

# A Unifying Contrast Maximization Framework for Event Cameras, with Applications to Motion, Depth, and Optical Flow Estimation

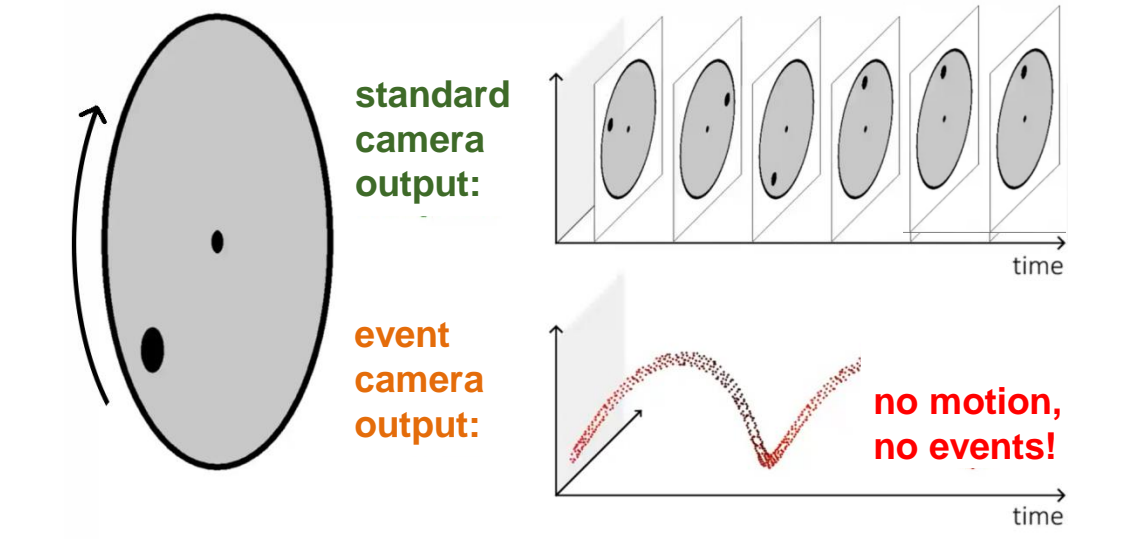
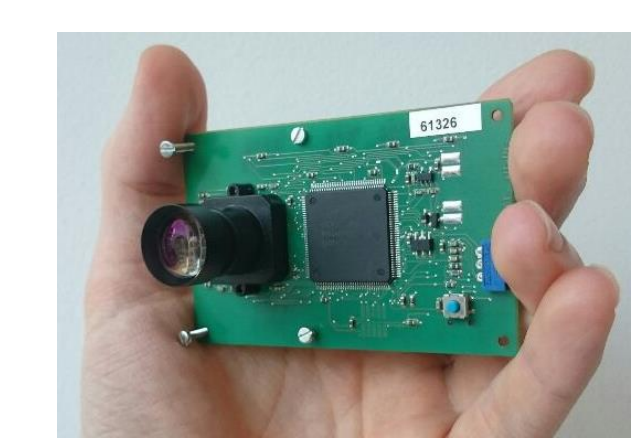
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Event-based Vision Research



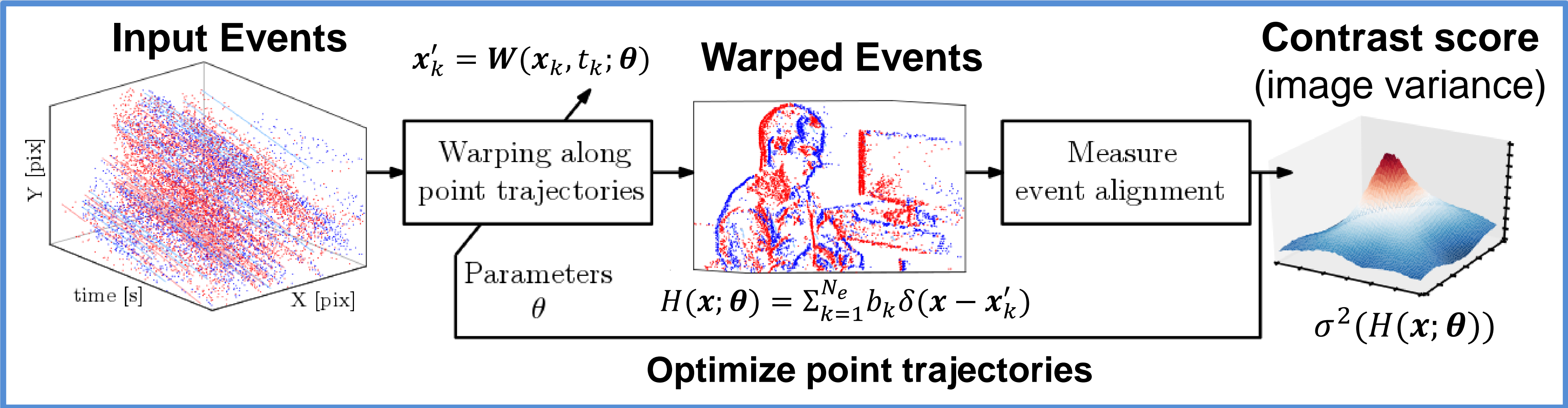
## What is an event camera?



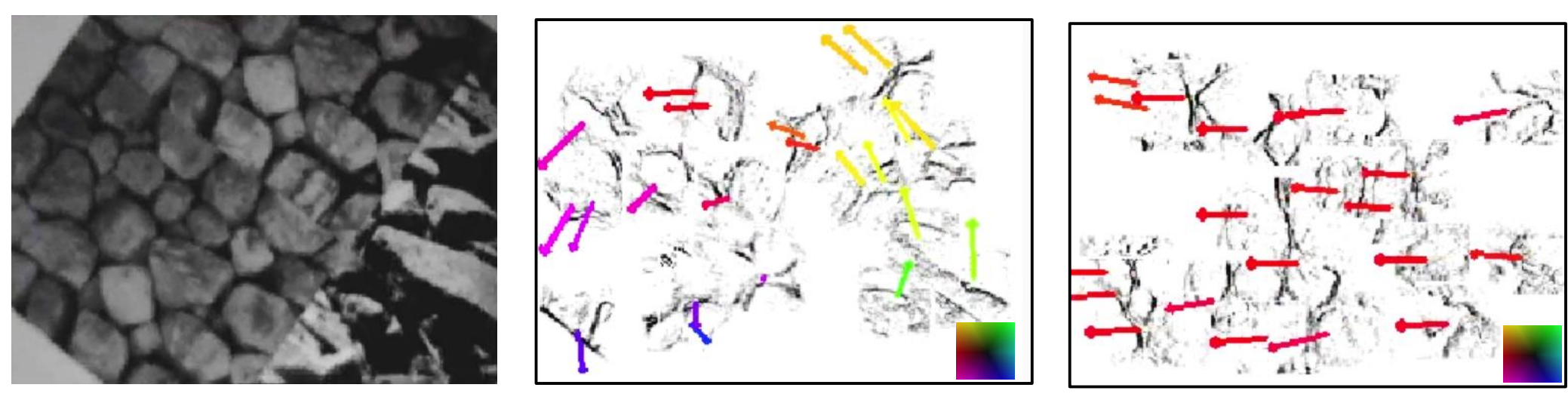
- Only transmits **brightness changes** (“events”).
- **Advantages:** low latency, no motion blur, HDR.

**Motivation:** Event cameras promise to **revolutionize computer vision** by unlocking scenarios currently inaccessible to standard cameras: **HDR, high speed, low latency.**

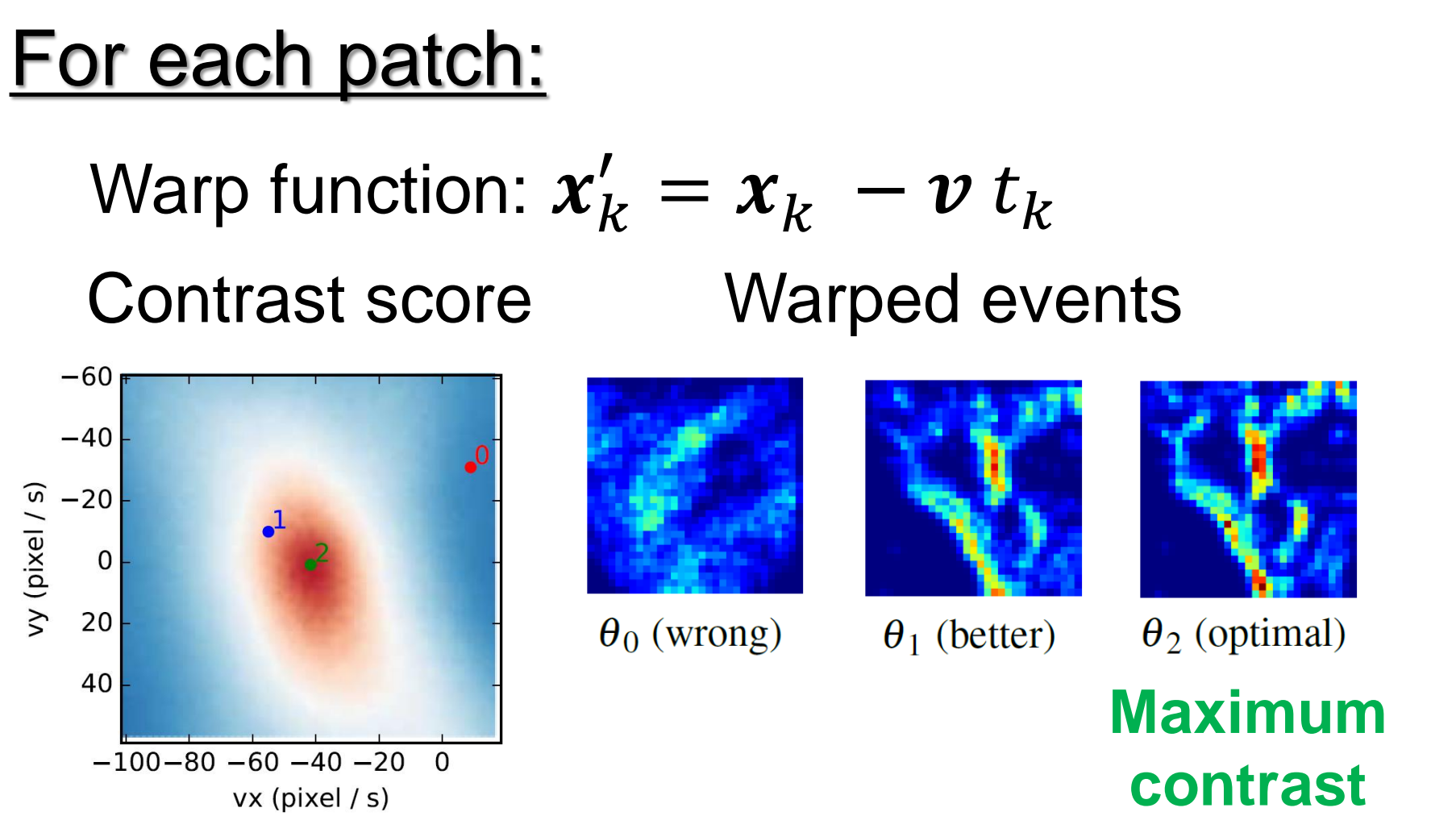
**Goal:** First unifying framework that allows to address **multiple computer vision tasks with event cameras.**



## Optical Flow Estimation

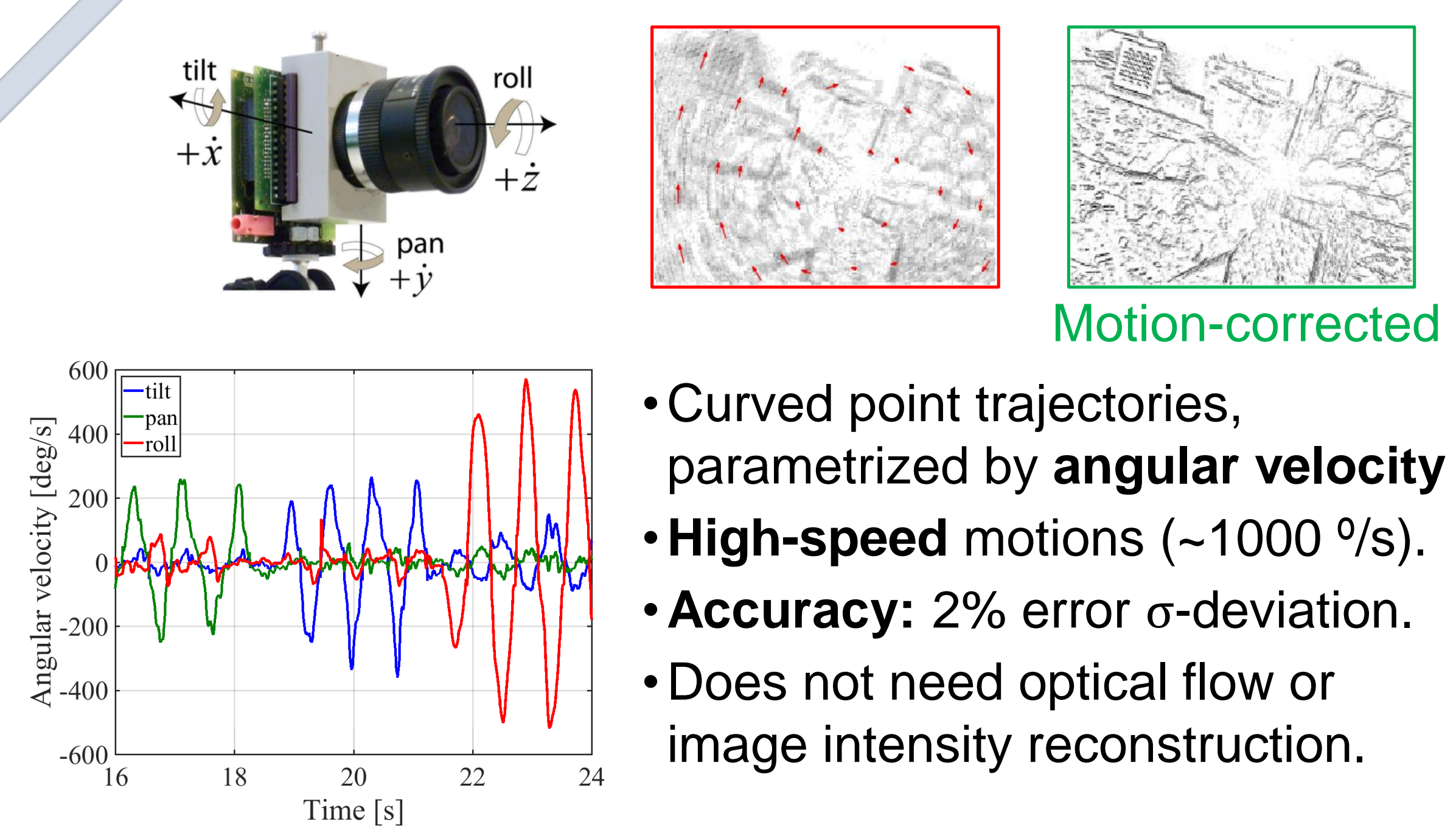


For each patch:



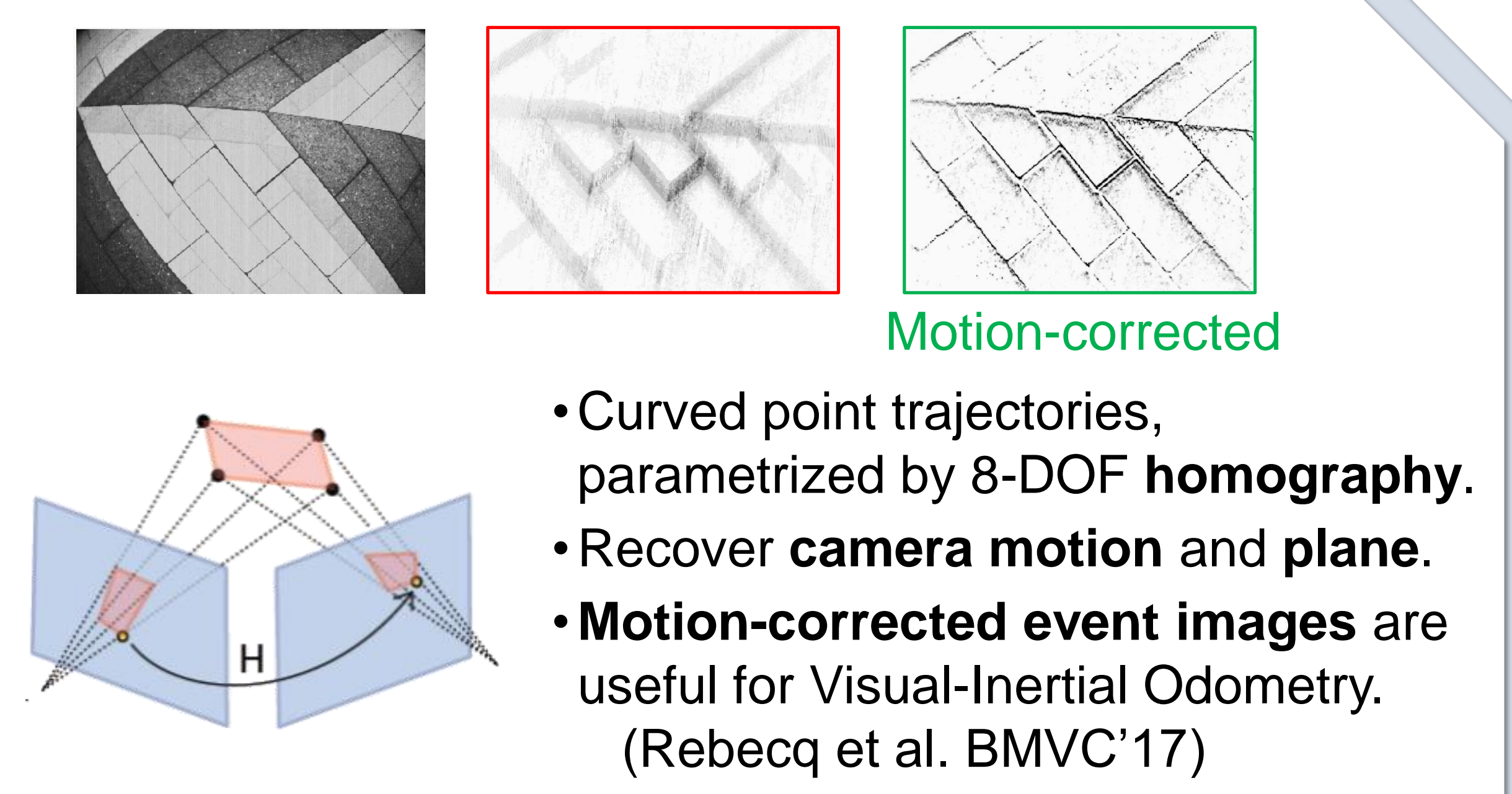
- **Straight point trajectories**, parametrized by patch velocity  $v \equiv \theta$  (2-DOF).
- Assume uniform **velocity** for events in patch.
- **Maximize patch contrast** w.r.t. optic flow  $v$ .

## Rotational Motion Estimation

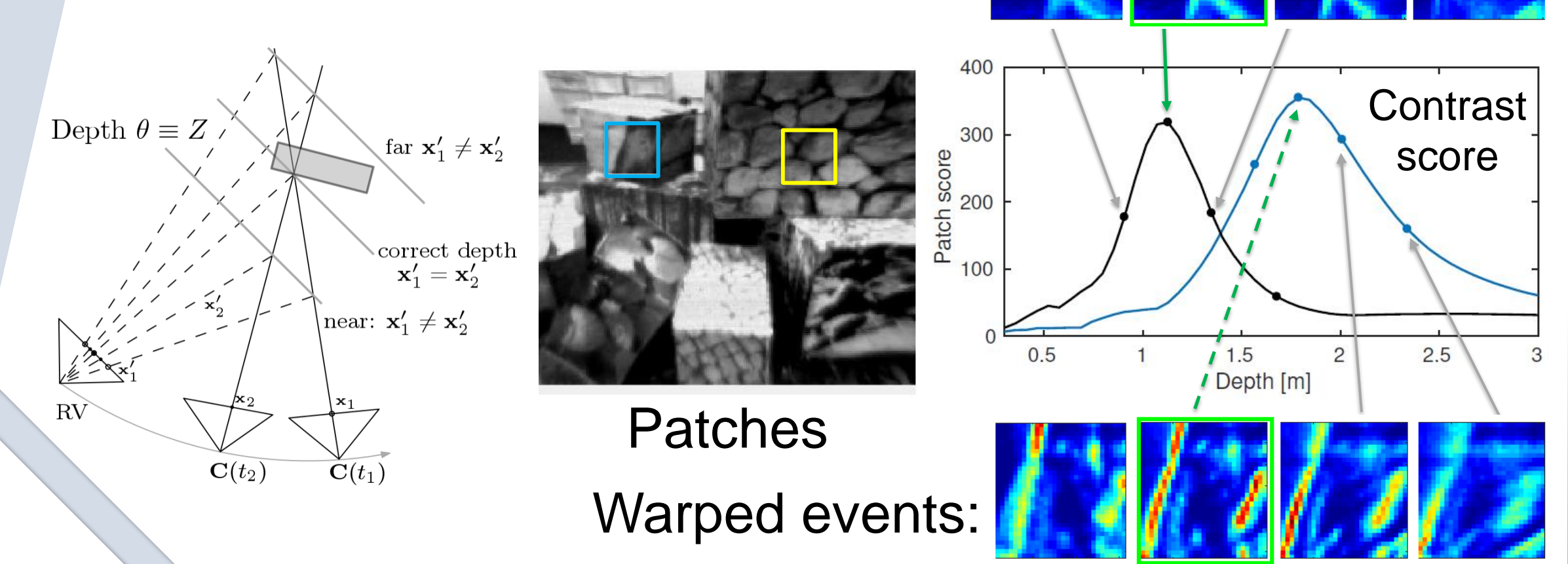


Low contrast and blurred High contrast and sharp (best point trajectories)

## Homography Estimation



## 3D Reconstruction



- **Given:** events and camera motion.
- Compute **patch-based, continuous depth**.
- 1-DOF point trajectories.

## Semi-dense 3D reconstruction

