1000 FPS HDR Video with a Spike-RGB Hybrid Camera

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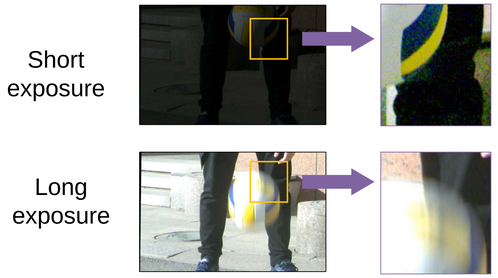
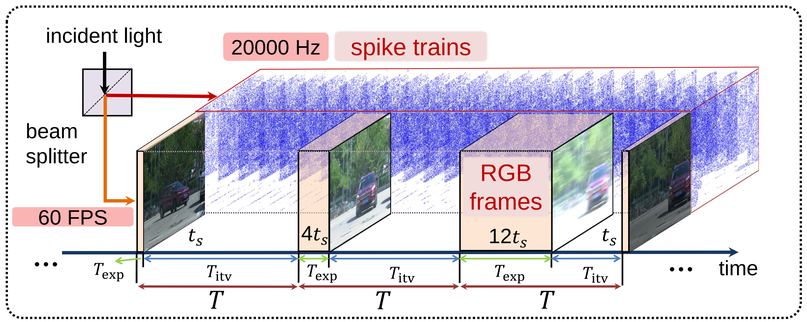
Motivation

- Capturing **HDR** videos in high-speed scenes is challenging.



- The total time from the starting of the current exposure to the starting of the next frame T is composed of the exposure time T_{exp} and interval time T_{itv}(containing the readout and waiting time).

- Previous **HDR** methods can not deal with high frame rate videos.

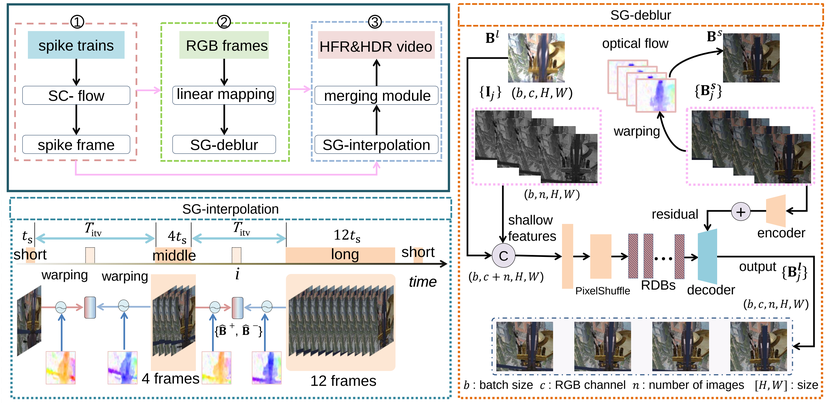


Method

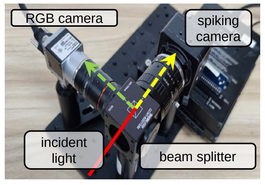
① Spike preprocessing. We estimate the optical flow and spike frames from the spike trains.

② RGB frame preprocessing. Take t_s as the reference time for the motion deblurring. Consequently, we can recover 4 and 12 sharp images from 4 t_s and 12 t_s images. 60 FPS (3 exposure×20)→ 340 FPS ((1+4+12) ×20)

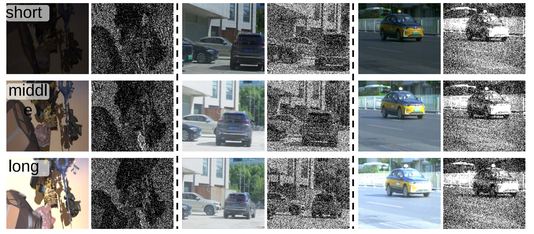
③ Merging into HFR video. Frame interpolation and multi-source image fusion. 340FPS → 1000FPS



- The prototype of our Spike-RGB imaging system which is composed of a spiking camera and an RGB camera (Basler acA800-510uc).



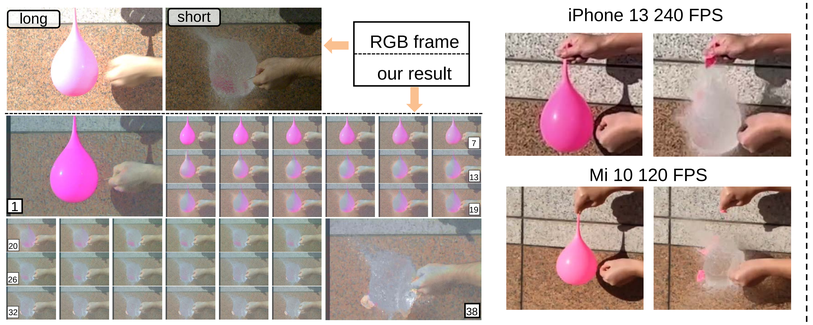
- There is no suitable datasets for training and testing our method. We collect a new one with three components.
- Each group shows three alternating-exposure RGB frames and the corresponding spike signals.



Experimental Results

- Comparison with a commercial high-speed camera (Phantom: VEO 640, F/1.8, 85mm lens).

- Comparison with smart phones with the slow-motion capability in a super fast condition.



- Quantitative results on our real synthetic data. We sample 60 FPS videos from our results for the comparison with Chen21. ↑ (↓) indicates larger (smaller) values are better.

Comparison with the state-of-th-art method

Method	PSNR↑	SSIM↑	HDR-VDP2↑	HDR-VQM↓	FPS
Chen21	18.46	0.697	27.34	0.536	60
Ours	30.14	0.921	60.14	0.093	
Chen21	/	/	/	/	1000
Ours	**24.38**	**0.903**	**47.79**	**0.120**	

[1] Guanying Chen, Chaofeng Chen, Shi Guo, Zhetong Liang, Kwan-Yee K Wong, and Lei Zhang. HDR video reconstruction: A coarse-to-fine network and a real-world benchmark dataset. In *Proc. of International Conference on Computer Vision*, pages 2502–2511, 2021.