# Motion Aware Double Attention Network for Dynamic Scene Deblurring



# Abstract

**Problem Statement** Event Camera Aided Dynamic Scene Deblurring

### Contribution

We propose an event camera-aided two-branch network structure, Motion Aware Double Attention Network (MADANet), which pays special attention to the areas with high blur. First, event data is efficiently used to locate these high-level blur regions, then event data is also injected onto feature space to provide required motion information needed to deblur images.

# Methodology

Current challenge: The large pixel sizes of the available event cameras (low spatial resolution)

- MADANet has two sub-networks, as illustrated in Figure 1, the High Blur Region Segmentation (HBRS) module and the deblurring module.
- Given a blurry image and the corresponding event frames the HBRS predicts the high blur regions caused by high relative local motion.
- Having two branches, the MADANet utilizes the predicted high blur mask to process the feature maps through these branches in a way that one branch gives special attention to the high blur regions.
- The event frames are injected directly into the lowerresolution feature space. In this way, low spatial resolution event data can be efficiently used to deblur higher resolution RGB frames.



## HBRS



A blurry image and the corresponding estimated attention map, A. The pixels with higher blur level due to relative high speed motion to camera are localize in A.

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# **PROPOSED NETWORK, MADANet**



## **Results on GoPro**





### Ablation

HBRS	Event Injection	n PSNR	SSIM	params
~		36.87	0.970	9.89M
	$\checkmark$	36.76	0.969	7.74M
$\checkmark$	$\checkmark$	37.09	0.971	9.89M
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Tabl <i>High-level</i> √	e 4. Performa <i>Low-level</i> S	nce of diffe Shared PSI 36. 36. 37.	erent bra NR SS 48 0.9 67 0.9 09 0.9	IN param M param 068 6.40M 069 6.40M 071 9.89M

\*TSlow Motion Dataset.One branch network PSNR is 36.48

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Method	PSNR	SSIM	Params
BHA [34]	29.06	0.943	N/A
DeepDeblur [31]	29.23	0.916	11.7M
SVDN [57]	29.81	0.937	N/A
SRN [47]	30.26	0.934	6.8M
DGN [23]	30.49	0.938	11.32M
PSS-NSC [12]	30.92	0.942	2.8M
MT-RNN [36]	31.15	0.945	2.6M
DMPHN [59]	31.20	0.945	21.7M
RADN [38]	31.76	0.953	N/A
LEBMD [18]	31.79	0.949	N/A
PVDNet [42]	31.98	0.928	23.4M
SAPHN [44]	32.02	0.953	N/A
GSTA [45]	32.10	0.960	N/A
MBRNN [35]	32.16	0.953	5.42M
BANET [48]	32.44	0.957	85.6M
MPRNET [58]	32.66	0.959	20.1M
MIMO-UNet++ [7]	32.68	0.959	16.1M
HINet [6]	32.71	0.959	88.6M
ERDN [15]	32.99	0.935	N/A
MADANET	33.09	0.958	9.9M
MADANET+	33.84	0.964	16.9M

# Conclusion

**Key features** 

- Double usage of event data
- Investigating the impact of motion segmentation
- Double branch, double attention mechanism in network
- Event frame injection on low resolution feature space