

GESTALT.ROBOTICS



WE DEVELOP SOLUTIONS FOR INTELLIGENT ROBOTICS

SUPPORTING YOUR BUSINESS WITH AI & AUTOMATION.

# *Company Presentation*



## Company Information

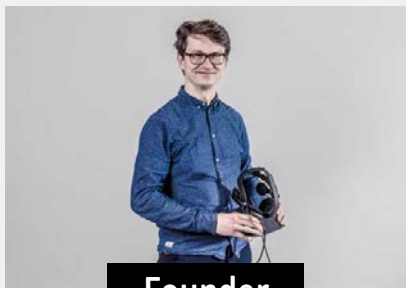
- ◇ Founded in 2016
  - ◆ GESTALT Robotics is a Berlin-based robotics startup focused on the development of perception-based robotics software
- ◇ Contractual Experience
  - ◆ The company has already realized contracted development projects in the field of industrial and social robotics
  - ◆ Clients like Deutsche Telekom, II-VI HIGHYAG, Hella Aglaia, TU Berlin, ARTIS Engineering and T-Systems
- ◇ Strong Team & Latest Equipment
  - ◆ Robotics, AI, CV, Interaction, Mobile, Cloud and Security experts in team
  - ◆ 100+ m<sup>2</sup> office space with service & industrial robots and a lot of sensory and peripheral equipment





## *The Core Team*

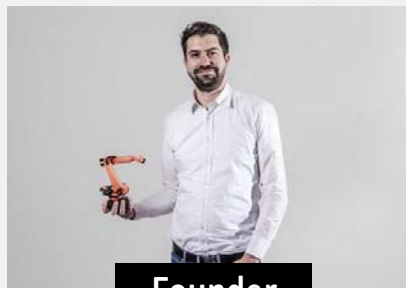
**Dr. EUGEN FUNK**



**Founder**

3D Computer Vision  
Optical Sensor Design

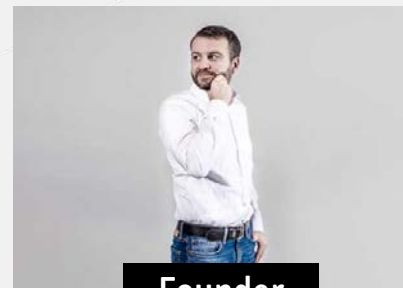
**Dr.-Ing. JENS LAMBRECHT**



**Founder**

Robotics, Human Machine  
Interaction, Cloud & Networks

**THOMAS STAUFENBIEL**



**Founder**

General Management  
Systems Engineering

**Dr. THE DUY NGUYEN**



**Lead Developer A.I.**

Object Recognition  
Robot Perception

**TOM KITTMANN**



**Lead Developer Mobile**

Service Robotics  
Security & Mobile

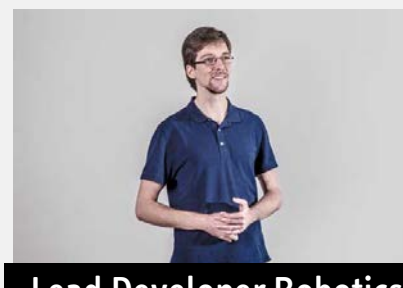
**STEFAN MILDNER**



**Creative Director**

Design and Communication  
User Experience & Interaction

**Dr.-Ing. MIRKO KUNZE**



**Lead Developer Robotics**

Industrial Robotics  
Optimal Control Theory

**THORSTEN BECKER**



**Lead Developer Machine Intelligence**

Deep Learning  
Data Engineering



# Company Core Pillars



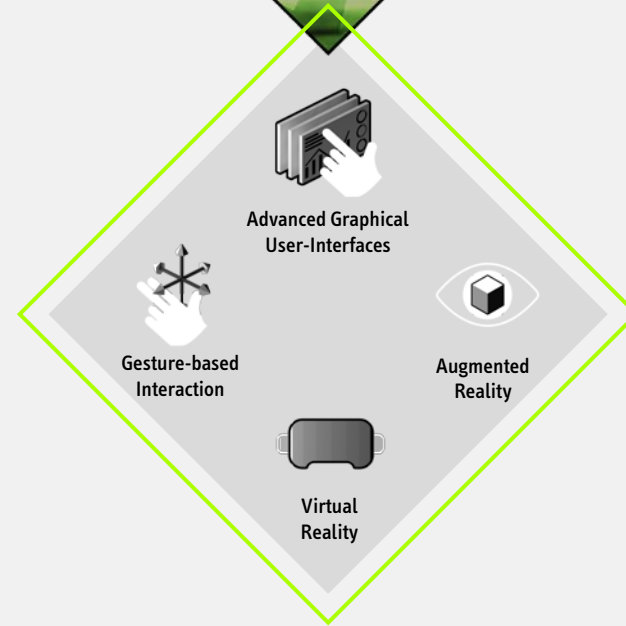
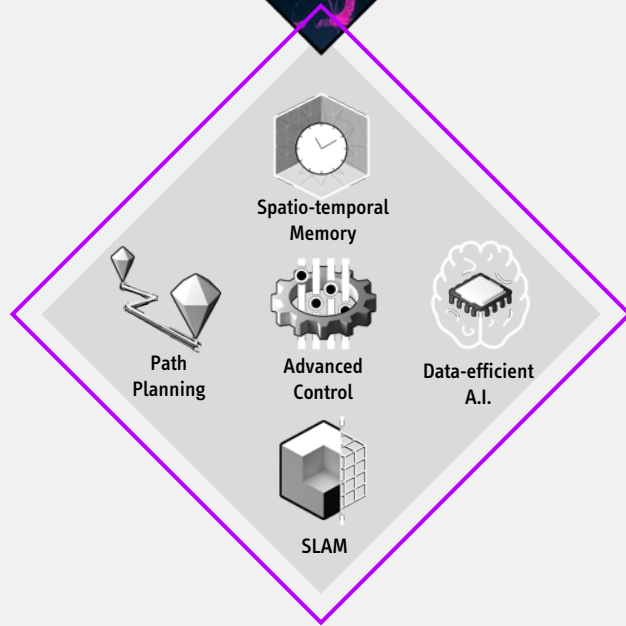
Perception



Cognition



Interaction





## *Perception*



THERE ARE THINGS KNOWN AND THERE ARE

THINGS UNKNOWN, AND IN BETWEEN ARE

THE DOORS OF PERCEPTION. —ALDOUS HUXLEY

**What we humans take for granted, is typically one of the prime challenges in any field of flexible automation and robotics: understanding any unstructured or unknown environment. For this purpose, intelligent perception and smart sensing are imperative in the field of contemporary robotics.**



# Perception



## WHAT, WHERE AND HOW BIG?

The task of object detection encompasses identifying, localizing and estimating the spatial dimension of objects, animals or people in a scene. It is a vital skill for humans as well as for robots to be able to act autonomously. We develop and customize object detection systems from video data. The processing of an image can be optimized to run in real-time on embedded devices.



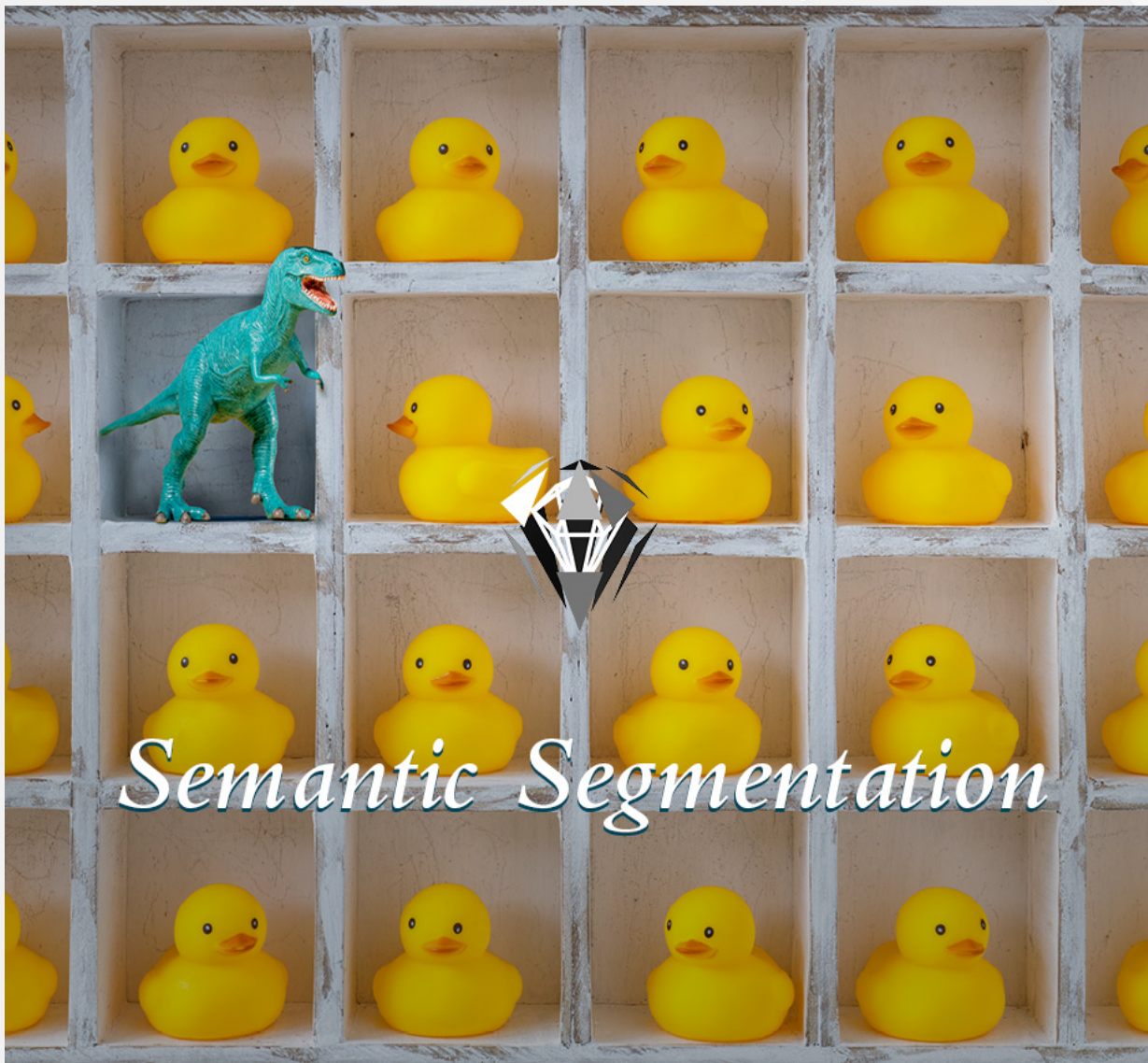
Traffic Monitoring off Car Cockpit



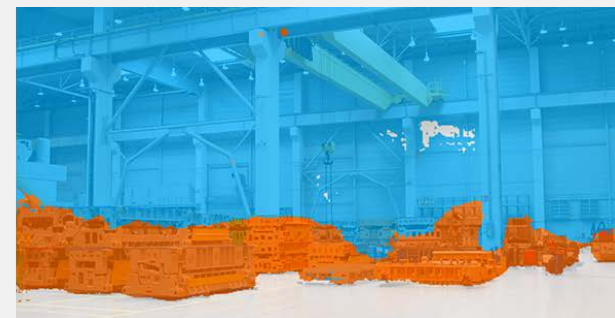
# Perception

## SHAPE IS ALL YOU NEED...

Image segmentation is defined as the task of partitioning an image into distinct groups of pixels. Semantic Segmentation requires that these groups represent humanly interpretable objects and regions, e.g. furniture, floor, walls, people, cars, doors or other relevant objects. We train and deploy segmentation models to enable robots to interpret their environment and use Path Planning algorithms to navigate in dynamic and unknown environments.



*Semantic Segmentation*



*We segment obstacles in industrial environments to enable path planning as well as solving class imbalances.*



# Perception



## NONVERBAL COMMUNICATION

Pose estimation is the task of accurately localizing relevant parts of a human body or/and object. There are various sensor types which can be used to estimate the pose, however, we concentrate on solving this task by merely using imagery. We develop tailored pose detection and tracking applications on this basis with the advantage that no additional equipment has to be worn.



*Pose estimation identifies the location and orientation of the body's joints and bones.*





*Cognition*



ARTIFICIAL INTELLIGENCE IS A TOOL,

NOT A THREAT.

—RODNEY BROOKS

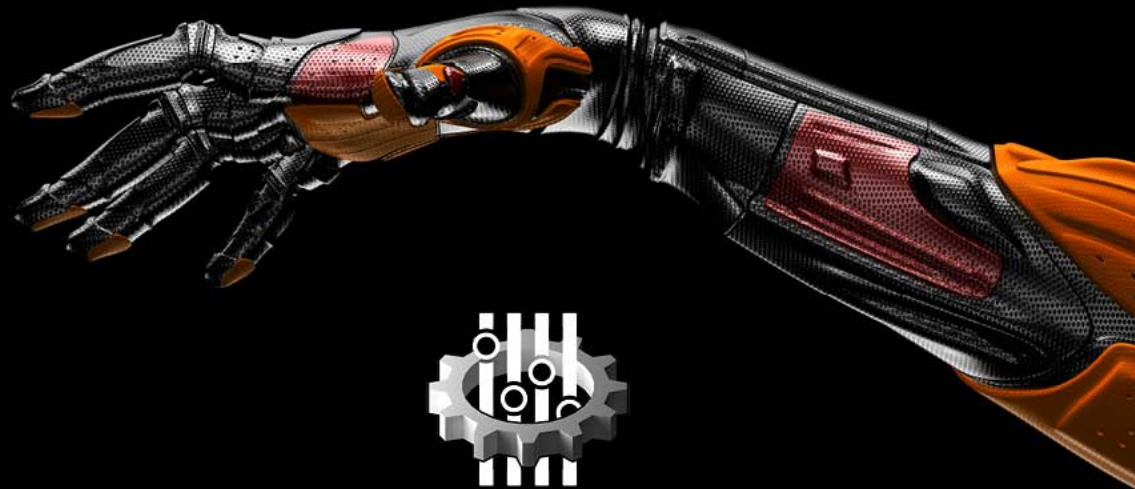
**Making robots intelligent means dealing with knowledge, attention and memory as mental actions. Cognition enables learning, decision making, problem solving, reasoning and evaluation as well as offering adaptive and flexible control behavior in conjunction with high performance.**



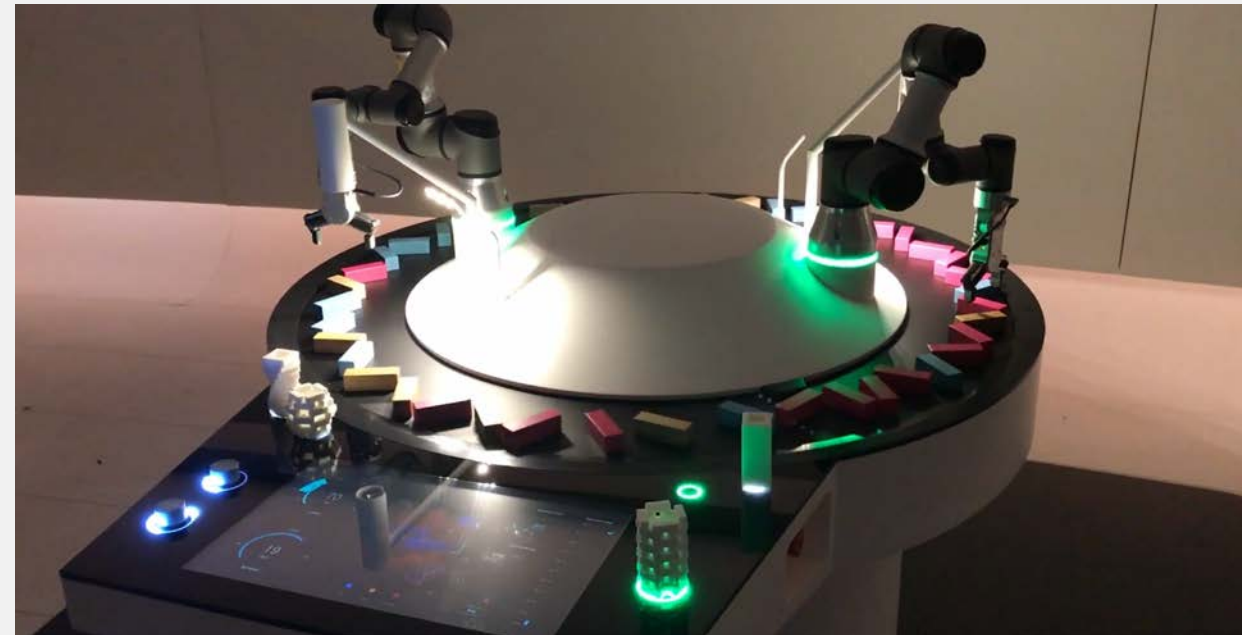
# Cognition

## CYBERNETICS – THE ART OF CONTROL

The general term Cybernetics describes the trans-disciplinary approach governing the control of machines and systems using sensors and actuators. We provide tailored control solutions for all levels of robot control ranging from low-level control of electric drives to adaptive and iterative learning process control based on in-process quality measurements. A focus of our work is about visual control using different camera technologies enabling e.g. the gripping of moving parts or mobile navigation.



# *Advanced Control*

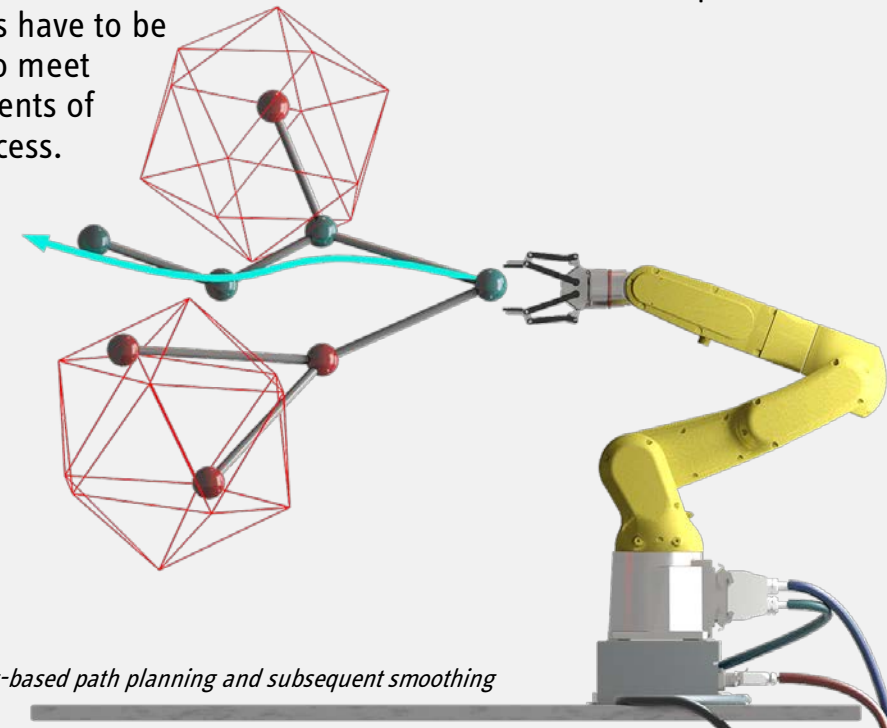


[Robotic Visual Servoing](#)



## ROBUST TRAJECTORY GENERATION FOR UNPREDICTABLE ENVIRONMENTS

Path planning facilitates global and local planning algorithms in order to find a feasible route to target coordinates, using both real-time sensory information and environment maps. It is the basic requirement for directed motion of a mobile robot to its target within the context of autonomous navigation. We employ a large spectrum of path planning algorithms and specialize in individual solutions for scenarios in which established path planning algorithms have to be extended in order to meet particular requirements of environment or process.



*Collision avoidance by sampling-based path planning and subsequent smoothing*

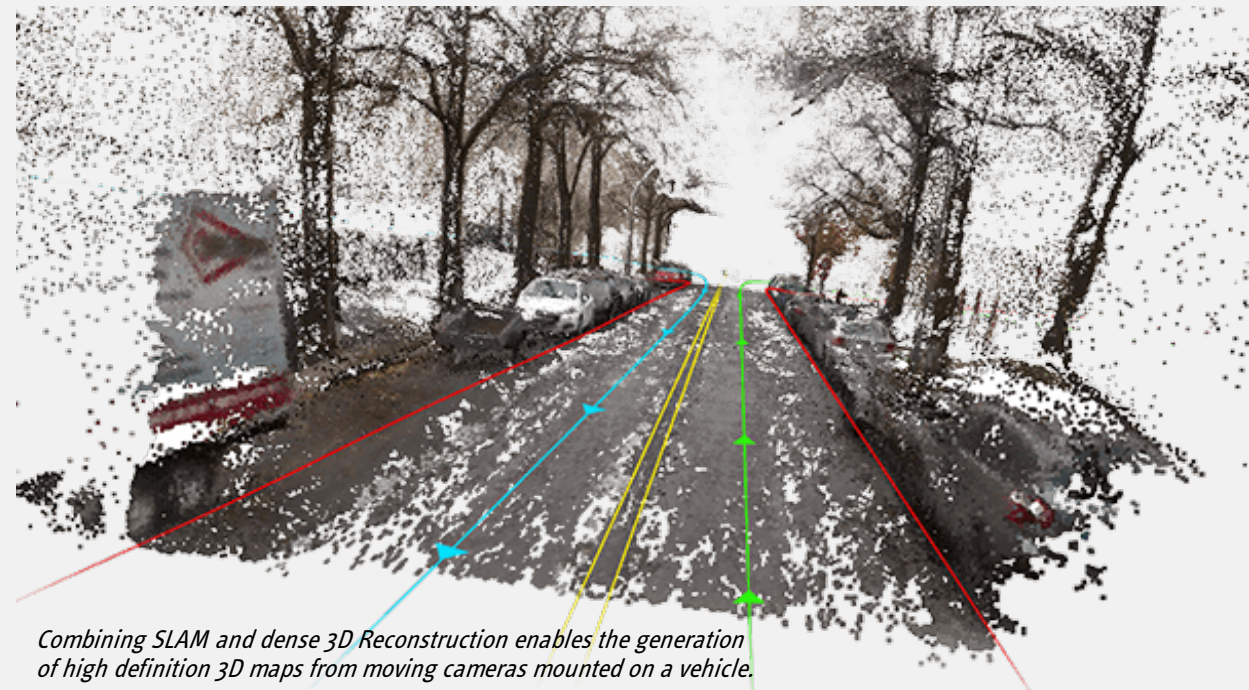


# Cognition



## MEASURING THE UNKNOWN

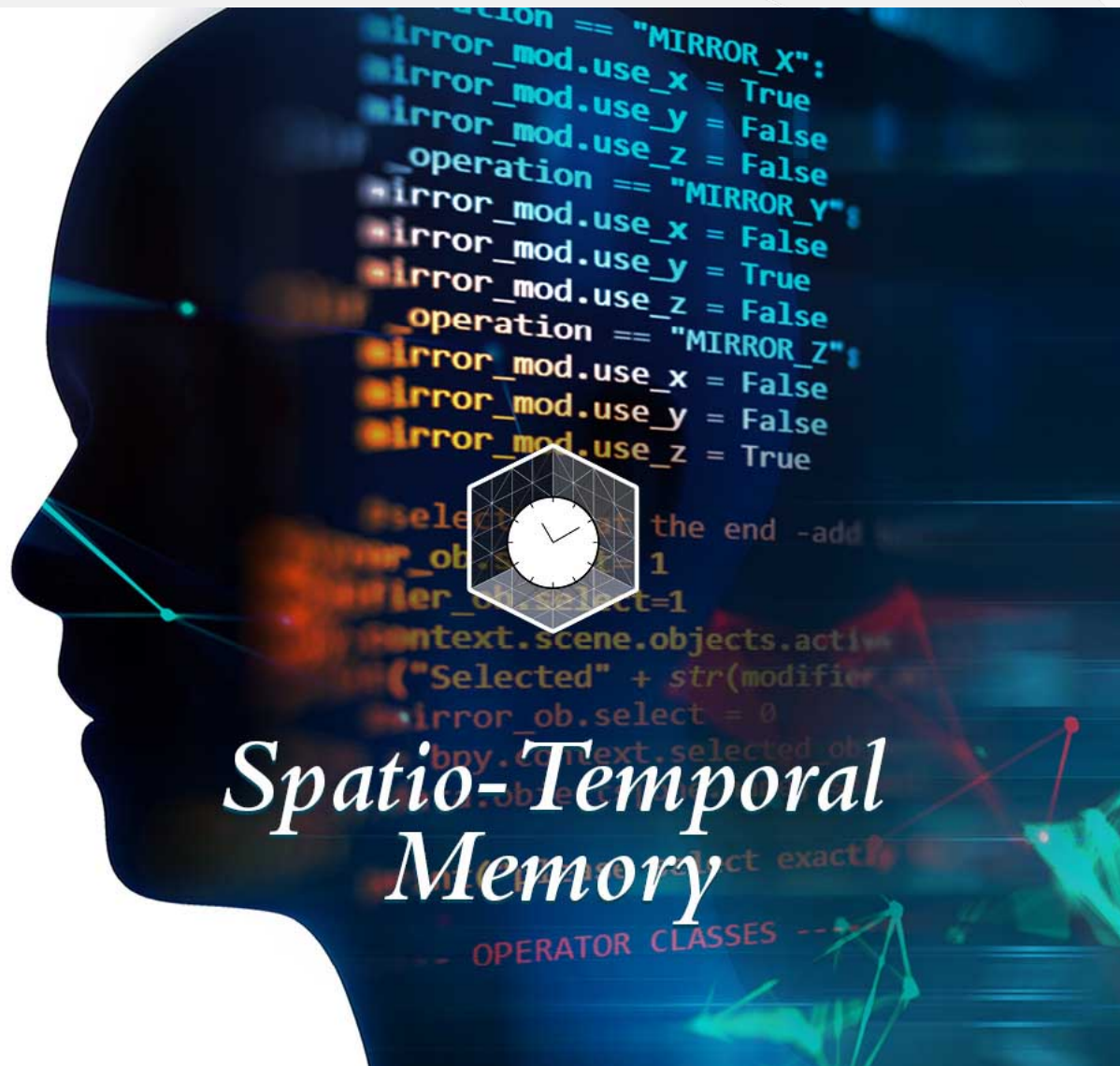
The core idea of SLAM is to imitate the human way of sensing space e.g. while moving around a building and observing it. We provide SLAM solutions for off-the-shelf sensors, which are common for cost-optimized robots. Enhancing state-of-the-art SLAM with our proprietary algorithms leads to higher accuracy and a broader application spectrum. Additionally, the integration of semantic perception algorithms enables the robots to understand and to map the environment in 3D.



*Combining SLAM and dense 3D Reconstruction enables the generation of high definition 3D maps from moving cameras mounted on a vehicle.*



# Cognition



## WHAT, WHERE AND WHEN?

The ability to process complex spatio-temporal information is a fundamental cognitive process underlying the behavior of all higher organisms with it being an important part of the long-term memory involving information about time and space based on our perception. We provide software development towards the usage of Spatio-Temporal Memory as a fusion of the core technologies: Object Detection and Simultaneous Localization & Mapping.



[Spatio-Temporal Memory used in basic office environment](#)



# Cognition



## DATA EFFICIENCY

Deep learning models have proven their recently unmatched performance in various use cases, however, in order to achieve competitive results, a vast amount of data is required. Data collection is especially expensive in robotics as collecting new data often requires actuators to be employed. We enable robots to acquire new knowledge using only a few new data samples.



In metric learning, we are not interested in the exact class of an object, but only how similar it is to the known ones. In the example, a wallet is compared to another set of wallets. The thickness of the arrows indicates the similarity. In our case, the wallet would be assigned to the same instance closest to its source.



## *Interaction*



BEAUTY AND BRAINS, PLEASURE AND USABILITY -

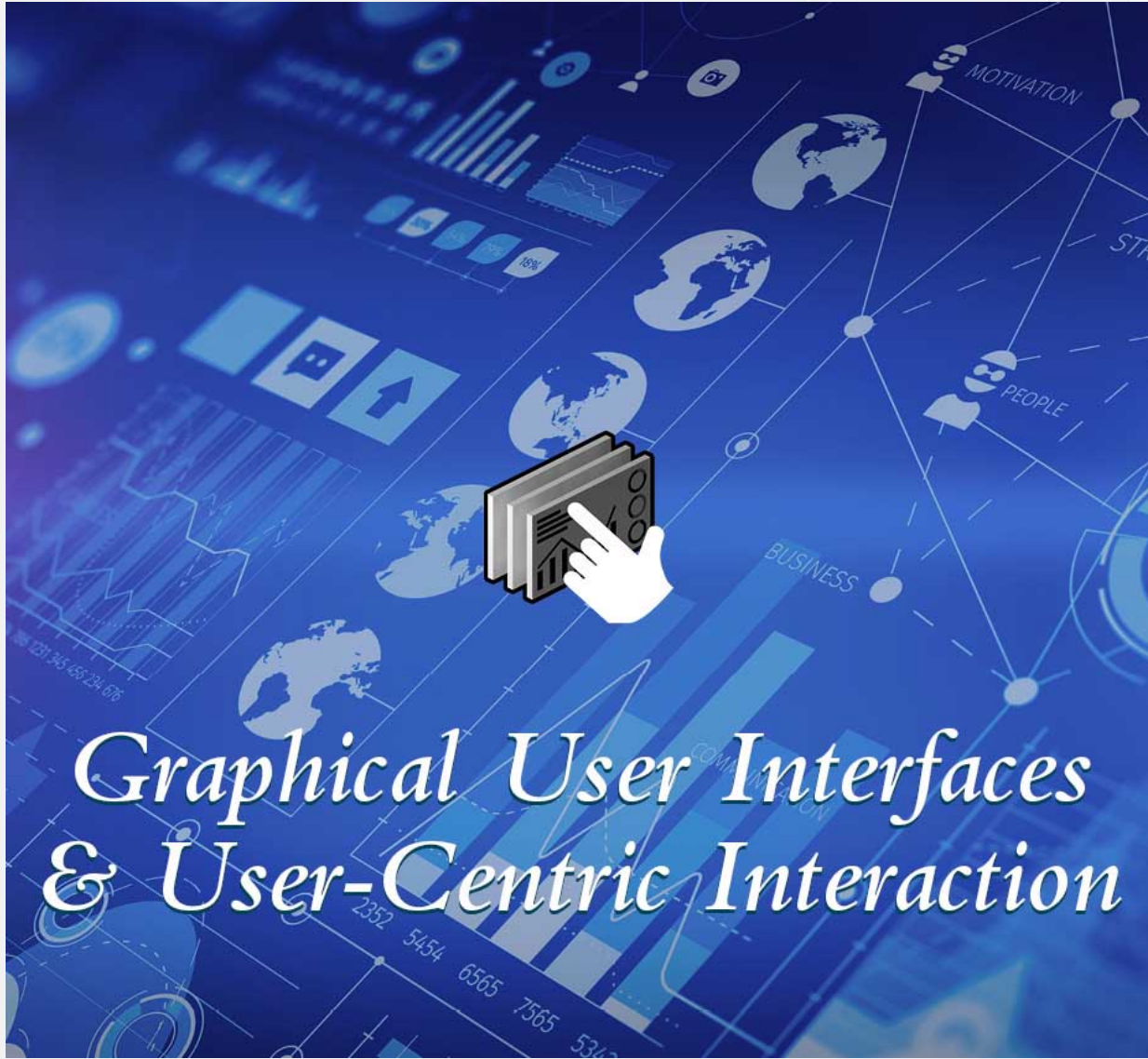
THEY SHOULD GO HAND IN HAND.

— DONALD A. NORMAN

The most prestigious principle in the realm of computer science comes together, when human and machine meet. We are following the paradigm of human-centric automation: support humans with classic and spatial interfaces enabling close collaboration of people and robots.



# Interaction



## FLEXIBILITY, MODULARITY AND INTUITION

In robotics, best practice user interfaces serve to ease the interaction, add intuitiveness and comprehensibility of complex operations. Touch-displays even found their way into manufacturing environments and one can spot tablet-PCs and smartphones with different IP-protection classes. Excelling at the design and development of graphical user interfaces for robotics, we target user-centric design, carry out user studies and develop interfaces for connecting external services as well as industrial robots from a wide range of manufacturers.



*Dashboard for a multi-robot control scenario*



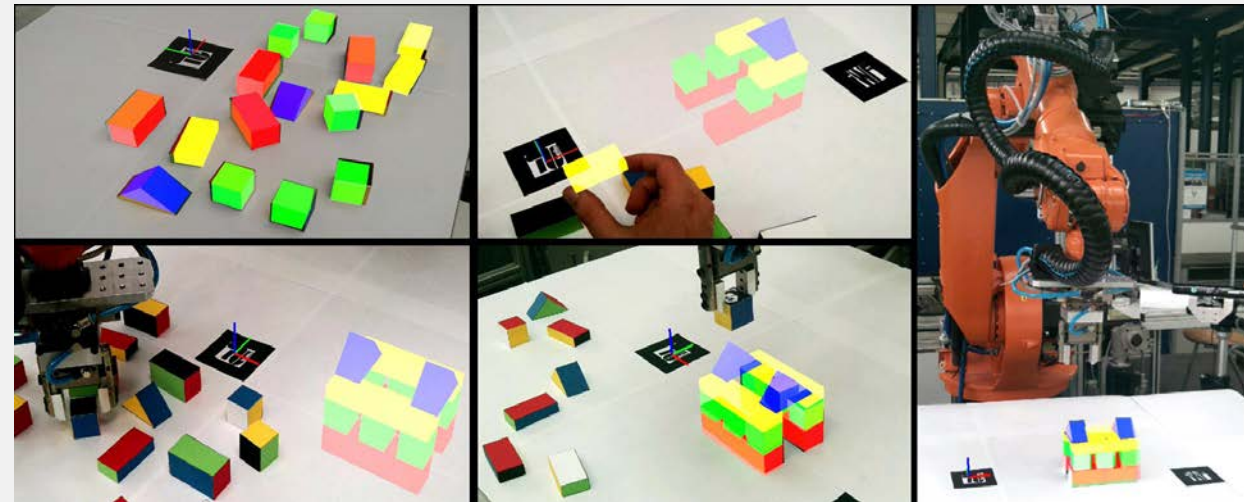


# Interaction



## ROLE-MODEL HUMAN COMMUNICATION

In addition to facial expressions and haptics, gestures are a type of intuitive nonverbal human communication and can be used in combination with or independent from other types and modalities of communication. We provide tailored gesture control interfaces for robotic applications. Furthermore, we develop multi-modal interfaces for fair exhibits.



*Visualization of the initial scene (top left), the translation process of individual workpieces by demonstration (top center), the execution of the task by the real robot (bottom left and right) Middle bottom) and completion of the task (right)*

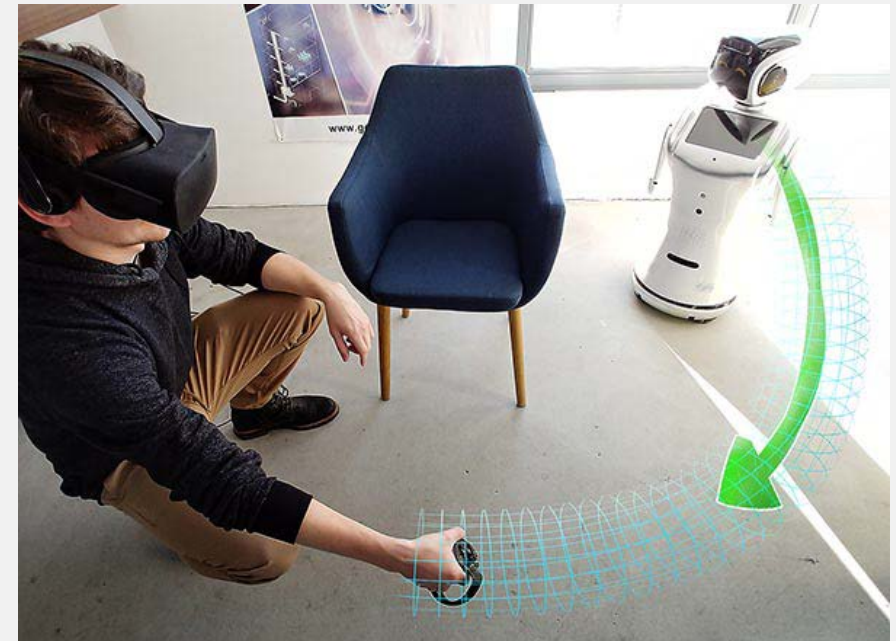


## Interaction



### VIRTUAL WORLD MEETS ROBOTICS

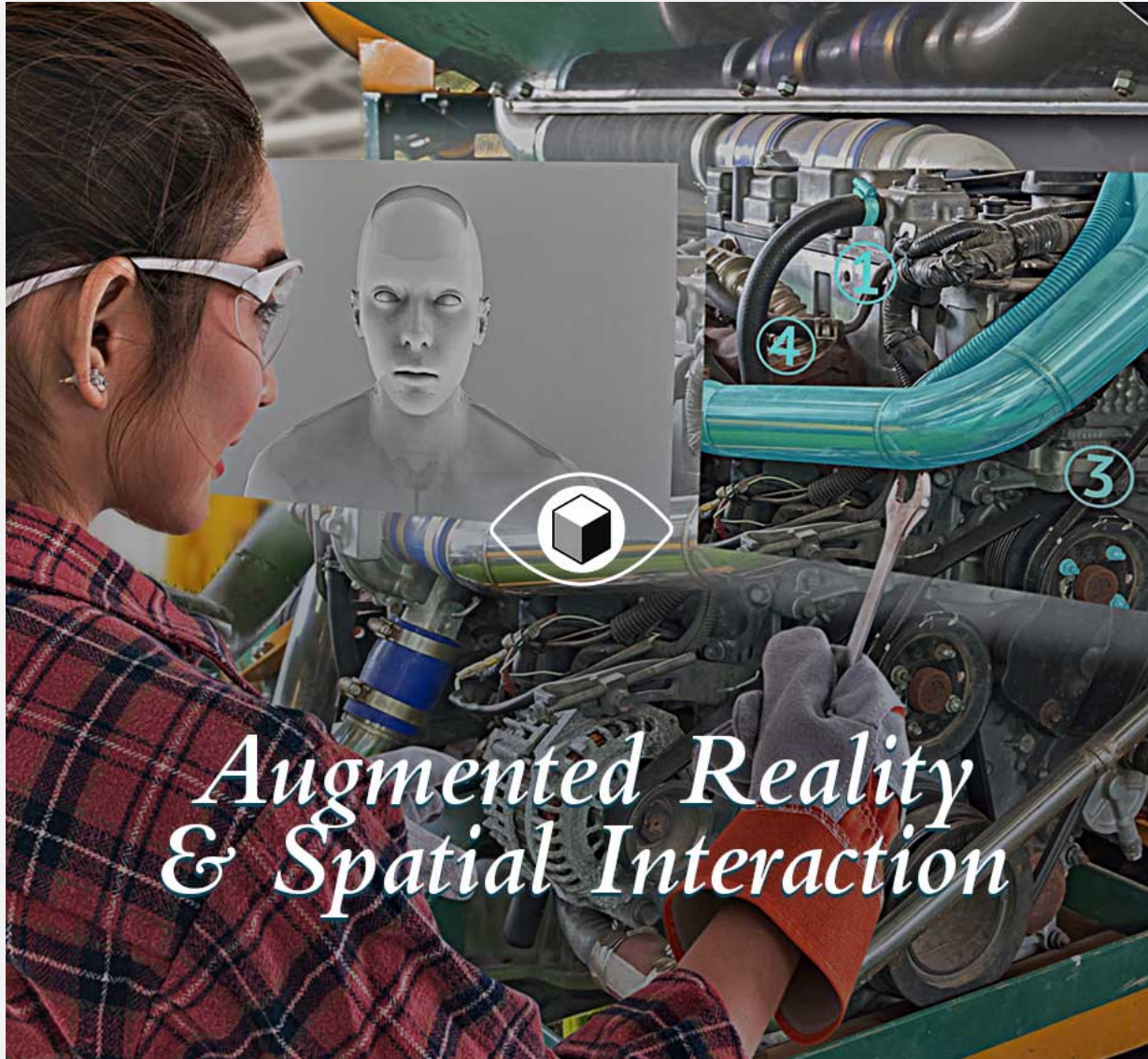
Virtual Reality became quite popular in areas, where the goal is to gain experience remotely. Related to robotics, it is considered to be a great benefit to experience a digital factory design, a robot simulation and tele-operation of robots. It is about control and communication with the robot via gestures or high-level commands.



*Illustration of the abstract visualization in VR, which is being delivered by the mobile robot in real-time*



## Interaction



## FUSING ROBOTICS' PHYSICAL REALITY WITH THE DIGITAL, VIRTUAL WORLD

Augmented Reality (AR) is a game changer fusing the reality of the factory with virtual worlds, bringing spatial visualization and (live) simulation to the shop floor. We provide tailored software development for your AR interfaces in robotic production, AR-based fair exhibits, human robot collaboration as well as the control of service robots.



*AR Android industrial robot simulation for the shop-floor*

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