Hauptseminar Sommersemester 2015:

Cognitive Computing

Dr. Frank J. Furrer

Language: English

→ 3 ECTS Credits

Kick-Off Meeting 17-April-2015
Content:

Part 1: Cognitive Computing
1. Introduction
2. Material for Q1: Cognitive SW architectures
3. Material for Q2: Future Cognitive Applications

Part 2: Authoring and Presenting
1. Principles of a good paper
2. Principles of a good presentation

Part 3: Seminar Organization
1. Objectives
2. Work Plan
3. Timing
4. ECTS Credits
Introduction
Mandatory Reading 1:

John E. Kelly III, Steve Hamm: 
**Smart Machines – IBM’s Watson and the Era of Cognitive Computing.**
Mandatory Reading 2:

Mandatory Reading 3:

Eric W. Brown:  
*Cognitive Computing Ushers in New Era of IT.*  
IBM Research Brief, 2014.  
Downloadable from:  
[last accessed: 8.9.2014]
Definition:

«Cognitive technologies are products of the field of artificial intelligence.

They are able to perform tasks that only humans used to be able to»

David Schatsky, Craig Muraskin, Ragu Gurumurthy: *Demystifying artificial intelligence – What business leaders need to know about cognitive technologies* 
Algorithmic Computing
- Execution of a pre-defined set of instructions
- Inputs & outputs (data/information)
- Decision points
- Optimization schemes

Cognitive Computing
- Context-aware
- Dealing with uncertainty
- Process unstructured data (e.g. language)
- Learning (Domain expertise) & adaptive behaviour
- Goal-directed

http://online.stanford.edu
Famous Algorithmic Computing
Garry Kasparov – IBM Deep Blue Chess Match 1997

3,5 : 2,5
Deep Blue = Chess World Champion
[200 millionen positions/sec]
... some examples of cognitive computing:

Audi driverless car racing on Hockenheimring

KUKA industrial robot in table-tennis championship
... more examples of **cognitive** computing:

Humanoid robot **iCub**
learning archery

**IBM Watson** cognitive computer
assisting cancer diagnosis
This seminar will work on answers to the central question: **Which are the situation, the challenges, and the impact of cognitive computing in the year 2025?**

Each participant chooses one of the 3 topics:

**Q1:** Which are the promising *software architectures* for cognitive computing?

**Q2:** How does cognitive computing enable *future applications*?

**Q3:** What is the *impact* of cognitive computing on people, work and society?
Q1:
Which are the promising software architectures for cognitive computing?
Cognitive Cyber-Physical Computing System

Implementation: SOFTWARE

Basic Technologies
- Artificial Intelligence (AI)
- Robotics
- Cognitive Science, ...

Cognitive Science, ...

Recognition
Inference
Decision
Knowledge
Reflection
Perception, assessment

Solving
Optimization
Prediction
Rules

Recognition
Inference
Decision
Knowledge
Reflection
Perception, assessment

Solving
Optimization
Prediction
Rules

Mechatronics
- Sensors
- Actuators
- Local controllers, ...

http://robotics.idsia.ch/robots

http://www.digitaltrends.com


Q2: How does cognitive computing enable future applications?
HS 2015: Cognitive Computing

Basic Technologies
- Artificial Intelligence (AI)
- Robotics
- Cognitive Science, ...

Cyber-Physical Systems
- Robots,
- Autonomous systems
- Swarms, ...

http://www.digitaltrends.com
http://robotics.idsia.ch/robots
David Schatsky, Craig Muraskin, Ragu Gurumurthy:

Demystifying artificial intelligence – What business leaders need to know about cognitive technologies

Peter Fingar:
Cognitive Computing – A Brief Guide for Game Changers.

Tim Estes:
Who will own cognitive computing? – The race for our century.
Digital Reasoning, April 2014
Q3:

What is the impact of cognitive computing on people, work and society?
New (cognitive) application

Impact?

Work

People

Society

HS 2015: Cognitive Computing


Principles of a good paper
Principles of a good paper:

Key element = An interesting, consistent and complete **storyline**

<table>
<thead>
<tr>
<th>Storyline:</th>
<th>Structure:</th>
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<tbody>
<tr>
<td>Context</td>
<td>Title</td>
</tr>
<tr>
<td>Vision</td>
<td>Abstract/summary</td>
</tr>
<tr>
<td>Mission</td>
<td>Introduction</td>
</tr>
<tr>
<td>Focus</td>
<td>Existing work, state-of-the-art</td>
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<tr>
<td>Material/body</td>
<td>Chapters</td>
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<tr>
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http://change4rchange.blogspot.ch

http://performancing.com
Principles of a good paper:

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1. **Storyline**
   - Context
   - Vision
   - Mission
   - Focus
   - Material/body
   - Message

2. **Paper**
   - Title
   - Abstract/summary
   - Introduction
   - Existing work, state-of-the-art
   - Chapters
   - Conclusions, Recommendations
   - References
Individual traffic using trucks and private cars forms an important element of our economy and of our individual life-style.

In the last decades the amount of traffic has increased considerably.

The results are daily congestions and higher accident rates.

They cause significant damage to the economy and to our individual mobility.
Principles of a good paper:

**Storyline:**
- **Context**
- **Vision**
- **Mission**
- **Focus**
- **Material/body**
- **Message**

**What we want to achieve**

"... how do we see an improved world"
(State [Utopia])

**What we want to do**

"... how do we improve the world"
(Action [Way to ...])

**Example:**
Modern individual traffic

Principles of a good paper:

**Storyline:**

**Context**

**Vision**

**Mission**

**Focus**

**Material/body**

**Message**

---

**VISION**

The vision is to keep traffic fluid, efficient and with low rates of accidents.

One promising approach is to support - or even replace - the drivers by electronic driving assistance systems.

Clear and comprehensive statement of the long-term goal

⇒ **Vision Statement**
Principles of a good paper:

**Storyline:**
- Context
- Vision
- Mission
- Focus
- Material/body
- Message

**MISSION**

This paper demonstrates the feasibility and implementation of one important electronic driving assistance system.

We present and discuss the sensor-based collision-avoidance systems.

Many such systems are under development - some of them can even be found in modern production cars.

Our target audience are graduate students in mechanical, electronics and computer science.

Precise statement of the work

⇒ Mission Statement
Focus

Sensor-based collision-avoidance systems is a wide field of research.

It encompasses sensor-, software-, image processing- and safety engineering.

We focus on one specific system: The system developed by Mercedes-Benz which can be found in most of their current production cars.

We explain its architecture, functionality, features and limitations.
Principles of a good paper:

**Storyline:**

- Context
- Vision
- Mission
- Focus
- Material/body
- Message

**Restrict, restrict, restrict!**

**Organize, organize, organize!**

**Avoid all unnecessary concepts.**

**Establish a clear state-of-the-art, of prior work and of relevant references.**

Principles of a good paper:

Conceptual Storyline:

Context
Vision
Mission
Focus
Material/body
Message

This paper has demonstrated the great value of collision-avoidance systems.

Such systems could greatly be improved by using real-time environmental information.

Therefore, research should continue into car-to-car and car-to-infrastructure communications.

HS 2015: Cognitive Computing

**Storyline:**
- Context
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- Message

**Paper:**
- Title
- Abstract/summary
- Introduction
-Existing work, state-of-the-art
- Chapters
- Conclusions/recommendations
- References

... your deliverables (2 separate documents)

⇒ Style
The content of your paper is:

- correct
- precise
- clear
- brief
- ethical

Your material must be free from error and in accordance with facts.

If it is vague, it is not scientific writing.

If it is unclear or ambiguous, it is not scientific writing either.

If it is long-winded and unnecessarily discursive, it is poor scientific writing.

Fair, truthful, respectful, references, copyrights, ...
Term „Human“ [Definition]:
We are bilaterally, symmetrical, sexually differentiated bipeds located on one of the outer spirals of the Milky Way, capable of recognising the prime numbers …

[NASA Deep Space Probe]
Clear is more important than brief

Acronyms and abbreviations are poison for the reader
⇒ Avoid them (whenever possible)
If necessary, introduce them (1x or 2x) at the beginning:

„This paper introduces the concept of System-of-Systems (SoS)“. An SoS ...

The vehicle can be seen as an SoS, with many CS, such as ABS, ESC, BA and possibly a CAS.
Principles of a good presentation
Principle 1: **Understand** your audience

- **Background?**
- **Prior Knowledge?**
- **Expectations?**
- **Reason for attendance?**

Tailor your presentation to the background and needs of your audience
Principle 2: Key Message

What is your message?

Why is it important?

What does it mean to your audience?

What do you want them to remember?

The key message is the continuous focus of your presentation.
**Example:** Thorium Nuclear Energy

**Audience:** YOU!

- **Background:** mathematical-physical-engineering education
- **Prior knowledge:** basic nuclear physics
- **Expectations:** Possible solution to world’s energy problem?
- **Reason for attendance:** critical assessment, gain of knowledge

**Key message:**

«**THORIUM – The Green Energy Source of the Future**»

Richard Martin: *Superfuel – Thorium, the green energy source of the future.*

Principles of a good presentation

Storyline:
- Context
- Vision
- Mission
- Focus
- Material/body
- Message

Additional power:
- Illustrations/pictures
- Animations
- Personal style

«Delivery»

Focus = Audience

Focus = Audience
Principles of a good presentation

- Illustrations/pictures
- Animations
- Personal style

- emotion
- feeling
- provocation
Principles of a good presentation

- Illustrations/pictures
- Animations
- Personal style

Cloud Definitions:

- **SaaS** - Software as a Service
- **PaaS** - Platform as a Service
- **IaaS** - Infrastructure as a Service

*Don’t overdo it!*
Principles of a good presentation

- relate to your audience
- be highly present
- be strongly engaged
Elements of a bad presentation:

- Small (< 22 pt) or unreadable fonts
- Too dense slides
- Few illustrations, pictures
- Excessive animations
- (Extensive) use of bullet point lists
- Unclear message, bad storyline
- Introduction of superfluous concepts
- … and some more

Garr Reynolds: Presentation ZEN – Simple Ideas on Presentation Design and Delivery.
Elements of a bad presentation:

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Garr Reynolds:
Presentation ZEN – Simple Ideas on Presentation Design and Delivery.
What is the sure death of a good presentation?

Time overrun!
Seminar Organization
What the Participants will learn:

1. Do focused research in a specific area
2. Author a **good** paper
3. Learn (or perfect) the use of TeX®
4. Experience the peer-review process
5. Hold a **convincing** presentation
6. Broaden your perspective in this field
Select topic:
- Cognitive architectures
- Future applications
- Impact

Kick-Off Lecture (1 DS)

Seminar 1 (1 day)

Seminar 2 (1 day)

Proceedings Volume (electronic, PDF)
Hauptseminar SS 2014:
Impact and Challenges of Software in 2025

Collected Papers

http://nbn-resolving.de/urn:nbn:de:bsz:14-qucosa-152785
Formats:
Paper: LaTeX
Presentation: PowerPoint

Please use the Template:
“Springer LNCS” for your paper.
Downloadable from:
http://www.springer.com/computer/lncs?SGWID=0-164-6-793341-0
[last accessed: 05.03.2015]
### Hauptseminar Kick-Off Meeting
- **Date and Time:** Friday, April 17, 2015: 14:50 – 16:20
- **Location:** Room INF 2101

<table>
<thead>
<tr>
<th>Seminar Day</th>
<th>Date and Time</th>
<th>Location</th>
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<tbody>
<tr>
<td>1st Seminar Day</td>
<td>Friday, June 5, 2015: 09:00 – 13:00</td>
<td>Room INF 2101</td>
</tr>
<tr>
<td>2nd Seminar Day</td>
<td>Friday, July 10, 2015: 09:00 – 13:00</td>
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More information at (TUD HS Website):

Hauptseminar limited to 8 participants
### Hauptseminar Kick-Off Meeting

**Friday, April 17, 2015: 14:50 – 16:20**  
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<tr>
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<tbody>
<tr>
<td>Introductory Lecture by Dr. Frank J. Furrer</td>
<td>Friday, April 17, 2015</td>
<td>e-mail your choice to:</td>
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<td>• All participants</td>
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<td>• <a href="mailto:frank.j.furrer@bluewin.ch">frank.j.furrer@bluewin.ch</a></td>
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<td>• <a href="mailto:Georg.Pueschel1@mailbox.tu-dresden.de">Georg.Pueschel1@mailbox.tu-dresden.de</a></td>
</tr>
<tr>
<td>Select 2 peer reviewers (from the participants and Georg Püschel is also available)</td>
<td>Friday, April 24, 2015</td>
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<tr>
<td>Note: All papers will also be reviewed by Dr. F.J. Furrer (as 3rd peer reviewer)</td>
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<tr>
<td>Deliver your choice of topic (i.e. Question 1, 2 or 3) and a short vision/mission statement to the 2 peer reviewers and to F.J. Furrer</td>
<td>Wednesday, April 29, 2015</td>
<td>e-mail your choice to:</td>
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<td>Feedback from Reviewers</td>
<td>Friday, May 8, 2015</td>
<td>By e-mail from:</td>
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<td>Deliver 1st draft of both your storyline and your paper to your peer reviewers</td>
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Peer discussions, Feedback on style & content |
|-----------------|-------------------------------------------------|-------------------------------------------------|
| Deliver 2nd, improved draft of your paper to your peer reviewers | Friday, June 19, 2015 | e-mail your paper:  
Peer reviewers  
frank.j.furrer@bluewin.ch  
Georg.Pueschel1@mailbox.tu-dresden.de |
| Feedback from Reviewers | Friday, July 3, 2015 | By e-mail from:  
The peer reviewers  
frank.j.furrer@bluewin.ch  
Georg.Pueschel1@mailbox.tu-dresden.de |
| 2nd Seminar Day | Friday, July 10, 2015: 09:00 – 13:00 Room INF 2101 | 2nd participants presentation  
Peer discussions, Feedback on style and content |
| Deliver final version of your paper | Latest: Friday August 7, 2015 | e-mail your paper to:  
All participants  
frank.j.furrer@bluewin.ch  
Georg.Pueschel1@mailbox.tu-dresden.de |
| pdf-volume of collected papers ready | Friday, August 28, 2015 | Downloadable from the seminar website |
3 ECTS Credits are awarded:

- Full participation in all 3 seminar days
- Delivery of a satisfactory paper
- Delivery of a good presentation
The next 2 steps:

<table>
<thead>
<tr>
<th>A list of all participants will be e-mailed next week</th>
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**Note:** Content and structure of the “vision/mission statement” will be explained in the Kick-Off Meeting

| Wednesday, April 29, 2015 |
Contact Details:

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Phone: +41 (0)52 740 32 28

Postal Address:
Dr. Frank J. Furrer
Guldifuess 3
CH-8260 Stein am Rhein
Schweiz

Hauptseminar Website: