New Prospects on Automation

Keynote INDIN 2007
Gerhard Pratl
What can automation engineers do?

- Automation: Influence a **process** on behalf of someone
  - Process can be dangerous, boring, difficult,…
  - Traditional: Room climate, manufacturing, traction,…
  - New: Hygiene, safety, evacuation, business,…
- Done by (a) machine(s)
- Digital Microcomputer
  - Digital data structures and algorithms
  - Interfaces to „real“ world (sensors, actuators, network)
  - Ubiquitous
2. Goal (engineers' view)

As little mechanics as possible (no gear, no steering column)

Towards complete differentiation between energy & information
Classical Engineering

.. the need to handle complex processes
- Linearization
- Reduction (abstraction) to decisive parameters
- Elimination of side effects
- Separation of processes
- Modularization
- Top-down design
Result: simplified, linearized processes as abstraction

Paradigm shift
- Integration of a huge number of sensors
- Careful, detailed description of processes
Perceiving Objects
Perceiving Objects
Datenmodellierung - Ausgang

\[ a = 0 \quad a = 0.5 \quad a = 1 \]
What do computers see today?

Head and hands detection and tracking
What do computers see today?

Head and hands detection and tracking
How many people do you “see”? 
Artificial Intelligence –
A history of overselling

"Within ten years a digital computer will be the world's chess champion"
Artificial Intelligence – A history of overselling

“Within ten years a digital computer will be the world's chess champion”

Newell, 1957
Artificial Intelligence – A history of overselling

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“There are now in the world machines that think, that learn and create”
“Within ten years a digital computer will be the world's chess champion”
- Newell, 1957

“There are now in the world machines that think, that learn and create”
- Simon & Newell, 1958
I have to transport water, so I use: A wooly hat or a soup plate?
If I look for a coffee cup, would I rather look in the garage or in the kitchen?
Is infertility inheritable?
What Happened in the Last Decade?

**Psychoanalysis**
- Sigmund Freud and his model of the human psychic apparatus

joined forces with

**Neurosciences**
- Studying the nervous system

the result:

**Neuro-Psychoanalysis**
Create a unitary model of the human mind

Apply this model to technical systems
How to perceive

- Apple outline
- Stem
- Red section
- Pink section
- Complete apple

Institute of Computer Technology
Gerhard Pratl
Sensor data:
aural, visual, haptic, ...

Association of existing “images”

Face shape

Nose shape
Recognition in Time

Current situation

Sequence of situations

Scenarios
“We cannot see what we do not know”

**Perceive:**
- Vision systems filter images
- Algorithms separate important from unimportant details

**Recognize:**
- Not all information is in the sensor data
- Recognizing is a cognitive task
- “What impact did this event or object have on *me*?”

I hear and I forget. I see and I remember.

I **do and I understand.** – Confucius
The existence of a human mind is tied to the existence of a human body.

- Not necessarily needed for technical systems

But: subjective experience will only work, if the technical system has some kind of body.

- Inner world and an outer world are mandatory
Drives and Emotions

- Drive: the body requests a work demand from the psychic apparatus to maintain homeostasis

- Emotions: evaluation criteria
  - Decision making

- Pleasure principle: satisfaction of needs
  - Technical systems have different needs than human beings
Conflicts

- Human psyche: moderator between inner world and outer world
- Permanently settling conflicts between requirements from different sides

- Don’t build a technical system in harmony – let there be conflicts
  - And then let the system maintain homeostasis
Use of neuro-psychoanalytic findings

- **Expectations**
  - New/better version of psychologically inspired AI
  - Affective & cognitive agents
  - Handling of complex situations
    - „Gut-feeling“
    - Focus of attention
    - Anticipation of consequences

- **Problems**
  - Translate things into functions/technology
  - Overwhelmingly many complicated details
    - Unfinished system trivial, (When) feasible?
**ENF – Emulating the Mind**

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The **first** joint forum between Neuro-Psychoanalysis and Engineers
Engineering and Neuro-Psychoanalysis Forum

www.indin2007.org/enf
Thank you