OverNet: Lightweight Multi-Scale Super-Resolution with Overscaling Network

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Supplementary Material

In this supplementary material, we present additional comparison and qualitative results.

1. Difference with recent models

Difference with MemNet. MemNet stands for the very deep persistent memory network proposed in [2]. The most crucial part of MemNet is the stacked memory blocks. Inside of the memory blocks of MemNet, the output features of each recursive units are concatenated at the end of the network and then fused with a 1×1 convolution. The motivation of MemNet and ours is similar. The key difference is that we fuse the features at every possible point inside the local and global dense groups (LDGs, GDG), which boosts the representation power via the additional convolution layers and non-linearity. On the other hand, MemNet takes upsampled images as input. Hence, the number of multi-adds of MemNet is larger than ours. The input of our model is a LR image and we upsample it at the end of the network in order to achieve computational efficiency.

Difference with SRDenseNet. SRDenseNet [1] adopts dense blocks and skip connections. In this method, all feature levels are combined at the end of the final dense block. Differently, we connect all the RBs at the end of each local dense group (LDG) and do the same strategy inside the global dense group (GDG). Therefore, the model incorporates features from multiple layers. This strategy makes information propagation efficient due to the multi-level representation and facilitates the model to restore the details and

Figure 1: Visual results of **BI** degradation model with scale factor $\times 3$.

context of the image simultaneously. Moreover, we gather local information progressively with the 1×1 convolution layer, but SRDenseNet preserves these dense block features via concatenation operations.

2. Additional qualitative results

In Figure 1, we introduce a set of visual results with the **BI** degradation model to show the reconstruction capacity of the OverNet compared with the baseline (ResNet+OSM), OverNet-L (OverNet without skip connections in GDG) and OverNet-G (OverNet without skip connections in LDGs).

We see that it is difficult to recover the details with the other models. However, OverNet can deliver good results, recovering more details, taking advantage of using SCs in both local and global dense groups.

In Figure 2, we provide additional visualizations with the **BI** degradation model to exemplify the reconstruction capacity of the proposed network. It can be observed that most of the methods produce noisy reconstructions of the fine-grained details, such as texture and lines. Whereas, OverNet produces clear images which are closer to the HR ground truth.

In Figures 3 and 4, we also show two sets of visual results with **BD** and **DN** degradation models. Compared to other methods, the proposed OverNet reduces distortion and generates more accurate details in SR images.

References

[1] C. Ledig, L. Theis, F. Huszár, J. Caballero, A. Cunningham, A. Acosta, A. Aitken, A. Tejani, J. Totz, Z. Wang, et al. Photo-realistic single image super-resolution using a generative adversarial network. In *Proceedings of the IEEE conference on computer vision and pattern recognition*, pages 4681–4690, 2017.

[2] Y. Tai, J. Yang, X. Liu, and C. Xu. Memnet: A persistent memory network for image restoration. In *Proceedings of the IEEE international conference on computer vision*, pages 4539–4547, 2017.

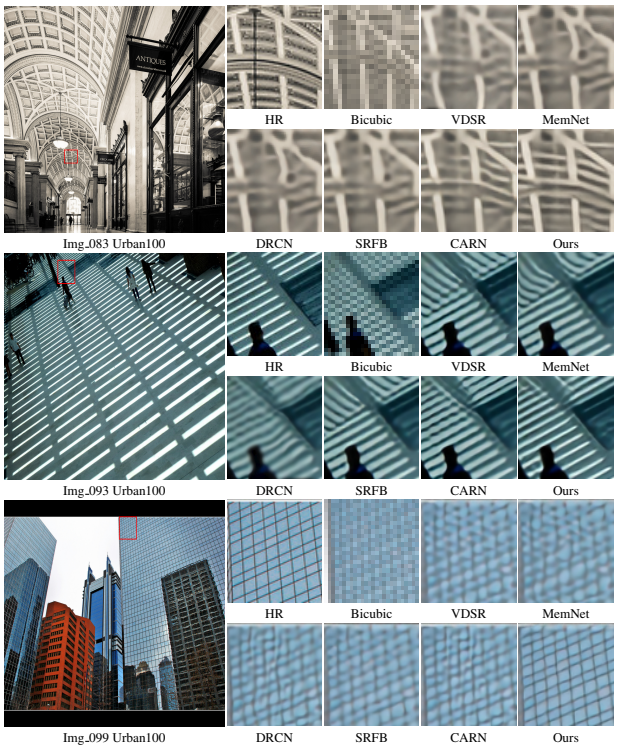

Figure 2: Visual results of **BI** degradation model with scale factor $\times 4$.

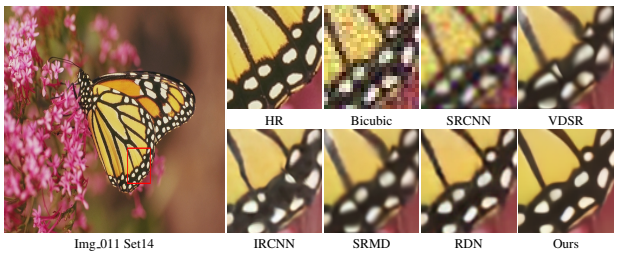

Figure 3: Visual results of **DN** degradation model with scale factor $\times 3$.

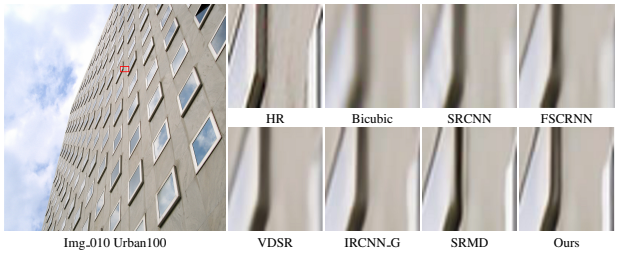

Figure 4: Visual results of **DB** degradation model with scale factor $\times 3$.