FRIEDRICH-ALEXANDER
UNIVERSITÄT
ERLANGEN-NÜRNBERG

SCHOOL OF BUSINESS
AND ECONOMICS

Danish-Bavarian Workshop on Robotics / ICT in Horizon 2020

Agenda

- Introduction
  - Chair of Digital Industrial Service Systems (FAU Erlangen-Nuremberg)
  - Software, Data, People & Society (SDPS) Section (University of Copenhagen)
- Idea: AI + Declarative Notations
- Potential Topics

FRIEDRICH-ALEXANDER UNIVERSITÄT ERLANGEN-NÜRNBERG

KØBENHAVNS UNIVERSITET

The University of Erlangen-Nuremberg is among the top 10

Rankings

Number 1 in Germany in the QS World University Ranking
Most cited Researchers

Number 2 in the Reuters-Ranking of the *most innovative universities*

Picture: FAU/Celina Henning

Chair of Digital Industrial Service Systems

Our Team

The research activities of our chair focus on three areas

Main fields of research

Digital Service Systems

- Development and modelling of services
- Design of information systems for services

Example:
“Industry-4.0”-services
- Information systems for cyberphysical systems (CPS)
- Dynamic business processes for CPS

Business Process Management

- Business Process Monitoring
- Business Process Mining

Example:
Methods and information systems for:
- Design and analysis of business processes
- Execution of processes and monitoring of instances

Information Management

- Modelling of data and processes for value creation networks
- Development of domain-specific modelling methods

Example:
Value Delivery Modelling Language

THE UNIVERSITY OF COPENHAGEN IN NUMBERS

200+ BACHELOR'S AND MASTER'S PROGRAMMES

USD 1.3 BILLION IN REVENUE

STUDENTS AND STAFF

50,000+

38,000 STUDENTS

3,100 PHD STUDENTS

9,400 EMPLOYEES

Established in 1479

Department of Computer Science, University of Copenhagen

- Established in 1970 by Turing Award winner Peter Naur
- First computer science Department in Denmark
- +100 researchers
- 6 Research sections:
  - Algorithms and Complexity,
  - Human-Centred Computing,
  - Image Analysis, Computational Modelling and Geometry,
  - Machine Learning,
  - Programming Languages and Theory of Computing,
  - ***Software, Data, People & Society***

Participating members of the SDPS section

Thomas Hildebrandt, Professor, Head of Software, Data, People & Society (SDPS) Section

- Formal methods, Declarative & Reactive Process Technologies, Concurrent, distributed and mobile context-aware systems. Model-driven software engineering for reactive systems

Marcos Vaz Salles, Associate Prof. co-leader of Data Management Systems Group

- Reactive Databases, smart agriculture using satellite data, IoT, spatial queries

Yongluan Zhou, Associate Prof. & co-leader of Data Management Systems Group

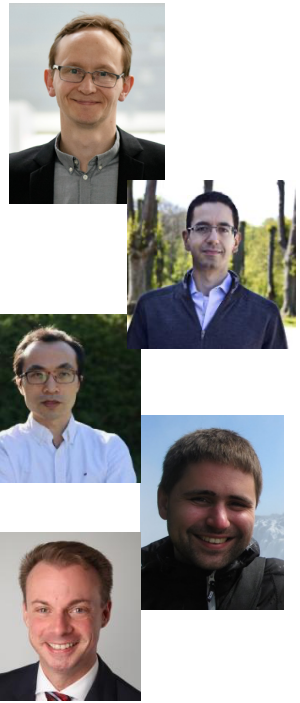
- Real-time data management, Complex-event processing, Robustness

Tijs Slaats, Assistant Professor & head of Process Modelling and Intelligence Group

- Process Management, Modelling and Mining, Declarative Process Technologies

Boris Düdder, Assistant Professor & co-leader of Security and Privacy Group

- Synchronous digital shadows of agile production systems, formal verification and automatic generation of robot code and configuration, and robot integration in decentralized, dynamic production systems.



Idea: Declarative Modeling + AI (1/2)

ICT-46-2020 – Robotics Core Technology

- Today, complete autonomy of robots is not realistic
  - Some kind of **goal** has to be known **a priori** (build / move something)
  - Handling of **unexpected situations** (safety in human-robot collaboration)
  - Learning with unexpected situations requires **massive amounts of training data**

- However
  - Goals can be described as **services** or **pending artifacts**
  - **Assertions** for safe situations can be modeled in advance
  - **Less training data** necessary if parts of a process / procedure are known a priori

Idea: Declarative Modeling + AI (1/2)

ICT-46-2020 – Robotics Core Technology

- Idea
  - Combine **declarative modeling** approaches with **ML methods**
  - Apply training data within **bounds of safety measures / goals**
  - Find **optimal paths** for the current situation (flexible re-planning in unexpected situations, learn best practices)

- **Searching for…**
  - Robotics company with medium process volume
  - Industry plant with connected robotics appliances

We are looking for industry partners!

Potential topics

- **ICT-46-2020**
  - Research and Innovation Actions (RIA) – Robotics Core Technology
    - **AI and Cognition:** Declarative Modeling + AI
    - Socially cooperative human-robot-interaction
    - **Model-based design and configuration tools**
  - Innovation Actions (IA) – Robotics for agri-food, and agile production
    - BPM: Experience in standards / norms / reference models

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Potential topics

- **ICT-47-2020**
  - Development of intrinsically safe physical powerful robotic systems with proximity sensing capability for human-scale collaborative tasks
    - Formal models
    - Extensions for flexibility, safety bounds, non-atomic transactions
  - Development of variable autonomy systems that significantly extend and enhance the operator's awareness of the working environment. Sharing autonomy between a human operator and a robot.
    - Same as above

We are looking for industry partners!

Here today

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