Progressive Splitting and Upscaling Structure for Super-Resolution

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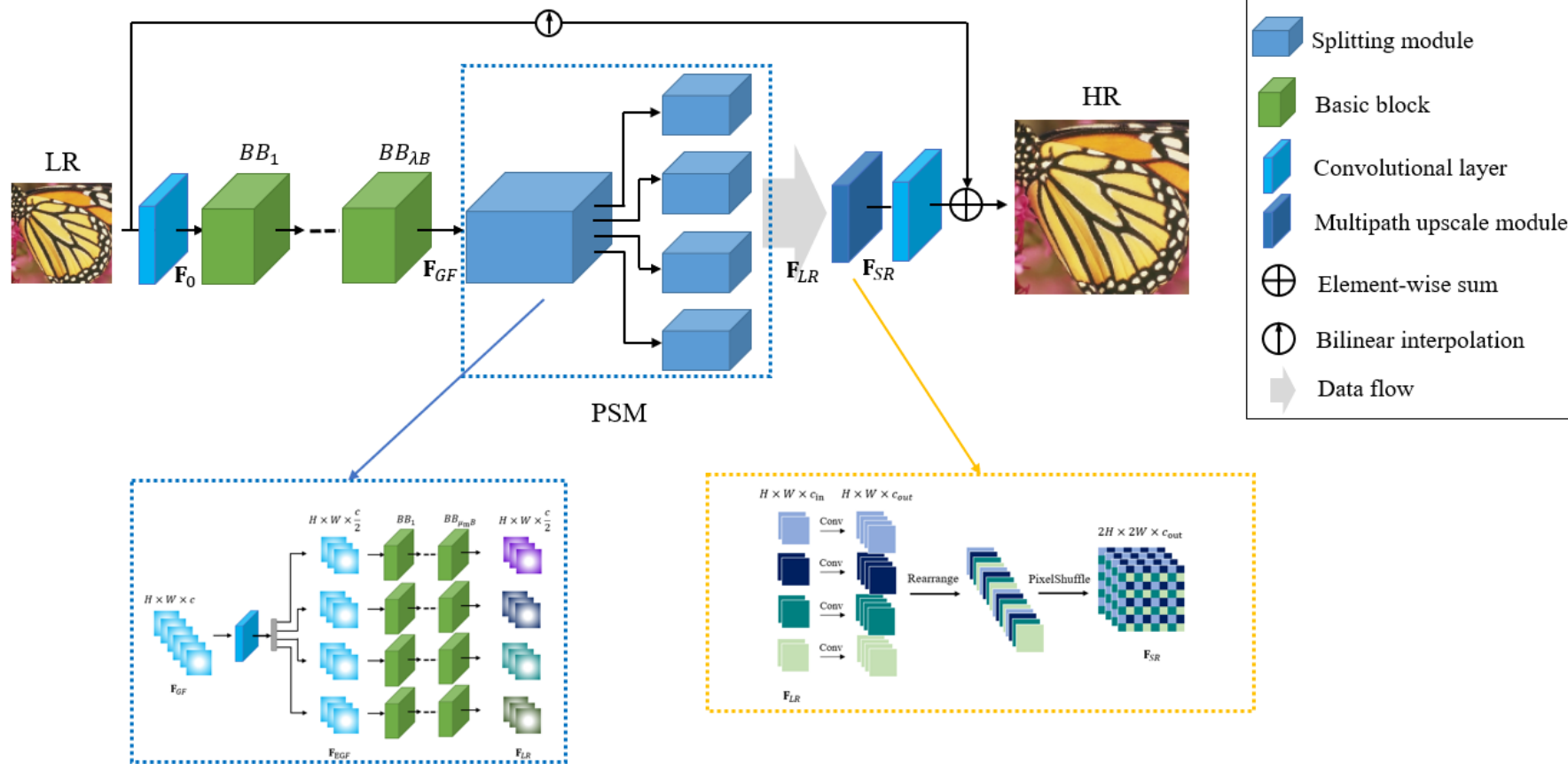# CATALOG

- Motivation

- Architecture

- Experiments

Motivation

- Few SR methods have paid attention to exploring potential representation ability of upscaling layer

- LR feature maps share similar patterns as they are extracted from a single trunk network

- We try generating decoupled SR features to get better SR results

HR Image → Downsample → LR Image → Reconstruct → LR Feature Maps (LR_1 ... LR_{r^2}) → PixelShuffle → SR Image
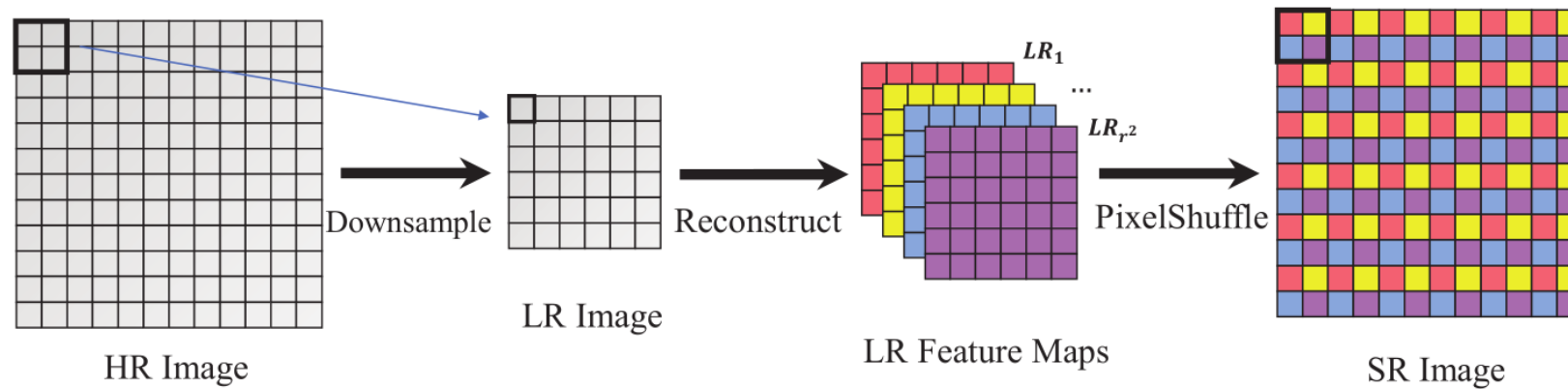
Architecture

Progressive Splitting and Upscaling Structure

Experiments

- **Study on Small Model : EDSR-baseline**

TABLE I: Quantitative results (scale ×2) of our PSUS with different λ and baseline. PSNR(dB) and SSIM are tested on Y channel without self-ensemble [10]. DIV2Kval denotes DIV2K validation set. Best results are **highlighted**.

	Baseline PSNR/SSIM	$\lambda = 0.875$ PSNR/SSIM	$\lambda = 0.75$ PSNR/SSIM	$\lambda = 0.5$ PSNR/SSIM
Set5	37.96/**0.9604**	37.96/0.9603	**37.98**/0.9603	**37.98/0.9604**
Set14	33.51/0.9168	33.48/0.9163	33.52/**0.9173**	**33.53**/0.9172
BSD100	32.13/0.8991	32.12/0.8989	**32.15/0.8994**	**32.15**/0.8993
Urban100	31.80/0.9255	31.86/0.9261	**31.96/0.9268**	31.95/**0.9269**
DIV2Kval	36.04/0.9449	36.06/0.9450	36.10/0.9453	**36.11/0.9454**
Average	34.29/0.9294	34.30/0.9293	**34.34/0.9298**	**34.34/0.9298**

TABLE III: Quantitative metrics of model complexity and computational cost for different ×4 models.

	EDSR-Baseline	PSUS with ResBlock
Params	1.518M	1.483M (-2.3%)
FLOPs	257.47G	224.27G (-12.9%)

TABLE IV: PSNR(dB) and SSIM results (scale ×4) of baseline and our proposed PSUS. Best results are **highlighted**.

	Baseline (from scratch) PSNR/SSIM	Baseline (from pre-trained x2) PSNR/SSIM	PSUS with ResBlock PSNR/SSIM
Set5	32.09/0.8936	32.11/0.8937	**32.13/0.8938**
Set14	28.53/0.7807	**28.56/0.7816**	28.50/0.7805
BSD100	**27.55**/0.7352	27.54/**0.7357**	27.55/0.7354
Urban100	25.95/0.7817	26.00/**0.7839**	**26.01/0.7839**
DIV2Kval	30.38/0.8366	30.40/0.8373	**30.42/0.8375**

Experiments

- **Study on Large Model : RCAN**

- **Study on Unsupervised Model: ZSSR**

TABLE V: PSNR(dB) and SSIM results of RCAN and PSUS with RG. Best results are **highlighted**.

Method	scale	Set5 PSNR/SSIM	Set14 PSNR/SSIM	BSD100 PSNR/SSIM	Urban100 PSNR/SSIM	Manga109 PSNR/SSIM
RCAN	×2	**38.27**/0.9614	34.01/0.9216	**32.39**/0.9023	**33.23**/**0.9379**	**39.42**/**0.9785**
PSUS	×2	38.26/**0.9615**	**34.07**/**0.9222**	**32.39**/**0.9024**	**33.23**/0.9376	39.37/**0.9785**
RCAN	×4	32.57/**0.8994**	**28.83**/0.7878	**27.74**/0.7421	**26.76**/**0.8067**	**31.12**/**0.9163**
PSUS	×4	**32.59**/0.8992	28.81/**0.7879**	**27.74**/**0.7424**	26.71/0.8057	31.05/**0.9163**

TABLE VI: Quantitative metrics of model complexity and computational cost for RCAN and PSUS with RG.

	scale	RCAN	PSUS
Params	×2	15.445M	15.420M
	×4	15.592M	15.591M
FLOPs	×2	1.989T	1.986T
	×4	2.068T	2.038T

TABLE VII: Quantitative metrics of baseline and our proposed PSUS. Best PSNR(dB) and SSIM (scale ×2) are **highlighted**.

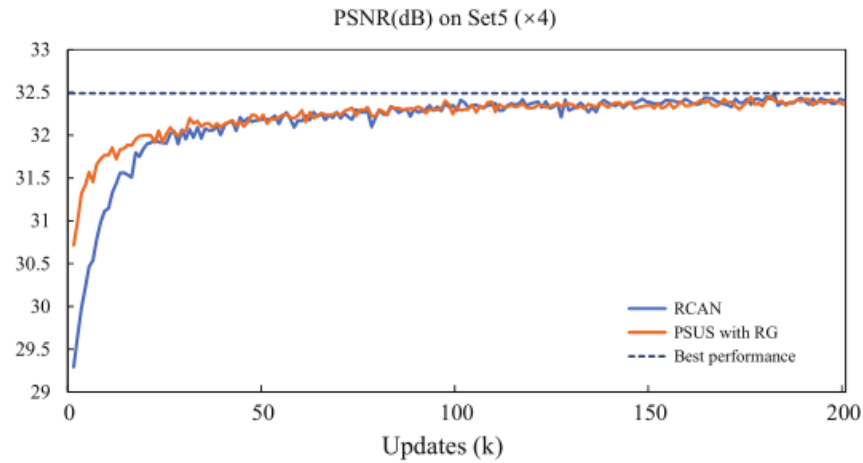| Method	Params	FLOPs	Set5 PSNR/SSIM	Set14 PSNR/SSIM	BSD100 PSNR/SSIM
baseline	372.80K	48.99G	36.23/0.9536	31.98/0.9037	30.98/**0.8859**
PSUS	373.12K	49.03G	**36.28**/**0.9545**	**32.08**/**0.9046**	**31.04**/0.8849

Experiments

- **Visual Comparison**

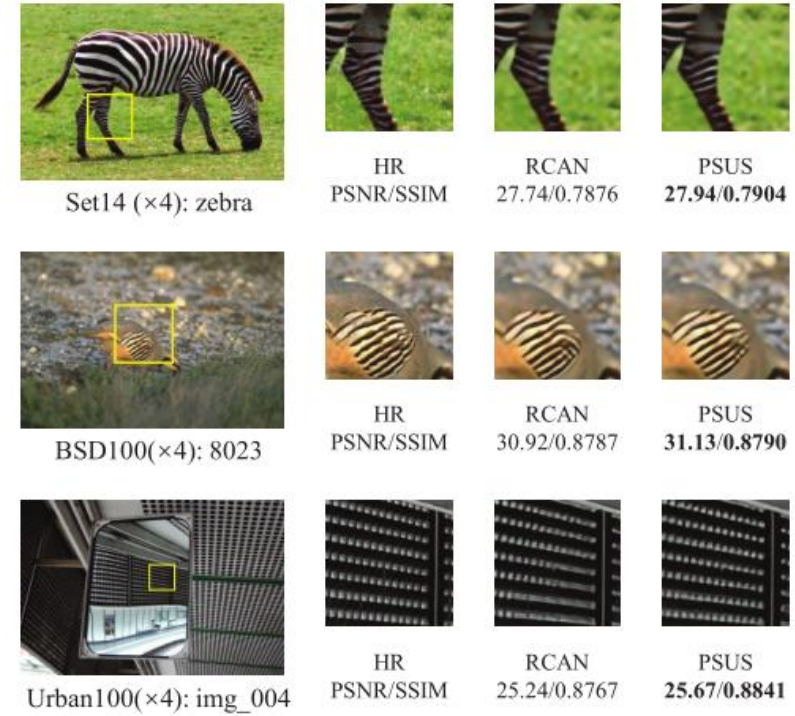Fig. 6: PSNR on validation set of ×4 models during first 2 × 10⁵ iterations of training.

Fig. 7: Visual comparison for ×4 SR. Best results are **highlighted**.

THANKS