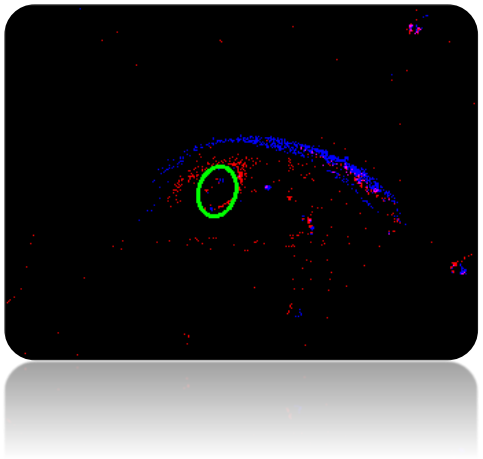
Event-based Vision 2025

CVPR Nashville JUNE 11-15, 2025



Event-based Eye Tracking Challenge

Event-based Vision CVPR 2025

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动微视觉 DVsense

PROPHESEE

Julius-Maximilians-UNIVERSITÄT WÜRZBURG

TU Delft

Where You Look, It Responds: Eye Tracking in XR

Meta Quest

- **Eye-Tracked Foveated Rendering**
- Providing substantial GPU savings

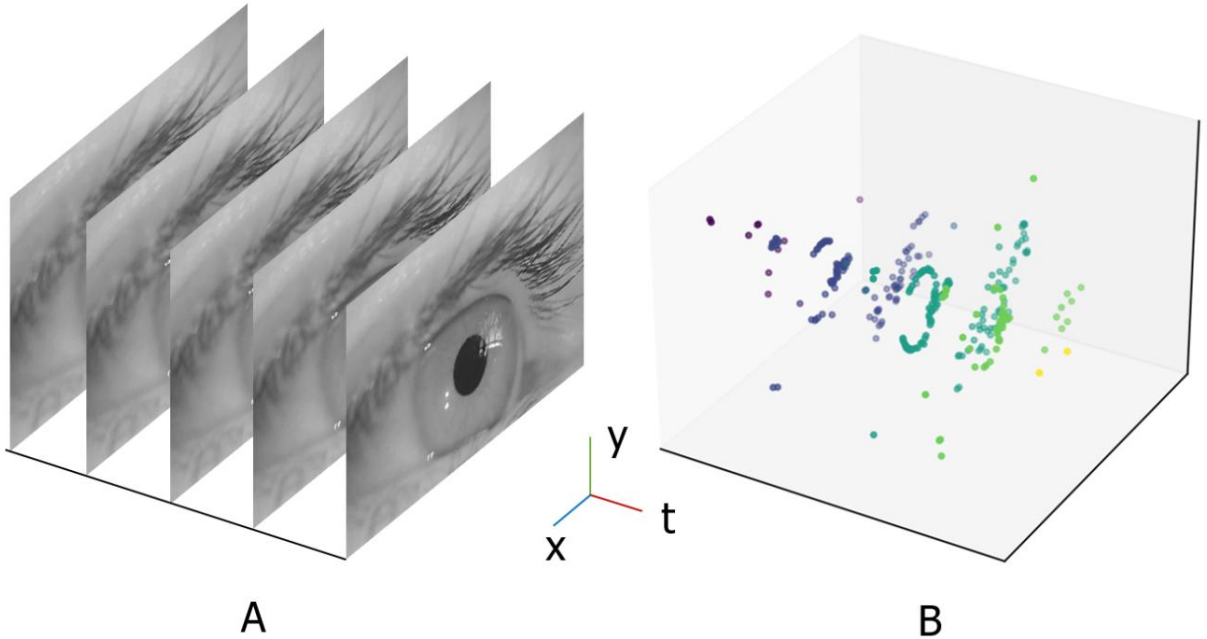
Apple Vision Pro

- Eye tracked interfacing to reduce the dependency on traditional input devices.
- Seamless and engaging user experience.

The same 53 ms eye movement motion

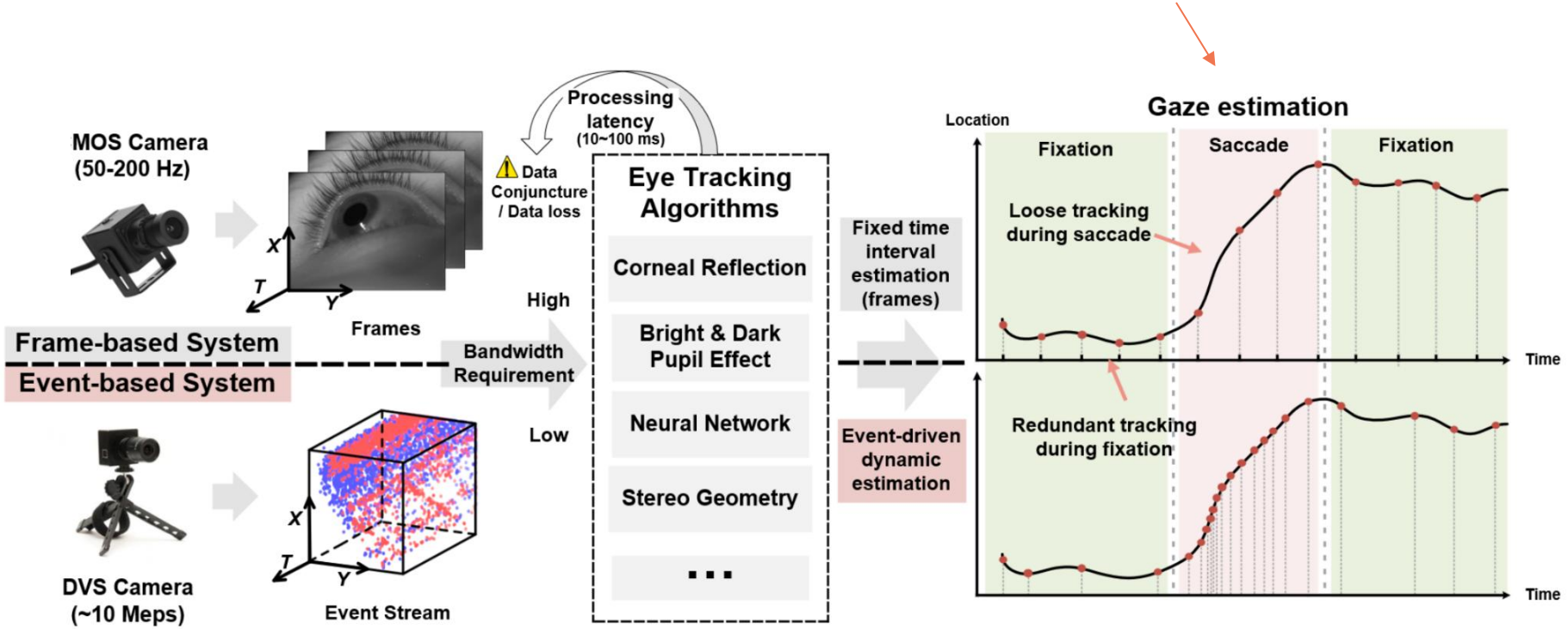
Video from the LPW dataset (95Hz)
5 frames of size 240×180

Synthetic DVS event streams
310 events



Q. Chen, Z. Wang, S. -C. Liu and C. Gao, “3ET: Efficient Event-based Eye Tracking using a Change-Based ConvLSTM Network,” *2023 IEEE Biomedical Circuits and Systems Conference (BioCAS)*, Toronto, ON, Canada, 2023.

Capture **fast movements** precisely



S. Tan *et al*., “Toward Efficient Eye Tracking in AR/VR Devices: A Near-Eye DVS-Based Processor for Real-Time Gaze Estimation,” in *IEEE Transactions on Circuits and Systems I: Regular Papers, 2025*

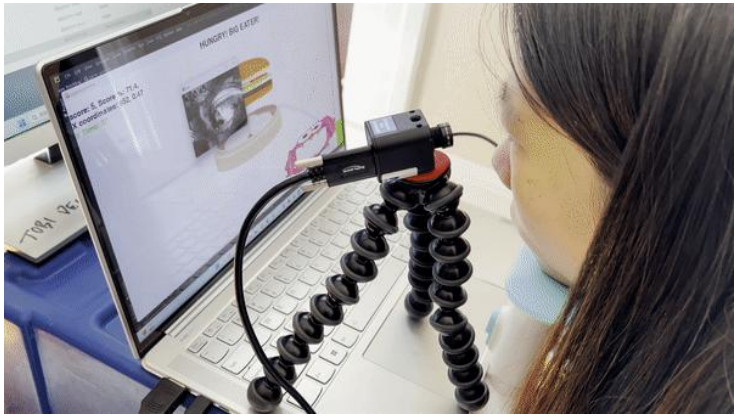
3ET+ Dataset

Telluride workshop

3ET+ event-based eye tracking dataset:

- 13 subjects
- 1- random 2- saccades 3- read text 4- smooth pursuit 5- blinks
- Label: pupil center (x, y) and blink or not

Neural control team @ Telluride 2023



Demo: Eye control game play

The Challenge

Event-based Vision 2025 CVPR Nashville JUNE 11-15, 2025

2024 AI4streaming CVPR workshop / 2025 CVPR event-based vision workshop
Event-based Eye Tracking Challenges using 3ET+ dataset [report 2024] [report 2025]

Affiliation, Country	TEAM	Rank	Method	Metric: P10 (%)
USTC, China	EventGroup	1	MambaPupil (GRU+ LTV-SSM)	99.58
USTC, China	FreeEvs	2	CNN+GRU+FC)	99.27
Brainchip Inc., US	bigBrains	3	CNN (temporal Conv + spatial Conv)	99.16
HKU, HK	Go Sparse	4	MobilenetV2+GRU+FC (FPGA hardware co-design)	98.74
Polito, Italy	MeMo	4	MobileNet-V3L + FC	98.74
TU Delft, Netherlands	ERVT	6	Recurrent Vision Transformer	97.60
HKUST, HK	EFFICIENT	6	PEPNet, Point-based Network	97.60
Gatech, US	GTechVision	8	convolutional LSTM / Spiking LSTM	91.86

Last year,
Top-1 team reported
pixel error **1.67**

The Challenge

2024 AI4streaming CVPR workshop / **2025 CVPR event-based vision workshop**
Event-based Eye Tracking Challenges using 3ET+ dataset [report 2024] [report 2025]

- 4 teams achieving pixel-error lower than 1.67 were invited to write challenge report and workshop paper, **push the pixel-error to 1.14**
- High diversity in methods!

Affiliation, Country	TEAM	Rank	Method	Pixel error	Param (M)
USTC, China	**EventGroup**	**1**	Bidirectional Relative Positional Attention Transformer	**1.14**	**7.1**
SMU, Singapore	EyeTracking@SMU	2	MobilenetV2+GRU+FC + Efficient Post-processing	1.42	**0.8**
HKUST, HK	HKUSTGZ	3	CNN+ Frequency Aware Module + GRU + and Mamba	1.50	**3.0**
VNU, Vietnam	CherryChums	4	CNN (temporal Conv + spatial Conv) + Data augmentation	1.61	**0.8**

Acknowledgement

Event-based Vision 2025 CVPR Nashville JUNE 11-15, 2025

Many thanks to all our challengers and workshop organizers!

Event-Based Eye Tracking. 2025 Event-based Vision Workshop

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Organizers

- Guillermo Gallego, TU Berlin, Germany.
- Kostas Daniilidis, University of Pennsylvania, USA.
- Cornelia Fermüller, University of Maryland, USA.
- Daniele Perrone, Prophesee, France.
- Davide Migliore, Tempo Sense, USA.

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