Benchmarking Microsaccade Recognition with Event Cameras: A Novel Dataset and Evaluation

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Problem Definition and Contribution

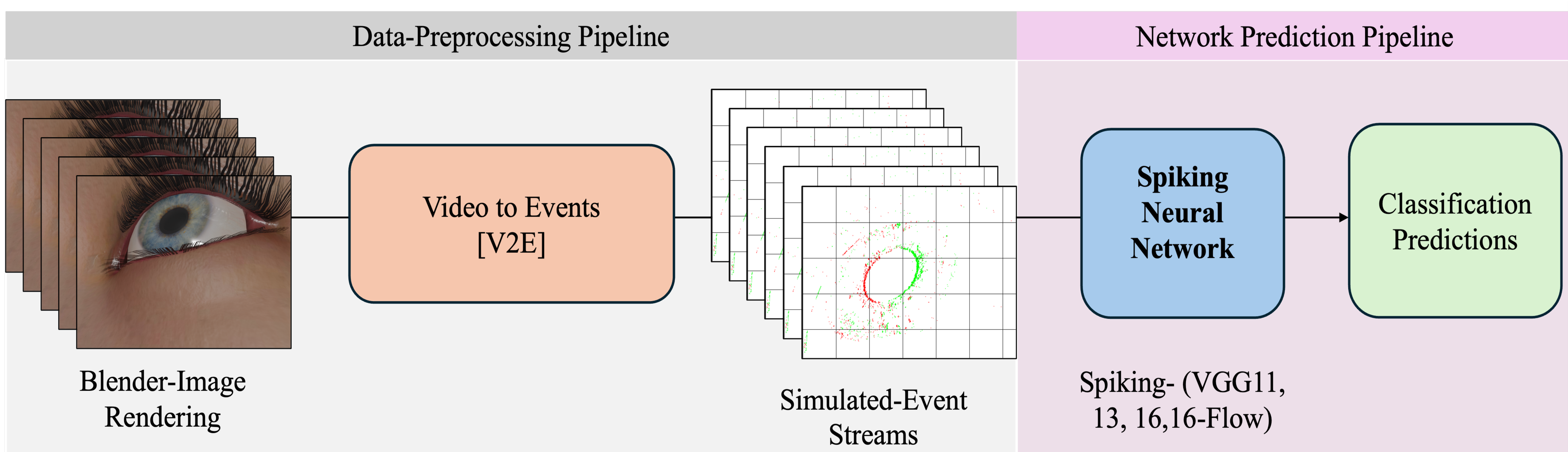
Goal: Microsaccades are small, involuntary eye movements that occur during visual fixation and are closely linked to attention, cognitive load, and internal brain states. Traditional frame-based eye trackers struggle to capture their high temporal dynamics due to limited frame rates and motion blur.

Microsaccades lasts from 0.5ms < 2ms and < 2° degrees

Key Contributions:

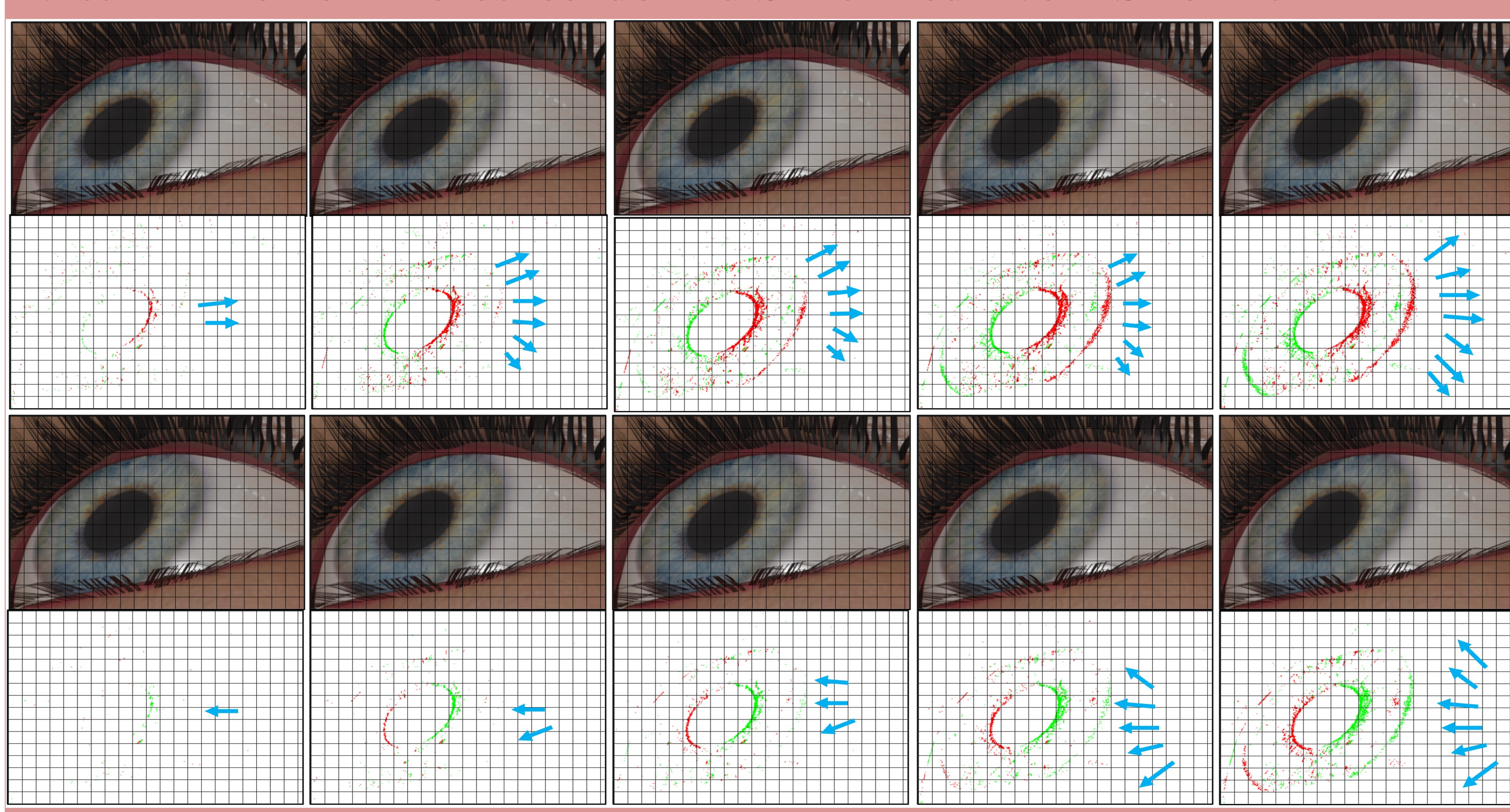
- First-ever event-based microsaccade dataset with annotated saccadic amplitudes and directions.
- Implementation of a microsaccade recognition pipeline.
- Demonstration of the potential of event-based sensing for cognitive state monitoring and driver attention analysis.

Method: Overview Pipeline and Dataset Details



Property	Values
Original Resolution	800 x 600
ROI Resolution	440 x 300
Total Event Sequences	175000
Number of Classes	7

Visualization of Microsaccade and Simulated Event Streams



Actionable Insights

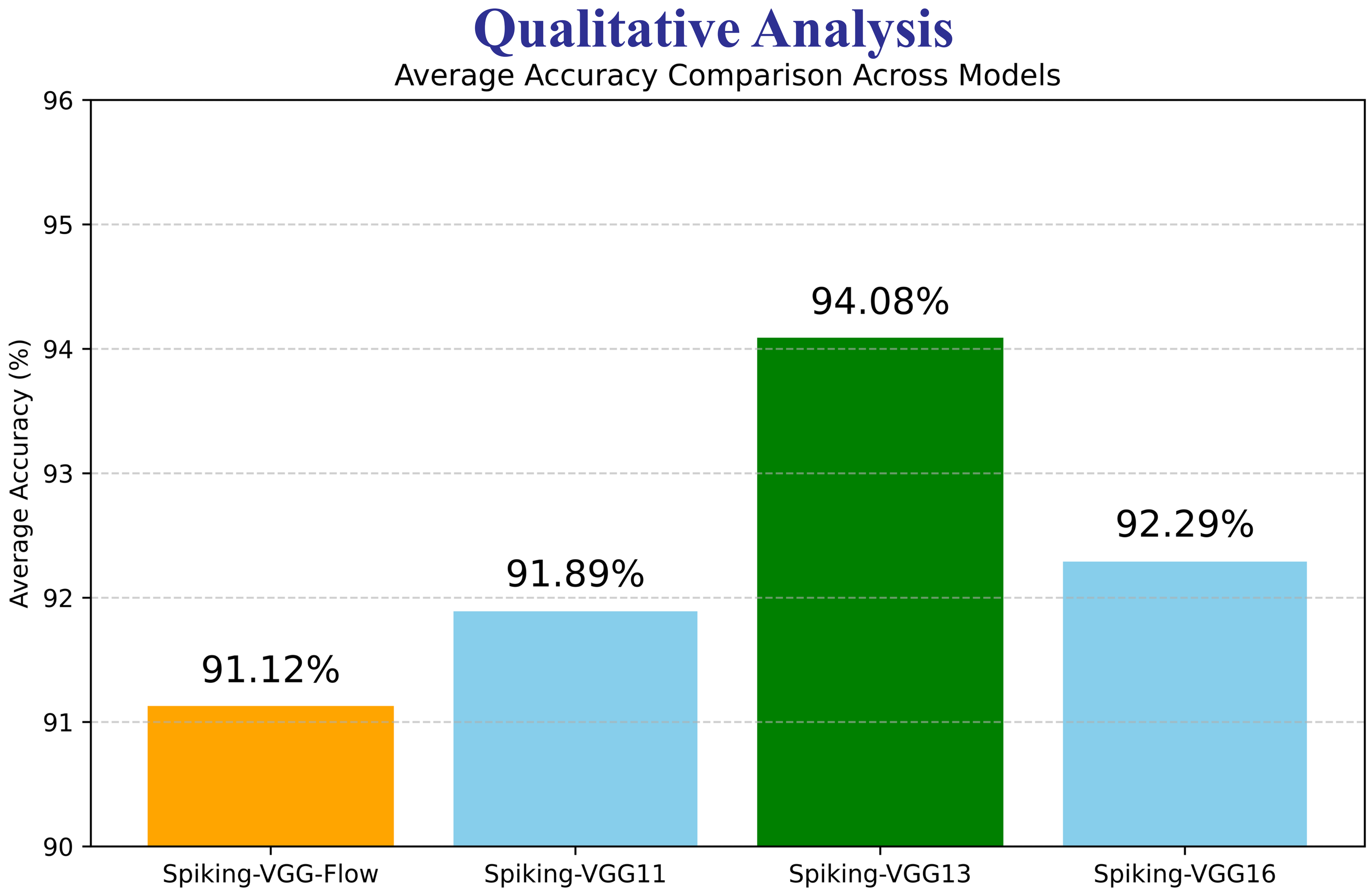
Motion-Regularized Learning: The proposed **Spiking-VGG-Flow** uses an auxiliary optical flow branch to enforce motion-aware representation learning.

Temporal Diversity: Event stream durations range from **0.25 ms to 2.25 ms**, enabling the model to capture both subtle and large microsaccadic motions.

Bias Reduction and Normalization: To prevent the model from exploiting event density or duration as classification cues, event streams are resampled post-simulation to align event count distributions across classes, ensuring discrimination is based on true motion dynamics.

Experiments & Results :

Qualitative Analysis



Real-Event Camera Data Analysis