



**AUDI**  
KONFUZIUS-INSTITUT  
INGOLSTADT



Technische Hochschule  
Ingolstadt

**AKII Microlab**

## Bachelor/Master Thesis **Neural Network Predictive Tracking System for VR Systems**

### Problem description

The tracking devices are the main components for the VR systems. They interact with the system's processing unit which computes the orientation of the user's view point. Solutions for full-body tracking / motion capturing need a lot of cameras and are therefore expensive. Furthermore, the calibration process prior to usage is not trivial and highly time consuming. The tracking data are updated with a certain frequency and to ensure smooth movements prediction is crucial. Despite the multitude of algorithms for such a predictive tracking scenario, the performance is dictated by the underlying tracking system's sampling rate and the noise and variance in the captured data. Moreover the types of motion that the user performs, being head or hand (controller) play an important role in determining which algorithm to use. The project proposes a neural network approach for predictive tracking. Such a neural network predictive tracker learns a generic relationship between motion and appearance. This approach doesn't need to develop a complex mathematical model of the problem, i.e. the projection of 18D body motion coordinates (three translational coordinates which define the position and three rotational coordinates which define the orientation for each of the head and hand VR controllers) to 3D world coordinates. The mapping is performed by the neural network which behaves like a universal function approximator.

### Tasks

- Program a data acquisition interface for logging the 18 degrees of freedom (DOF) as input from the VR controllers tracking system. These are six DOFs for the head and each of the hands.
- Investigate the design of deep neural networks for regression in multidimensional problems.
- Design and develop a novel position calibration using VR controllers data using deep artificial neural networks.
- Design a prediction model which uses the neural network calibration for tracking.
- Test and evaluate the learnt mapping against ground truth (i.e. camera tracking system).

### Required skills

Strong programming experience, good mathematical skills, basic VR technologies, machine learning and algorithms.

### Preferred field of study

BA/MA Computer Science, BA/MA Mechatronics(Robotics)

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