Digitalization Tools for Human-centered Intelligence

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

Lecturer
As of 2017

Postdoctoral Fellow, Lecturer
2016-2017

Research Assistant (PhD)
2011-2016

Industry Research

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

Software Engineer Automotive
2009-2011

Software Engineer Automotive
2009-2011

Software Engineer Embedded Systems
2007-2008

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.
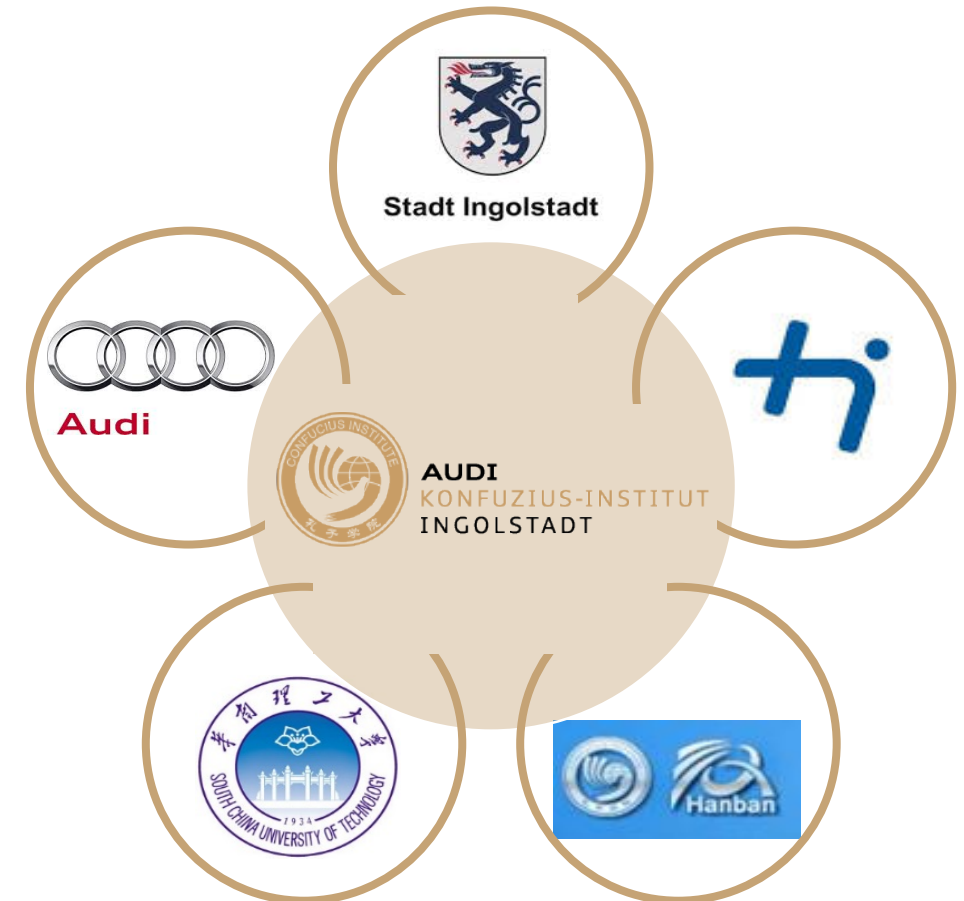
AI and VR? What, where, why?

AI and VR? What, where, why?

From the OR ...

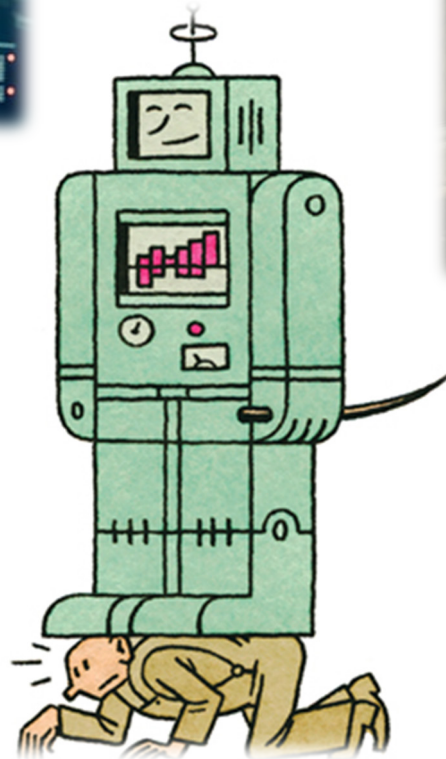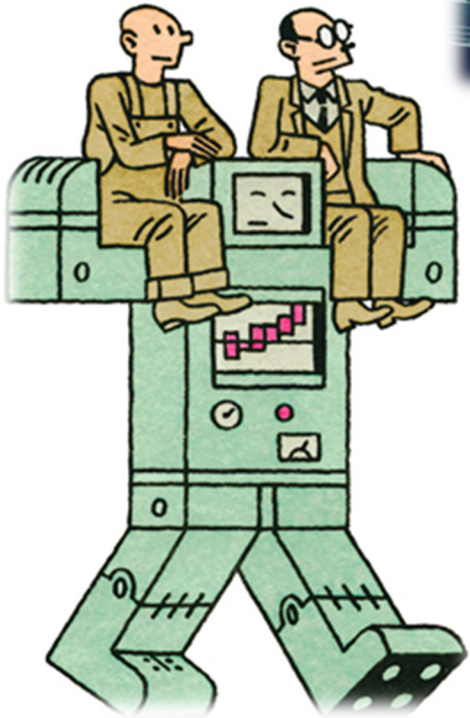... to the grocery store.

From the theater ...

... to the classroom.

AI and VR? What, where, why?

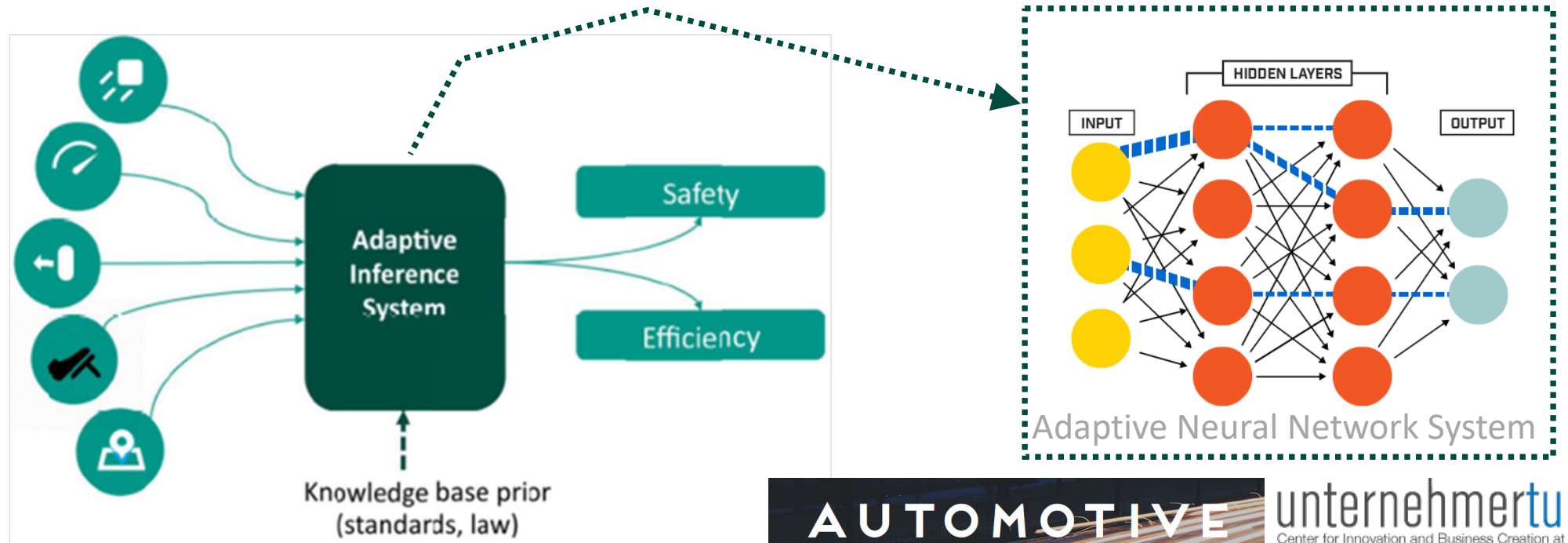Toward utopia…   … or dystopia …
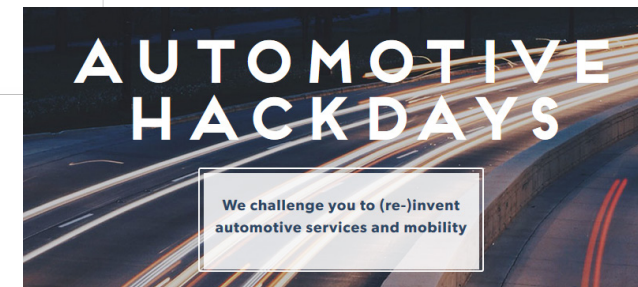
AI in the Digital World

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.

Adaptive Neural Network System

*Awarded 1st prize (5000EUR)

AUTOMOTIVE HACKDAYS

We challenge you to (re-)invent automotive services and mobility

unternehmertum
Center for Innovation and Business Creation at TUM

BMW

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.
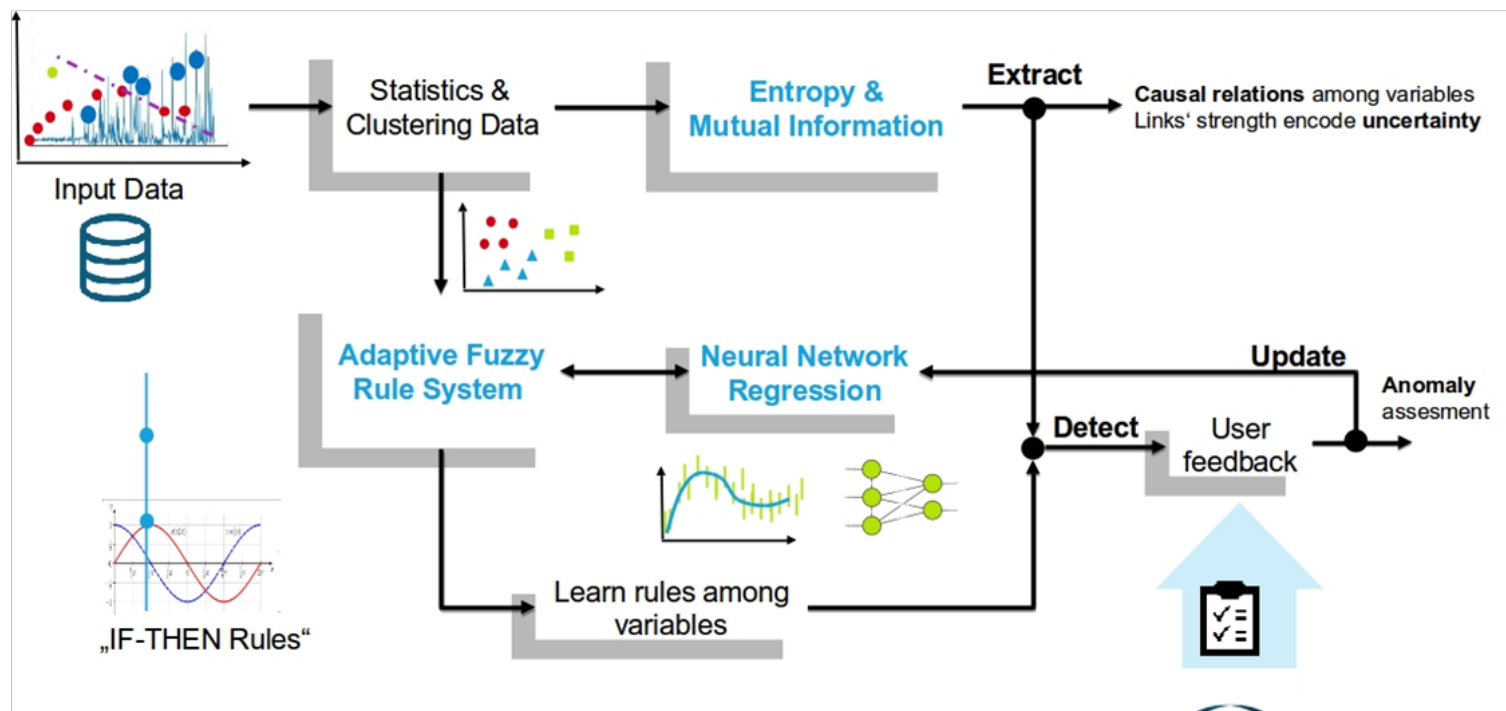

*Awarded 1st prize

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.

Self-Organizing Feature Maps
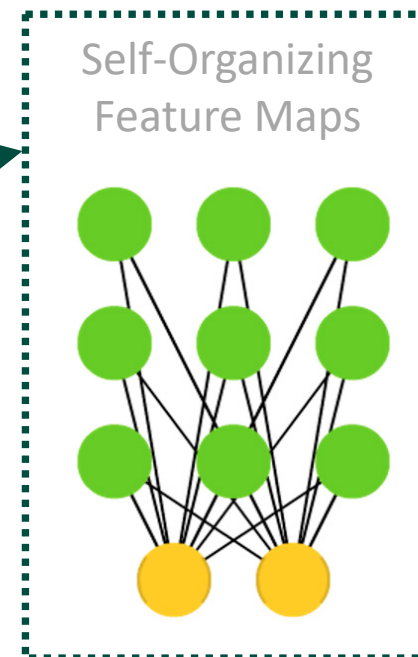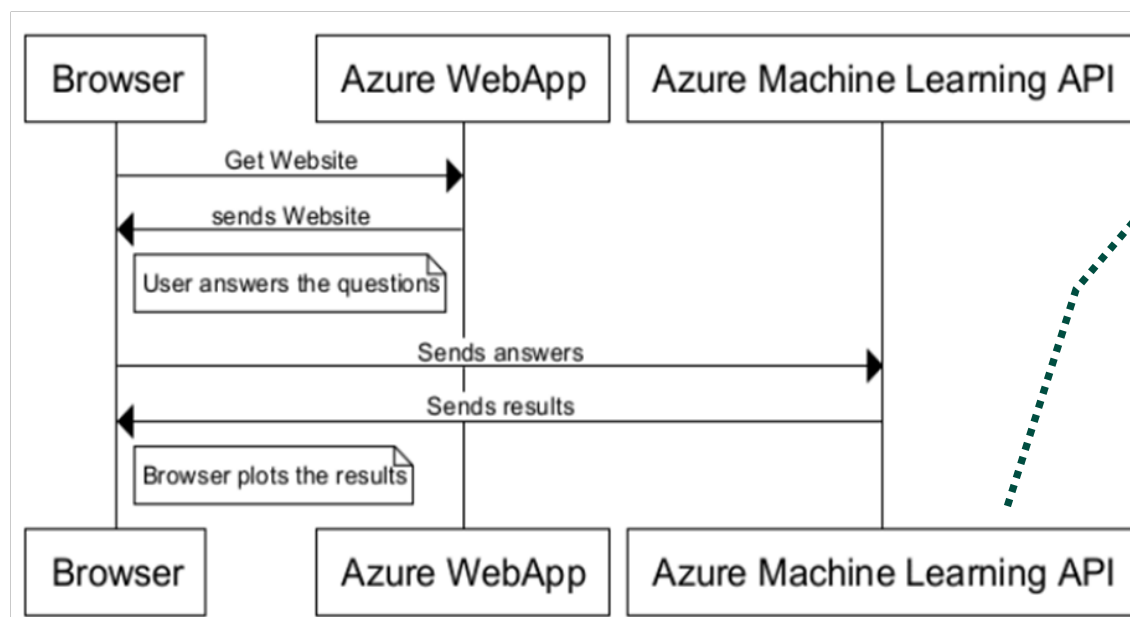
Hubert Burda Media

*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
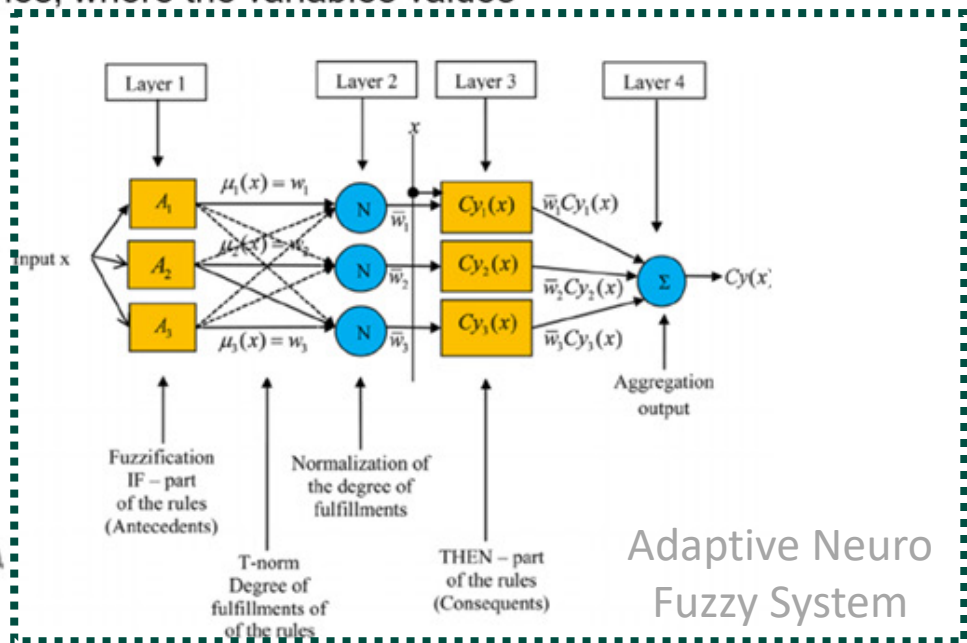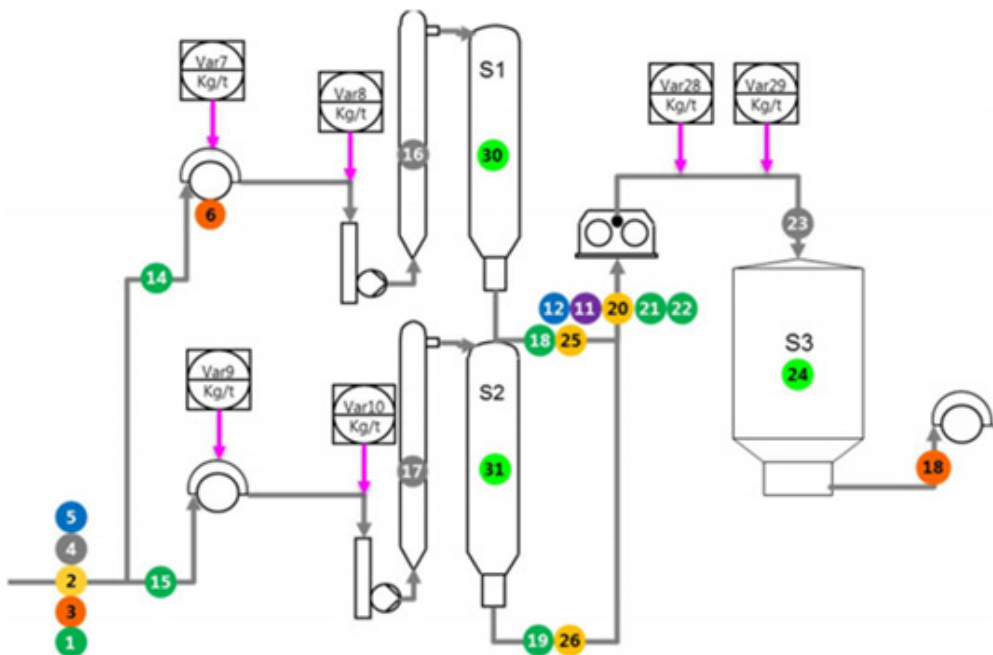
HACKATHON
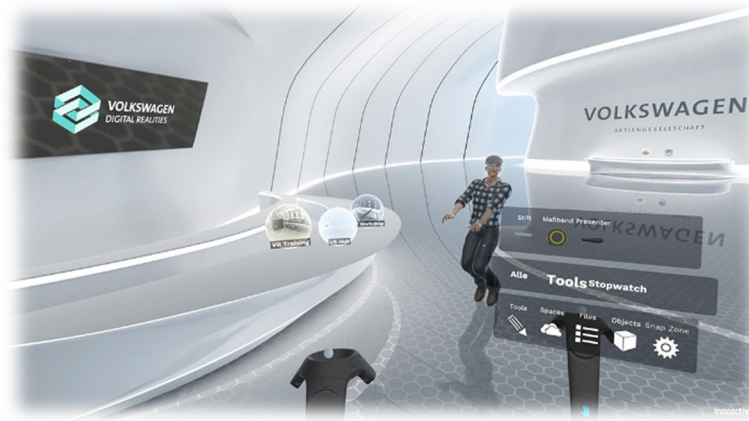GRAZ, AUSTRIA
BIG DATA ANALYSIS
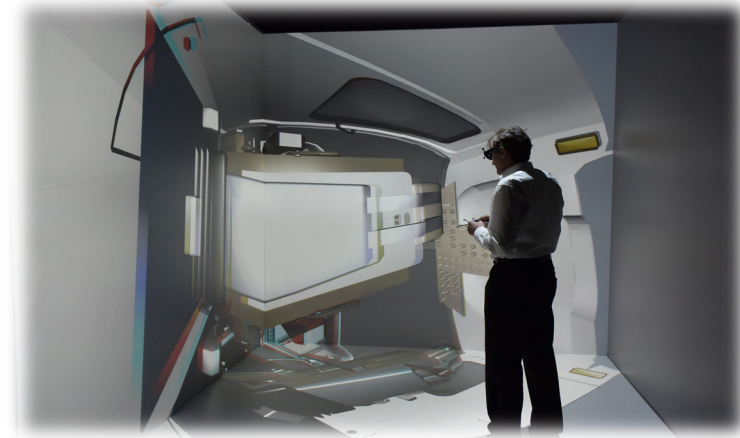PIONEERS ✕ ANDRITZ

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

- **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

High-end renderings

Construction validation

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**

DER FUTUROLOGISCHE KONGRESS
INGOLSTADT
14.-16. JUNI 2018

Game playing

High-end renderings

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

- Collaboration with public instutions and companies

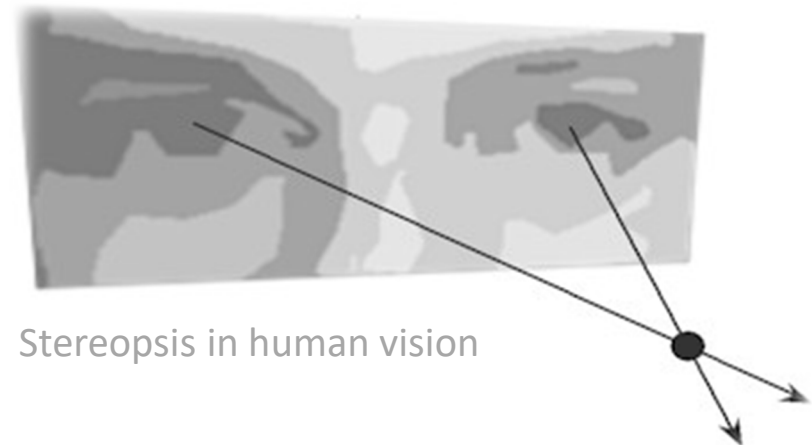# VR in the digital world – Rehabilitation *(Project completed)*

- 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
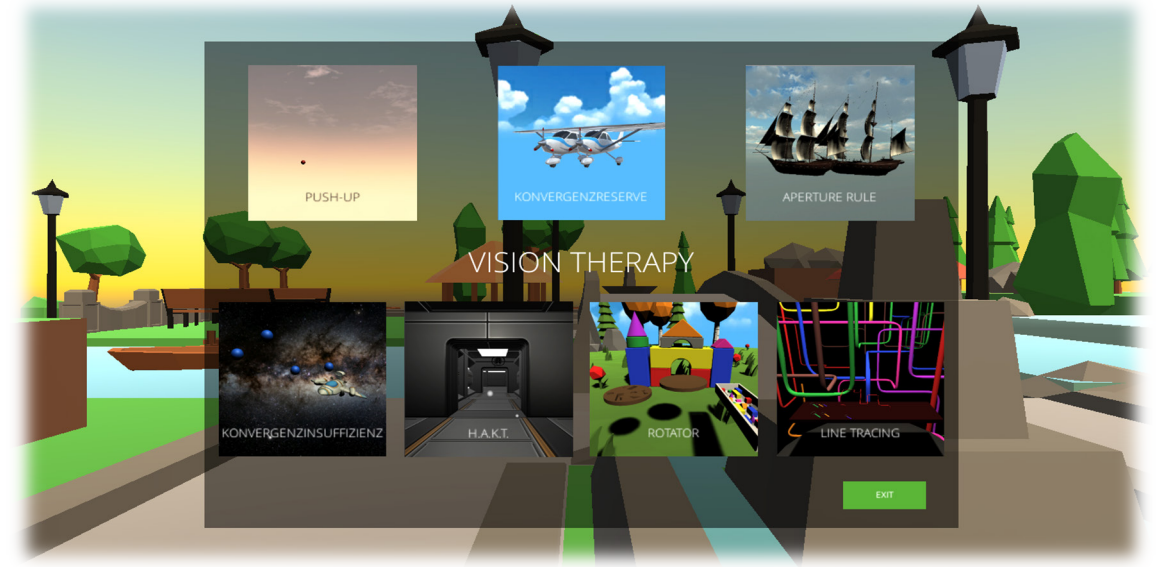
Software interface and functionality

System setup

Stereopsis in human vision

When AI meets VR for society

When AI meets VR for society

Educational Technologies (EdTech)

VIRTOOAIR EDTECH

Virtual Reality TOOlbox for Avatar Intelligent Reconstruction in EDucational TECHnology
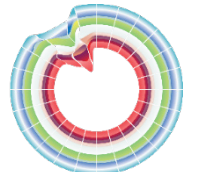
- **Combine AI and VR**
- Augment **teaching methodologies** and **learning techniques**
- Use in **remote** and **online learning**
- **Easy adoption**

Sample experience: Solar System Lecture

Sample experience: Learning bike riding rules

When AI meets VR for society

When AI meets VR for society

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.
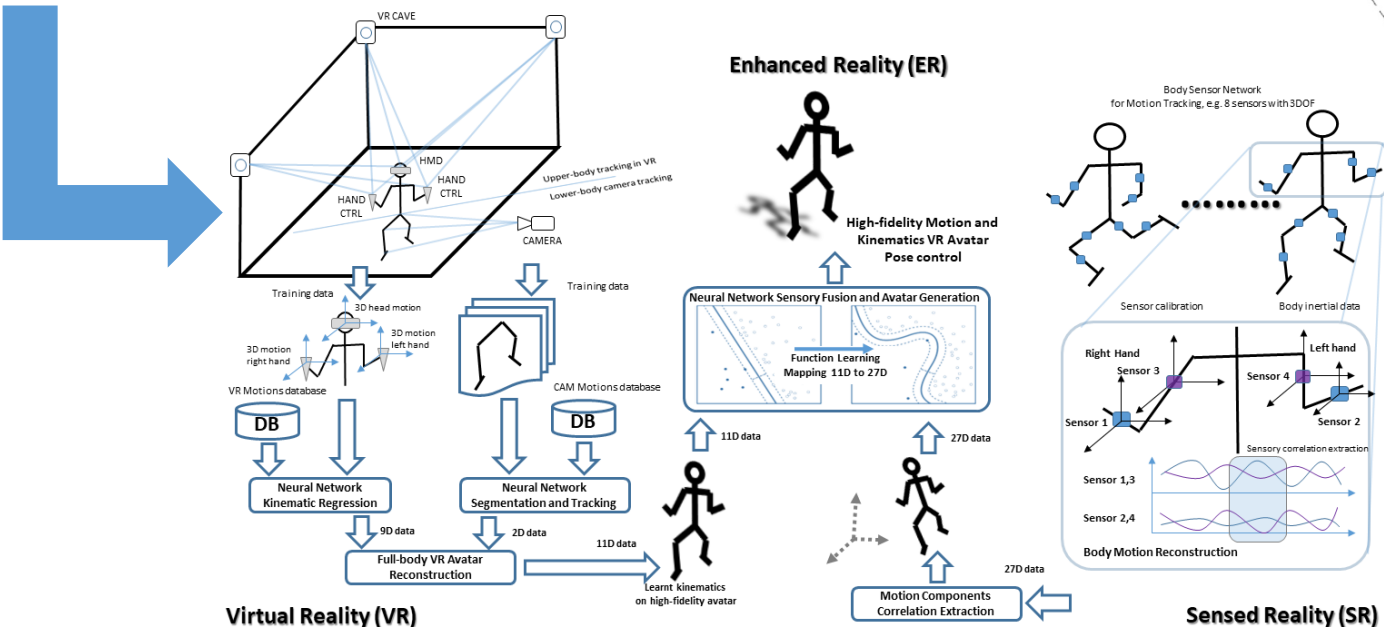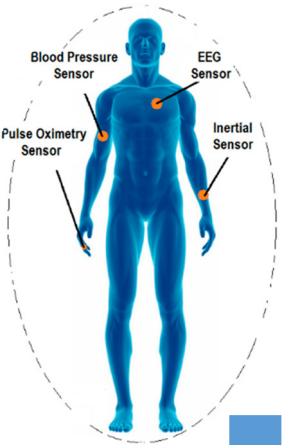
When AI meets VR for society

When AI meets VR for society

Automotive Inspection Technology

VIRTOOAIR AUTOTECH

Virtual Reality TOOlbox for Avatar Intelligent Reconstruction in Inspection Technology

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

USED VEHICLE INSPECTION REPORT

Detected scratch

Detected custom tuning

When AI meets VR for society

When AI meets VR for society

Rehabilitation Technology

VIRTOOAIR SPORTTECH

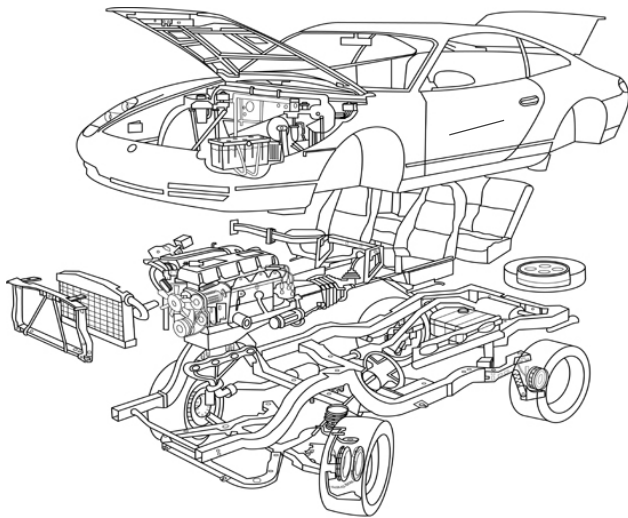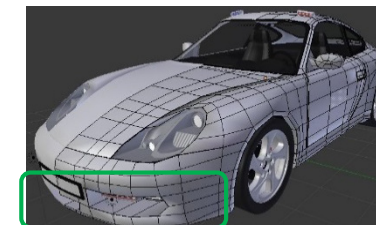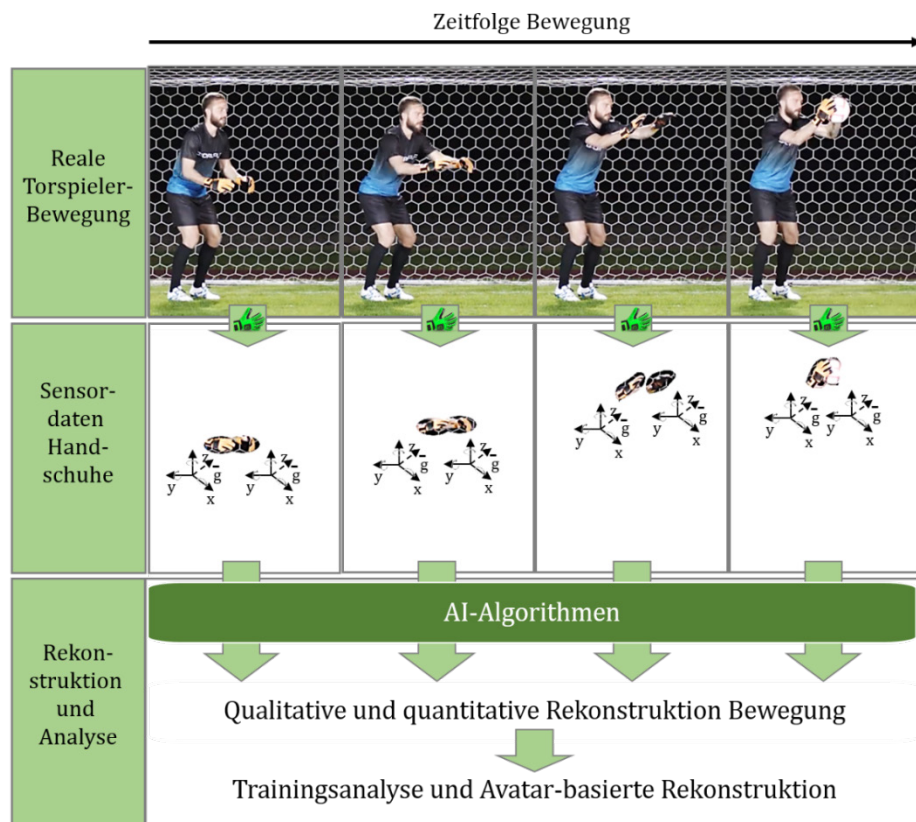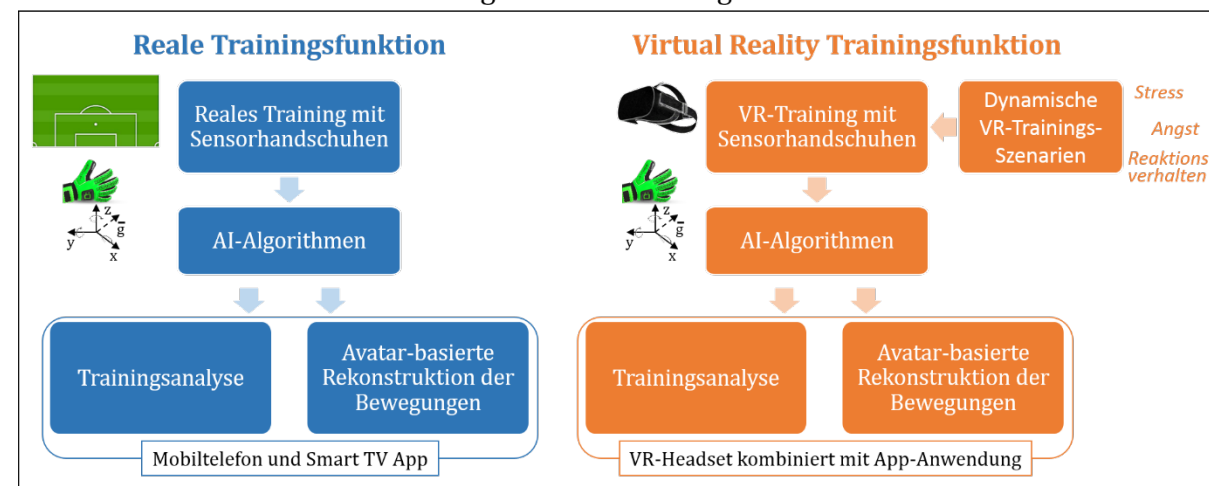*Virtual Reality TOOlbox for Avatar Intelligent Reconstruction in Sports Training Technology*

Planning project

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

Zeitfolge Bewegung

Reale Torspieler-Bewegung

Sensor-daten Hand-schuhe

Rekon-struktion und Analyse

AI-Algorithmen

Qualitative und quantitative Rekonstruktion Bewegung

Trainingsanalyse und Avatar-basierte Rekonstruktion

G:OALPLAY
zu null.

AI-gestütztes Trainingstool

Reale Trainingsfunktion

Reales Training mit Sensorhandschuhen

AI-Algorithmen

Trainingsanalyse

Avatar-basierte Rekonstruktion der Bewegungen

Mobiltelefon und Smart TV App

Virtual Reality Trainingsfunktion

VR-Training mit Sensorhandschuhen

Dynamische VR-Trainings-Szenarien

Stress

Angst

Reaktions-verhalten

AI-Algorithmen

Trainingsanalyse

Avatar-basierte Rekonstruktion der Bewegungen

VR-Headset kombiniert mit App-Anwendung

When AI meets VR for society

When AI meets VR for society

Medical Technologies (MedTech)

VIRTOOAIR MEDTECH

Virtual Reality TOOIbox 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

HOSPITAL

VR + PROGRAM

Easy adoption setup

Where are we heading?

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

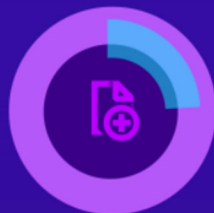**Reasons why healthcare consumers will/will not use an AI-powered virtual doctor**

Why use AI?

47 % Available whenever I need it

36 % Saves time by avoiding a trip to the doctor

24 % Assesses vast amounts of relevant information

Why not?

29 % I like visiting the doctor

26 % I don't understand enough about how...

23 % I don't like to share my data

Source: Accenture 2018

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**!