Cognitive Products – Open Student Topics

Cognitive products are products that **perceive** their environment, **analyze** it, make well-informed **decisions**, **adapt** to the situation and **learn & evolve** from past experience to fulfill a higher goal. This requires technologies that are dependable but low-cost and low-power, and involves sensing, networking, SW- and HW platforms, as well as infrastructures with industrial-grade robustness and performance. **We explore and research** these **technological building blocks** required for **future products and production systems**, and demonstrate them by **realizing case studies** and prototypes **together with our industry partners**.

Open Topics:

1. **Object Tracking for Conveyor Belts in Sorting Sites**
   Detect, track, and classify objects on conveyor belts to support sorting and manipulating.

2. **Tactile Internet and Haptic Feedback for Hand-Gesture Recognition**
   Control a robotic arm and give haptic feedback to the user.

3. **Exploring the Learning Factory for Automation and Process Optimization**
   Retrofit our learning factory and upgrade the components to do experiments for safety, optimization, and dynamic adaption in factories.

4. **Acoustic Anomaly Detection for Machine Condition Monitoring**
   Use sensors like microphones and cameras for anomaly detection in drilling and milling machines to predict the condition, health, and lifetime of the tools and the machine.

5. **Model-Based Analysis of Non-Functional Requirements in AUTOSAR**
   Create models for non-functional requirements in real-time operating systems in the automotive domain.

6. **Semantic Monitoring and Digital Copilot for Automotive Test drives**
   Develop applications for recognizing the environment using cameras and sensors.

7. **Cognitive Safety for Dynamic Industrial Environments**
   Develop automatic mechanisms and tools for creating safety concepts in the industry.

8. **Data Analysis / Processing / Algorithms for Weather and GHG reduction**
   Implement, Upgrade, and Adapt physical particle and gas simulation models to calculate weather predictions and green-house-gas reduction potentials.

9. **Generating Safety Concepts with Large-Language-Models**
   Apply Large-Language Models to evaluate and generate hazard- and risk analyses (HARA), as well as FMEA and other safety-related documents.

If you have a **creative and growth mindset**, you are a **maker**, a **creator**, or a **builder**, then we happily invite you to join us in **bringing cognition to the world of products and production systems** – let us **make products that think**. If you are interested, simply contact me:

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