FLYSIGHT

Neuromorphic sensor for security and surveillance

Dr. Niccolò Camarlinghi FlySight' s head of research: niccolo.camarlinghi@flysight.it

EPIC Online Technology Meeting on Neuromorphic Cameras
07/10/2024

FlySight profile

Who we are:

- SME located in Italy, Livorno, https://www.flysight.it/
- Software house operating in the defense and security domain

What we do:

- Cutting-edge software solutions for Decision Support Systems
- Remote sensing and data analytics
- Solutions based on Artificial Intelligence & Augmented Reality

What we offer:

- Flagship product OpenSight mission console → Cross platform solution for data fusion + GIS + AR + AI
- Custom solutions implementation

What we look for:

- Clients
- Scientific and Industrial partnership

Aim of this study

- Evaluate the potential of EVT cameras in security and defense domain
- Evaluate the possibility of using AI in this context for automatic target detection especially in challenging condition

↓

- Setup a fair workbench to assess the relative advantages:
  - Built a specific VIS+EVT equipment for collecting synchronized data
  - Performed a data collection session under different condition
  - Used automatic target recognition as a metric to compare the two modalities

Data collection and experimental setup

- **Experimental setup:**
  - Visible camera: ZED 2i stereo camera (*Stereo labs*)
  - Event camera: Vision Cam EB (*Imago Technologies*)
  - Setup was mounted on a fixed rig on a tripod
- **Software:**
  - Custom python SW based on Metavision SDK and ZED SDK → allow to acquire synchronized images
- **Camera setup:**
  - Cameras have different FOV → FOV alignment carried out using a flashing light → detectable both in the EVT and VIS domains
  - Bias setup performed manually based on visual assessment
- **Data Collection:**
  - Rural area → drone flight allowed
  - Target: person, car , drones
  - Selected videos where target are visible by both cameras at the same time

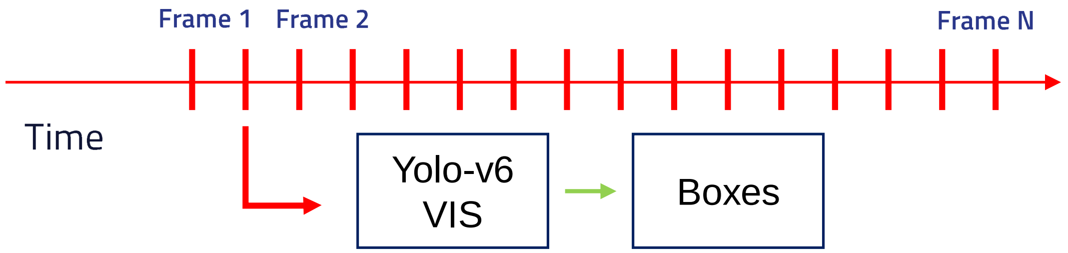
Camera	Link	FPs	Lens	Image resolution	VFOV (deg)	HFOV (deg)
VIS	USB 3.0	30	Fixed 4 mm FL lens	1920x1080	31°	53°
EVT	ETH	NA	Removable 16mm FL lens	640x480	25°	33°

Automatic target detection VIS vs EVT

Domain	ATR technology	Training set	Classes	Source
VIS	YOLO-v6	COCO	81 classes	https://github.com/meituan/YOLOv6
EVT	YOLO-v6-EVT	GEN1 dataset	Pedestrian and car	https://github.com/uzh-rpg/event_representation_study

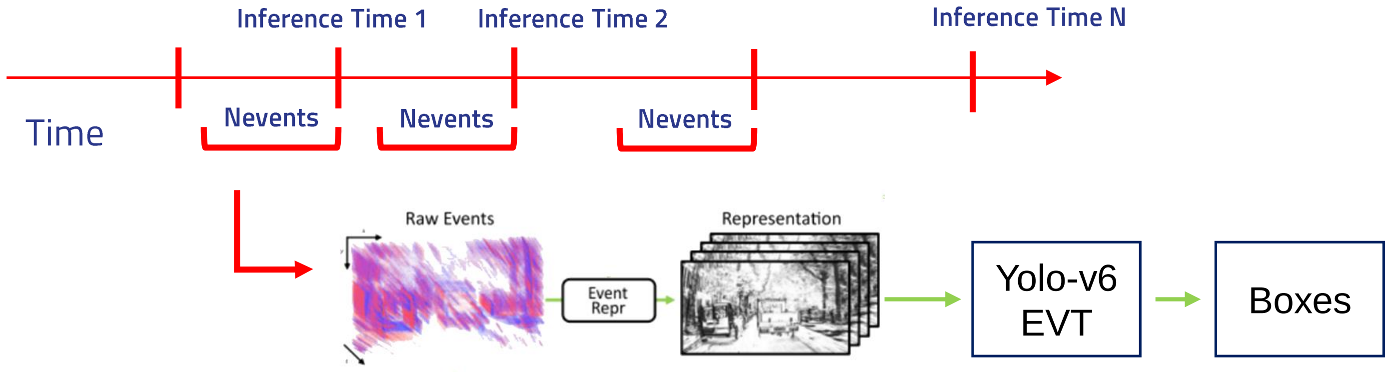
VIS domain (Yolo v6)

- Max inference rate in VIS Domain → driven by Frame rate
- Data to perform inference → Frame



EVT domain (Yolo v6 EVT)

- Inference rate in EVT Domain → user tunable (60Hz)
- Number of events to perform inference → user tunable (5000 Hz)



Data & KPI

Data stratified into

- Pedestrian in low light condition
- Pedestrian wearing camouflage/cluttered background
- Pedestrian in unobstructed scenarios

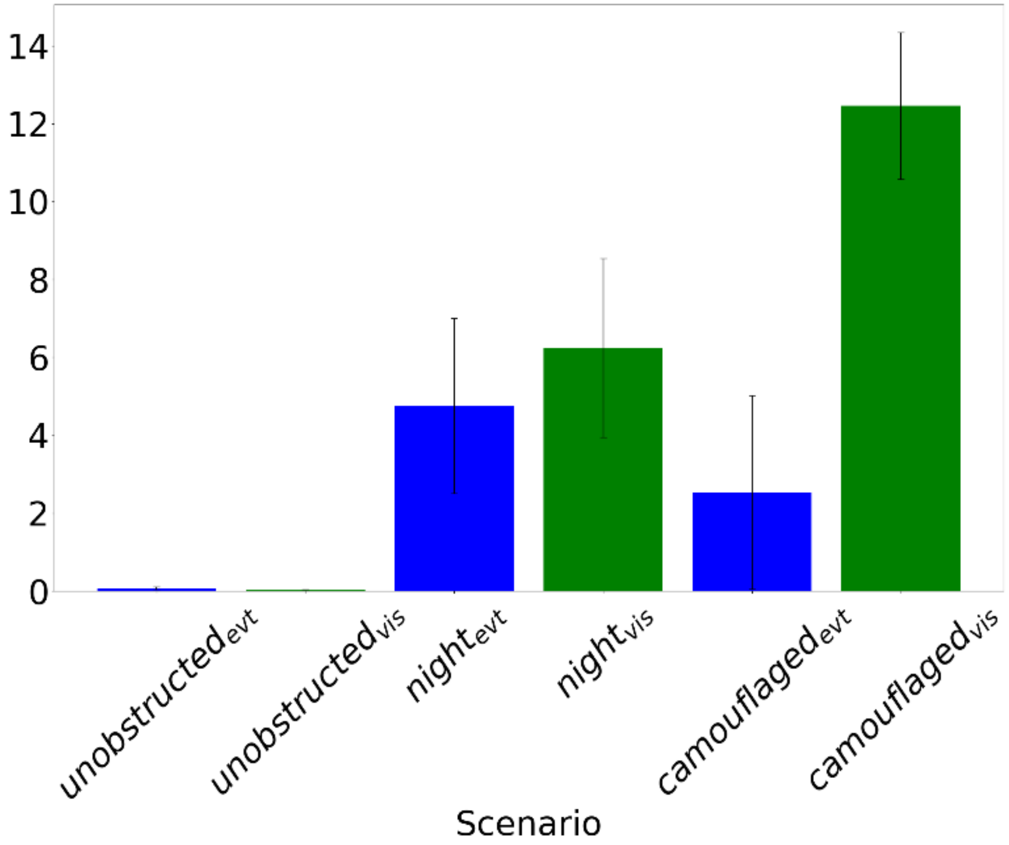
Key Performance Indicators

- Time to detect a target [s] → seconds before the first detection of the target
- False positive rate [Hz] → average number of false alarm per second

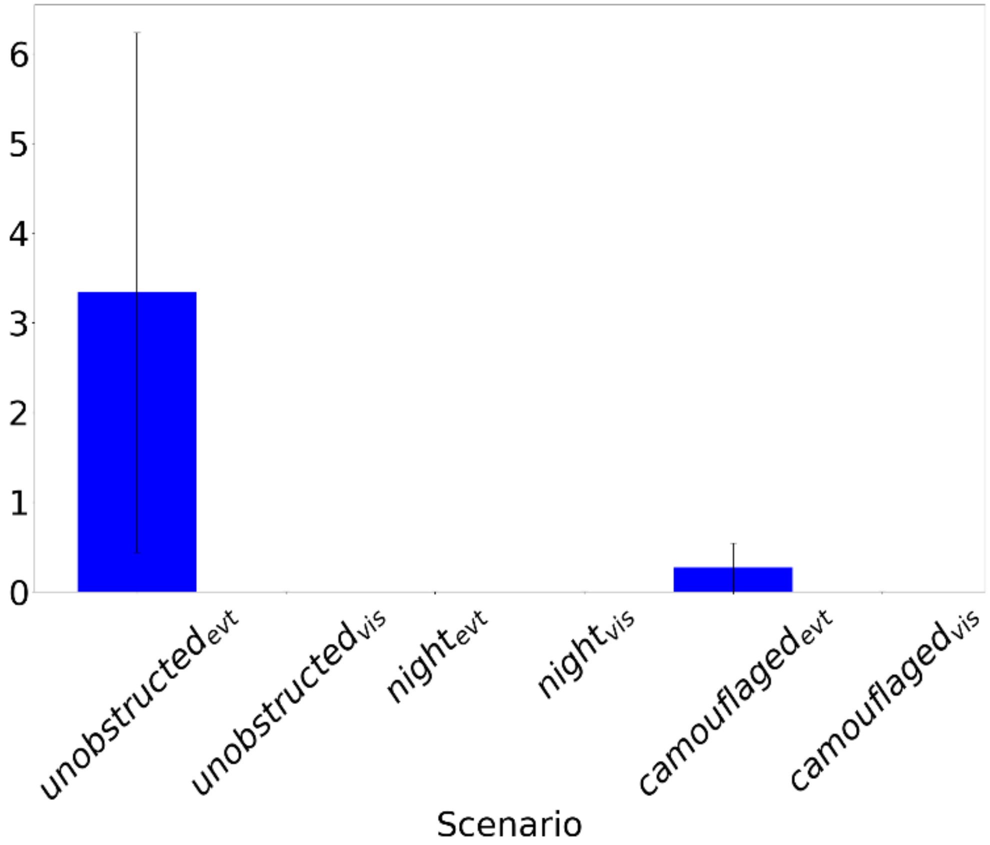
For all KPIs less is better!

Results person detection

Time to detect [s]



False positive rate [Hz]



Qualitative results (drone flying over cluttered background)

Qualitative results (Pedestrian wearing camouflage)

Conclusion and discussion

- Potential advantages of event based vision, particularly in terms of:
    - Time to detect
    - Data sparsity
- Artificial intelligence object detection results are promising especially in context where regular vision is challenged
- Open issues:
    - How to adjust camera bias automatically ?
    - Improve ATR in EVT domain need more data → synthetic data simulation?