AUDI KONFUZIUS-INSTITUT INGOLSTADT

AKII Microlab

Technische Hochschule Ingolstadt

Bachelor/Master Thesis

Deep Learning Networks for Efficient Learning in VR Avatar Reconstruction

Problem description

The projects proposes the exploration and evaluation of Deep Residual Learning for Image Recognition for the end-to-end reconstruction framework in VIRTOOAIR: Virtual Reality Toolbox for Avatar Intelligent Reconstruction. VIRTOOAIR focuses on designing and developing a Deep Learning framework for improved avatar representations in immersive collaborative virtual environments. Deeper neural networks are more difficult to train. ResNet is a novel deep learning architecture capable of explicitly reformulate the layers as learning residual functions with reference to the layer inputs, instead of learning unreferenced functions. Empirical experiments shown that these residual networks are easier to optimize, and can gain accuracy from considerably increased depth. Such a network is used in the end-to-end reconstruction framework for converting the encoded RGB image from a camera into a position vector. In other words, an image I is passed through a convolutional encoder. This is sent to an iterative 3D regression module that infers the latent 3D representation of the human that minimizes the joint re-projection error. The project aims at exploring ResNet architectures and re-implement the regression module in the end-to-end framework to also consider data from the VR controllers (i.e. 2 hand controllers and 1 head controller). The VR controllers 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, from hand and head devices.

Tasks

- Get familiar with VIRTOOAIR deep learning end-to-end reconstruction framework and existing code base.
- Investigate the design and usage of the existing VIRTOOAIR ResNet neural networks in the regression module for pose, shape and camera parameters estimation.
- Design and develop a novel position calibration using VR controllers' data using deep artificial neural networks.
- Design and implement the ResNet to combine image data with VR Controllers data and apply it in real-time in the end-to-end reconstruction framework.
- Design experiment for testing and evaluating the implementation (i.e. latency, accuracy).

Required skills

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

Preferred field of study

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

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