EVO: Event-based 6-DOF Parallel Tracking and Mapping in Real-time

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**Motivation:** Address challenging SLAM scenarios (high-speed, HDR, low latency).

**Goal:** Semi-dense SLAM with an event camera in real time.

**Key properties:**
- **Semi-dense** 3D reconstruction and 6-DOF tracking.
- Works even in **high-speed** and HDR scenes, where standard cameras fail.
- **Real-time** on a smartphone CPU.
- **Intensity reconstruction** not needed, but available.

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**Tracking:** edge-map alignment

- **Event images** (~1000 events)
- **Minimize alignment error** between projected map and events:
  \[
  \min_{T} \sum_{u} (M(u) - l(W(u; T)))^2
  \]
- 6-DOF warp: \( W(u; T) := \pi(T \cdot \pi^{-1}(u, d_u)) \)

**Mapping:** EMVS (IJCV’17) [2]

Event-Based Space-Sweep Method:
- **Back-project events** into space.
- **Disparity Space Image** (DSI) with **ray density**.
- Projective sampling of DSI + Adaptive thresholding.

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**References:**

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**What is an event camera?**
- Only transmits brightness changes.
- Output is a stream of asynchronous events.
- **Advantages:** low latency, no motion blur, HDR.

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**Watch video!**

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**References:**