1. Additional results for the non-blind setting

Additional visual results of the different methods in the non-blind setting (which are not included in the paper due to space limitation) are presented in Figures 2 and 3.

We also present in Figure 1, the results obtained by the DPSR method [6] (using its official implementation code). It can be seen that DPSR results have many artifacts. In fact, DPSR average PSNR as produced by its official code is lower by more than 10 dB than the other examined methods (SRMD [5], ZSSR [3], DBPN [2], proSR [4], RCAN [7], and our proposed approach). Therefore, it is not displayed in the tables in the paper.

2. Additional results for the blind setting

Additional visual results of the different methods in the blind setting (which are not included in the paper due to space limitation) are presented in Figures 4 and 5. Results for DIV2KRK testset are presented in Table 1 below.

Table 1: Blind super-resolution comparison on DIV2KRK [1]. Each cell displays PSNR [dB] (left) and SSIM (right).

<table>
<thead>
<tr>
<th>Method</th>
<th>x2</th>
<th>x4</th>
</tr>
</thead>
<tbody>
<tr>
<td>DBPN</td>
<td>29.186 / 0.828</td>
<td>25.642 / 0.733</td>
</tr>
<tr>
<td>DBPN + estimated correction</td>
<td>29.389 / 0.832</td>
<td>26.204 / 0.736</td>
</tr>
<tr>
<td>kernelGAN (claimed)</td>
<td>30.363 / 0.867</td>
<td>26.810 / 0.7316</td>
</tr>
</tbody>
</table>

Figure 1: DPSR [6] results for non-blind super-resolution of baboon and monarch images from Set14, for scale factor of 2 and Gaussian downsampling kernels. Left is with filter of std $1.5/\sqrt{2}$, and right is with filter of std $2.5/\sqrt{2}$. 
3. The spectrums of sampling kernels

In Figure 6 we present the frequency spectrums of Gaussian kernels that are used in this work and two bicubic kernels, one for scale factor of 2 and one for scale factor of 4. In order to ease the presentation, the curves are plotted for the one-dimensional version of these kernels. Our experiments show that for super-resolution factor of 2 the proposed filter correction approach yields very good results for Gaussian sampling kernels of $1.5/\sqrt{2}$ and $2.5/\sqrt{2}$ (see Tables 1 and 2 in the main body of the paper), but not for $3.5/\sqrt{2}$. This behavior correlates with the recovery guarantees in Theorem 2. The theory essentially requires that the passband of the bicubic kernel (associated with relevant scale factor) is contained in the passband of the downscaling kernels. Indeed, it can be seen in Figure 6 that the passband of the bicubic kernel for scale factor 2 is contained in the passband of the Gaussian with $1.5/\sqrt{2}$, but extremely larger than the passband of the Gaussian with $3.5/\sqrt{2}$. On the other hand, for super-resolution factor of 4 we do get good results for Gaussian sampling kernel of $3.5/\sqrt{2}$ (see Tables 1 and 2 in the main body of the paper). This is aligned with the fact that the bicubic kernel for scale factor 4 is much narrower in frequency domain than the bicubic kernel for scale factor 2, as shown in Figure 6.

We note that the deficiency of the correction filter approach for the setting with Gaussian kernel of $\sigma = 3.5/\sqrt{2}$ and scale factor of 2 can be resolved by increasing the regularization parameter $\epsilon$ used in (11), which helps compensating the null space.
Figure 3: Non-blind super-resolution of image 148026 from BSD100, for scale factor 4 and Gaussian downsampling kernel with standard deviation $3.5/\sqrt{2}$.

in $\mathcal{S}^*\mathcal{R}$ and stabilizes its inverse. For example, plain application of DBPN on Set14 yields PSNR of 24.71 dB, and applying it after correction filter with $\epsilon = 0$ yields PSNR of 10.34 dB. However, applying DBPN after correction filter with $\epsilon = 10^{-5}$ yields PSNR of 28.67 dB.
Figure 4: Blind super-resolution of comic image from Set14, for scale factor 2 and box downsampling kernel of width 4.

References


Figure 5: Blind super-resolution of baboon image from Set14, for scale factor of 2 and Gaussian downsampling kernel with standard deviation $1.5/\sqrt{2}$.

Figure 6: Frequency spectrums of different one-dimensional kernels.