T-0.050
Research Methods and Areas in Computer Science Department

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- Basic terms

- Research process

- Research methods

- Research areas in computer science at HUT

Three levels of research

- Basic research

- Applied research

- Research and development (no science)

Research process

1. Defining the research problem
2. Focusing of the problem
3. Selection of research strategy
4. Collecting material
   - Background literature, measurements, interviews, etc.
5. Analysis of material
6. Conclusions
7. Publication of the results

Research strategy

- Practical issues such as:
  - Funding
  - Research group
  - Organization of work
  - Schedule
  - Required equipment and other resources
  - Research methods

Research methods

- Set of tools to perform the actual research.
- Several possible classifications.
- The following is based on the one presented in "Tekniikan alan väitöskirjaopas" by Airila and Pekkanen.

  - Modeling
  - Computational methods
  - Laboratory experiments
  - Case studies
  - Statistical methods

  - Concept Innovation

Research Methods in VR

- Example

    - Computational **modeling** of room acoustics
    - Verification with **case studies**
        - Listening tests using several subjects
        - Objective verification with measurements (**laboratory experiments**)
    - Analysis of the results with **statistical methods**
    - The achieved models are applied in simulation of acoustics (**computational method**)

Laboratories

- We have 6 laboratories, and their research areas will be presented as follows:

    - CIS, Jaakko Hollmen
    - SoberIT, Marko Nieminen
    - LIPS, Vesa Hirvisalo
    - TCS, Pekka Orponen
    - TML, Riitta Smeds & Lauri Savioja
    - INIT, Juha Tuominen

Research in Telecommunications Software and Multimedia

Separate areas

- Telecommunications Software
  – Antti Ylä-Jääski

- Security
  – Teemupekka Virtanen

- Multimedia
  – Petri Vuorimaa, Tapio Takala, Lauri Savioja

- Business Process Innovation
  – Riitta Smeds

Telecommunications & Security

- Typical titles of conference papers:

    1. A study on denial of service -resistance of some Ipsec-implementations

    2. Exploiting sshd1 with logarithmic complexity

    3. Intrusion detection using a pre-IDS system

Telecommunications & Security

- All the techniques employed, but modeling is the dominant one

- Lots of case-studies in Security

- Cross-disiplinary
    - Psychology, Sosiology
    - Mathematics (game theory, network theory, etc.)

Multimedia

- New techniques for rich media distribution
  - XML
  - Digi-TV

- Computer graphics and VR
  - Audio in Virtual Environments
  - Human-Computer Interaction in VR
  - Efficient high-quality rendering

Multimedia (cont.)

- Cross-disciplinary skills
  - Physics and mathematics
  - Cognitive psychology

- Standardization activities
  - W3C
  - MPEG-4