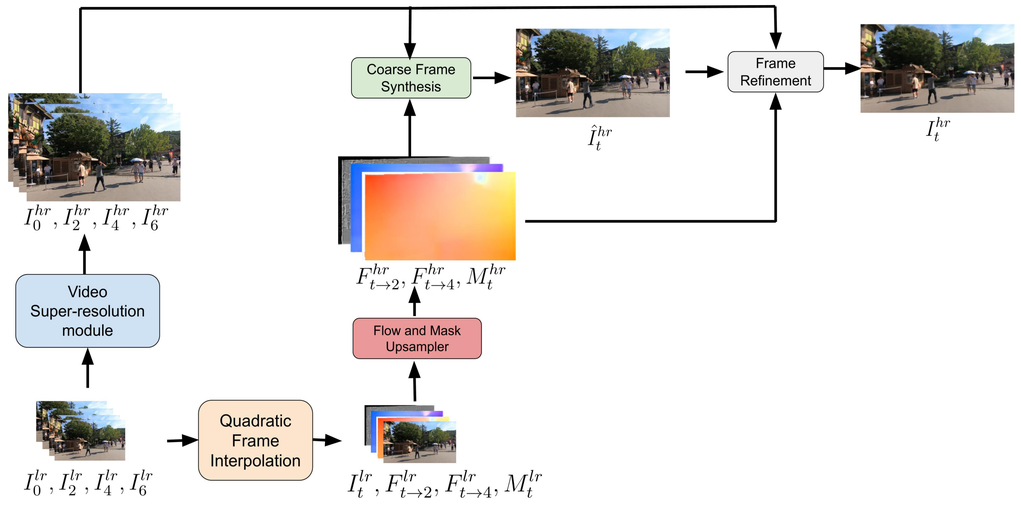
Efficient Space-time Video Super Resolution using Low-Resolution Flow and Mask Upsampling

Saikat Dutta (IIT Madras); Nisarg A. Shah (IIT Jodhpur); Anurag Mittal (IIT Madras)

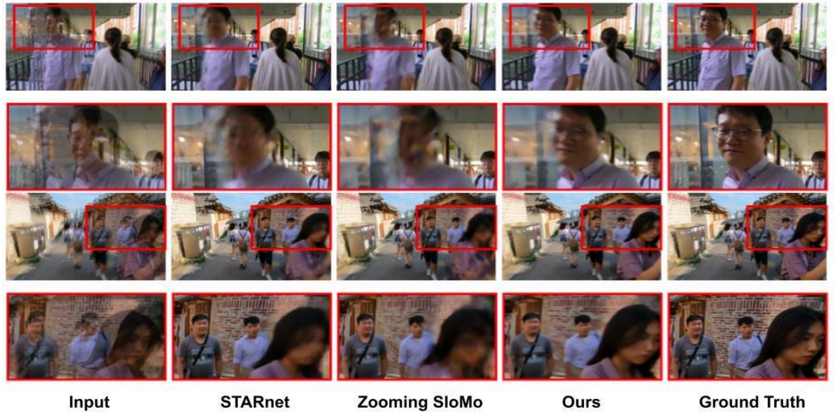
Overview

- In this paper, we have presented an efficient framework for Joint Video Super Resolution and Frame Interpolation.
- Unlike prior work, we have considered non-linear motion between LR frames explicitly through quadratic modeling to interpolate in LR frames.
- We have used a state-of-the-art Recurrent Neural Network to super-resolve the input LR frames.
- We have made our model computationally efficient by estimating intermediate HR flowmaps and blending masks using bilinear interpolation instead of directly estimating them in HR space.
- Estimated HR frames, coarse HR flowmaps and mask produces a coarse intermediate frame estimate.
- This coarse estimate is further refined by a refinement module.
- In this work, we have considered 4x upscaling in spatial domain and 2x upscaling in temporal domain.
- Our model is parameter-efficient and performs better than current state-of-the-art models in REDS STSR Validation set.

Model Architecture



Qualitative Results



Quantitative Results

Method	Even Frames		Odd Frames		Overall	
	PSNR	SSIM	PSNR	SSIM	PSNR	SSIM
STARnet [10]	28.43	0.7978	21.55	0.5925	25.03	0.6961
Zooming Slomo [37]	**28.95**	**0.8151**	21.63	0.6010	25.33	0.7091
Ours	28.56	0.8018	**22.41**	**0.6148**	**25.51**	**0.7093**

Table 1. Quantitative comparison with other state-of-the-art models.

Efficiency

Method	Runtime (s)	Parameters (M)	GPU Memory Usage (GB)
STARnet [10]	1.13	111.61	5.27
STVUN [17]	0.24	30.90	**2.90**
Zooming Slomo [37]	**0.15**	**11.10**	4.55
Ours	0.25	20.09	3.43

Table 2. Runtime, Parameter and Memory usage consumption comparison with State-of-the-art methods.

References

- Isobe, Takashi, et al. "Video super-resolution with recurrent structure-detail network." *European Conference on Computer Vision*. Springer, Cham, 2020.
- Xu, Xiangyu, et al. "Quadratic video interpolation." *Advances in Neural Information Processing Systems* 32 (2019).

Code and Models

https://github.com/saikatdutta/FMU_STSR