Event-based Robot Vision for Autonomous Systems and Animal Observation

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Motion Estimation

Contrast Maximization for…
Optical Flow, SLAM and Image Reconstruction

Extending CMax to SLAM

Shuang Guo

Rotational Motion CMax-SLAM, with front-end and back-end

Front-end

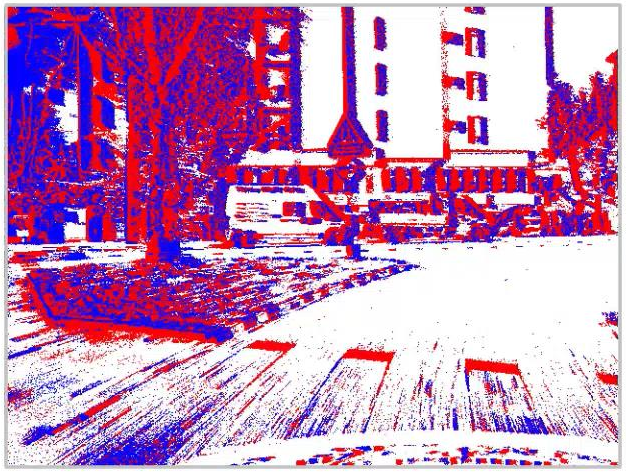
Scene

Back-end

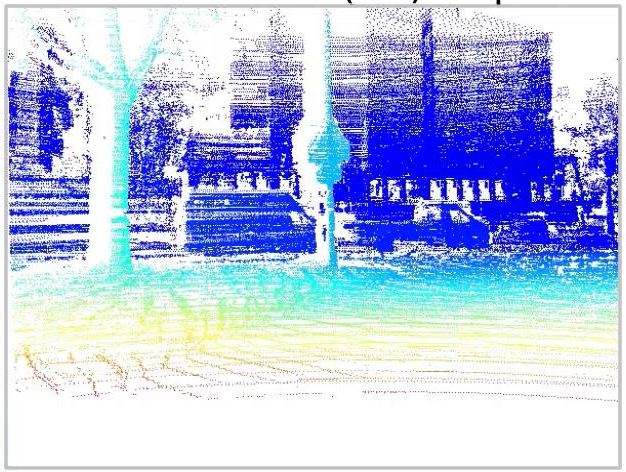
CMax Stereo 3D Reconstruction

S. Ghosh

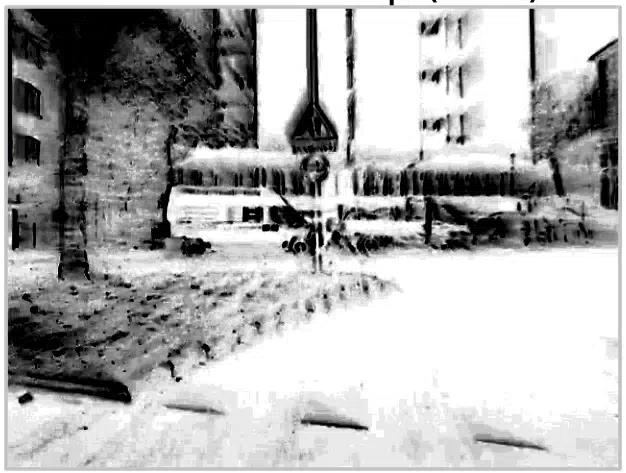
Left events



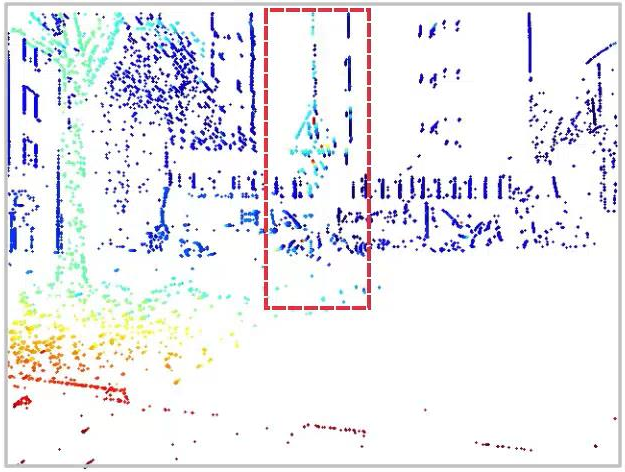
Ground-truth (GT) Depth



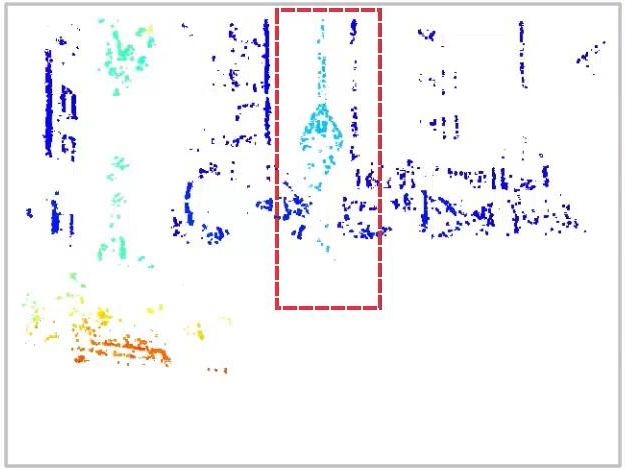
Confidence map (ours)



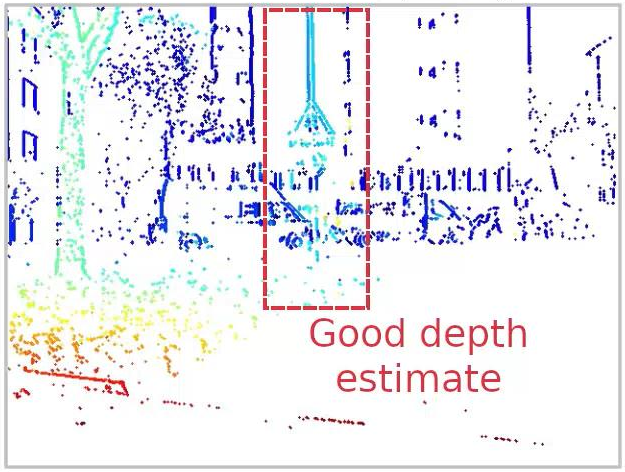
EMVS (Monocular)



ESVO



Stereo fusion (ours)

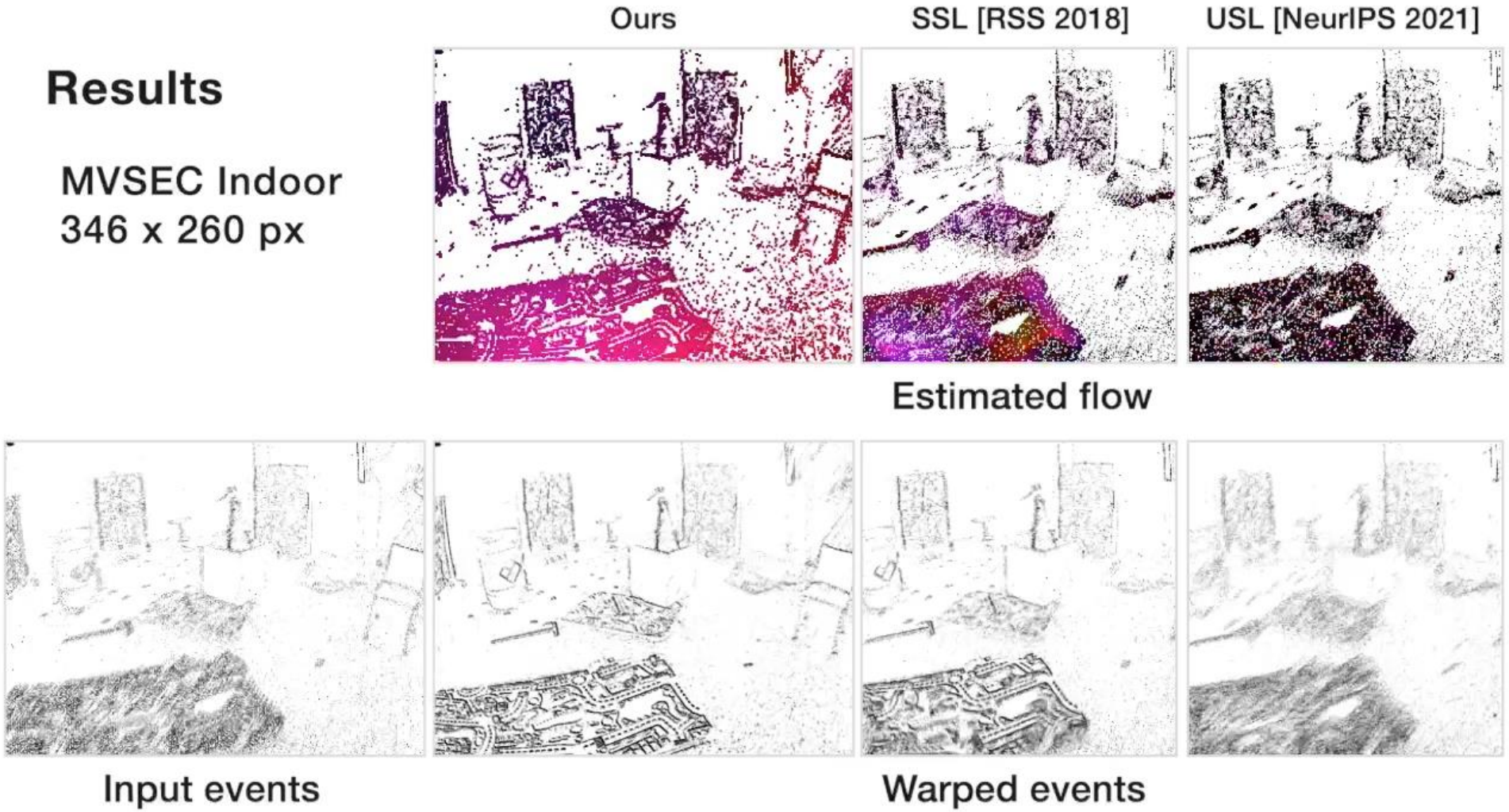


Code is available: https://github.com/tub-rip/dvs_mcemvs

Ghosh and Gallego, *Multi-Event-Camera Depth Estimation and Outlier Rejection by Refocused Events Fusion*, Adv. Intell. Syst. 2022. PDF, YouTube

CMax Dense Optical Flow

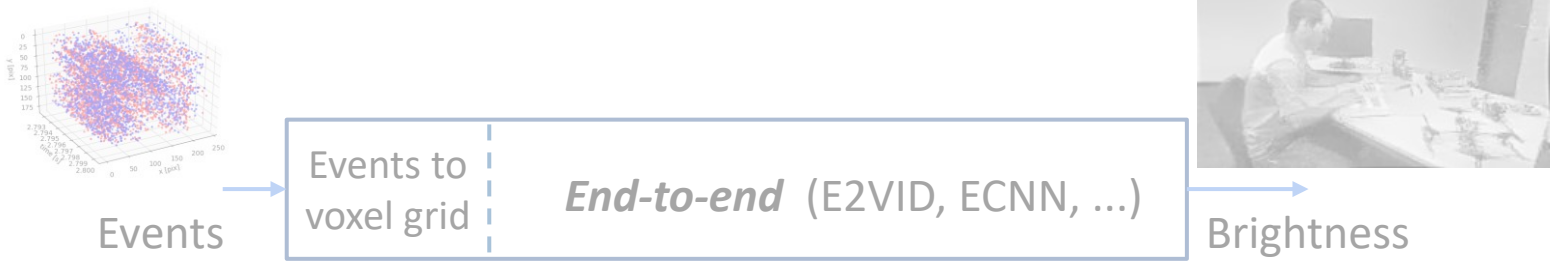
S. Shiba



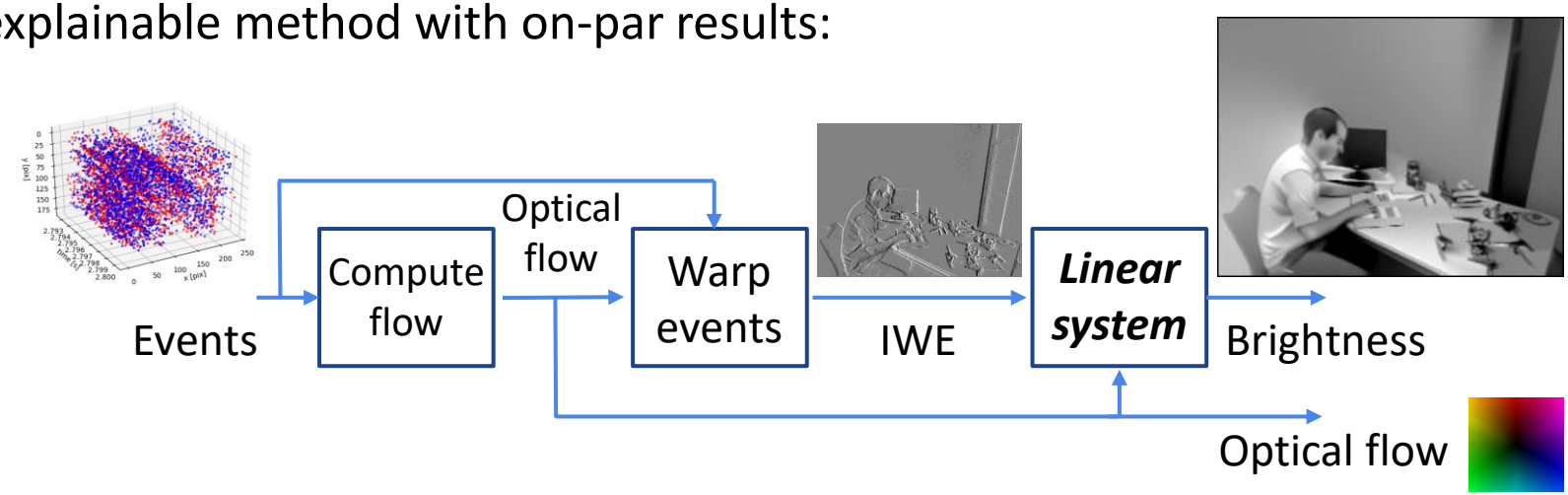
Code available: https://github.com/tub-rip/event_based_optical_flow

CMax facilitates Image Reconstruction

State of the art: Recurrent Neural Network (black-box)



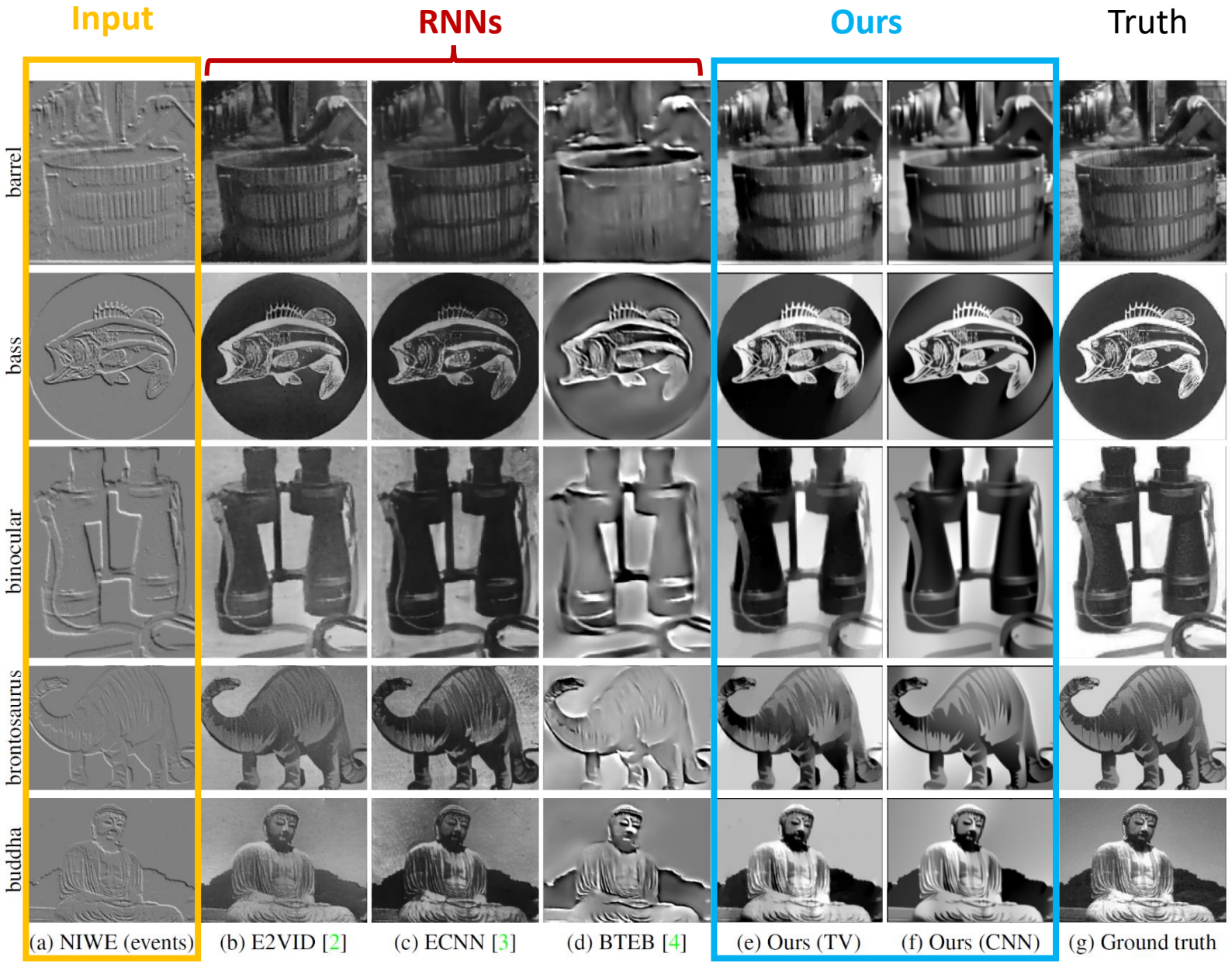
An explainable method with on-par results:



Zhang et al., *Formulating Event-based Image Reconstruction as a Linear Inverse Problem using Optical Flow*, TPAMI 2022.

Image Reconstruction (TPAMI 2022)

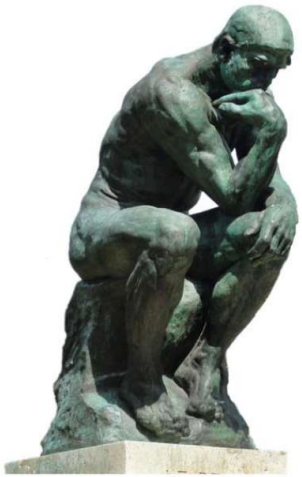
Z. Zhang

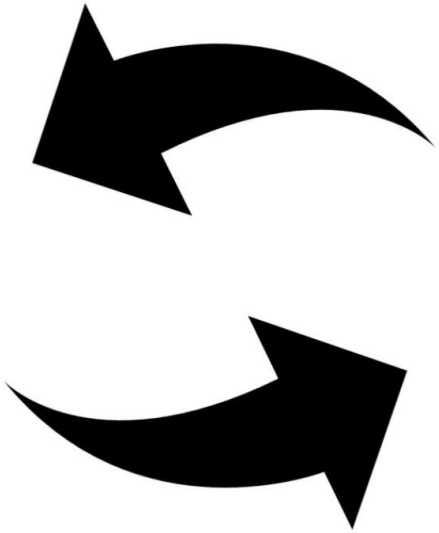


Animal Observation

science of intelligence

Analysis of natural intelligence





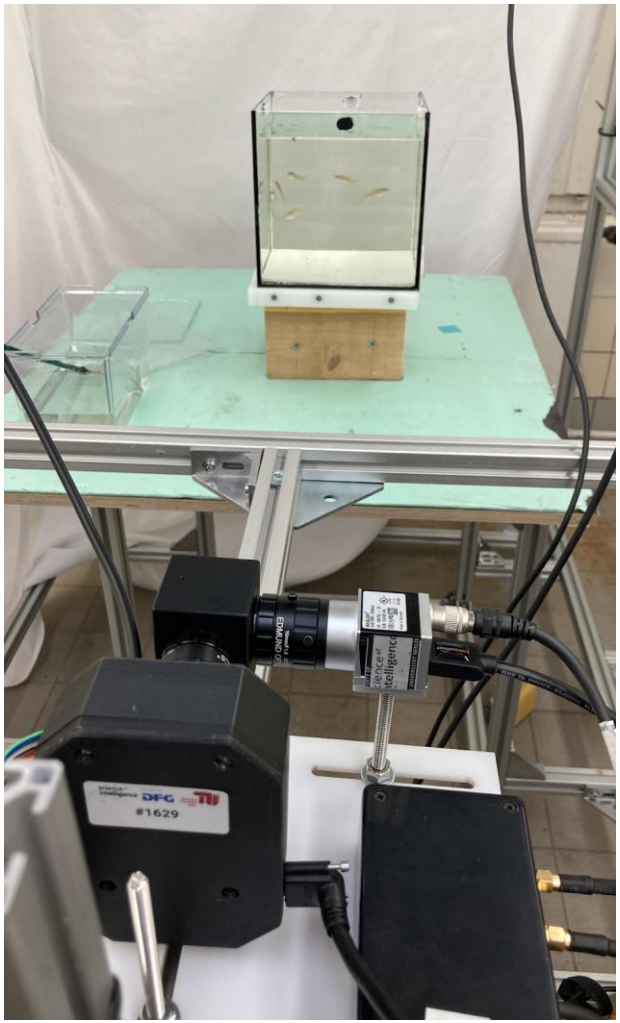
Synthesis of artificial intelligence

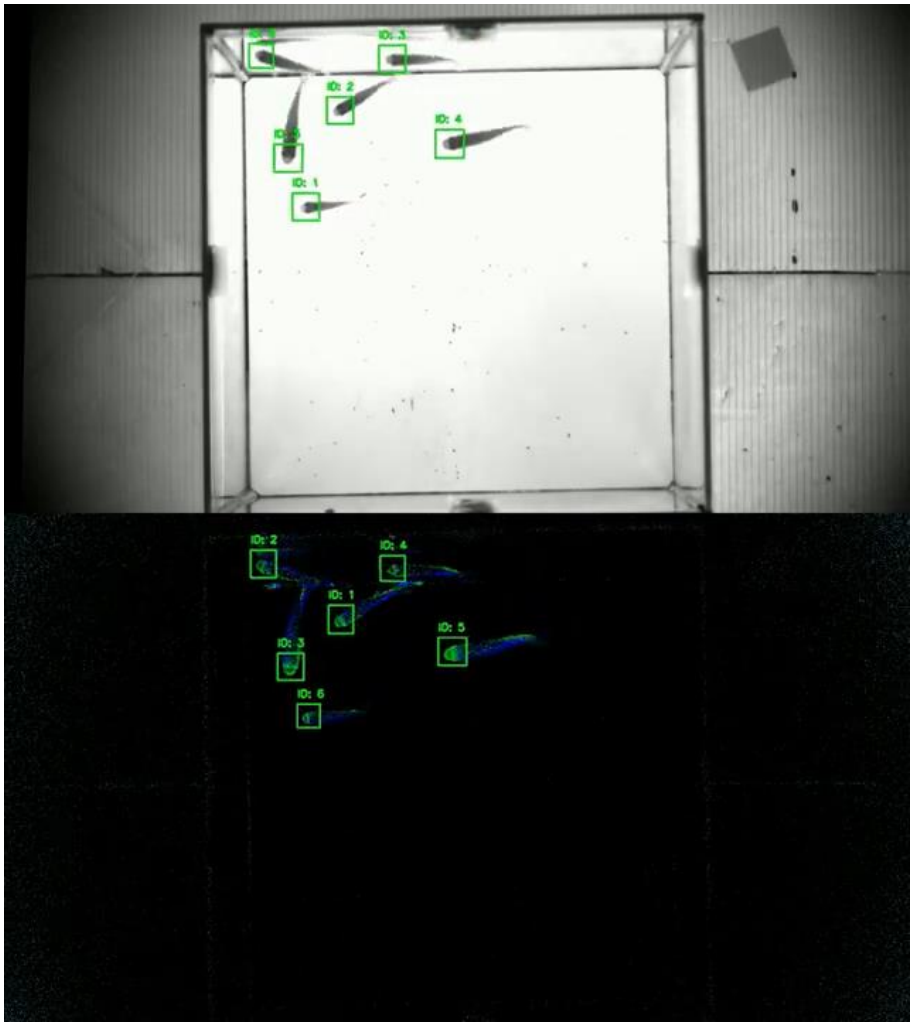
Slide from SCIoI – Prof. O. Brock

Animal behavior observation and analysis

science of intelligence

Fish tracking. In collaboration with HU University

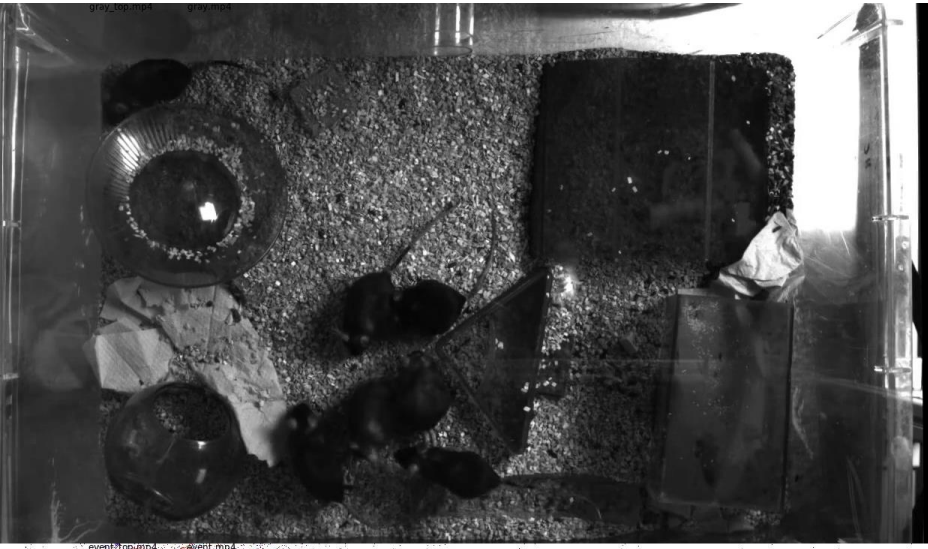


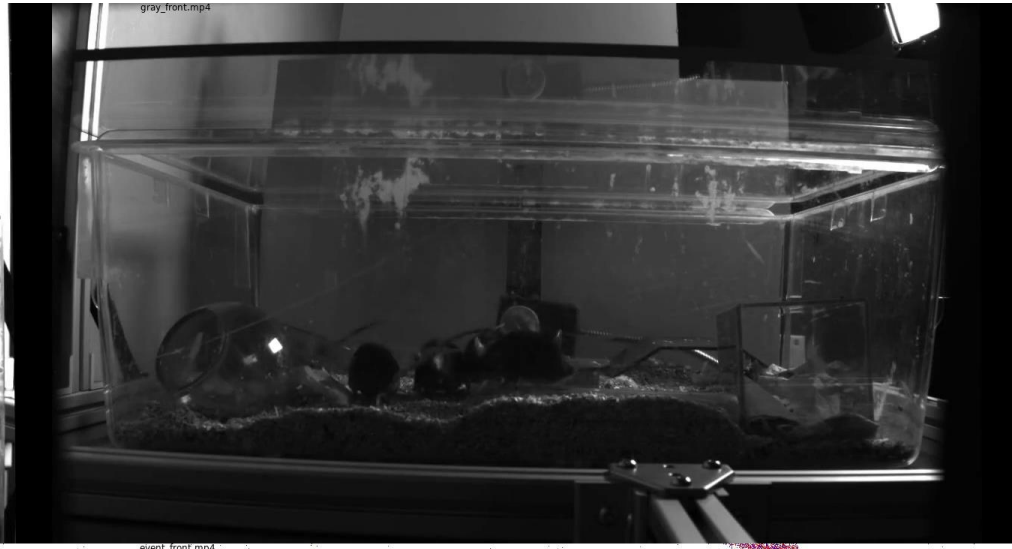


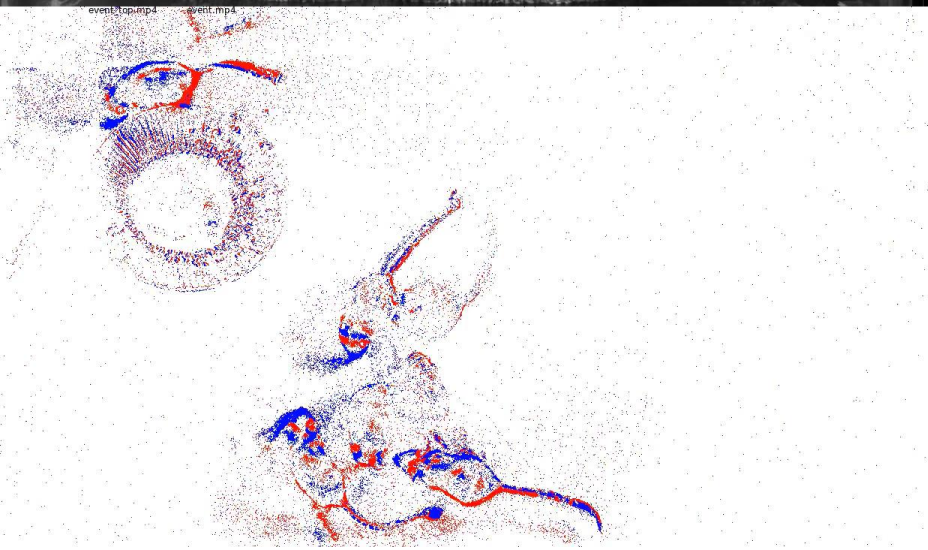
Hamann and Gallego, *Stereo Co-capture System for Recording and Tracking Fish with Frame- and Event Cameras*, ICPR-W VAIB, 2022

Animal behavior quantification

science of intelligence







TU Berlin Lab working on event cameras

Suman Ghosh

Friedhelm Hamann

Shintaro Shiba
(from Aoki Lab)

Shuang Guo