

Propagating Difference Flows for Efficient Video Super-Resolution

Ruisheng Gao
Zeyu Xiao
Zhiwei Xiong



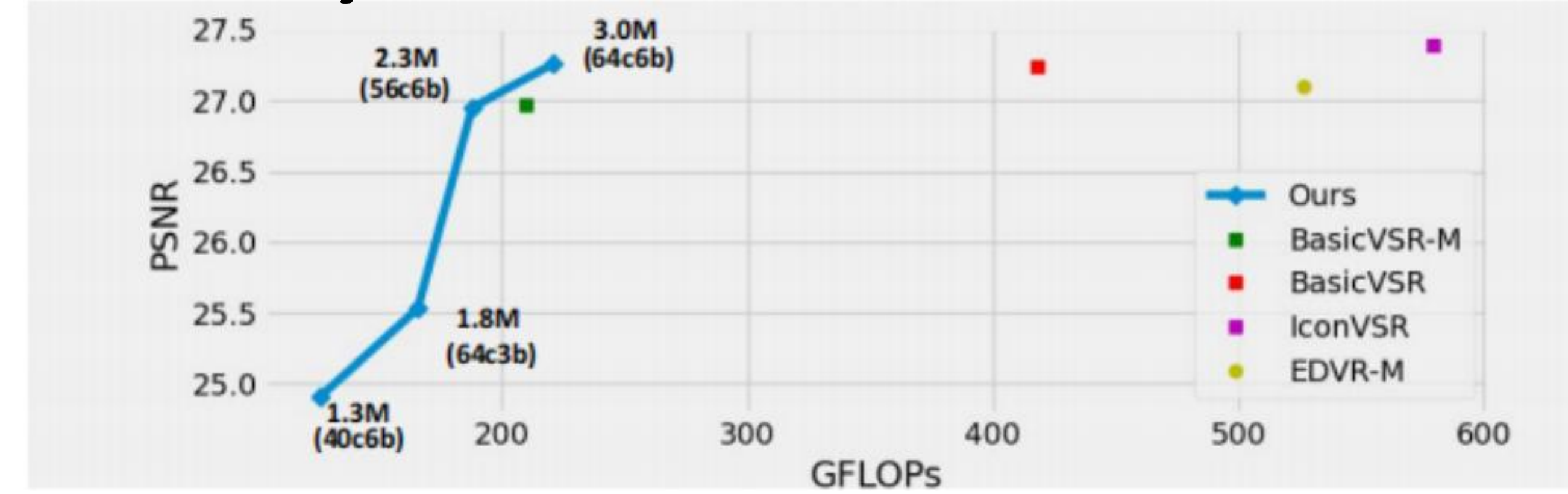
Motivation

- Various complex temporal modeling techniques in existing VSR methods hinder the deployment of VSR networks on resource-constrained platforms, e.g., smartphones and wearable devices.
- To reduce the required computational cost and memory consumption, we argue that, designing efficient alignment and multi-frame fusion/refinement schemes are the keys to lightweight VSR networks.

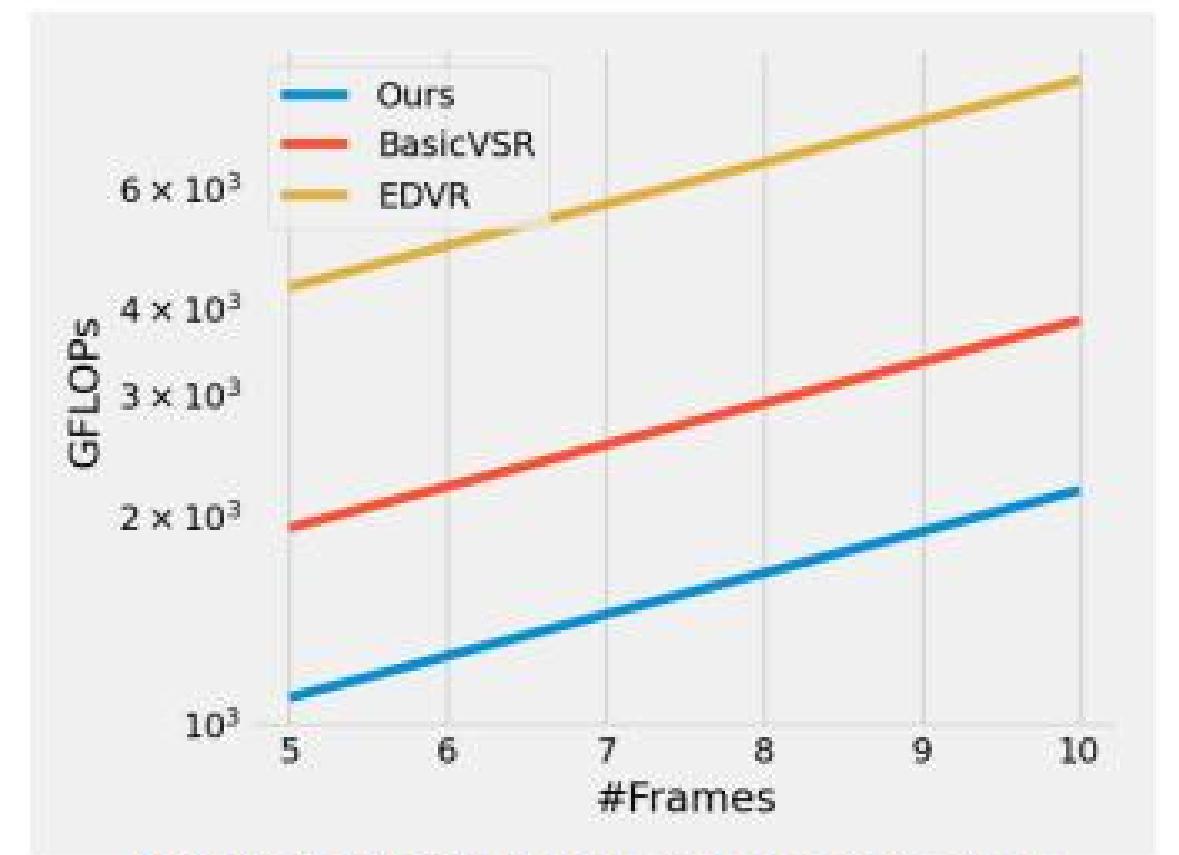
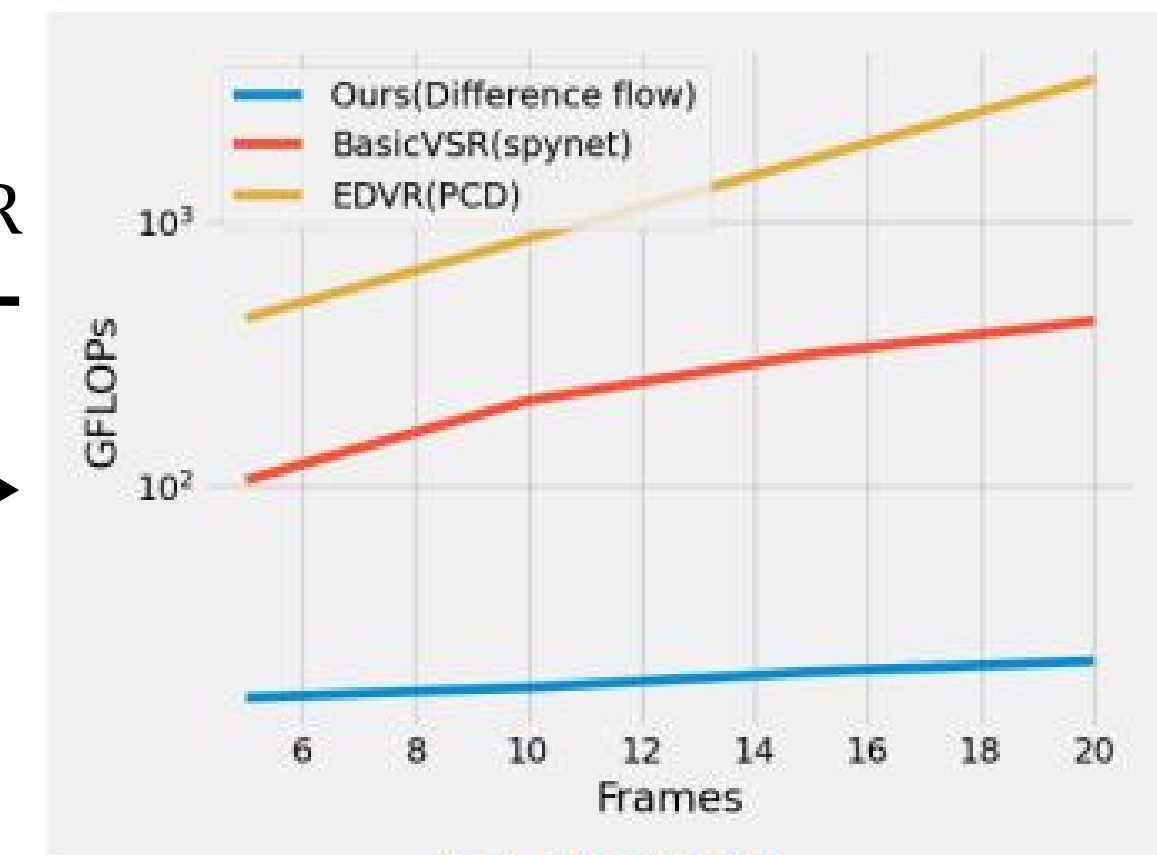
Contribution

- A novel ***motion propagation scheme*** is proposed for efficient feature alignment, which estimates preliminary motion fields called ***"difference flow"*** and modifies them per frame pair adaptively. A dense alternative of RFDB is designed to distill and refine warped features ***without deep stacked structures***, which maintains the efficiency and effectiveness of the network.
- The proposed network achieves comparable performance with state-of-the-art VSR methods on two benchmark datasets Vid4 and Vimeo90K-T while ***enjoying a clear advantage in model size and computational efficiency***.

Efficiency

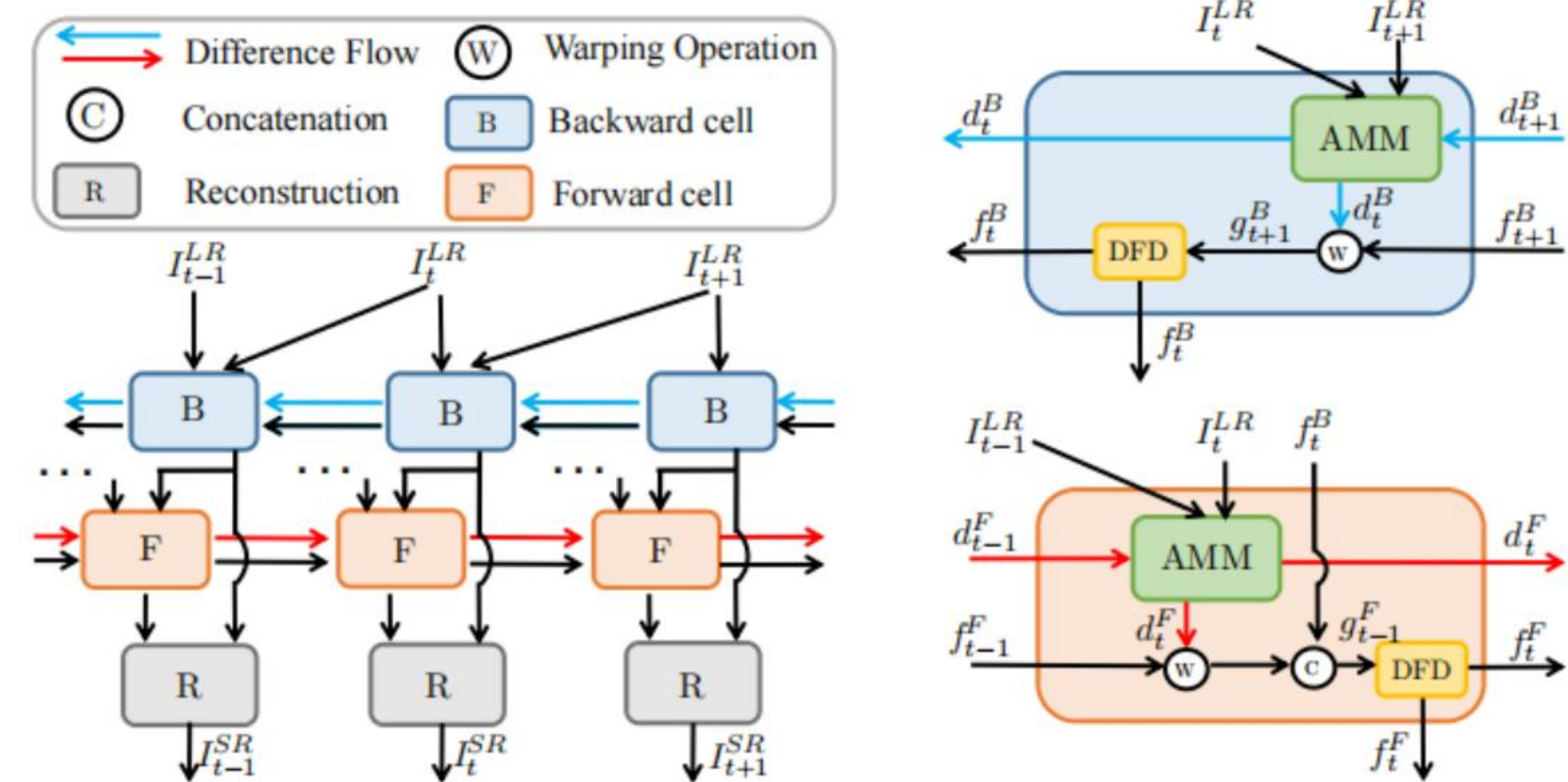


Tradeoff between GFLOPs and PSNR
Insensitive GFLOPs grows when input frames increases

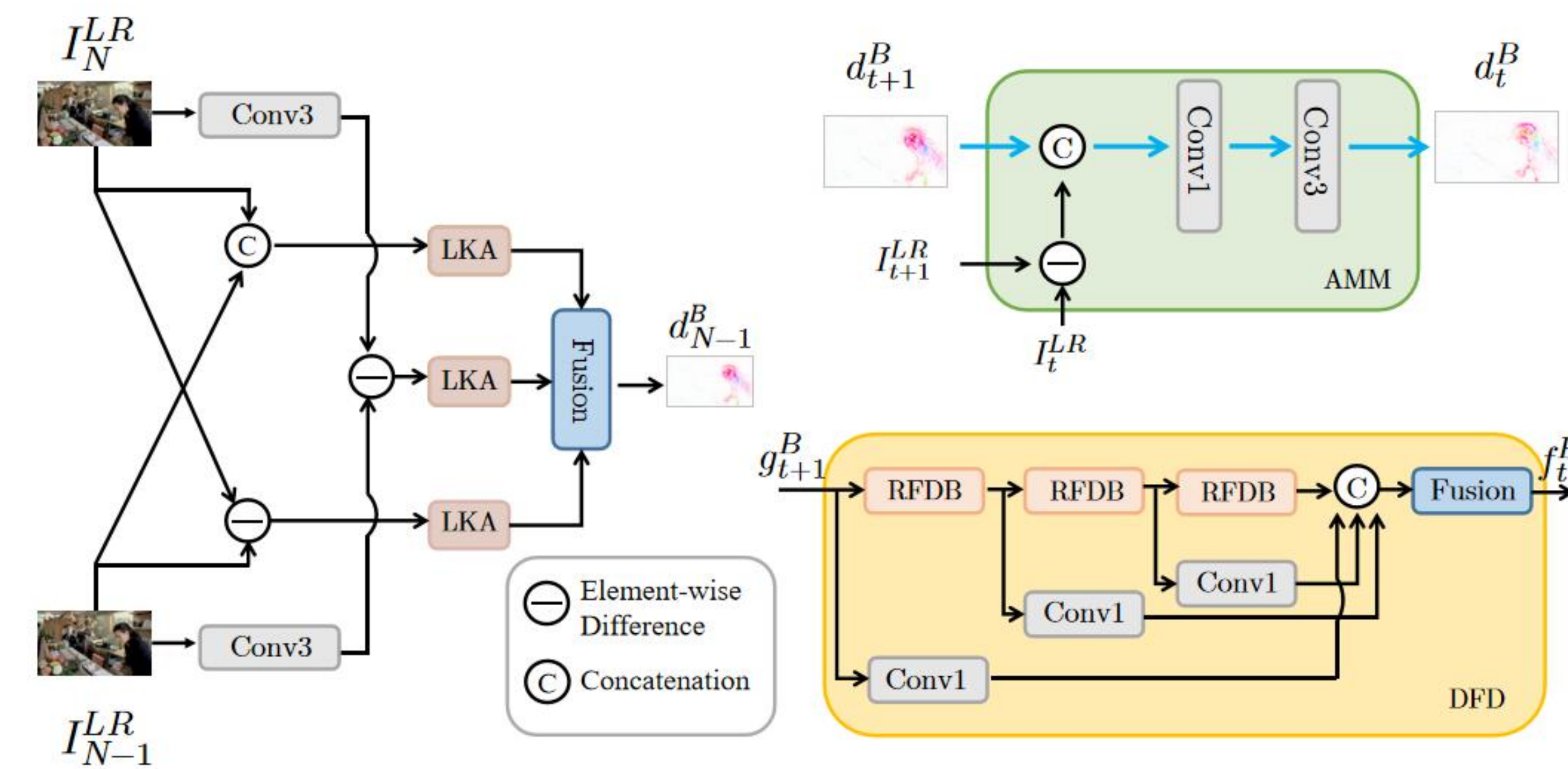


Methods

Bidirectional recurrent arch to propagate difference flows



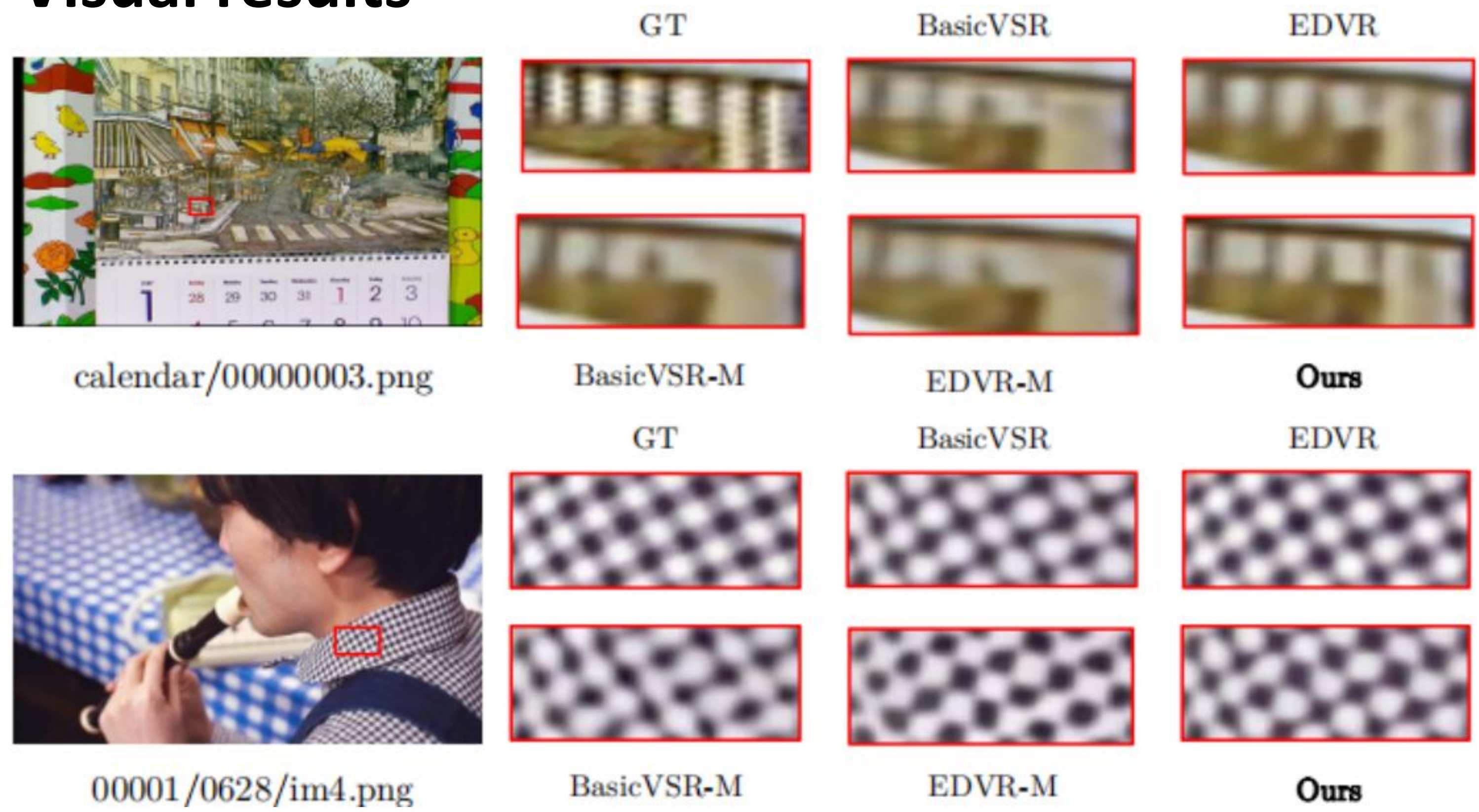
Details of components



Quantitative results

Methods	Params (M)	GFLOPs	Vid4	Vimeo90K-T
Bicubic	-	-	23.78/0.6347	31.32/0.8684
RBPN [10]	12.2	28230.68	27.12/0.8180	37.07/0.9435
EDVR [36]	20.6	2296.50	27.35/0.8264	37.61/0.9489
BasicVSR [3]	6.3	417.82	27.24/0.8251	37.18/0.9450
IconVSR [3]	8.7	579.36	27.39/0.8279	37.47/0.9476
PFNL [42]	3.0	1067.72	26.73/0.8029	36.14/0.9363
EDVR-M [36]	3.3	526.59	27.10/0.8186	37.09/0.9446
BasicVSR-M	3.2	209.46	26.97/0.8145	36.65/0.9404
Ours	3.0	221.15	27.26/0.8230	36.95/0.9428

Visual results



Ablation studies

Alignment		Feature refinement				
Method	PSNR	Method	#Blocks	PSNR	Params	GFLOPs
IME w/o image residual	27.13	Resblock	15	27.26	2.94M	249.04
IME w/o feature residual	27.12	RFDB	8	27.15	2.94M	223.14
AMM w/ concat	27.10	DFD(Ours)	6	27.26	2.95M	221.15
w/o AMM	27.16	GFLOPs are computed for generating an 512×1024 output frame.				
Spynet	27.20					
Ours	27.26					

Visualize difference flows

