtual hand and virtual objects
- Physically plausible, real-time object behavior
Hardware Design and Robotics Group

apl. Prof. Dr. G. Kemnitz

Prof. Dr. C. Siemers

Members: C. Giesemann, S. Lützel, N.N.

Research Areas:

- Hardware Design: Development of Small Microprocessor Applications, FPGA Programming (VHDL), e.g. Hardware Algorithms for Computer Vision
- Robotics: Programming
- Test and Dependability: Theory and Application

Key Collaborations:

AMD (Dresden, DE) Qimonda (Munich, DE)
Lenze (Hameln, DE) Block Transformatoren (Verden, DE)
Wipro Technologies (Kiel, DE) ESE/Vogel-Verlag (München/Würzburg, DE)

Website: http://techwww.in.tu-clausthal.de
Hardware Design

- Laboratory Exercises with Microcontrollers, FPGA, ...
- Industrial Projects, e.g. the Control of a Solar Desalization Device (below)

Test and Dependability (Text Book)

- Text Book (Springer Verlag)
- Techniques to Measure Reliability, Diversity, ...
- Built-In Self-Test

Robotics

- Programming, Vision, Wireless Communication, ...
Data Protection Enhancements

- Architecture for enabling failure prevention at runtime
- Principle: Compiler generates diversitary redundant information

```
original = <computation>
抄 = <computation, multiplied with 3>

if( 3 * original != copy )
    if( (copy % 3) == 0 )
        original = copy / 3;
else
    copy = 3 * original;
```

Software-based Error Detection

- for FPGA: to correct code/data (soft) errors
- for microprocessors: to mitigate data corruption

Time Enhancements

- Time Management Unit enables execution monitoring
- Feedback is used for debugging, monitoring, task pairing

Time-driven Development

- Time-driven Development, specifically for small systems
- Language enhancements for imperative languages
- Compiler technology for translation under time constraints
Computer Systems Group

Prof. Dr.-Ing. Dr.rer.nat.habil. H. Richter

Members:  S. Alexejew, C. Asam, G.M.J. Khan, G. Rank, D. Sommerfeld, M. Wille

Mission:
- Focus on Car Informatics (Fahrzeuginformatik)
- Intra-Car Communication: real-time data transmission in automobiles
- Network simulations
- Projects: CarRing II, CarRing Simulator, TUCar
- Data acquisition and Control: parallel computers for real-time acquisition and processing
- Project: MessPar
- Grid Computing: Software Infrastructure for Grids
- Projects Compute Grid, Data Grid

Collaborations:
- Harald Ludanek (Volkswagen)
- GWDG Göttingen (Neumayer, Haan)
- Uni Göttingen (Hogrefe, Grabowski)
- IPP Garching (Heimann, Raupp)
- RZG Garching (Soddemann, Heilgeist)

Website: http://www.in.tu-clausthal.de/abteilungen/rechnersysteme/personen/
CarRing II and TUCar

- Communication and Networking in Cars, X-by-wire
- Simulation and Realization of Local-Area Real-Time Computer Networks
- English Movies about the project under http://video.tu-clausthal.de/kurzfilme_forschung/ifi/carRingII_eng and http://video.tu-clausthal.de/kurzfilme_forschung/ifi/steer_by_wire

Project MessPar

- Real-time Parallel Computer for Measuring and Processing
- Feed Forward and Feed Back Control

Grid Computing

- Gridification of Applications
- Job and Data Scheduling in Grids
Software Systems Engineering Group

Prof. Dr. A. Rausch

Members:  A. Appel, C. Bartelt, C. Deiters, M. Deynet, E. Fischer, S. Herold, H. Klus
          D. Niebuhr, S. Niebuhr, B. Schindler, T. Ternité

Research Areas: Software Systems Engineering - Bridging Adaptability and Dependability

- goal: improve the dependability of SW-systems and their development, operation, maintenance, support and evolution
- therefore: provide a kit containing methods, techniques and tools for successful software systems engineering
- task: improve this kit with valid findings from research and to transfer it to practice

Key Collaborations:

- TU München (DE)
- Universität Karlsruhe (DE)
- Budapest University (HU)
- University of Auckland (NZ)
- TU Wien (AS)
- TU Kaiserslautern (DE)
- Fraunhofer IESE (DE)
- Politecnico di Milano (IT)
- University of California San Diego (US)
- Italian National Research Council (IT)
- Universität Duisburg-Essen (DE)
- Fraunhofer FIRST (DE)
- Charles University Prague (CZ)
- TU Wien (AS)
- Italian National Research Council (IT)

Website: http://sse.in.tu-clausthal.de
Sustainable Software Architectures
- component technology
- architecture design and evaluation
- dynamic adaptive architectures

Practicable and Applicable Process Models
- development and modeling
- evaluation and improvement
- implementation and operationalization

Model based Software Development
- UML- and view based modeling approaches
- domain specific languages and specification approaches
- transformation, evaluation and management of models

Continuous Tool Support
- adaptive system infrastructures
- project- and quality management
- enhancement of CASE-tools

Fundamental Technologies and Methods of Resolution
- programming techniques and UML
- middleware, infrastructures, technologies and frameworks
- design-, modeling- and architecture know-how
Business Information Technology Group

Prof. Dr. J. P. Müller  
Prof. Dr. N. Pinkwart

Members:  
T. Dokters, O. Foalem, A. Hornung, M. Melato, H. Olivier, P. Stiefel  
(external:) U. Bartlang, M. Born, C. Gerdes, S. Paradies, F. Stäber

Research Areas:

- Decentralized information systems
- Model-driven process automation
- Ambient-aware logistics
- Group-oriented modeling systems
- Intelligent support for cooperative learning and work
- Virtual 3D environments as collaboration tools

Key collaborations:

- B. Bauer (U Augsburg, DE)  
- K. Fischer (DFKI, DE)  
- K. Ashley (US)
- X. Zhou (SAP AG, AU)  
- S. Willmott (UPC/3Scale, ES)  
- B. McLaren (DE)
- P. Petta (U Vienna, AT)  
- V. Aleven (US)  
- A. Harrer (DE)

Website: http://winf.in.tu-clausthal.de
Business Information Technology

Mobile and Enterprise Computing
(Prof. Dr. Jörg Müller)

- Model-driven business process automation
- Ambient-Aware Logistics
- Decentralized information systems

Collaboration Systems and CSCW
(Prof. Dr. Niels Pinkwart)

- Virtual 3D environments as collaboration tools
- Social Software for Learning and Work
- Cooperative Modeling Support

Computer Science, Economics, Engineering Sciences
Decentralized information systems

- Decentral architecture, methods, and tools for collaborative model-centric product engineering
- Agent/P2P Interaction and coordination

Model-driven process automation

- End-to-End modeling of enterprise processes (EP) from business to deployment and back
- Flexible EP automation and control

Ambient-aware logistics

- Models, methods, and applications of ubiquitous computing
- Supply network monitoring and decision support
Virtual 3D environments as collaboration tools

- Interaction and collaboration analysis
- Impact of social bindings on group productivity in 3D worlds

Social Software for learning and work

- LARGO: legal argumentation
- CoChemEx: Intelligent Tutoring System for chemistry

Cooperative modeling support

- Theoretical foundations of cooperative modeling languages
- Groupware applications
Databases and Information Systems Group

Prof. Dr. Sven Hartmann

Members: M. Kirchberg, H. Koehler, S. Link, A. Steele, T. Trinh, J. Wang

Research Interests:

- XML Data Processing: foundations, standards, algorithms, technologies
- Distributed Databases: architectures, transactions, consistency
- Web Information Systems: design, adaptation, evolution, collaboration
- Conceptual Modelling: languages, constraints, ontologies, integration
- Business Intelligence: mining, learning, warehousing, decision making
- Interdisciplinary Applications in education, life sciences, ecoinformatics

Key Collaborations:

- K.D. Schewe (Massey, NZ)
- G.O.H. Katona, A. Sali (Renyi, HU)
- M. Stumptner, M. Vincent (UniSA, AU)
- Kinshuk (Athabasca, CA)
- J.X. Yu (CUHK, CN)
- Y. Kiyoki (Keio, JP)
- Y.P. Chen (Griffith, AU)

Website: http://www.in.tu-clausthal.de
Databases and Information Systems Group

XML Data Processing
- keys, dependencies, selectivity
- reasoning, expressiveness vs tractability
- query optimisation, transformation

Conceptual Modelling
- decomposition, components, evolution
- management of large database schemas
- cardinality constraints

Distributed Databases
- multi-level object stores
- transaction scheduling, concurrency control
- logging and recovery mechanisms

Business Intelligence
- dependency mining
- ontology-based risk assessment
- analytical lab automation

Web Information Systems
- storyboarding
- personalised learning systems
- collaborative design

Conference & Workshop Series
- APCCM - Asia-Pacific Conferences on Conceptual Modelling
- CMLSA - ER Workshops on Conceptual Modelling for Life Sciences Applications
Distributed Systems Group

Still running
Human-Centered Information Systems

Committee just appointed (February 2008)