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Hannover Messe 2019: Four exhibits highlight CCIT's research and implementation projects

Agile and mobile production systems in the Industry 4.0 environment as well as mobility applications rely on technologies that allow the unequivocal identification and localization of components, machine parts and tools within a network of sensors that capture and process data – smart data which enables real-time decision-making at the receiving end.

CCIT's research findings in this context are – transferred to a Logistics 4.0 usecase – displayed by the demonstrator "Secure product tracking with trustworthy technologies". A first implementation of this scenario is shown by a Low-Cost-Tracker, which sovereignly monitors the supply chain of fragile goods.

The integration of artificial intelligence (AI) methods at many networked levels is a key part in CCIT's mission. The current state of research in modern machine learning methods is displayed by the exhibit "Image-based quality control". How so-called Informed Machine Learning technologies can improve human-machine-interaction and offer completely new services for industrial customers is subject of the exhibit "Spoken dialog systems for business and domain knowledge". These spoken dialog systems guarantee digital sovereignty and are in compliance with General Data Protection Regulation (GDPR).

The four exhibits at Hannover Messe 2019 display how CCIT is going to enable Germany's and Europe's digital sovereignty and business competitiveness in the manufacturing and processing industry.

Be part of the Industrial Internet

The CCIT offers a wide range of cooperation opportunities, which can be individually adapted within the framework of strategic partnerships:

- From the analysis of partial approaches up to the planning of a sustainable corporate strategy

- Agile cooperative technology development according to the current state of research

- Technology testing in state-of-the-art laboratories, research factories and test environments

- Technology transfer

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DIGITAL SOVEREIGNTY FOR THE COGNITIVE INDUSTRIAL INTERNET

HANNOVER MESSE 2019

70 JAHRE ZUKUNFT
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Our Mission: A cognitive Internet for industrial needs

Today's Internet-based applications are focused on the paradigms of communicating, collecting and processing vast amounts of data. However, essential for adequate industrial application scenarios is an infrastructure that offers extended functions for knowledge generation: from heterogeneous data sources and for dynamic behavior adaptation through machine learning.

"Cognitive" abilities need to be integrated into digital networks: Sensory perception, memory, planning, orientation and learning. "Cognitive Internet technologies" offer a whole new scope for industry – a scope that increases even more if intercompany platforms are provided in order to merge data from a wide variety of sources to be accessed in a controlled way. This is the basis for innovative forms of industrial data economy with full data sovereignty.

Bundled Expertise: CCIT – A Cluster of Excellence

In order to respond to industry's demand to combine applied specialist knowledge for comprehensive needs, the Fraunhofer-Gesellschaft started a strategic research cluster approach. The Cluster of Excellence Cognitive Internet Technologies CCIT launched its mission in 2018 with 13 Fraunhofer Institutes pooling their expertise in order to face the challenges of digitalization and develop new solutions for industry. Organized in the research centers IoT-COMMs, Data Spaces and Machine Learning, researchers from various disciplines develop key technologies along the value chain from sensors to intelligent learning methods in data processing and the cloud.
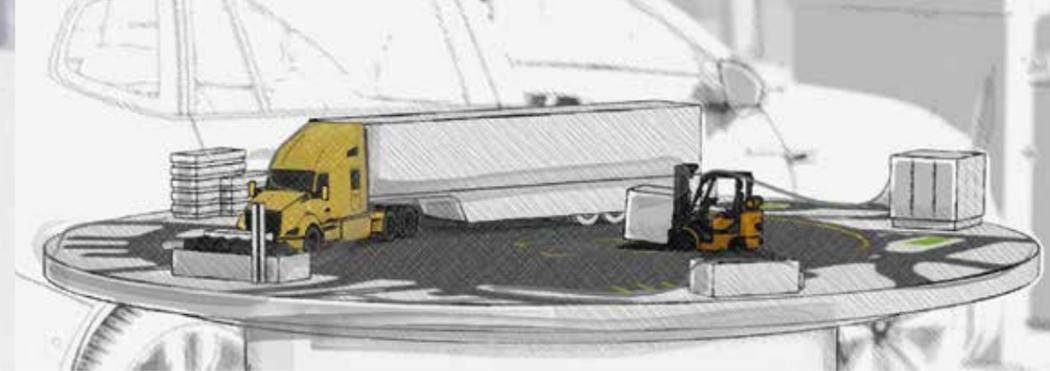
DATA ECOSYSTEMS BASED ON "INTERNATIONAL DATA SPACES": SUPPLY CHAINS OF FRAGILE GOODS MONITORED SOVEREIGNLY

The International Data Spaces Initiative makes open data market places possible for the economy. Via these marketplaces data can be exchanged between trustworthy partners. Data sovereignty of all parties is always ensured throughout the complete data value chain. The International Data Space architecture, developed by Fraunhofer, is part of a secure data infrastructure and thus a key technology for innovative applications of Artificial Intelligence. It thus contributes to economy's competitiveness as well as society's prosperity. As an important component of digital infrastructure, the IDS aides to exploit chances AI offeres for the well-being of humantity and companies, as well as encountering risks. The IDS framework creates real data sovereignity within an industrial context and serves as a key component of a data infrastructure in and for Europe.

Deutsche Telekom is one of first telecommunication companies, implementing this architecture within corporate reality. Taking the example of glass bottles, Telekom will show how differently rated data of the supply chain can be analyzed comprehensively. This here demonstrated data ecosystem consists of the Telekom Data Intelligence Hub, the Low-Cost-Tracker and the first ever connector of the International Data Spaces Association, called "IDS ready". This connector is dedicated to a safe and sovereign data exchange via the International Data Space architecture.

SECURE PRODUCT TRACKING WITH TRUSTWORTHY TECHNOLOGIES: COGNITIVE SENSORS AND BLOCKCHAIN

In order to maintain leading global market positions industries nowadays need Internet systems with cognitive capabilities and highly secure shared data spaces. The CCIT is presenting its high-level vision of these key technologies with an example from the field of logistics: seamless, trustworthy product tracking by means of cognitive sensor and blockchain technology.

Temperature, storage, position and movement patterns – modern sensor technology is able to record a wide range of data regarding the state of sensitive goods during transport. However, the amount of data that has to be collected, aggregated and evaluated leads to enormous complexity. With the CCIT's "Cognitive Sensor Connector" complexity becomes manageable: As an edge device, it analyzes and preprocesses the raw data at the point of collection. Thus data are refined into Smart Data. When data about the status of the cargo is being transmitted out of the connector to the actors involved, this is subject to strict data flow and data usage control.

For a traceable compliance history the real time information out of the connector can be collected in a "Trackchain", a secure blockchain that preserves data protection when supply chains have to be tracked company- or worldwide. The use of cryptographic approaches such as "Attribute-Based Encryption" ensures that only parties with the required authorization have access to the information relevant for them.

SPOKEN DIALOG SYSTEMS FOR BUSINESS AND DOMAIN KNOWLEDGE

Speech assistants are used in more and more areas of life, enabling intuitive interaction with technology, providing service and information. They are not only useful in everyday life, but also offer companies great potential for facilitating human-machine interaction and offering completely new services to customers.

Fraunhofer develops speech-driven dialog systems with a special focus on domain-specific knowledge for application in various fields of business and industry. Using and combining state-of-the-art components for Speech Recognition, Question/Answering via Knowledge Graphs and Speech Synthesis, our technologies in particular address the concrete challenges and needs of enterprises and B2B applications. Moreover, these technologies "made in Germany" ensure technological sovereignty, data can be stored and processed within secure data spaces and the methods of "Informed Machine Learning", developed within the Fraunhofer Center for Machine Learning, make sure that the systems can even be trained on small data sets. In cooperation with Volkswagen AG, a first research prototype has been developed which answers questions about certain points of interest, e.g. buildings within a specific use case.

IMAGE-BASED QUALITY CONTROL OF MATERIAL SURFACES FOR INDUSTRIAL APPLICATIONS USING MACHINE LEARNING

Machine Learning applications for automatic detection of damage to material surfaces can improve product quality and reduce cost and time for the quality control process. Within the Fraunhofer Research Center for Machine Learning, scientists of Fraunhofer IAIS are working on expanding the application field of Machine Learning to make it more explainable and applicable to cases where there is a lack of suitable data. One approach is Informed Machine Learning, which integrates expert knowledge, for example data from simulations or physical laws.

In one project, the Fraunhofer IAIS team developed an image-based detection system for damage from hailstorms on vehicles. Insurance companies and their appraisers face the challenge of having to assess a large number of cases within a short time span. To facilitate the process, a mobile unit scans the car body's damaged parts. Afterwards, the Fraunhofer Machine Learning algorithm detects, classifies and measures the damages automatically. The system is filed for patent application.

The technology is applicable to other areas of industrial quality assurance and damage control, where smooth and reflective surfaces are produced, processed or tested.

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