Artificial Intelligence and Virtual Reality

Digital transformation, research and society

Dr. Cristian Axenie

https://audi-konfuzius-institut-ingolstadt.de

Agenda

A perspective, current projects and future work

- Introducing the speaker and AKII Microlab
- AI and VR? What, where, why?
- AI and VR in the digital world
- When AI meets VR for society
- Where are we heading?

Introducing the speaker

PhD in Neuroscience and Autonomous Robotics,
Summa cum Laude

Specialized in designing and implementing
AI and ML system for
real-world problems

Academic Research

Head of Research Lab
AI and VR
As of 2017

AUDI KONFUZIUS-INSTITUT INGOLSTADT

Lecturer
As of 2017

Technische Hochschule Ingolstadt

Postdoctoral Fellow,
Lecturer
2016-2017

bccn munich
Center of Competence on Neuroengineering

Research Assistant (PhD)
2011-2016

Technical University of Munich

Industry Research

Senior Research Engineer
AI, ML & Big Data
As of 2017

HUAWEI

Software Engineer
Automotive
2009-2011

intel

Software Engineer
Automotive
2009-2011

WIND RIVER

Software Engineer
Embedded Systems
2007-2008

freescale semiconductor

Introducing AKII Microlab

DR. CRISTIAN AXENIE,
GROUP LEADER,
PI IN AI AND ML

PROF. DR. THOMAS GRAUSCHOPF,
PI IN VR

ARMIN BECHER,
PHD STUDENT

SEBASTIAN POHL,
MSC STUDENT

STEFAN SCHIECHEL,
BA STUDENT

MARTIN KUNZ,
BA STUDENT

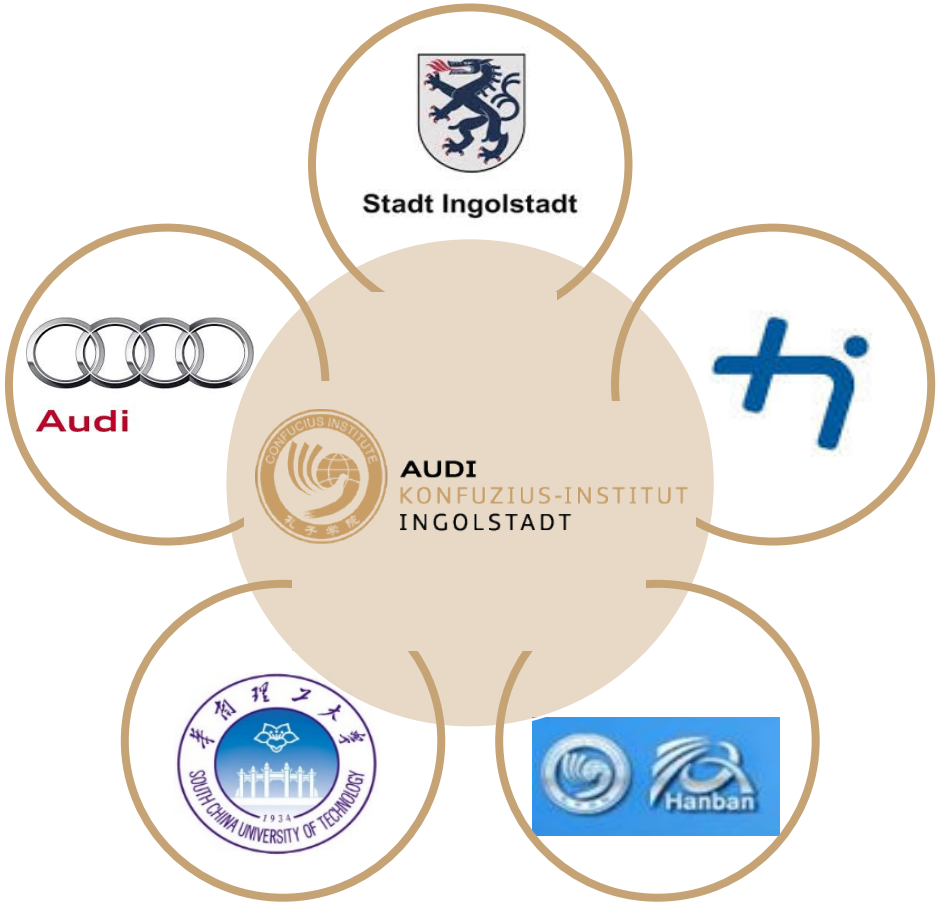
MARTIN GNAHN,
BA STUDENT

Confucius Institutes in Germany

Audi Konfuzius Institut Ingolstadt (AKII)

Specialization in Technology, Innovation, Management and Sustainability

- Among **19 locations** in Germany, **AKII** is **unique** in its **focus**.
- **AKII** offers the usual **basic Chinese language** and **cultural** programs.
- **AUDI** and the **Local Administration Ingolstadt** are dominant partners bringing a **technological**, **innovation management** and **sustainability** component to AKII.
- **AKII** has an **advisory board** from **SCUT** and **THI** as academic components.



AI and VR? What, where, why?

AI and VR? What, where, why?

From the OR …

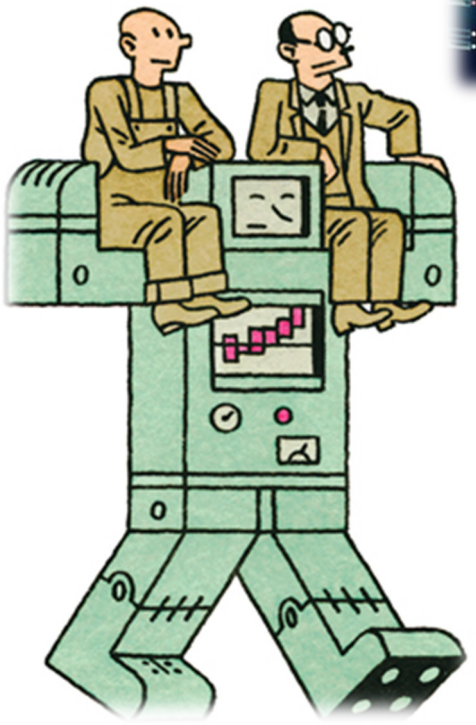
… to the grocery store.

From the theater …

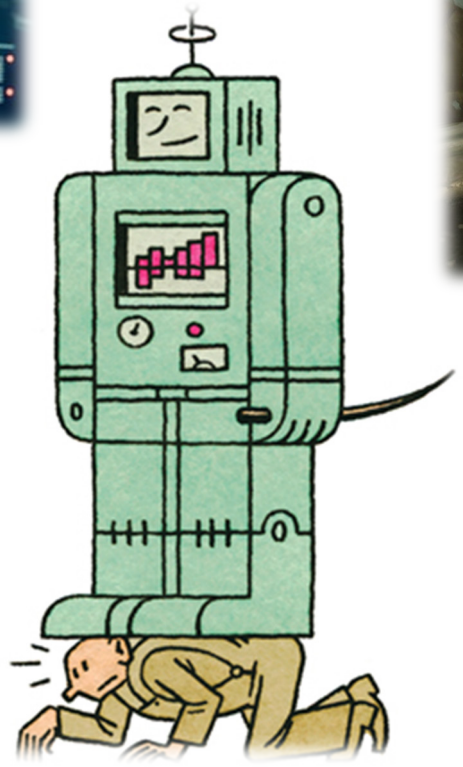
… to the classroom.

AI and VR? What, where, why?

Toward utopia…



… or dystopia …

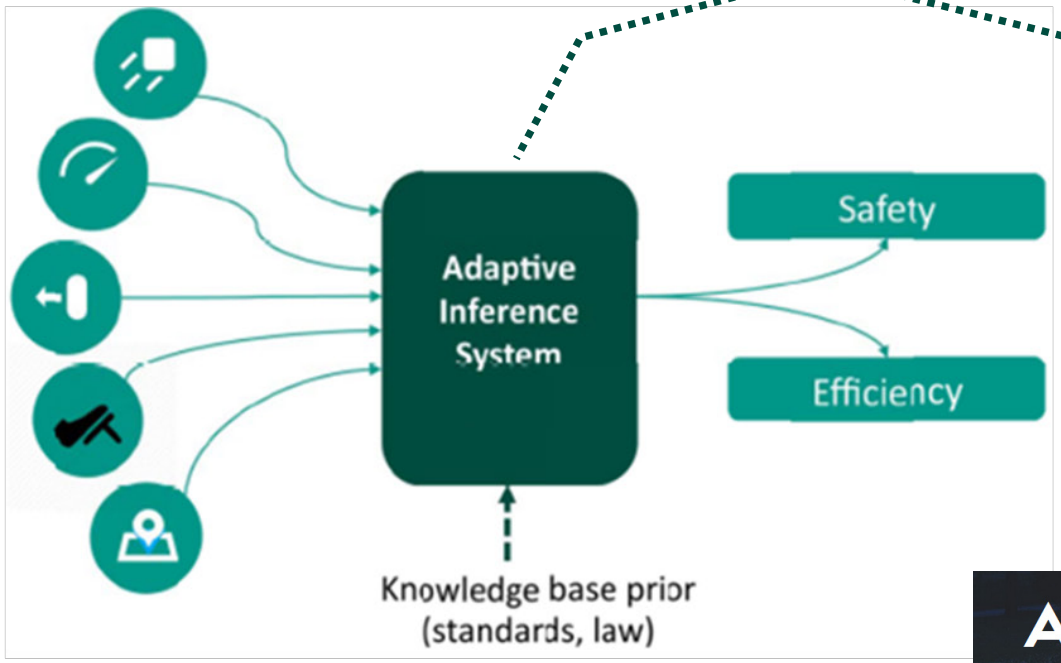


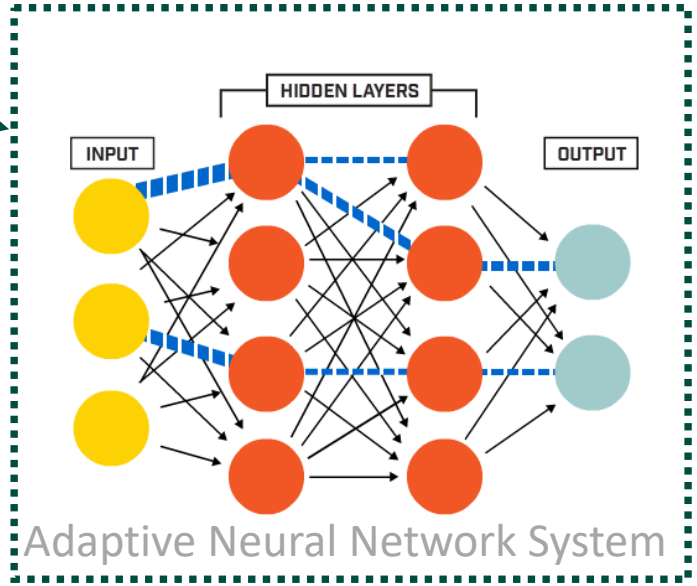
AI in the Digital World

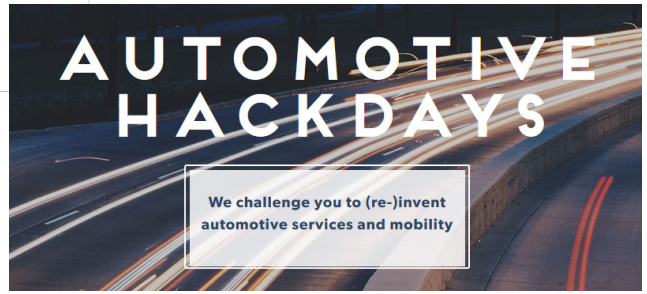
AI in the digital world – Automotive

BMW Automotive Data Hackdays* – Mobility SaaS *(Project completed)*

The Automotive Hackdays are a 5 day coding event where developers, designers, engineers and makers get together to rapidly prototype and iterate new automotive concepts using data gathered from real BMW and MINI cars.







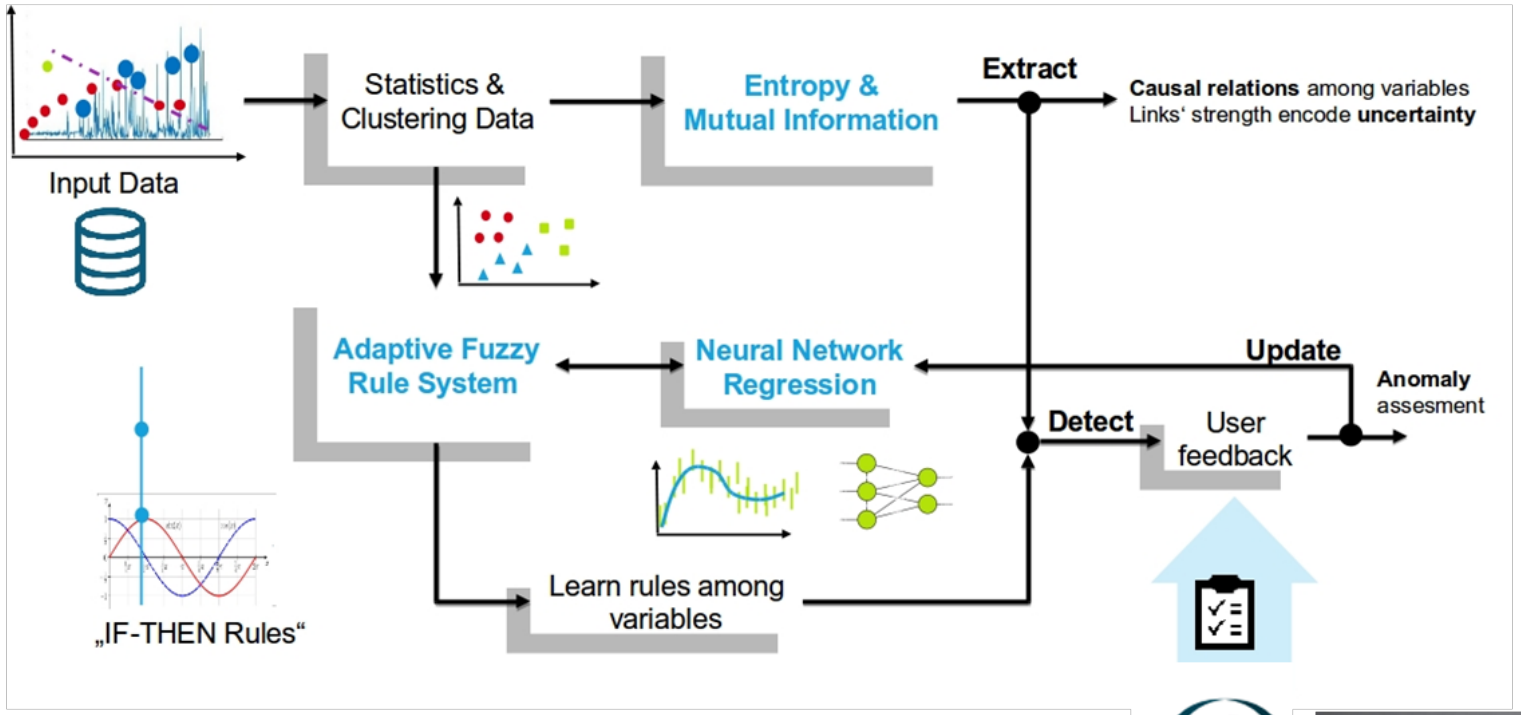
unternehmertum
Center for Innovation and Business Creation at TUM

***Awarded 1st prize (5000EUR)**

AI in the digital world – Fintech

Daimler Financial Tech Data Hackaton* – Anomaly Detection Agent *(Project completed)*

Develop an AI agent constantly runs through the data (leasing contracts in Sweden) and makes the user aware of potential data inconsistencies, incorporates user's feedback and adapts.



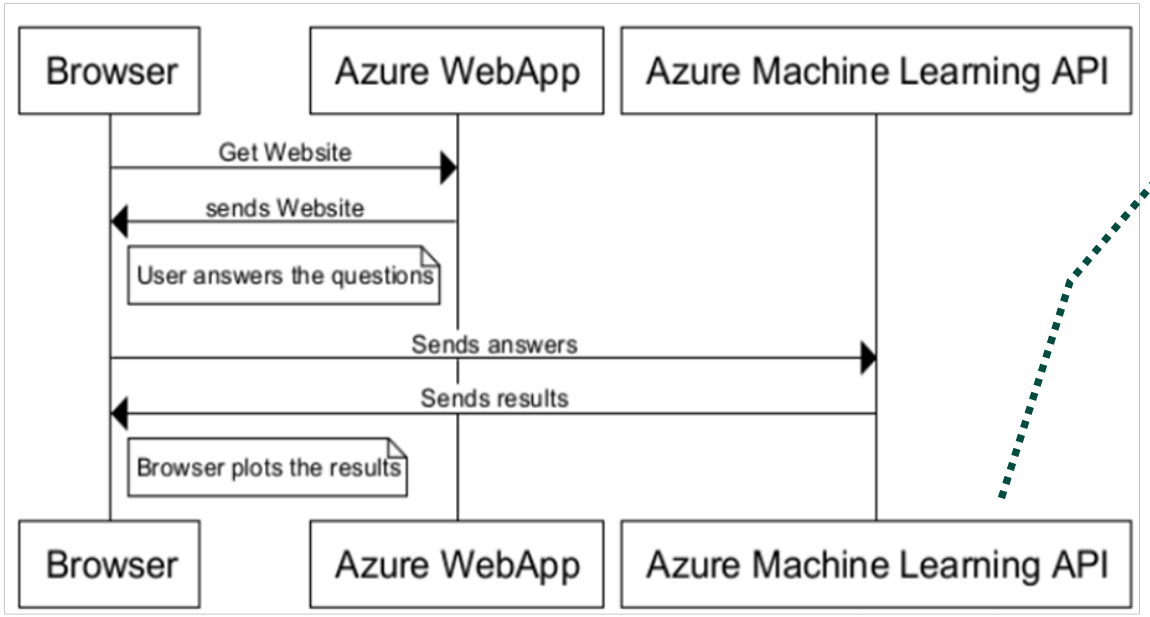
*Awarded 1st prize

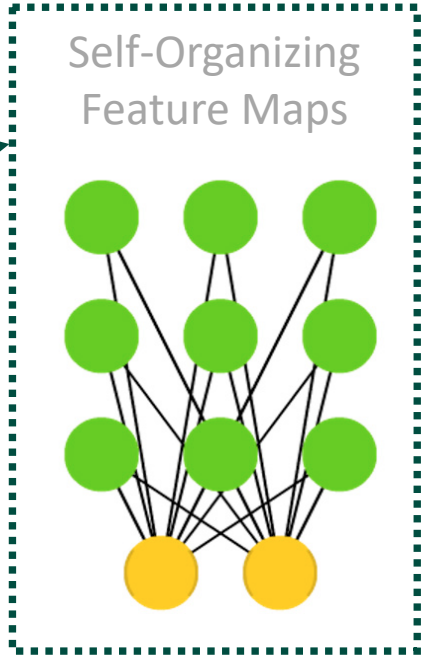
DAIMLER

AI in the digital world – HR and Psychology

Burda HR Data Hackaton* – Psychometric Data Mining *(Project completed)*

Using neural networks to learn the complex patterns that exist among and between the responses to items in questionnaires. These could represent crucial aspects of human personality if only they could be made available to human resource professionals.





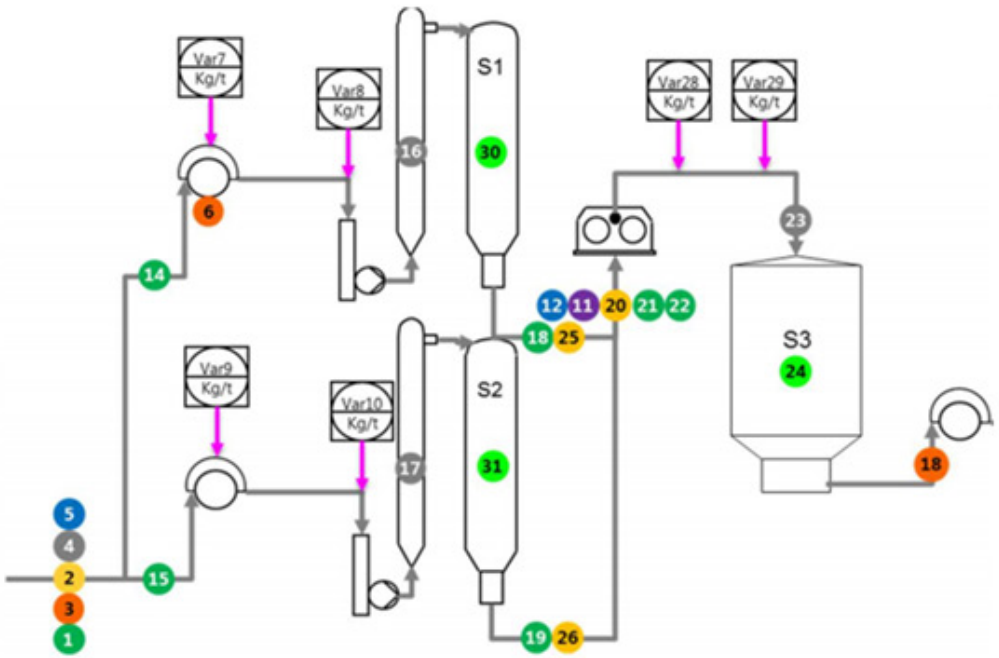
Hubert Burda Media

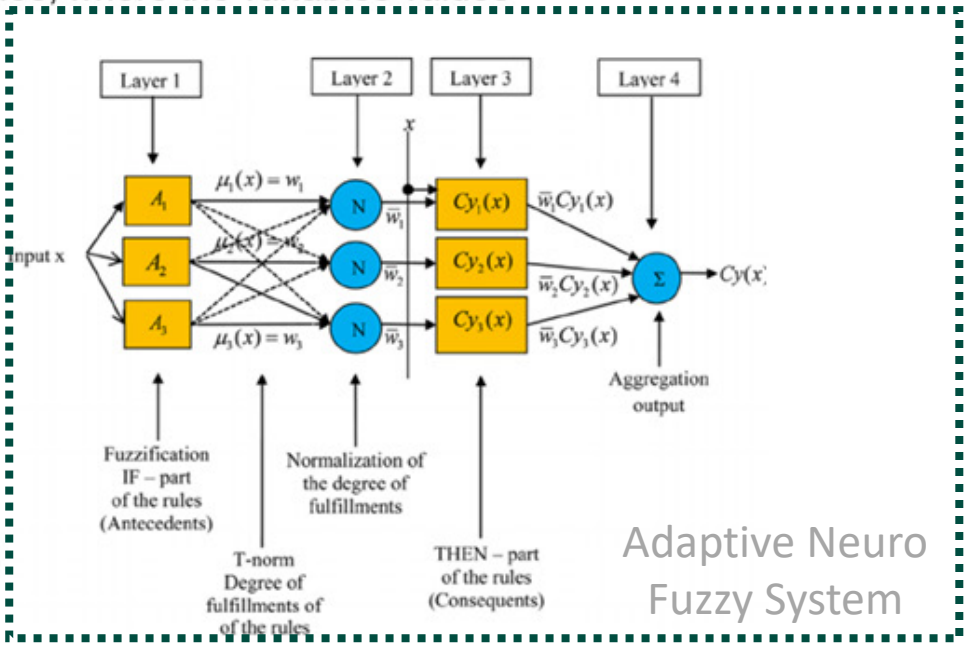
***Awarded Microsoft Cognitive Technologies Prize**

AI in the digital world – Industrial Automation

Andritz Big Data Analytics – Industrial Process Optimization *(Project completed)*

The task was to find relationship between alarms, operator actions and process data from some pulp and paper mill. The process data was given as time series, where the variables values always have a timestamp.





Adaptive Neuro Fuzzy System

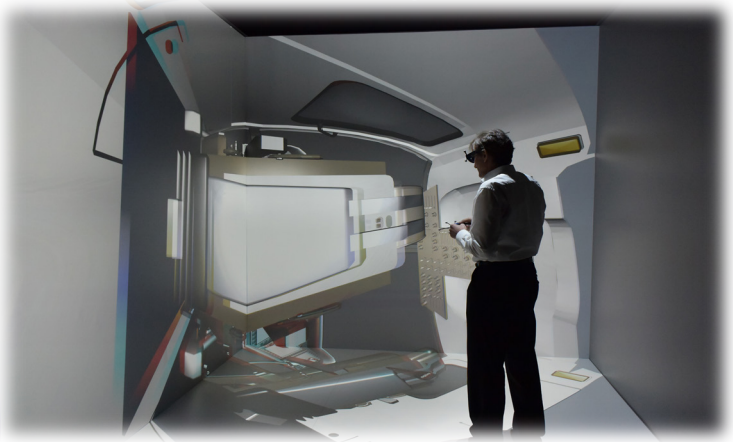
ANDRITZ

VR in the Digital World

VR in the digital world – Automotive *(Projects completed)*

- Project in Automotive for collaborative VR:
  - High-end renderings
  - Construction validation
  - Virtual installation
  - Ergonomics

High-end renderings



Construction validation

- **Latencies** in distributed VR causes **misunderstandings** and **decreases** the **efficiency**

- **Cooperation** with **Audi** to develop a measurement system to **measure delays between distributed** VR systems

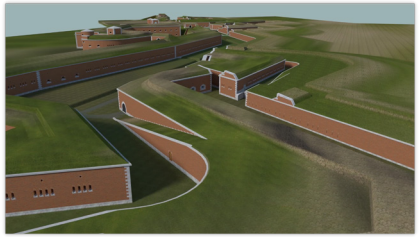
Virtual installation for ergonomics

VR in the digital world – Artistic performances and historical projects *(Projects completed)*

- The Futurologische Kongress is an **art and interactive media** event in cooperation with the Theater Ingolstadt

- Over 14.000 people visit the congress and AKII Microlab for an **interactive 3D experience** in the **VR CAVE**

Game playing



High-end renderings

- **Virtual Reconstruction** of the 1875 Ingolstadt Fortress

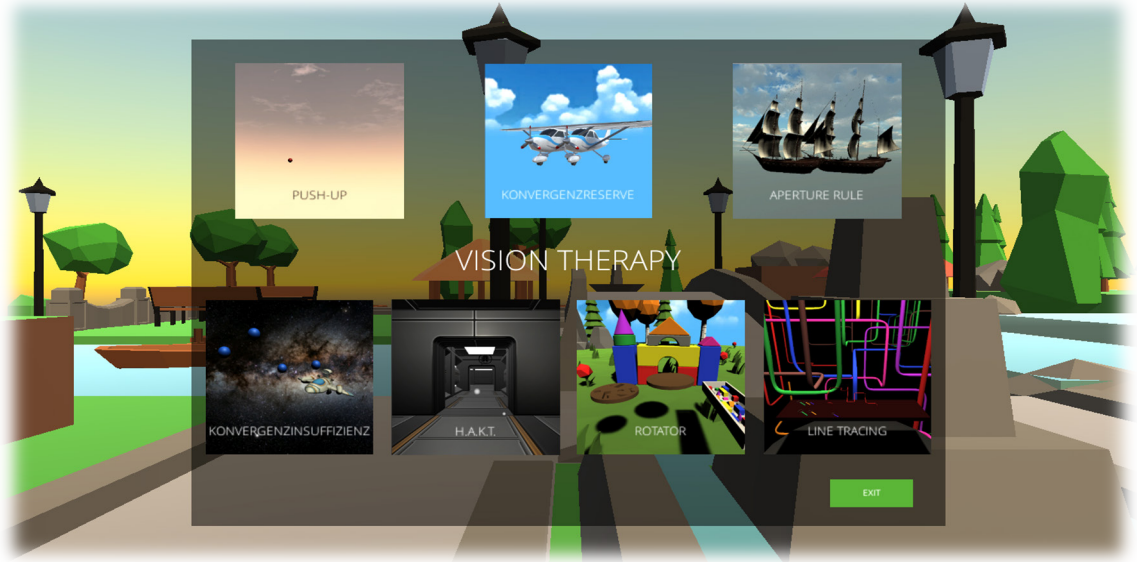
- Collaboration with public instutions and companies

VR in the digital world – Rehabilitation *(Project completed)*

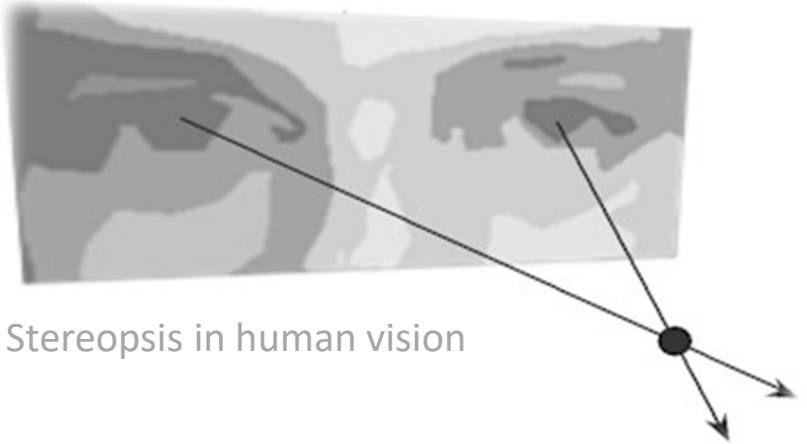
- Software to treat deficiency in stereopsis – **perceiving depth using our two eyes** using an immersive VR

- Cooperation project and **preliminary tests** with **optometrists** of Brillenburg Ingolstadt

System setup



Software interface and functionality



Stereopsis in human vision

When AI meets VR for society

When AI meets VR for society

VolkswagenStiftung

Artificial Intelligence and the Society of the Future

Grant application in review

Educational Technologies (EdTech)

VIRTOOAIR EDTECH

Virtual Reality TOOlbox for Avatar Intelligent Reconstruction in EDucational TECHnology

- **Combine AI and VR**
- Augment **teaching methodologies** and **learning techniques**
- Use in **remote** and **online learning**
- **Easy adoption**

Sample experience: Solar System Lecture

Sample experience: Learning bike riding rules

When AI meets VR for society

When AI meets VR for society

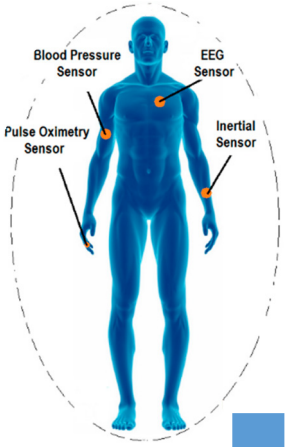
ABB Research Award
in Honor of Hubertus von Gruenberg

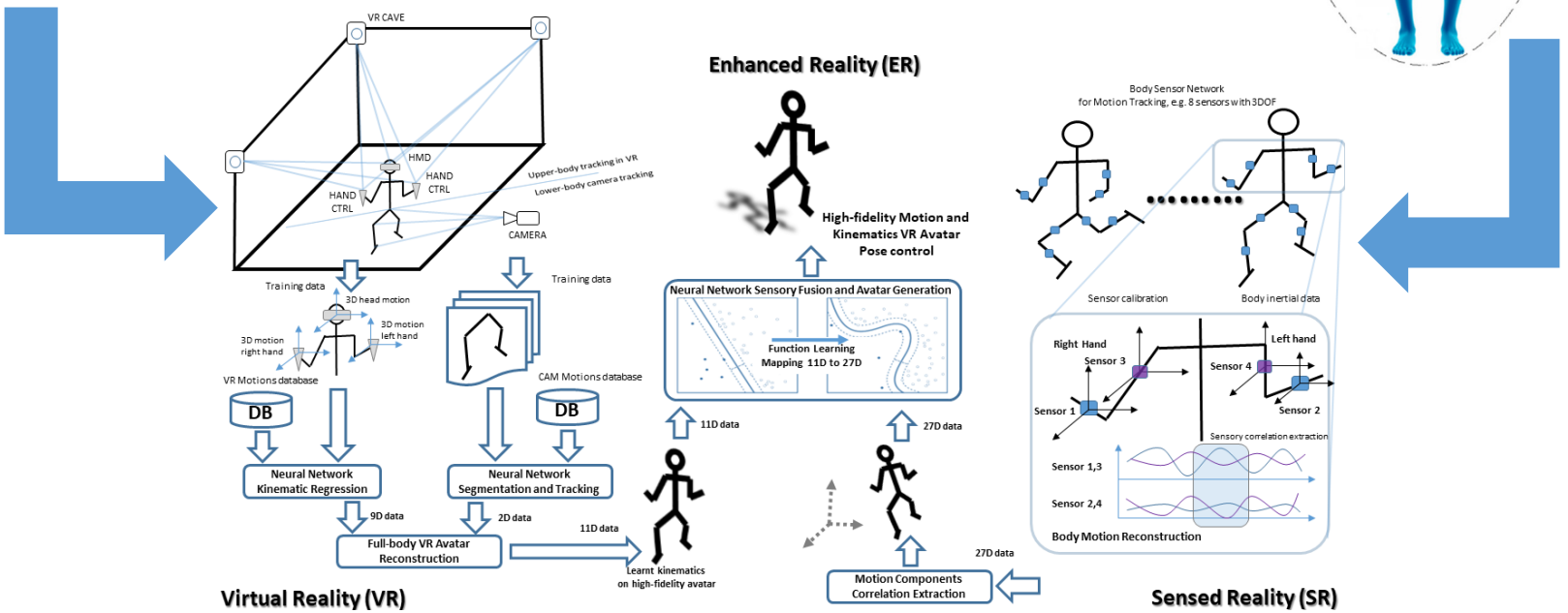
Grant application in review

Physical Rehabilitation Technology

VIRTOOAIR REHABTECH

Virtual Reality TOOlbox for Avatar Intelligent Reconstruction in Rehabilitation Technology





- **MOREPHEUS**: **MO**tor **R**ehabilitation in an **E**xtended reality **P**latform using **H**igh-fidelity **E**xercise **U**nderstanding and **S**ensing.
- **VR and AI** for **personalized** motor **rehabilitation** and **posture control** in **Parkinson's Disease** patients.

When AI meets VR for society

When AI meets VR for society

Automotive Inspection Technology

VIRTOOAIR AUTOTECH

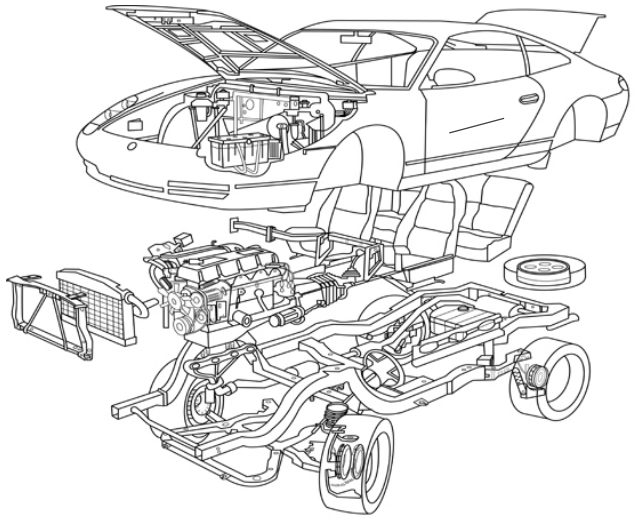
Virtual Reality TOOlbox for Avatar Intelligent Reconstruction in Inspection Technology

150 JAHRE TÜV NORD

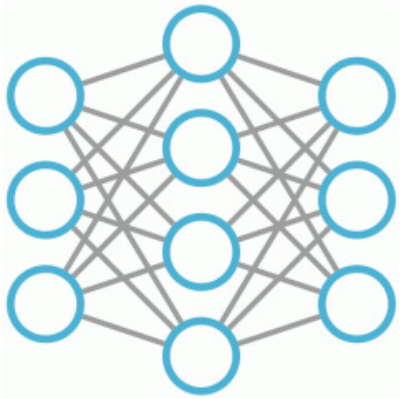
Planning pilot project

- **Automated visualization & AI analysis of car damage** / **homologation** inspection data in VR
  - AI based anomaly / defect (scratch) finding in 360 images of cars
  - Homologation problems

AVANTI: **A**utomated **V**R visualization and **AI** u**N**derstanding of **T**ÜV **I**nspections

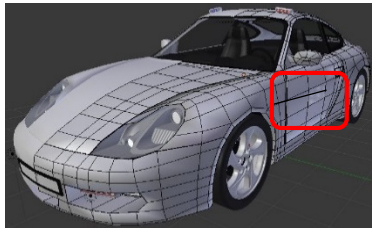


Explosion diagram of car or 3D pictures

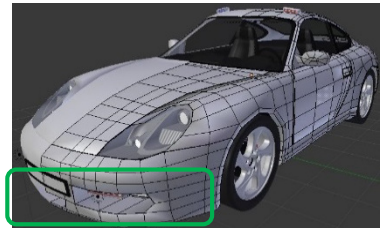


Deep Neural Network

TÜV® USED VEHICLE INSPECTION REPORT



Detected scratch



Detected custom tuning

When AI meets VR for society

When AI meets VR for society

ZIM
Zentrales Innovationsprogramm Mittelstand

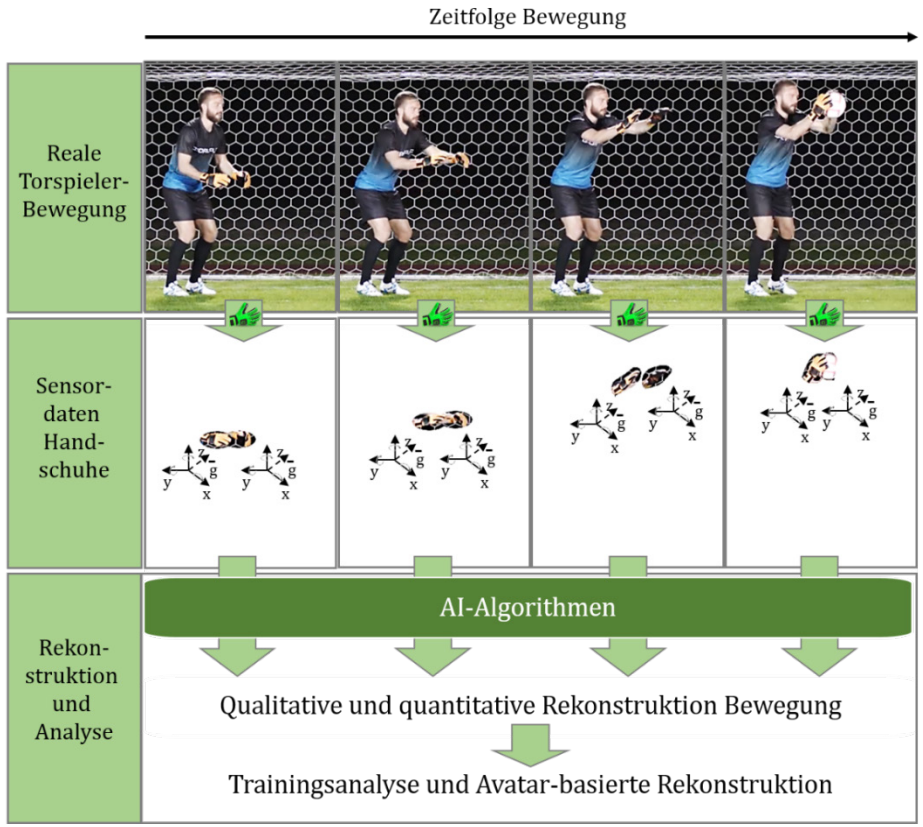
Planning project

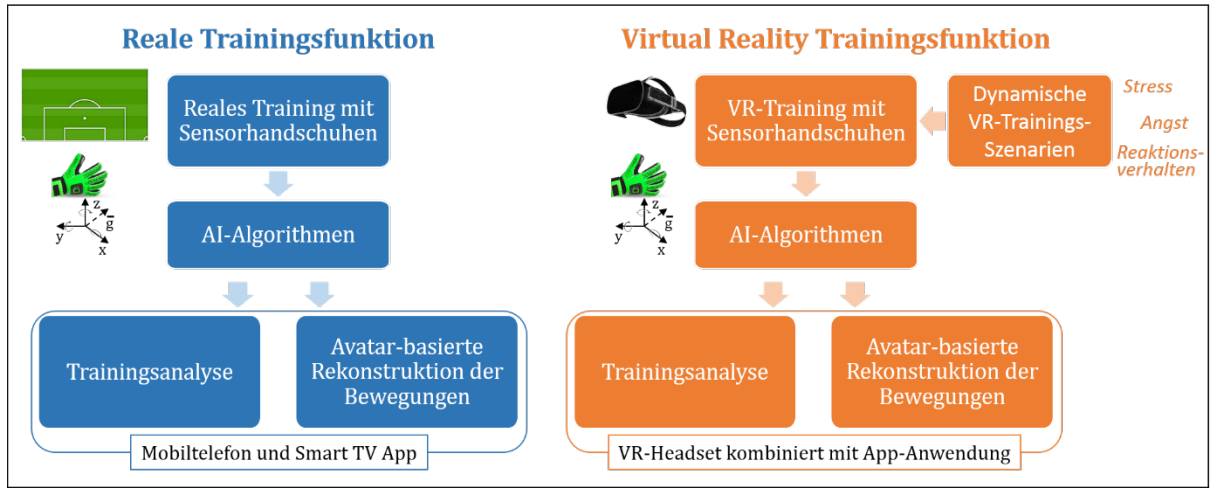
Rehabilitation Technology

VIRTOOAIR SPORTTECH

Virtual Reality TOOlbox for Avatar Intelligent Reconstruction in Sports Training Technology

- Combine **AI and VR Goalkeeper Biomechanical and Psychological Training**





When AI meets VR for society

When AI meets VR for society

Medical Technologies (MedTech)

VIRTOOAIR MEDTECH

Virtual Reality TOOlbox for Avatar Intelligent Reconstruction in MEDical TECHnology

- **pain management** and **attenuation** after **chemotherapy**
- **VR** to **decrease** the number of **treatment sessions**
- may **reduce** or **eliminate** the need for **pharmaceutics**

Neuropathy caused by taxanes in chemotherapy
healthcaremindxchange.com

Helios Klinikum München West

Akademisches Lehrkrankenhaus der Ludwig-Maximilians-Universität München

Daria Kurz

Leitende Oberärztin

Gynäkologisches Krebszentrum

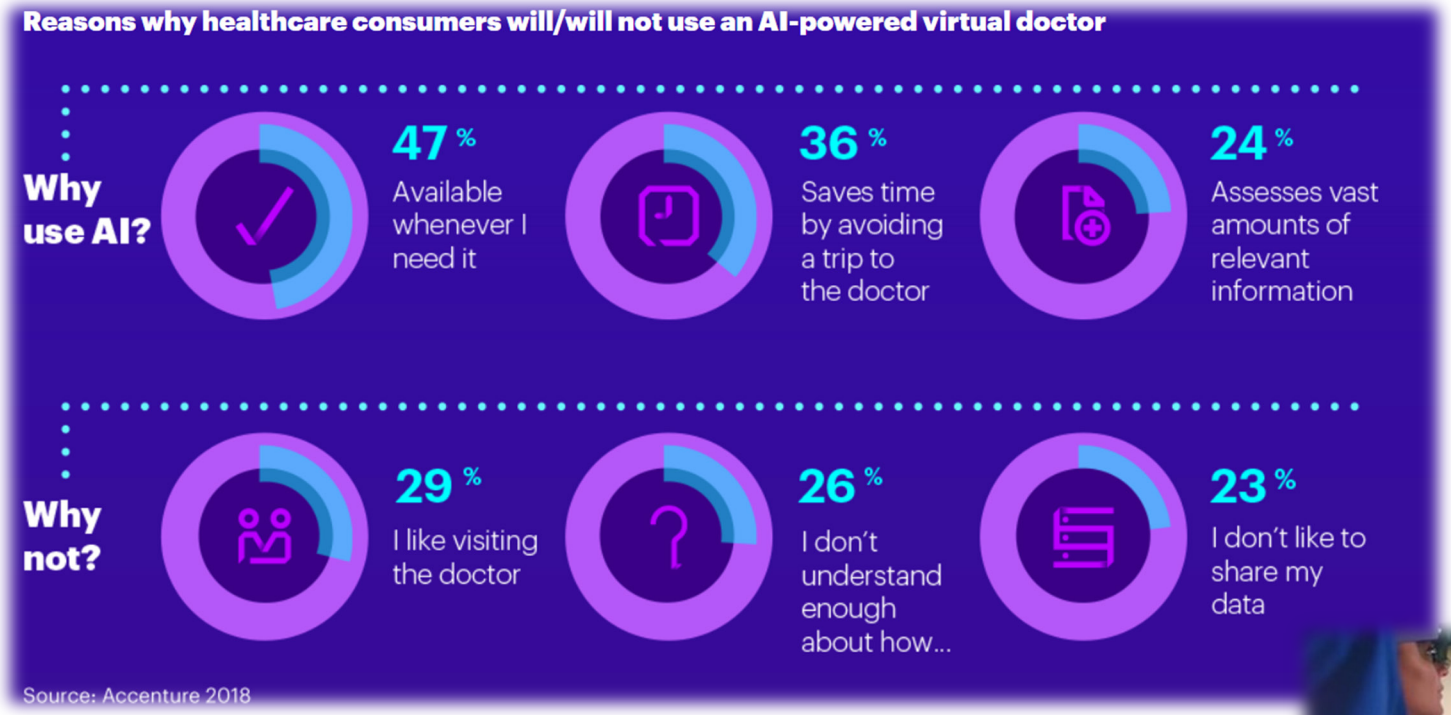
Interdisziplinäres Brustzentrum

Planning collaboration

Easy adoption setup

Where are we heading?

Where are we heading? *Pros and Cons of AI and VR*



Are you ready?

Is your business / service ready for the digital transformation?

- We are still **focused** on **academic research**.
- We continuously **seek new challenges** and **funding options** to **support** our **research**.
- **Support** is always **appreciated**, and we are more than **happy** to **collaborate** on **new challenges**!

Elitenetzwerk Bayern

ine Institute of Neuromorphic Engineering

NVIDIA ACCELERATED COMPUTING
GPU Grant Program

Convergent Science Network
of Biomimetics and NeuroTechnology

Bayerische Forschungs- und Innovationsagentur