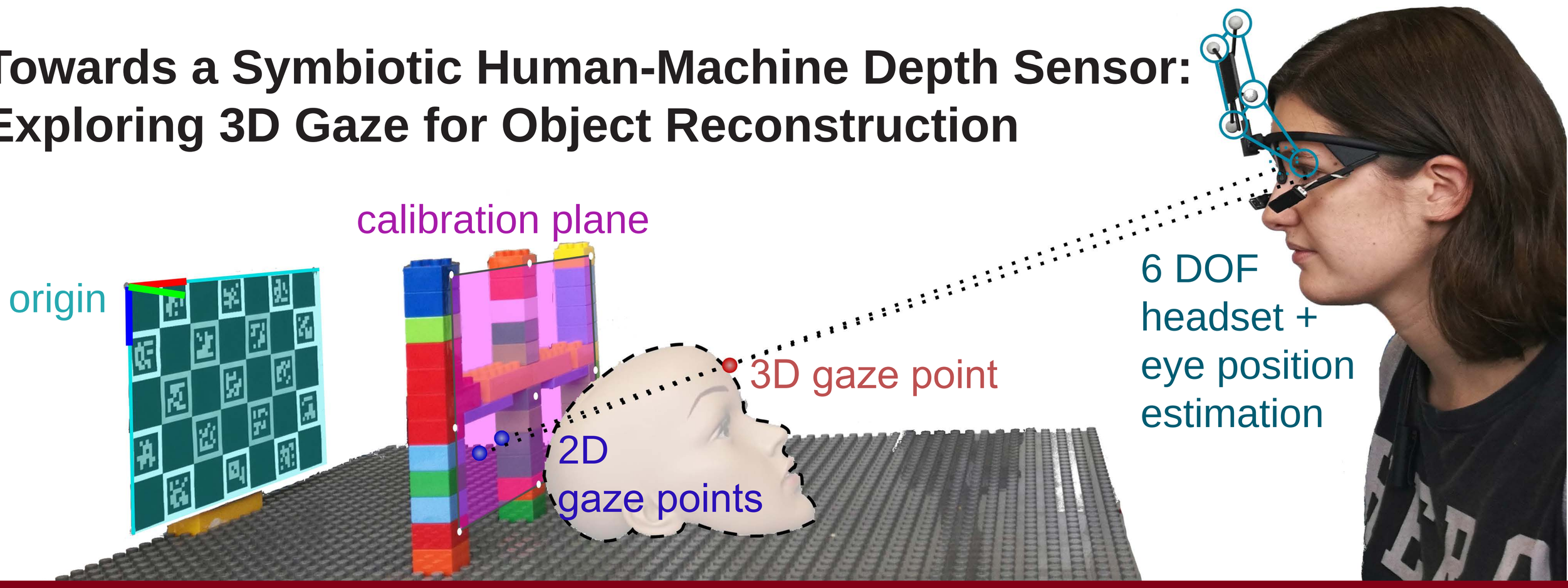
institute of media informatics
ulm university universität ulm
Institut für Visualisierung und Interaktive Systeme
University of Stuttgart Germany

Towards a Symbiotic Human-Machine Depth Sensor: Exploring 3D Gaze for Object Reconstruction



Teresa Hirzle[1], Jan Gugenheimer[1], Florian Geiselhart[1], Andreas Bulling[2], Enrico Rukzio[1]

[1]Institute of Media Informatics, Ulm University

[2]Institute for Visualization and Interactive Systems, University of Stuttgart

Eye tracking is expected to become an integral part of future augmented reality (AR) head-mounted displays (HMDs). To augment objects in the real world, AR HMDs require a three-dimensional understanding of the scene, which is currently solved using depth cameras. In this work we aim to explore how 3D gaze data can be used to enhance scene understanding for AR HMDs by envisioning a symbiotic human-machine depth camera, fusing depth data with 3D gaze information. We present a first proof of concept, exploring to what extent we are able to recognise what a user is looking at by plotting 3D gaze data.

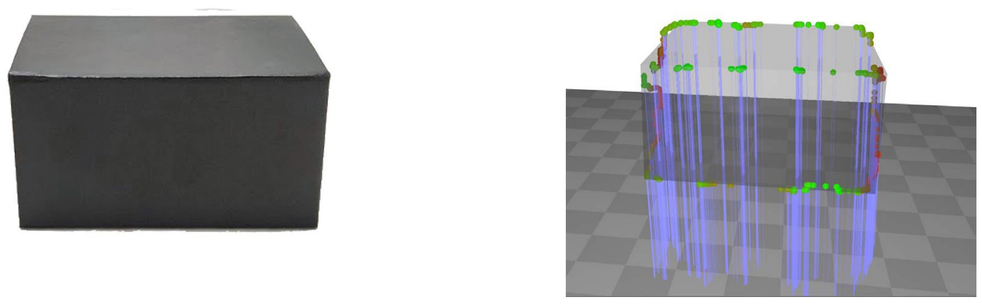
Prototype

our prototype consists of a head-mounted eye tracker (Pupil Labs) and a motion capture system (OptiTrack). Our 3D gaze algorithm is based on a gaze point triangulation approach.

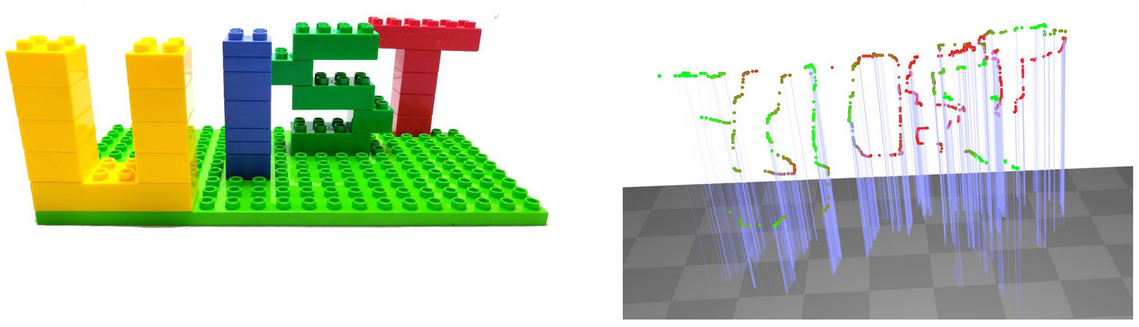
Gaze-Scans

were obtained by one author who scanned the objects with the eyes by consciously looking at the objects‘ outlines and main features. For a proof of concept we tested our approach with three obejcts, differing in geometric complexity and contained depth information.

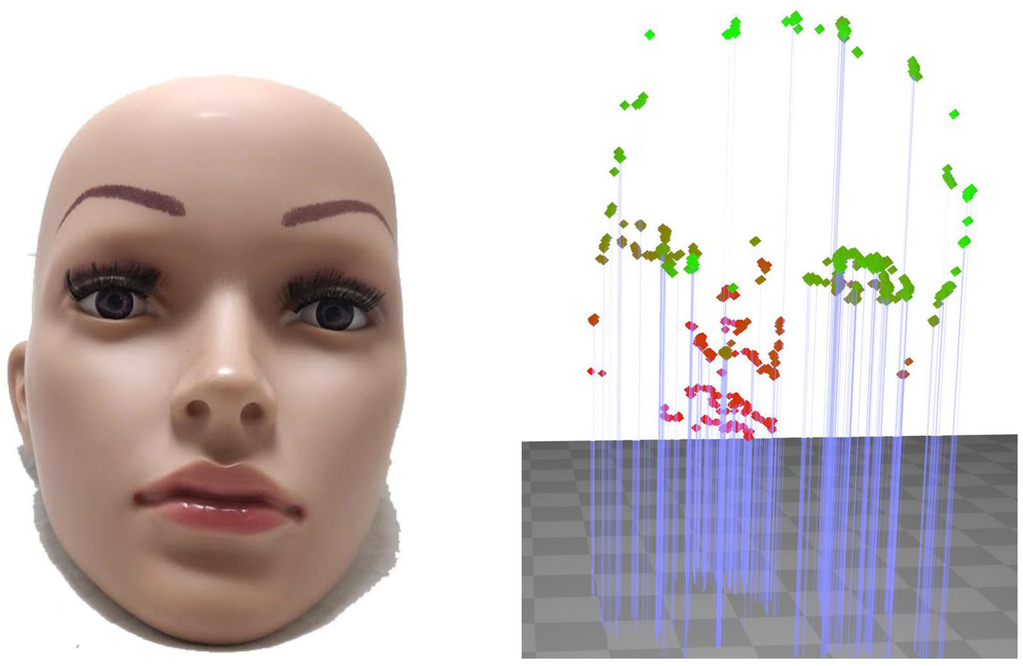
Gaze-Scan 1: simple three dimen geometric form (box)



Gaze-Scan 2: simple geometric obejcts at different depth levels



Gaze-Scan 3: organic object (head of mannequin)



A Symbiotic Human-Machine Depth Sensor

We envision a symbiotic scenario extending current technology with „human sensing“ data. We believe that the fusion of physical sensors and human abilities has the potential to create an enhanced scene understanding by leveraging each individual advantages.

Conclusion

We presented a first proof of concept implementation to measure 3D gaze in a 50x50x50 cm volume and explored to what extent we are able to recognise simple objects a user is looking at. In the future we are planing to fuse this information with depth cameras and quantify performance improvements of the environmental depth map.

Contact: Teresa Hirzle | teresa.hirzle@uni-ulm.de | www.uulm.de/?th