EVREAL: Towards a Comprehensive Benchmark and Analysis Suite for Event-based Video Reconstruction

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Introduction

- A fundamental task in event-based vision: **Reconstructing intensity images from events**
- It enables us to:
  - **Visualize** and **interpret** the scene being captured
  - Use frame-based computer vision methods for **downstream tasks** (recognition, calibration, ...)
- Not completely solved yet
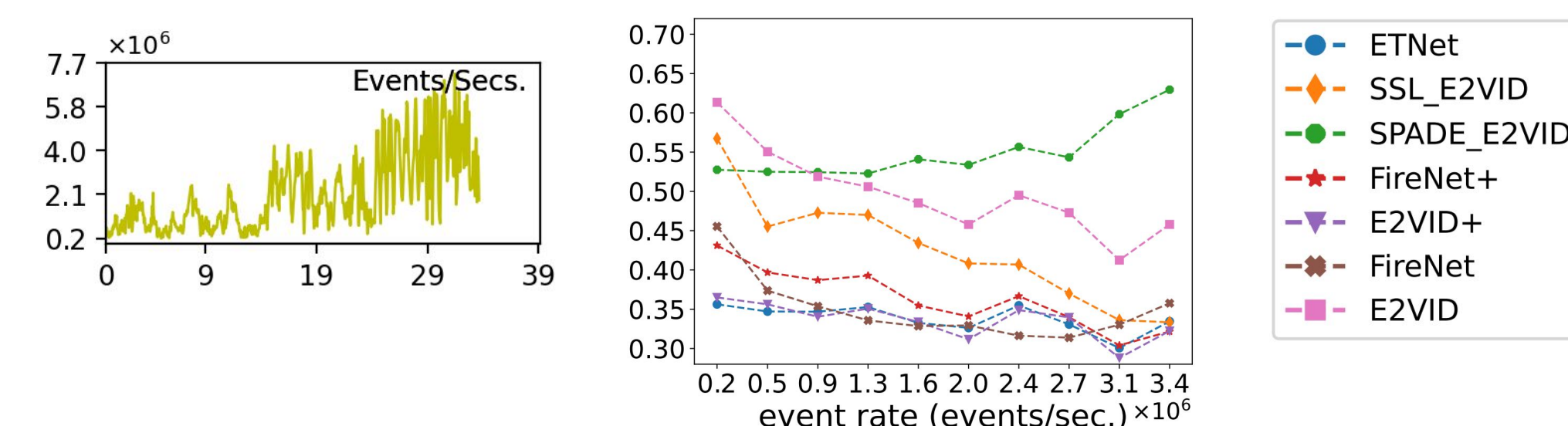- **Evaluation has challenges on its own** ...

Issues with Evaluation

- **Lack** of a standard evaluation procedure
- Benchmark datasets **limited in scale and scope**
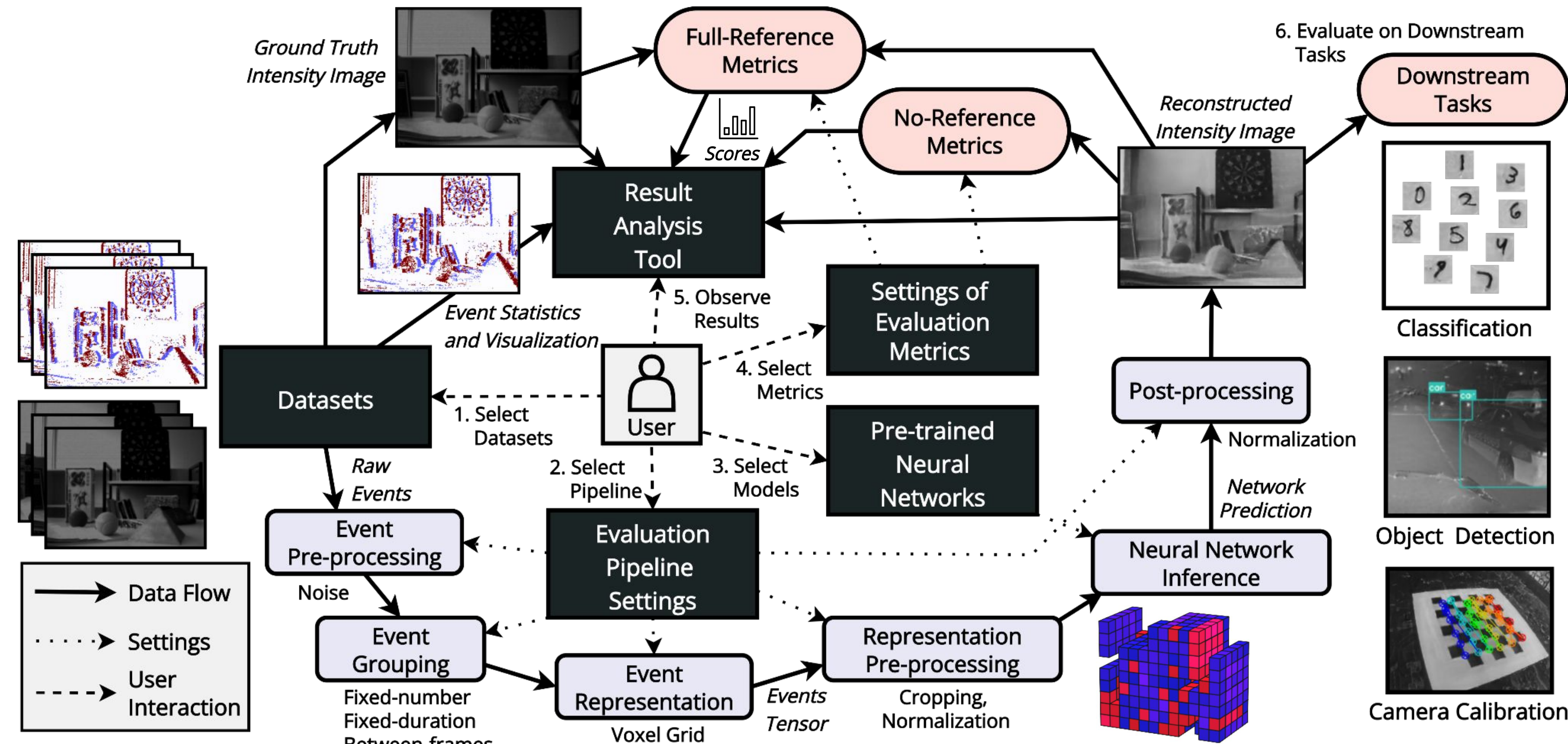- **Paradox of ground truth:** We want to evaluate especially when reference frames are low quality:

Motion blur Low Dynamic Range Low Light

- Assessing **robustness** under changing conditions:

- **Subjective** nature of image quality assessment

What We Propose with EVREAL

- A **unified evaluation pipeline**
- A **result analysis tool** to visualize and compare reconstructions and scores
- **Large set** of real-world test sequences
- **Full-reference** and **no-reference** metrics
- Evaluation in **challenging scenarios**
- **Robustness analysis** under varying conditions
- Evaluation on **downstream tasks**
- Evaluation of **computational efficiency**

Evaluation Details

Models: E2VID, FireNet, E2VID+, FireNet+, SPADE-E2VID, SSL-E2VID, ET-Net, HyperE2VID*

Datasets: ECD, MVSEC, HQF, BS-ERGB, ECD-FAST, MVSEC-NIGHT, HDR

Image Quality Metrics: MSE, SSIM, LPIPS, BRISQUE, NIQE, MANIQA

Main Takeaway from Experimental Results

- Good scores on standard benchmark sequences **do not always indicate** good scores on challenging scenarios, varying conditions, and downstream tasks.
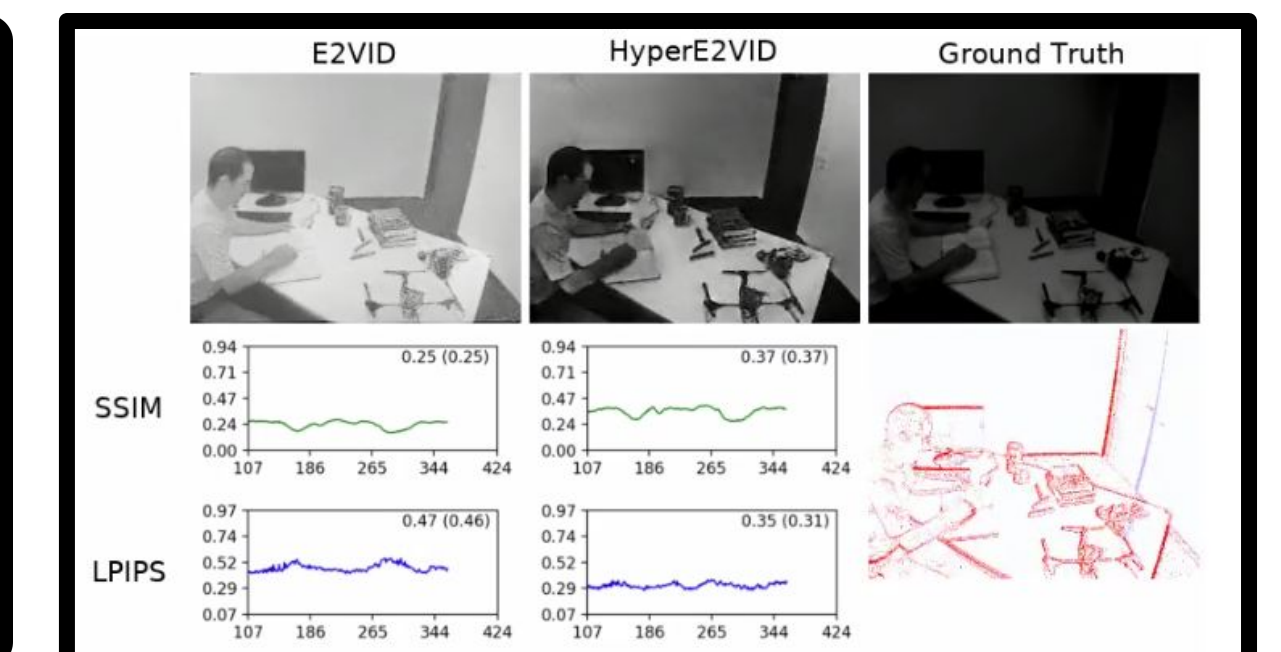
Summary & Conclusions

- EVREAL can serve as a **valuable resource** for researchers and practitioners.
- Using EVREAL yielded **insightful observations** under varying settings, challenging scenarios, and downstream tasks.
- Results imply that standard benchmark sequences are not enough and **further analysis needed.**
- We believe our work will contribute to the development of more **effective** and **robust** models.

Note: In our interactive webpage, we also present results of a **new state-of-the-art model, HyperE2VID!** 👇

Scan me for EVREAL   Scan me for HyperE2VID