AUDI KONFUZIUS-INSTITUT INGOLSTADT

AKII Microlab

Technische Hochschule Ingolstadt

Bachelor/Master Thesis

Event-based Vision for End-to-end VR Avatar Reconstruction

Problem description

The proposed project explores the capability of using a novel vision sensor (i.e. event-based/frameless camera) for 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. There have been substantial efforts in designing end-to-end frameworks for reconstructing a full 3D mesh of a human body from a single RGB image. However, these solutions all need to: a) construct or learn a camera model, b) have available keypoints information, and c) segment / pre-process RGB data in order to extract the kinematics of the body in the field-of-view. Typical approaches offer a rich and complex representation of such quantities, with the price of increase latency. We propose the use of a novel camera type as input to an end-to-end reconstruction framework, namely a Dynamic Vision Sensor (DVS), which will allow the system to “go away from frames”. Similar to photoreceptors in the human retina, a single DVS pixel (receptor) can generate events in response to a change of detected illumination. Events encode dynamic features of the scene, e.g. moving objects, using a spatio-temporal set of events. Since DVS sensors drastically reduce redundant pixels (e.g. static background features) and encode objects in a frameless fashion with high temporal resolution (about 1 µs), it is well suited for fast motion analyses and tracking. Such an input can be used to replace the RGB input used in the VIRTOOAIR end-to-end infrastructure. The goal is to explore, how such low-latency input can improve the overall response time of the end-to-end reconstruction.

Tasks

- Get familiar with the DVS sensor and its programming model.
- Investigate the design and usage of the existing VIRTOOAIR end-to-end reconstruction framework and existing code base.
- Design and implement a novel algorithm to interface the event-based data with the end-to-end reconstruction framework.
- Design experiment for testing and evaluating the implementation versus the RGB implementation (i.e. latency, accuracy).

Required skills

Strong programming experience (Python), good mathematical skills, machine vision experience.

Preferred field of study

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

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