TimeLens: Event-based Video Frame Interpolation

Stepan Tulyakov*, Daniel Gehrig*, Stamatios Geourgoulis,
Julius Erbach, Mathias Gehrig, Yuanyou Li, Davide Scaramuzza

Code and Dataset: http://rpg.ifi.uzh.ch/timelens

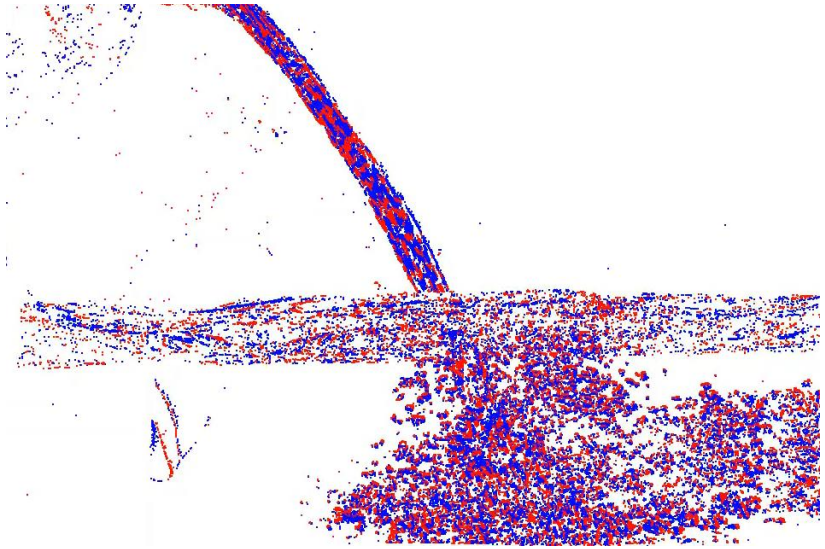
University of Zurich[UZH]

HUAWEI

* these authors contributed equally

Time Lens: Event-based Video Frame Interpolation

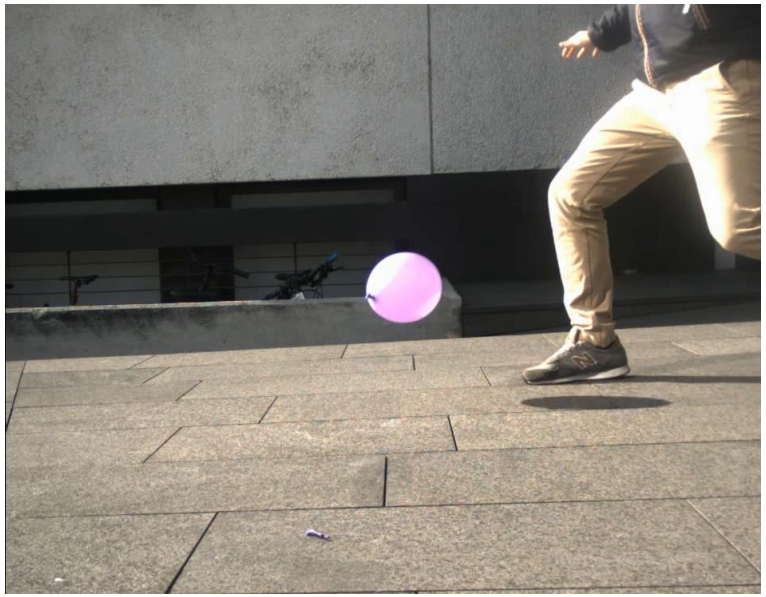
low framerate
video input



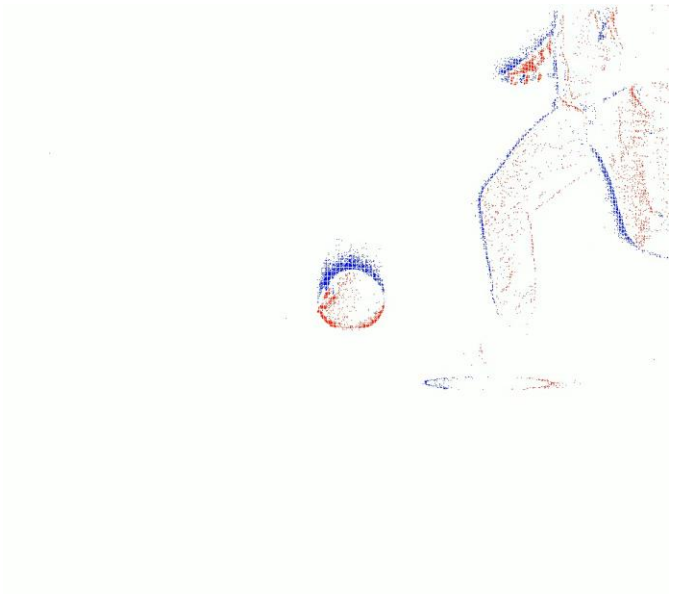
event camera
input

Time Lens
(this work)

Time Lens: Event-based Video Frame Interpolation



low framerate
video input

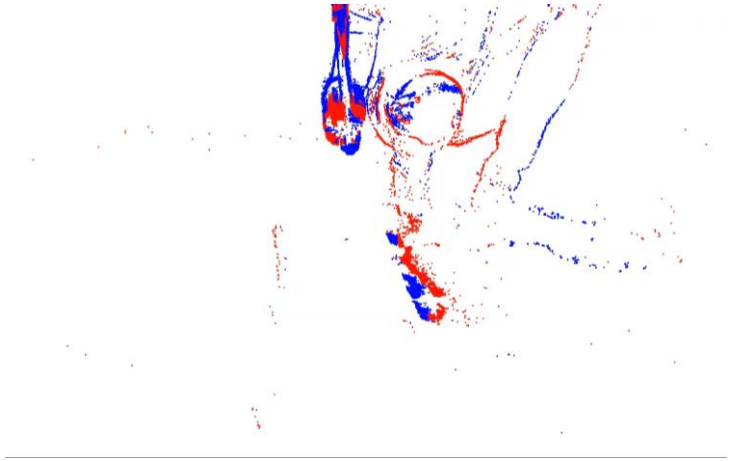


event camera
input

Time Lens
(this work)

Time Lens: Event-based Video Frame Interpolation

low framerate
video input

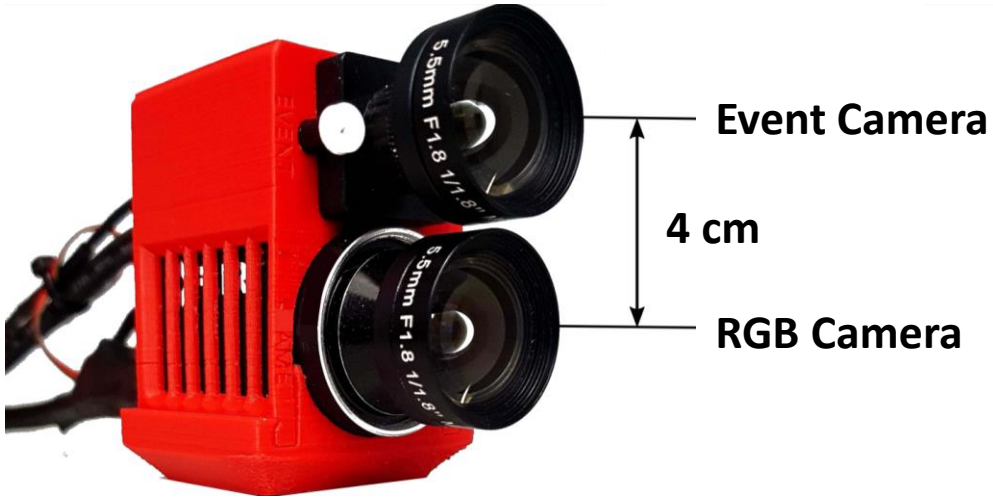


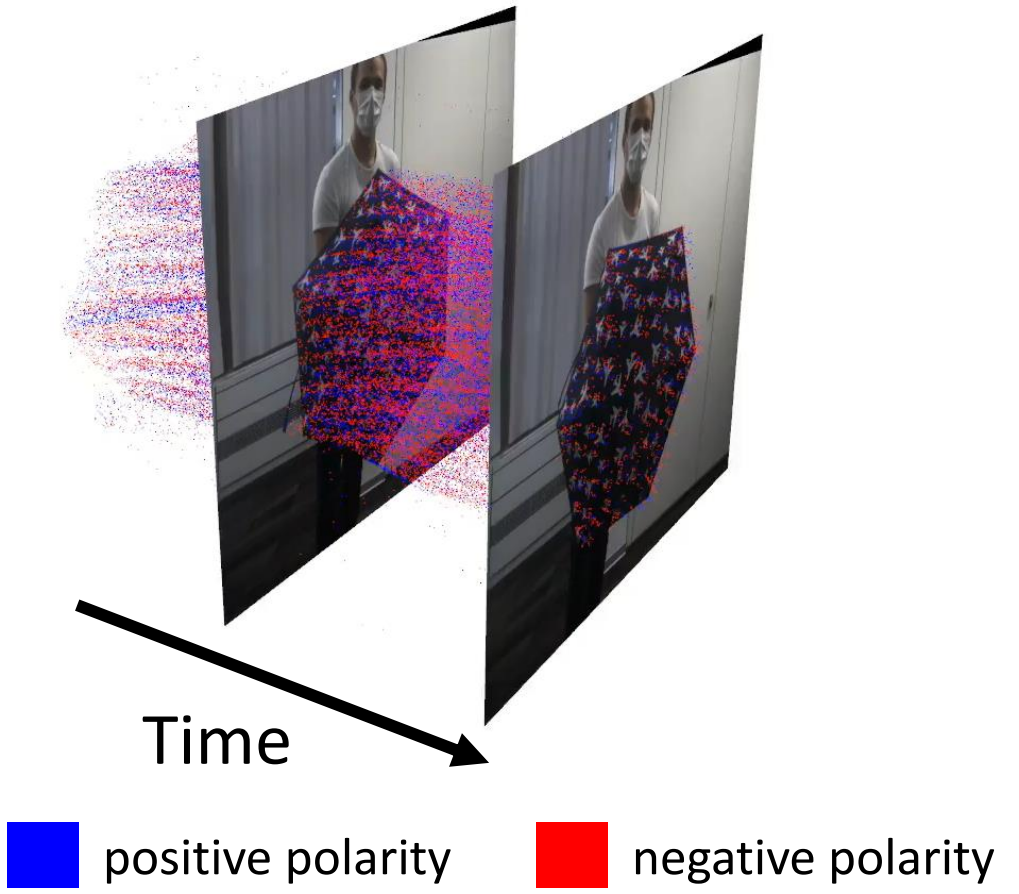
event camera
input

Time Lens
(this work)

Time Lens: Event-based Video Frame Interpolation

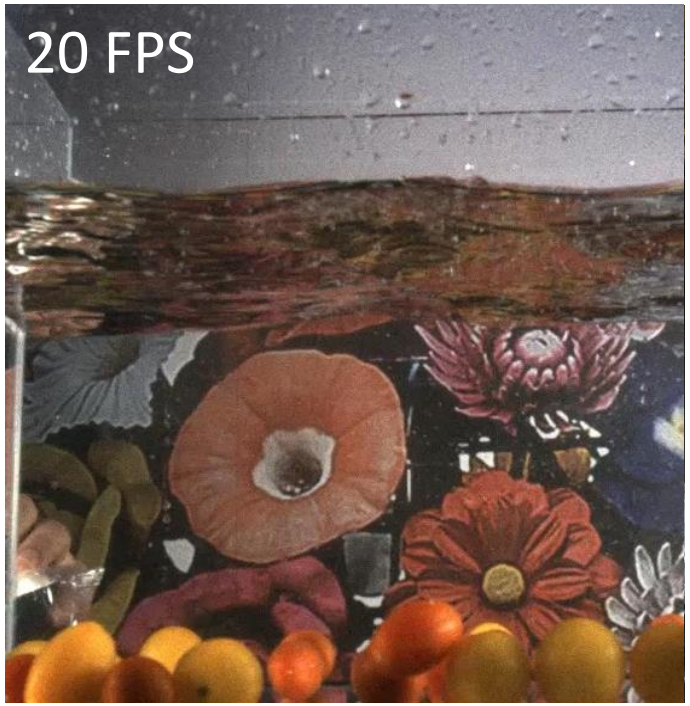
It does this by leveraging event cameras which provide a compressed stream of visual information in the blind-time between frames.



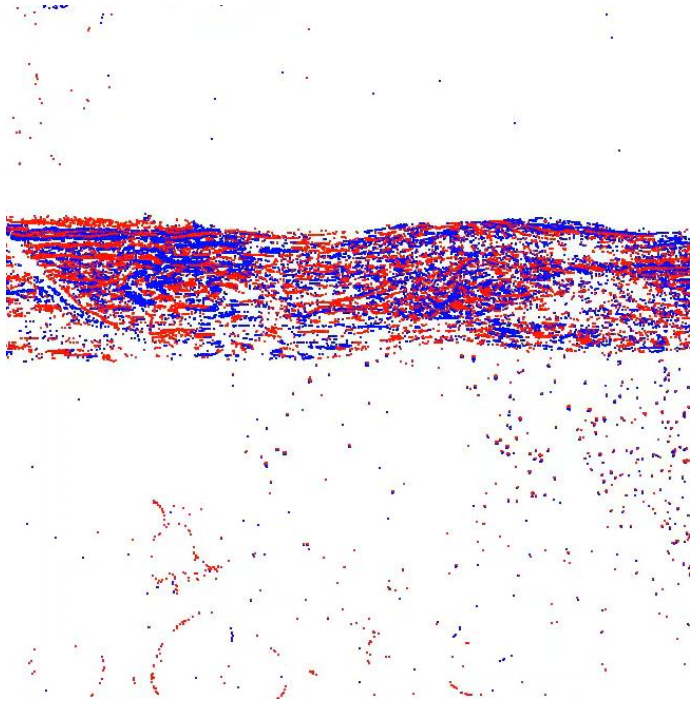


Time Lens: Event-based Video Frame Interpolation

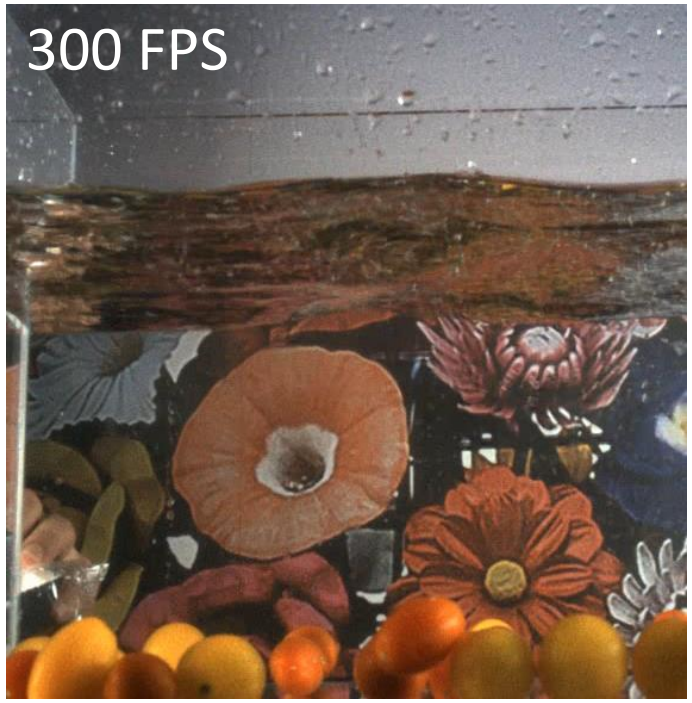
It does this by leveraging event cameras which provide a compressed stream of visual information in the blind-time between frames.



low framerate video input

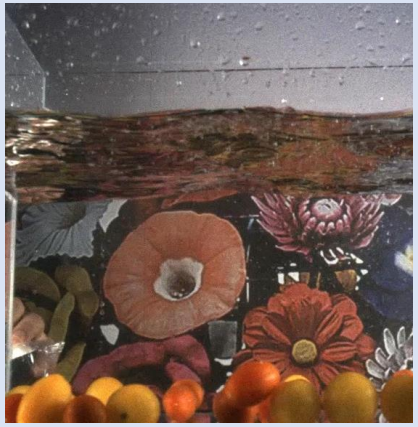


events

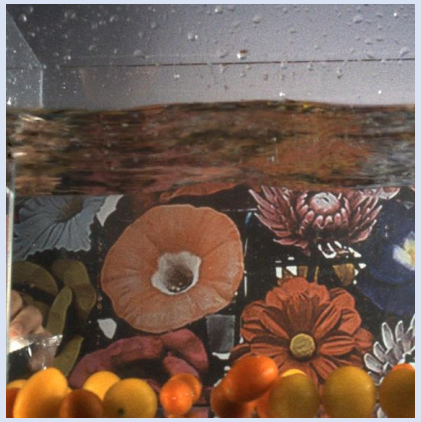


high framerate video (ours)

Time Lens: Event-based Video Frame Interpolation

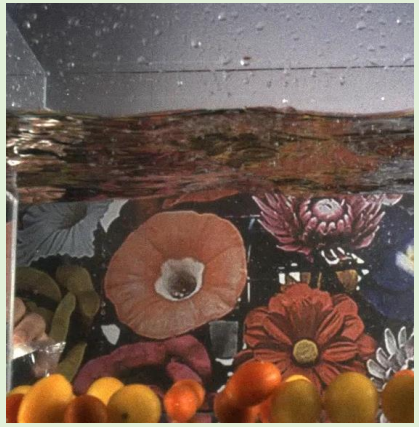


low framerate video input

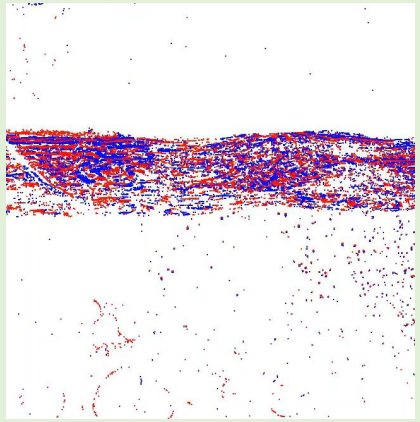


high framerate video

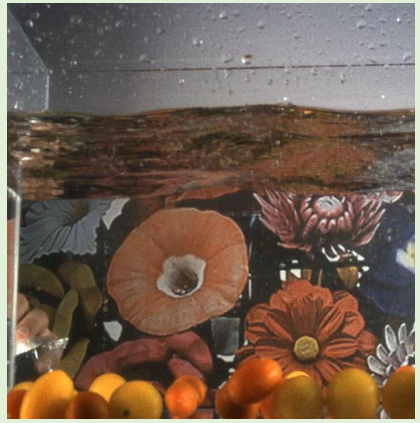
frame-based methods (DAIN) [Bao CVPR'19]



low framerate video input



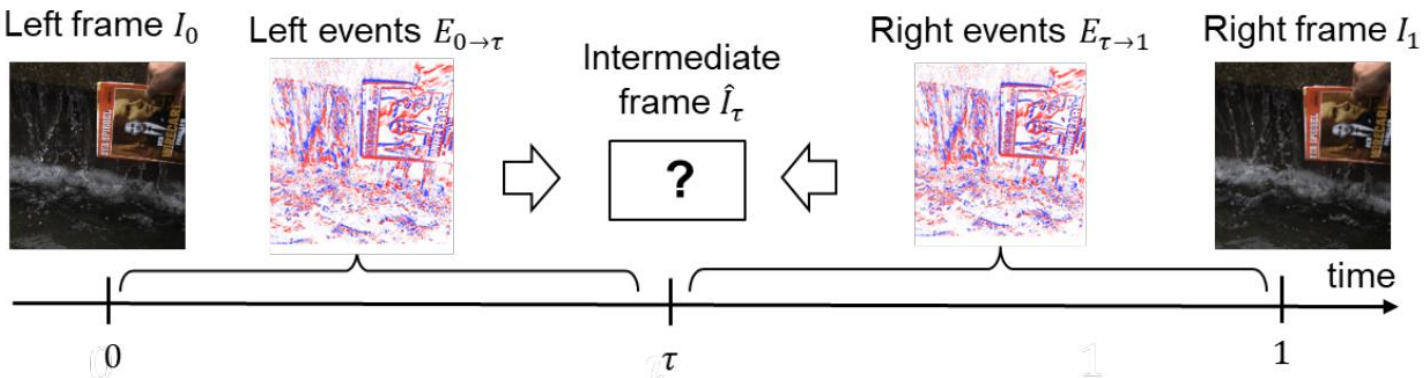
events

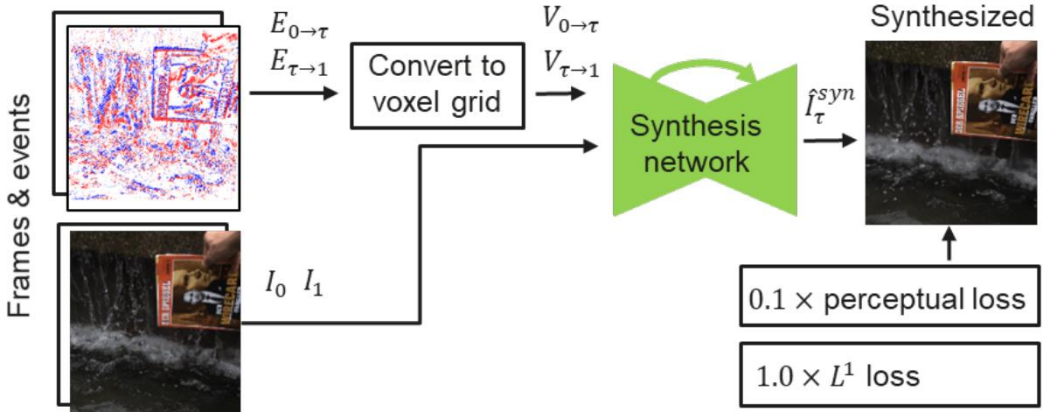


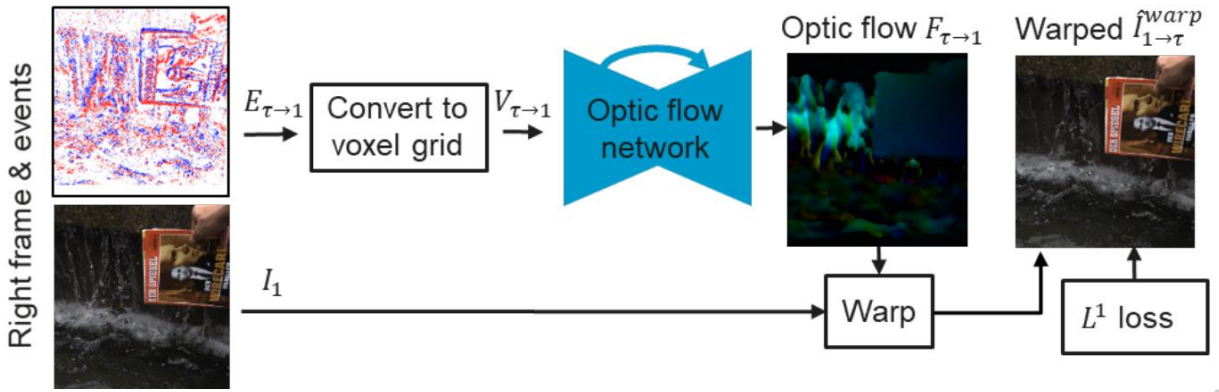
high framerate video

Time Lens (this work)

Methodology







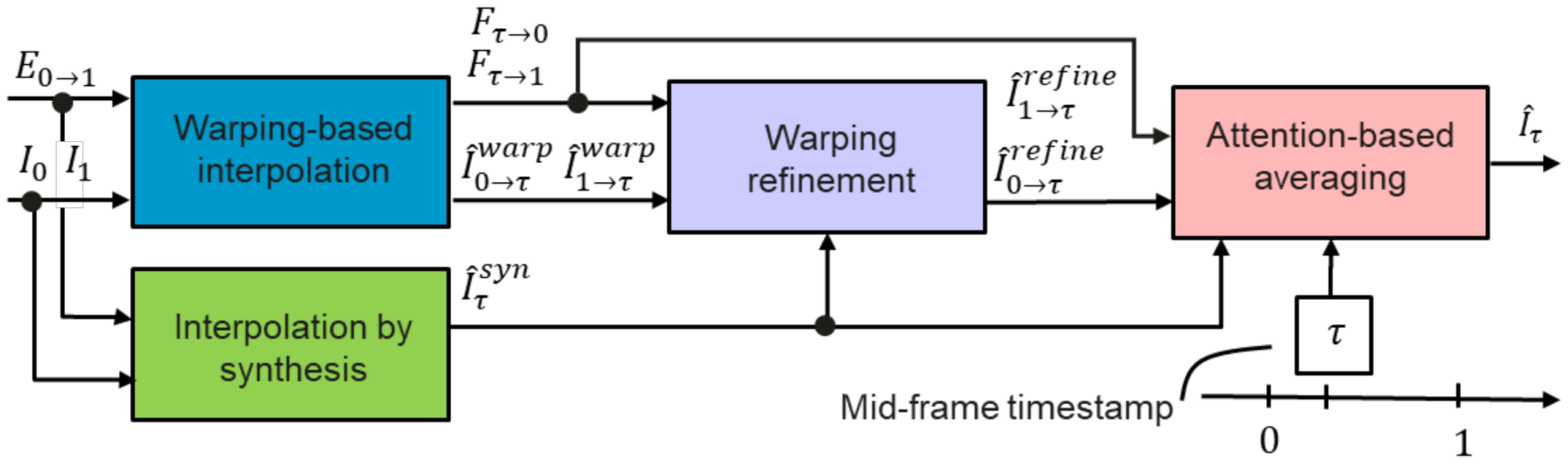
Synthesis-based Module

Warping-based Module

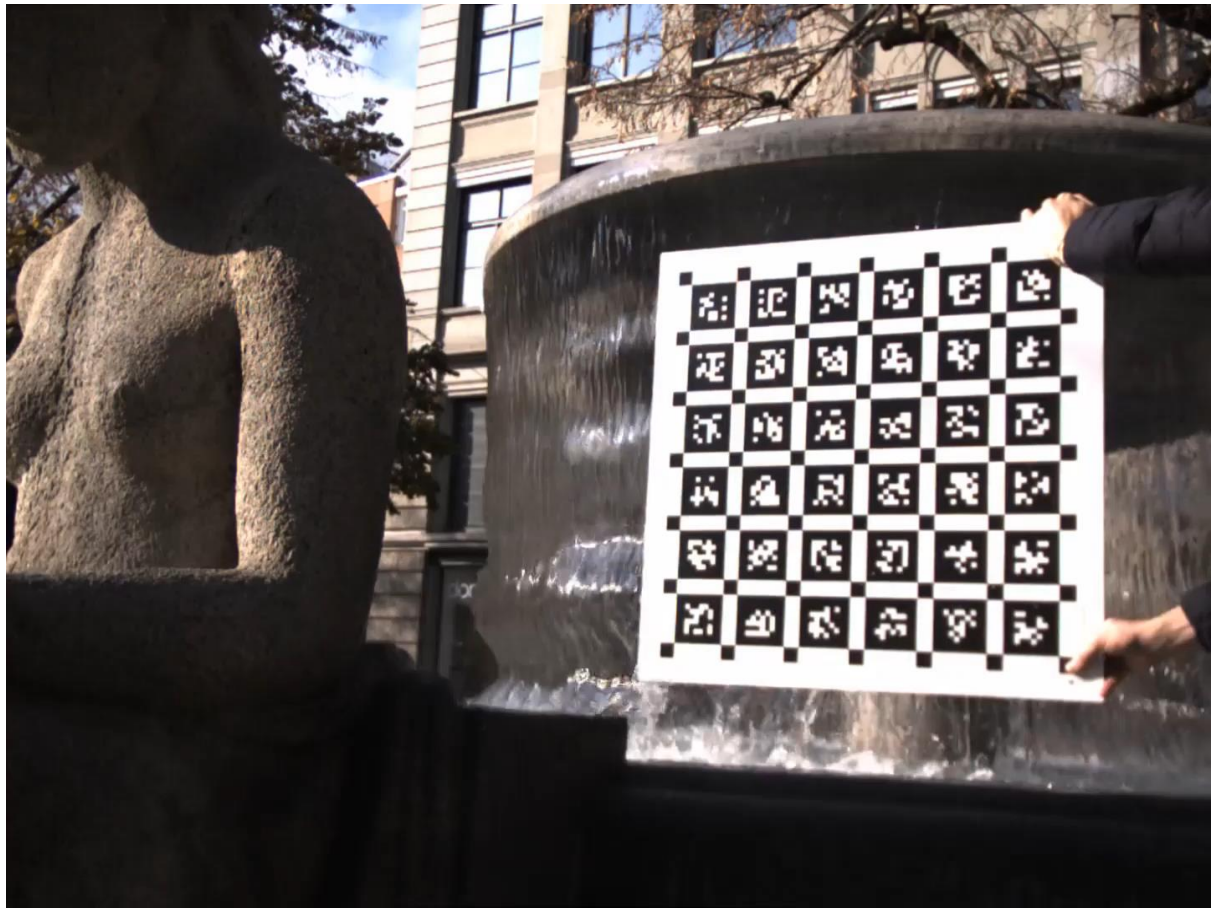
Methodology - Overview

Separate **synthesis-** and **warping-based** modules with warping refinement

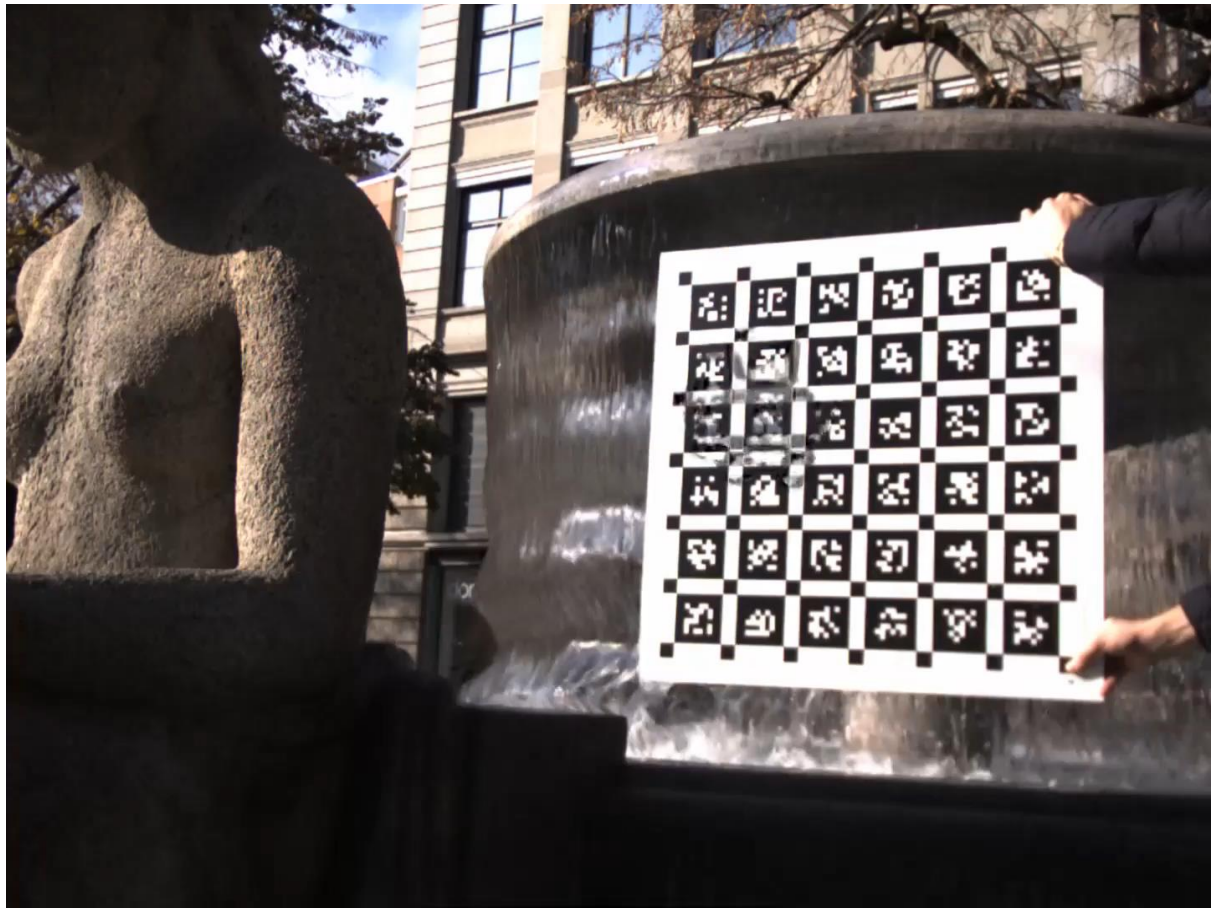
Fusion of separate candidates with **attention**.



Challenging Scenarios: Highly Dynamic Scenes



Time Lens (ours)



DAIN [Bao CVPR'19]

Challenging Scenarios: Highly Dynamic Scenes

Time Lens (ours)

DAIN [Bao CVPR'19]

Challenging Scenarios: Highly Dynamic Scenes

Time Lens (ours)

DAIN [Bao CVPR'19]

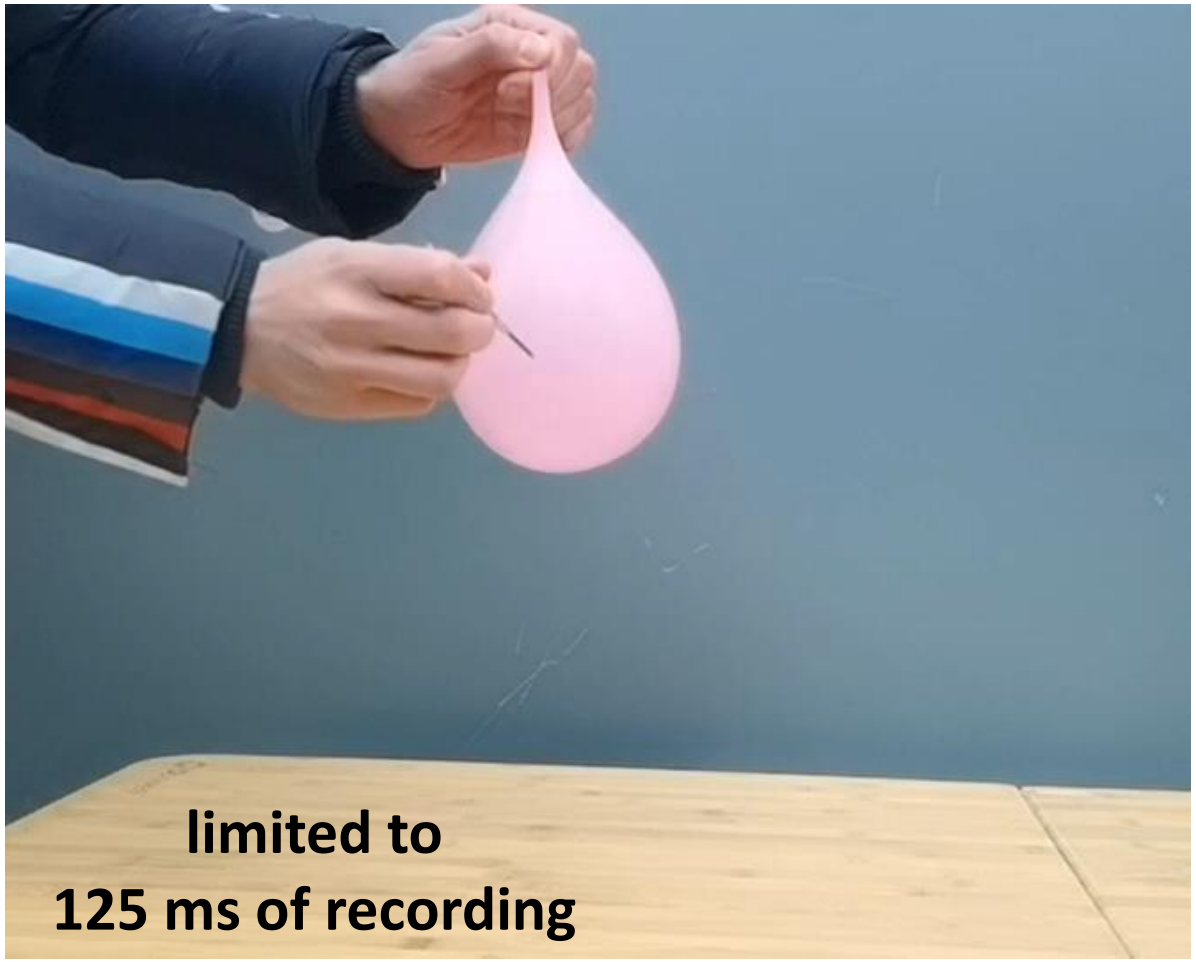
Comparison with Event-based Methods

Time Lens (ours)

LEDVDI [Lin ECCV'20]

Applications: Slow Motion Video at 7680 FPS

Upsampled from 1920 FPS to 7680 FPS



Huawei P40 Pro

Upsampled from 160 FPS to 7680 FPS

Time Lens (ours)

Applications: Slow Motion Video at 7680 FPS

Upsampled from 1920 FPS to 7680 FPS

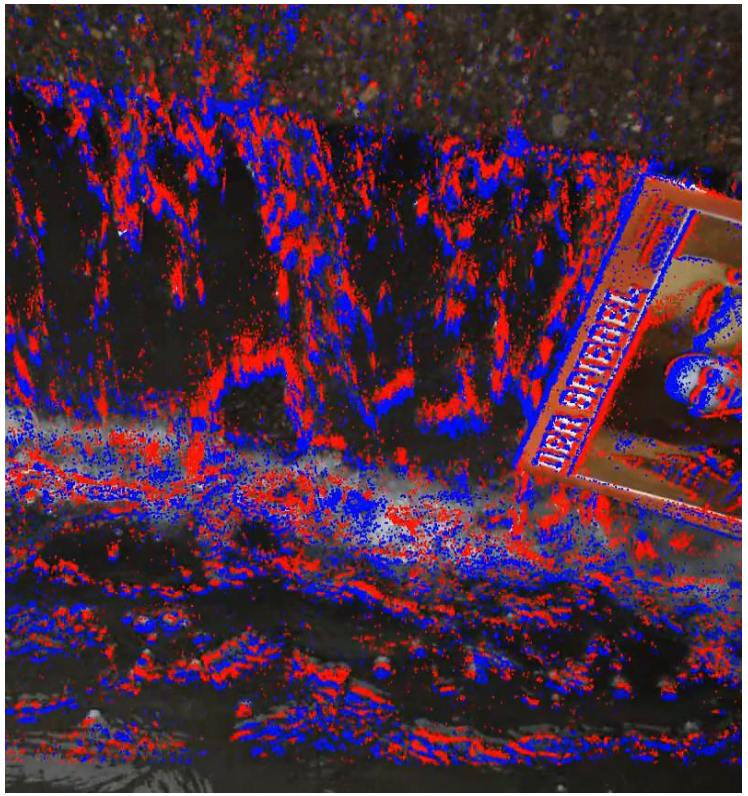
Huawei P40 Pro

Upsampled from 160 FPS to 7680 FPS

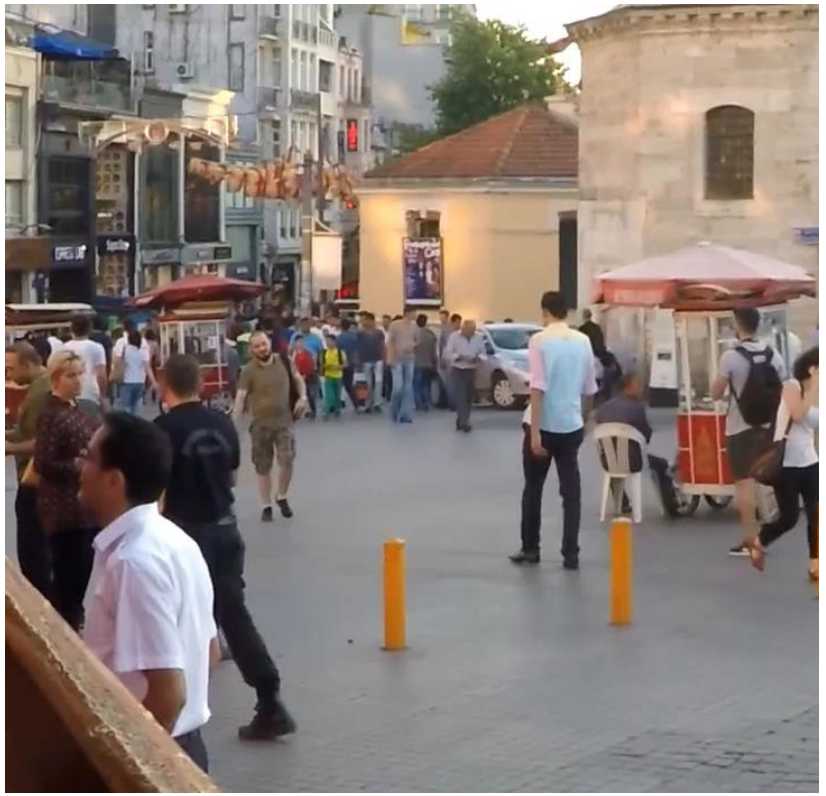
Time Lens (ours)

Experimental Results on Public Datasets

Extensive evaluation on both synthetic and real datasets shows an **up to 5.4 dB improvement in PSNR** compared to both event- and frame-based methods.



High Speed Event and RGB Dataset (HS-ERGB)

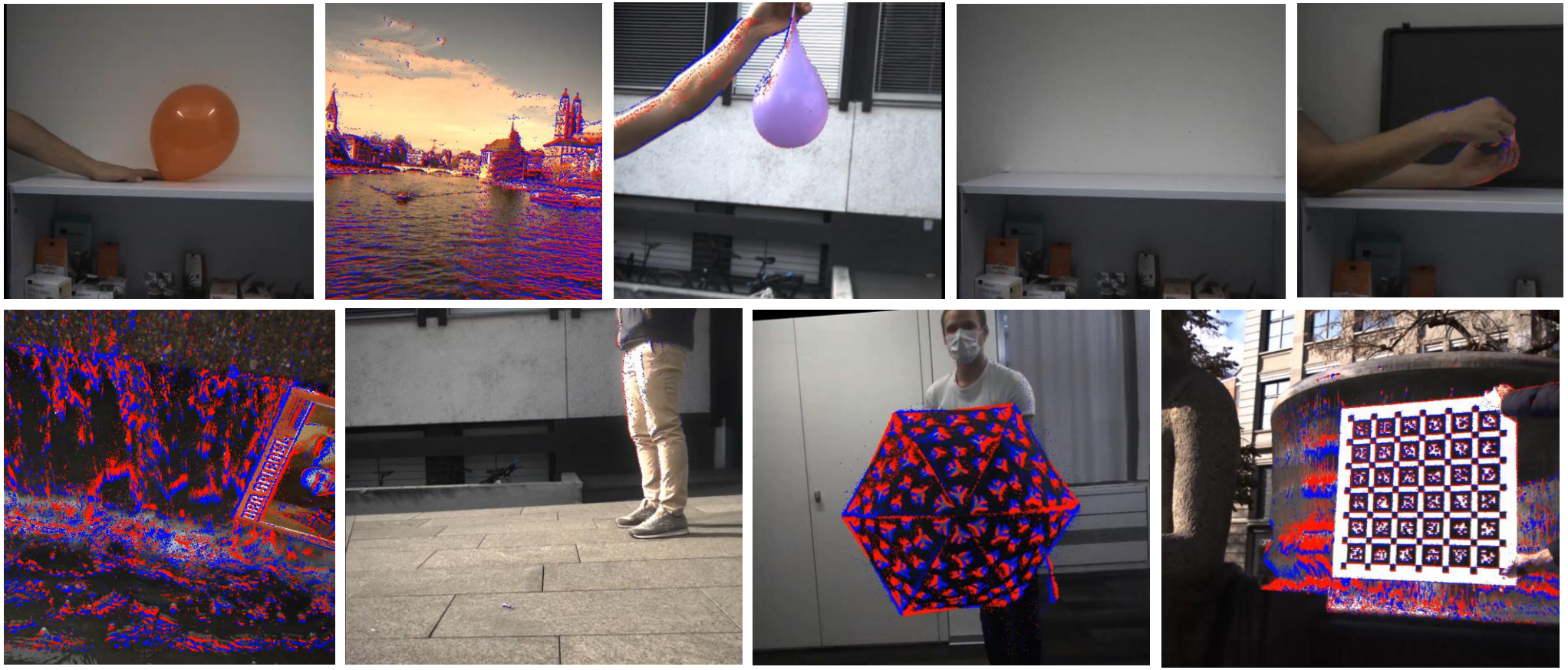


GoPro [Nah CVPR'17]

HQF Dataset
[Stoffregen ECCV'2020]

High-Speed Event and Color Camera Dataset

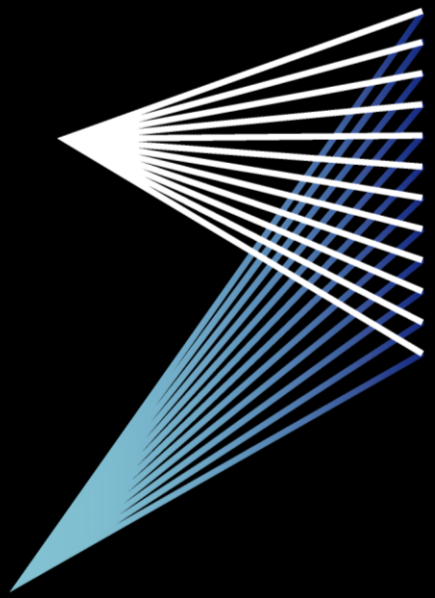
We release the first high resolution and high speed (160 FPS) event and frame dataset to push the limits of existing frame interpolation approaches.



Conclusion

- We present a method which combines frames and asynchronous events for video frame interpolation
- We address many frame-interpolation challenges, such as **visual aliasing, highly dynamic motions and illumination changes.**
- We show **up to 5.4 dB improvements in terms of PSNR** over both frame- and event-based methods
- We achieve similar results to a high-speed camera with a significant reduction in data, greatly extending the recording time.

Code and Dataset: http://rpg.ifi.uzh.ch/timelens



ROBOTICS &
PERCEPTION
GROUP

rpg.ifi.uzh.ch

HUAWEI