Hybrid CNN Architectures for Image Super-resolution

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1 Introduction

Single image super-resolution (SISR) aims to reconstruct a high-resolution image from a single low-resolution image. SISR is a severely ill-posed problem and has received considerable attention. In this study, we propose two hybrid CNN architectures for SISR: dual branches network (DBN) and enhanced dual path attention network (EDPAN).

2 Proposed Method

Whole network architectures are based on recent methods [1] as shown in Fig. 1. Our networks are different from existing methods in block architectures. Figures 2 and 3 show proposed blocks. Following the great success of DPN [2], we combine the residual network and the densely connected network.

DBN has two branches in DB blocks to combine the residual network and the densely connected network. Since previous studies showed accuracy improvements, we employ grouped convolutions with 1×1 convolutions to the residual branch.

EDPAN is an enhanced DPN [2] for SISR by our observations. We remove 1×1 convolutions of DPN and introduce the weight normalization (WN). Moreover, we add the channel attention (CA) mechanism which rescales feature maps by channel-wise relationships and the significance [5].

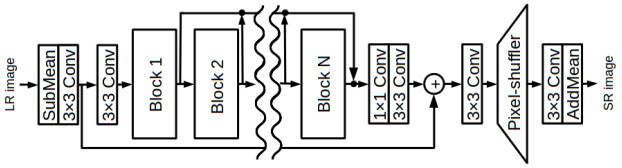


Figure 1 The whole architecture of networks. ⊕ denotes the element-wise addition. • is the feature-maps concatenation.

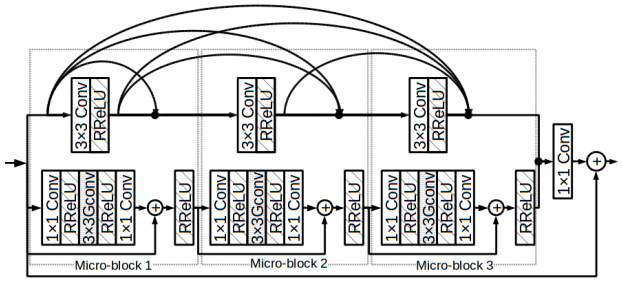


Figure 2 A DB block with three micro-blocks.

3 Experiment

We used DIV2K dataset [3] for training and four standard datasets for testing. From the constraint of memory size that a single NVIDIA GTX1080Ti GPU has, DBN was set to eight DB blocks with twelve micro-blocks. EDPAN was set to eight EDPA blocks with seven micro-blocks.

4 Results

Figure 4 shows visual comparisons on test dataset. DBN and EDPAN accurately reconstructed checkered patterns, grid lines, and characters. Table 1 shows quantitative comparisons for bicubically down-sampled test dataset. For ×2, our EDPAN performed favorably against the state-of-the-art methods. For ×3, our EDPAN achieved high PSNR as RDN [1].

5 Conclusion

In this study, we proposed two hybrid CNN architectures for SISR: DBN and EDPAN. Experiments demonstrated DBN and EDPAN accurately reconstructed fine textures. The limitation is that the number of parameters is larger than the other methods. As future works, we should reduce parameters.

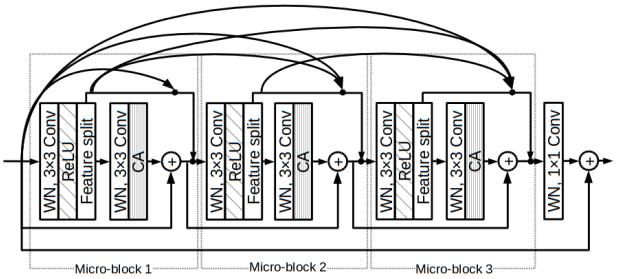
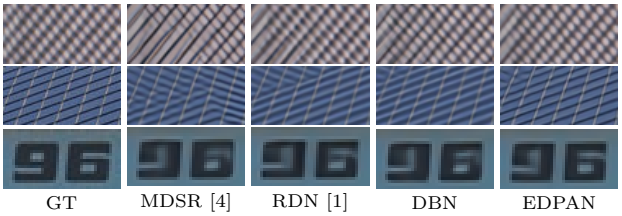


Figure 3 An EDPA block with three micro-blocks.



GT MDSR [4] RDN [1] DBN EDPAN

Figure 4 Super-resolved test images for ×3

Table 1 Average PSNR/SSIM on test dataset.

Scale	MDSR [4]	RDN [1]	DBN	EDPAN
×2	32.77/0.9188	32.83/0.9196	32.82/0.9194	32.87/0.9196
×3	29.24/0.8399	29.25/0.8400	29.18/0.8388	29.25/0.8396

References

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