NEURAL INFORMATION PROCESSING SYSTEMS

Event-based HDR Structured Light

*Jiacheng Fu, Yue Li, Xin Dong, Wenming Weng, Yueyi Zhang, Zhiwei Xiong**

University of Science and Technology of China

Poster Session: Fri 5 Dec 11 a.m. PST — 2 p.m. PST

中国科学技术大学
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VIDAR
Visual Information Discovery And Recovery

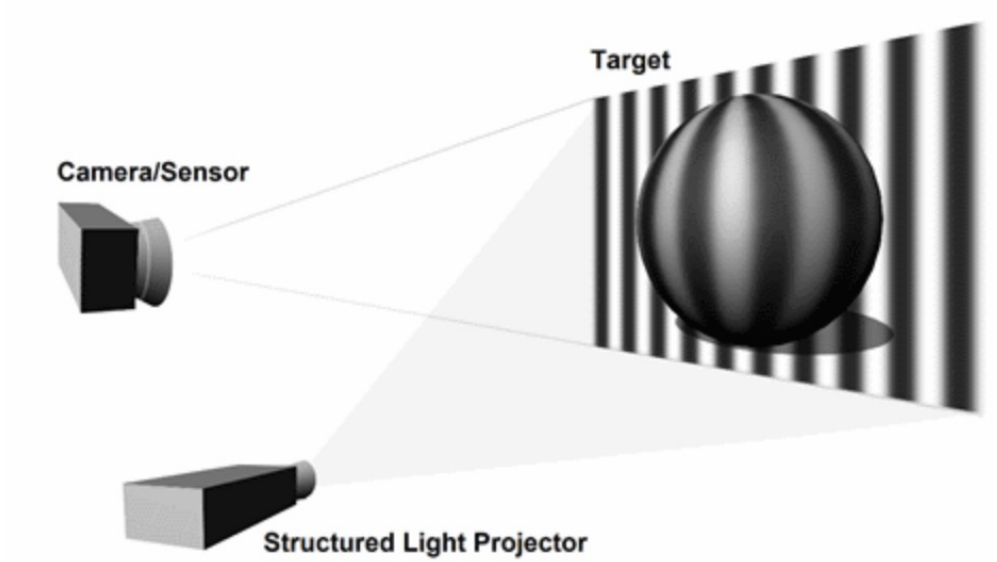
NEL-BITA
National Engineering Laboratory for Brain-Inspired Intelligence Technology and Application

Event-based Structured Light

Event Camera

Latency | Motion blur | Dynamic Range

Structured Light System



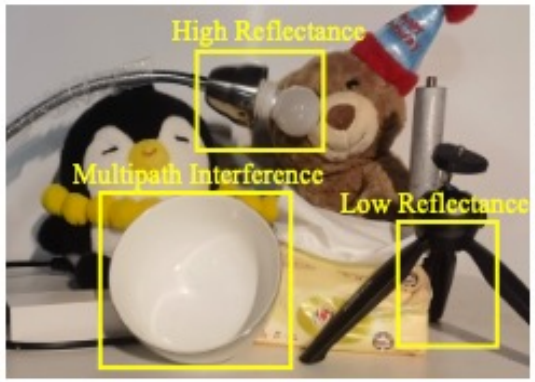
Author (Method)	Year	Device	Priors	Event Rep.	Real-time	Output (Dense?)
Leroux et al. [34]	2018	Structured light	Pose	Time surface	✓	Point cloud (✓)
Huang et al. [35]	2021	Structured light	Pose	Event-by-event	✗	Point cloud (✓)
Zuo et al. (Devo) [36]	2022	D-RGB camera	Trajectory	Time surface	✓	Point cloud (✗)
Xiao et al. [37]	2023	Structured light	Pose	Event frame	✓	Point cloud (✓)
Fu et al. [38]	2023	Structured light	Pose	Time surface	✓	Point cloud (✓)
Li et al. [39]	2024	Structured light	Pose	Event-by-event	✓	Point cloud (✓)

Event-based Structured Light

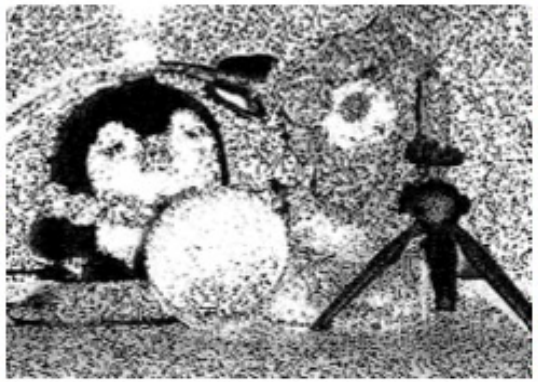
Existing Problem

High Reflectance Areas ⇨ event clutter (Overexposure)

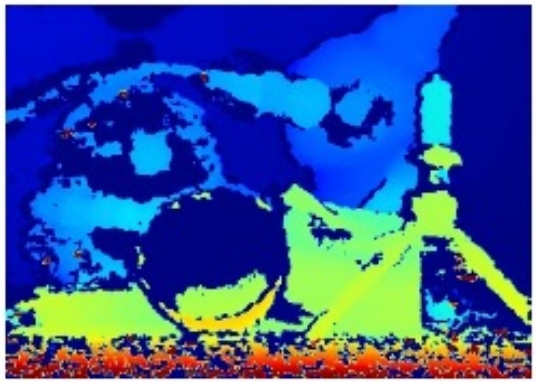
Low Reflectance Areas ⇨ event absence (Underexposure)



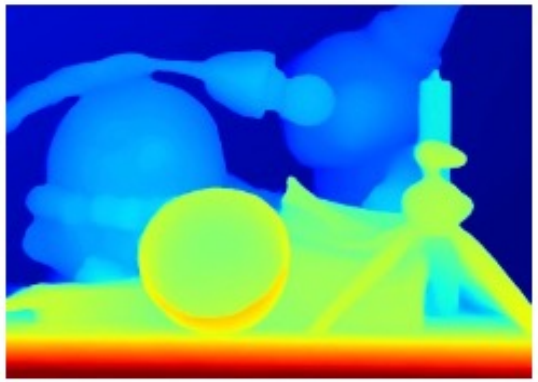
(a) HDR Scene



(b) Event Frame with Speckle Coding



(c) Disparity from (b)



(d) Ours

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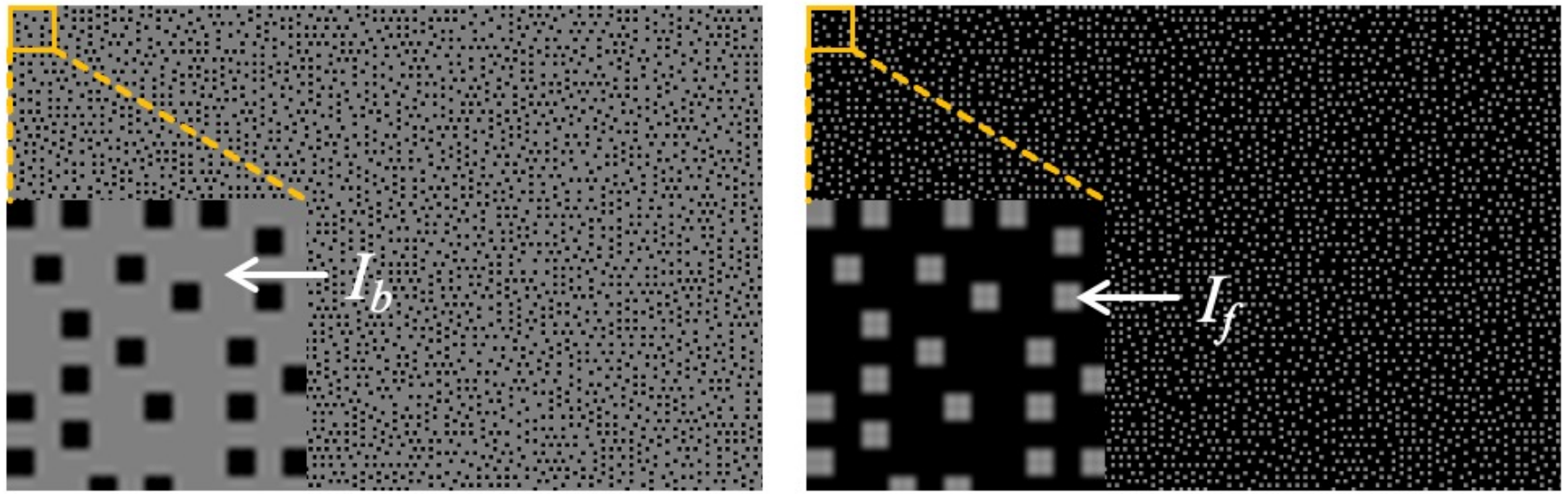
Method: Multi-Contrast Coding



(a) Projected Frame 1 (b) Projected Frame 2

We propose a range-partitioned sensing strategy. By sequentially projecting the designed patterns, we artificially introduce luminance changes that trigger events in the event camera.

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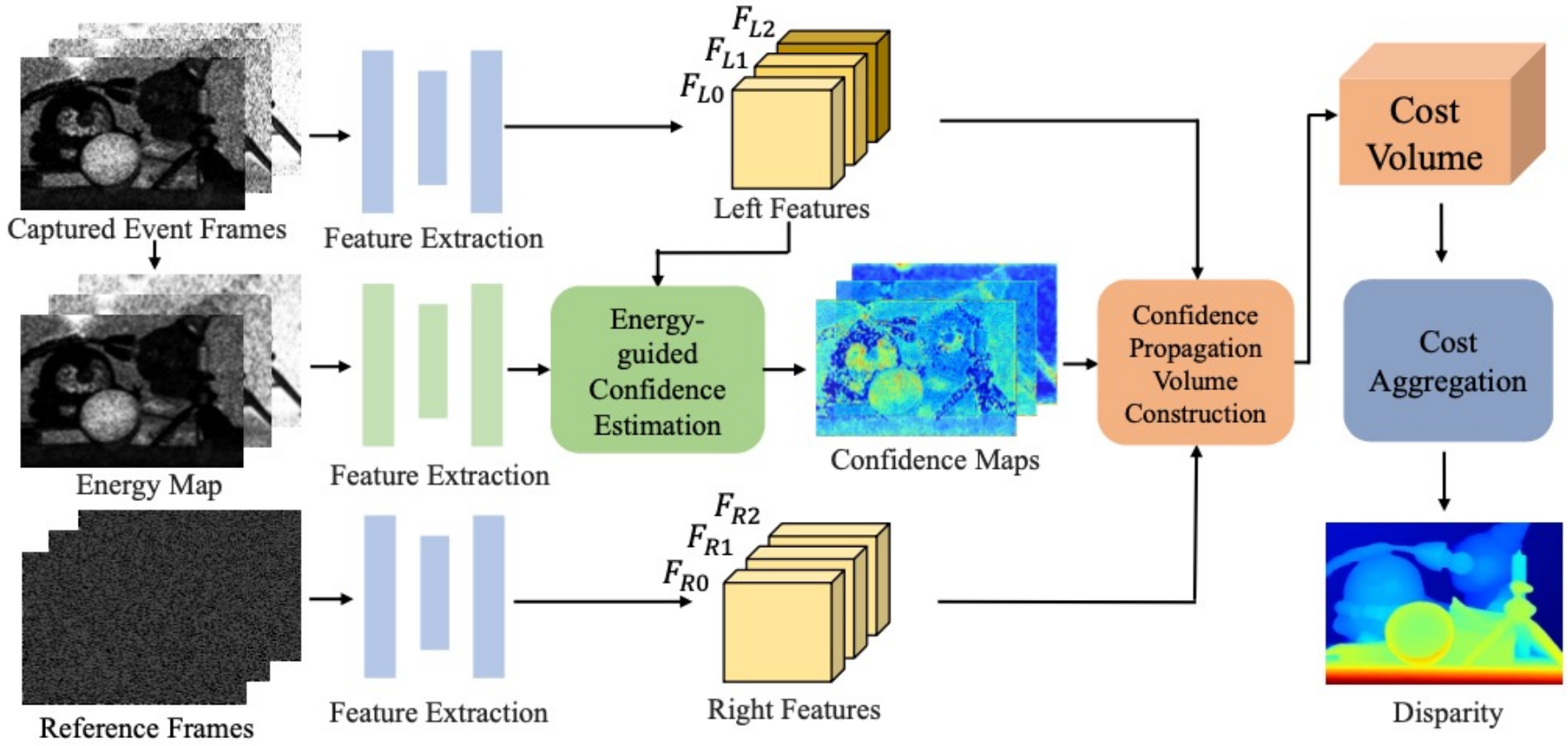
Method: Confidence-Driven Stereo Matching Strategy

Aim: To tackle the problem of Interframe Interference



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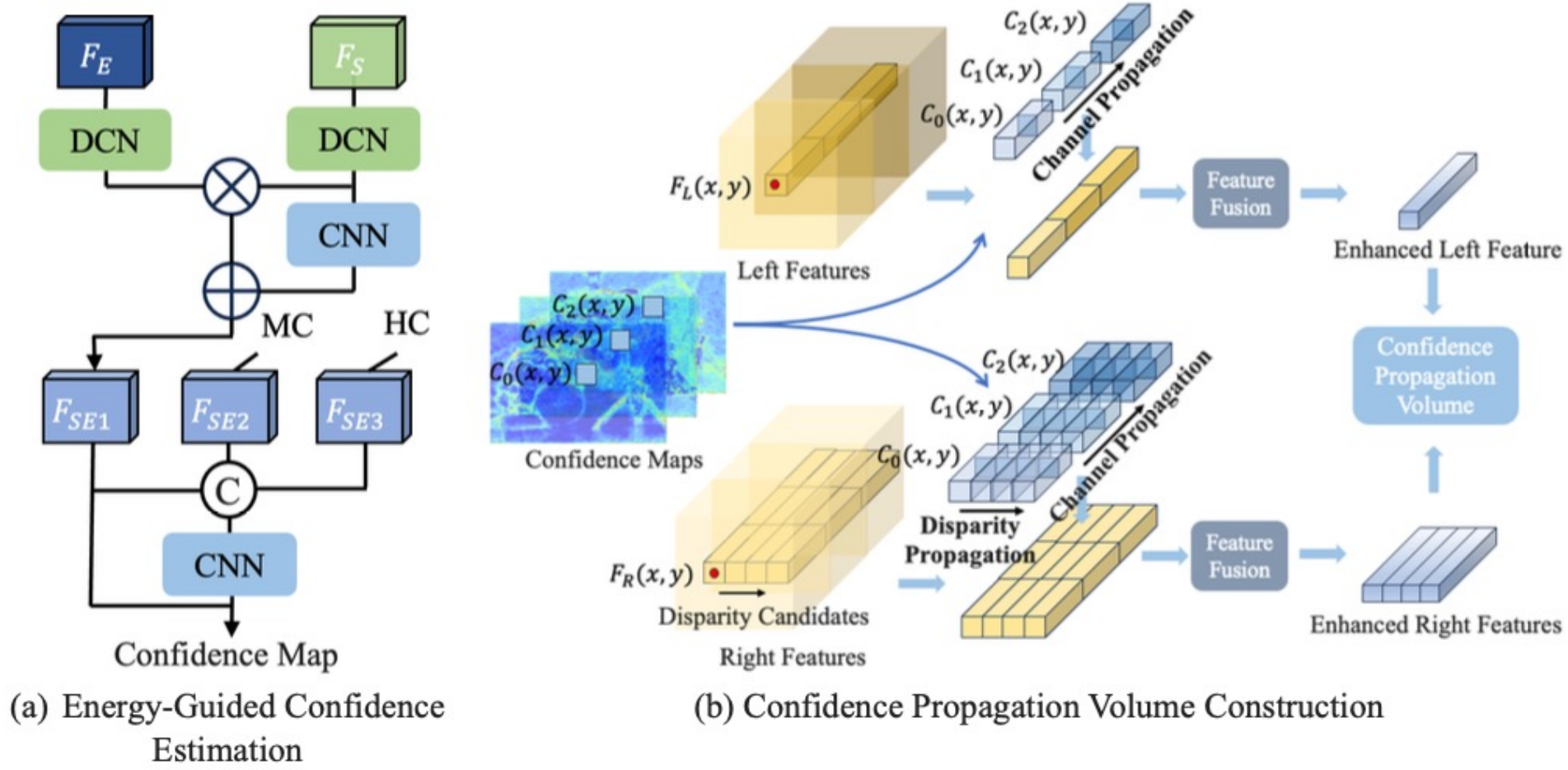
Method: Confidence-Driven Stereo Matching Strategy



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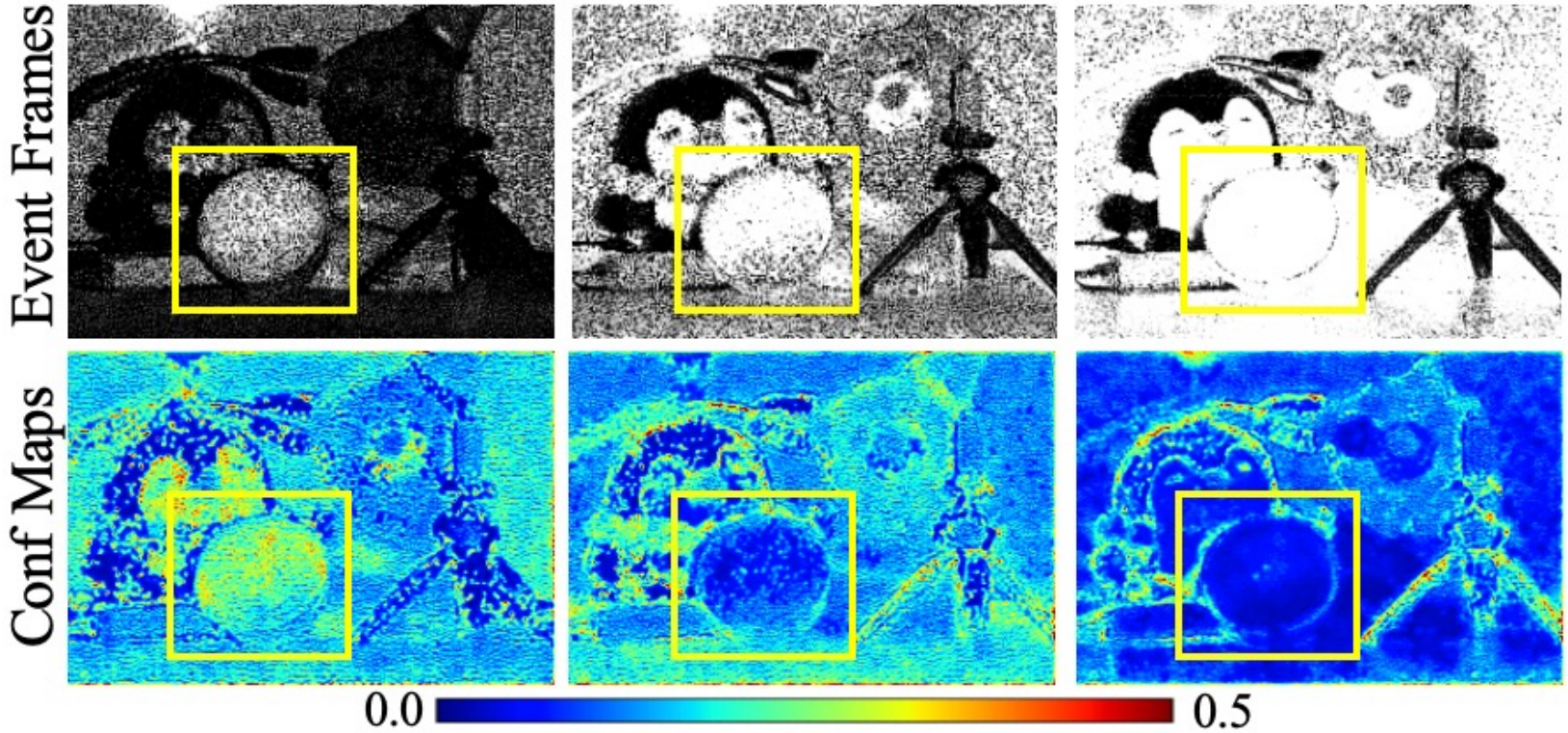
Estimated Confidence Map



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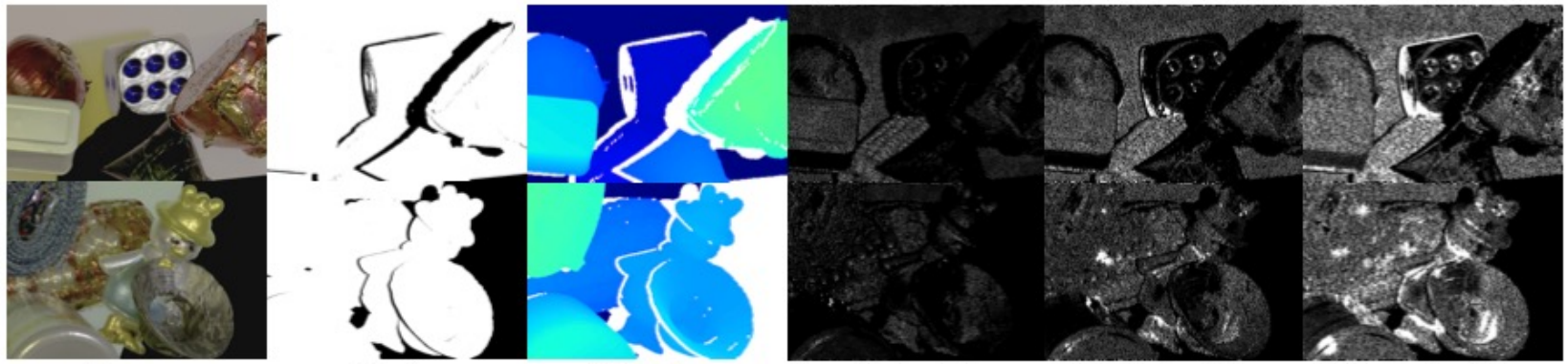
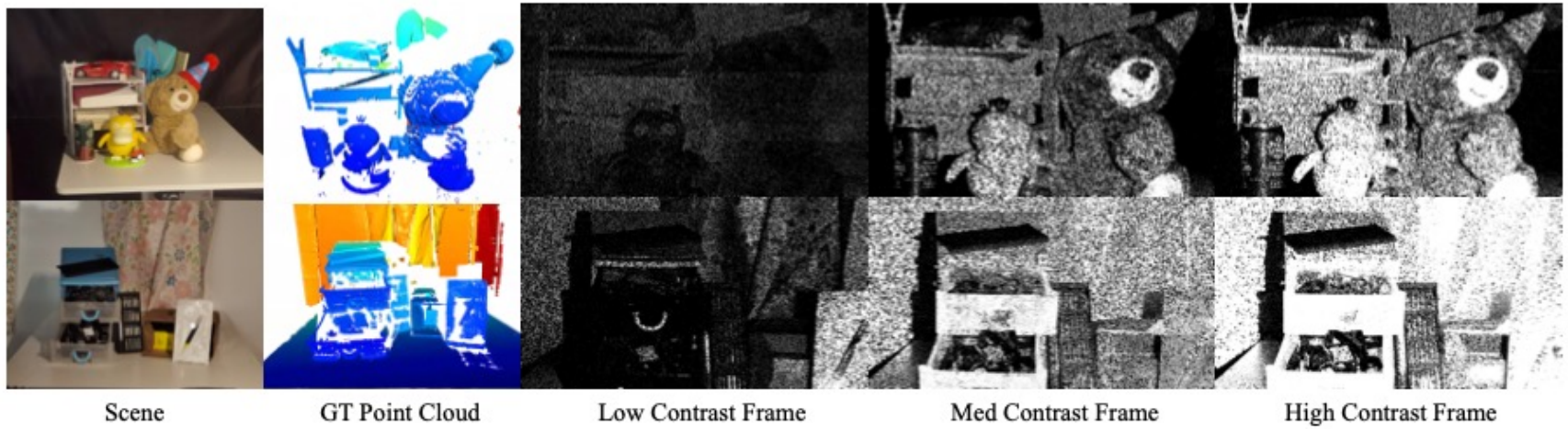
Event-based SL Simulator



Real-World Benchmark Dataset



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Synthetic Results

Methods	EPE ↓	Bad 0.5 ↓	Bad 1.0 ↓	Bad 2.0 ↓	Bad 3.0 ↓	Bad 5.0 ↓	D1 ↓
BM	31.4518	0.3919	0.3213	0.3156	0.3120	0.3053	0.3112
BM-3	18.2216	0.3141	0.2453	0.2401	0.2349	0.2274	0.2302
SGBM	13.3384	0.2697	0.1563	0.1421	0.1390	0.1359	0.1363
SGBM-3	6.3327	0.2243	0.1082	0.0918	0.0874	0.0830	0.0831
CTD	26.8375	0.3341	0.2755	0.2638	0.2598	0.2465	0.2489
GigaDepth	8.6688	0.1425	0.1210	0.1135	0.1111	0.1082	0.1070
FastACV	0.7112	0.1068	0.0600	0.0342	0.0243	0.0159	0.0154
RAFT-Stereo	0.4136	0.1286	0.0507	0.0219	0.0136	0.0077	0.0077
IGEV	0.3863	0.0548	0.0311	0.0177	0.0127	0.0084	0.0076
Ours	**0.2937**	**0.0359**	**0.0203**	**0.0122**	**0.0090**	**0.0063**	**0.0062**

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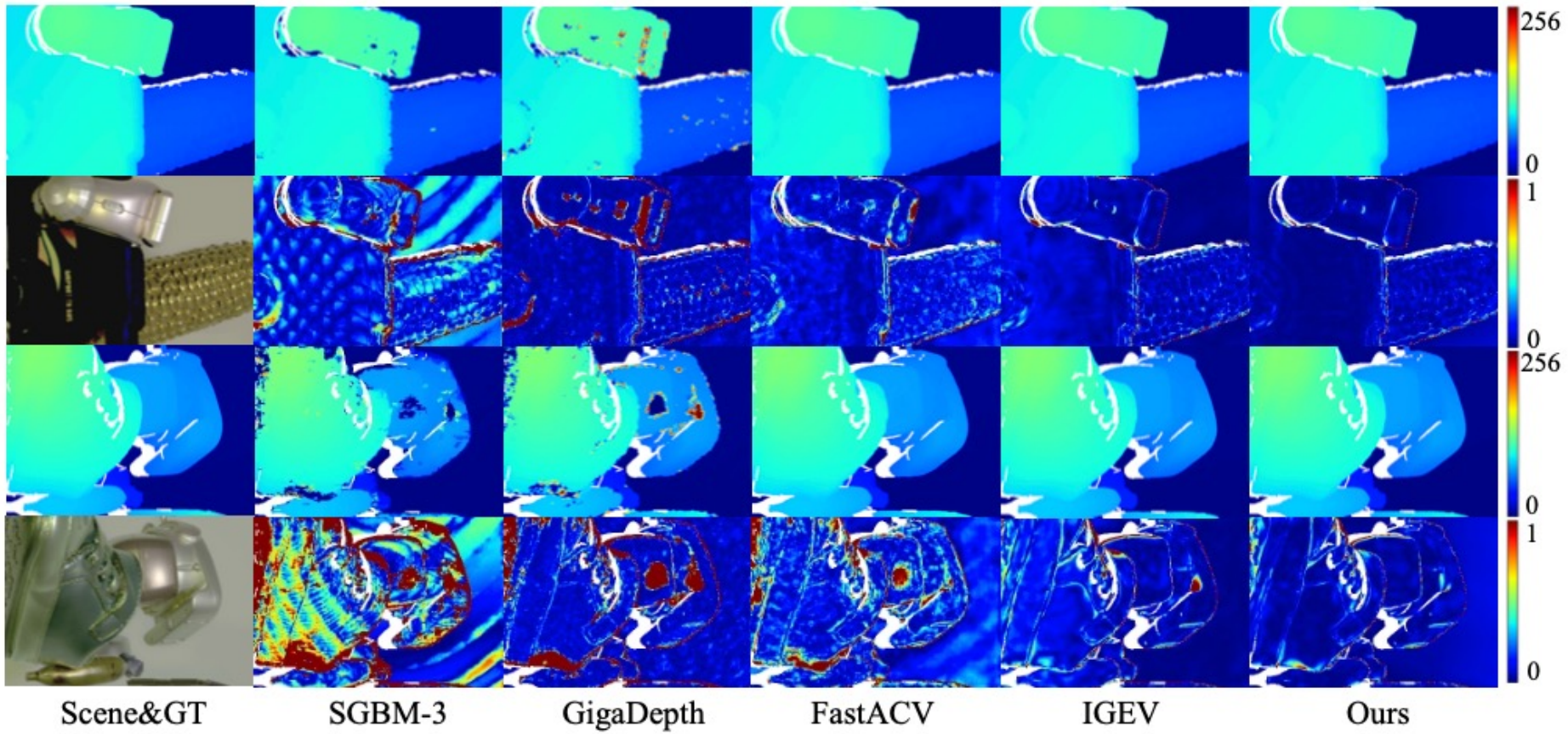
Synthetic Results



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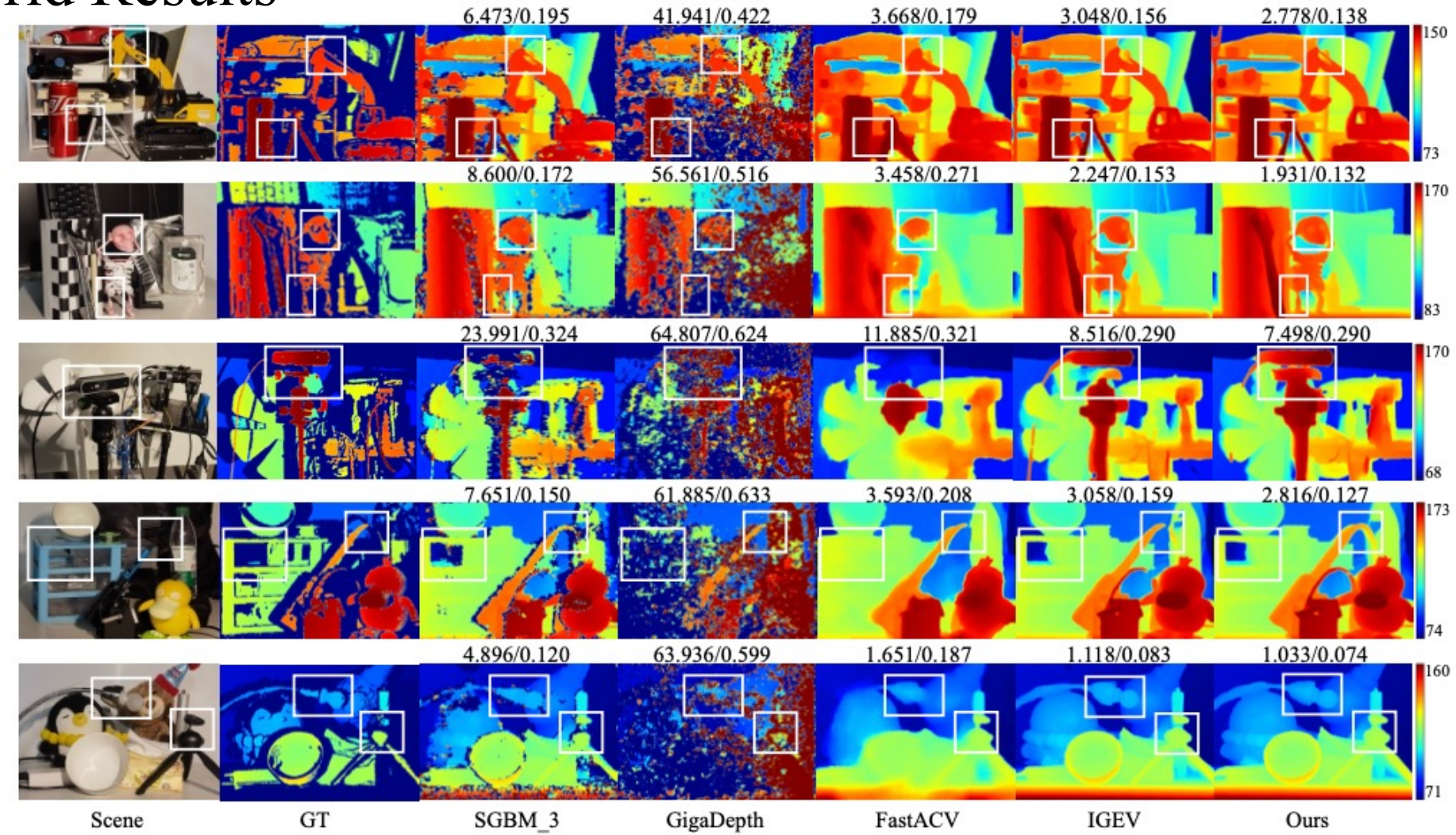
Real-world Results



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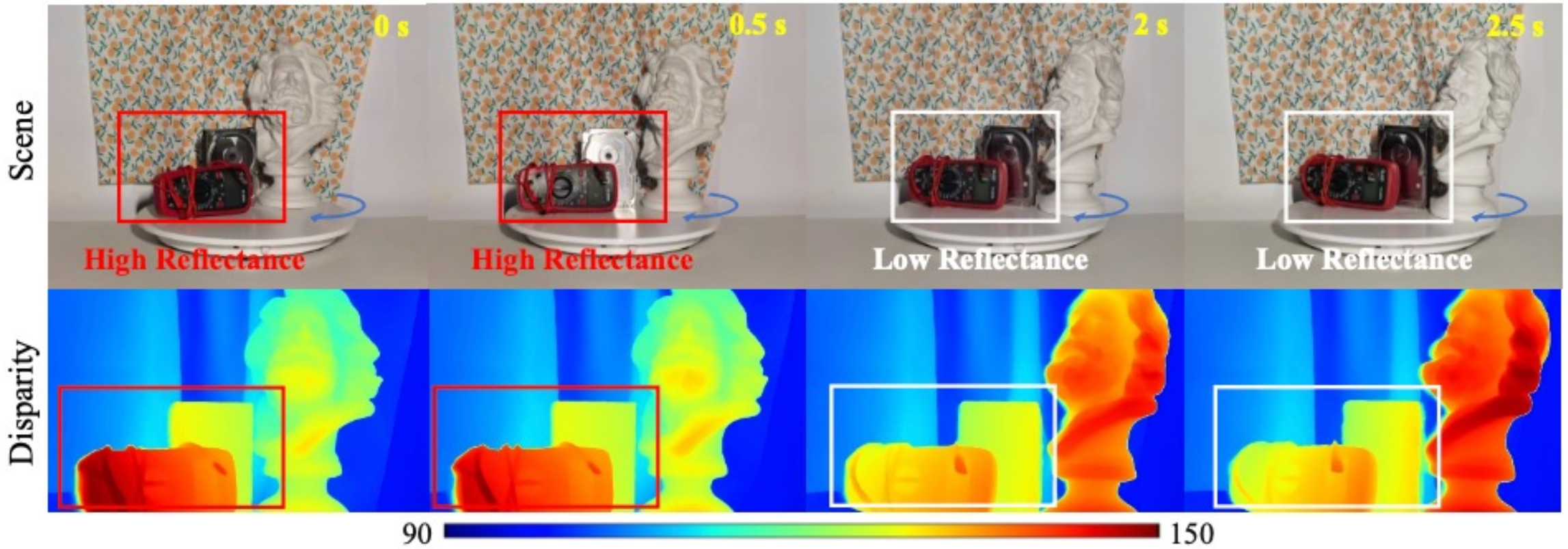
Real-world Dynamic Results



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Thanks for Watching!

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