Blind Super-Resolution Kernel Estimation using an Internal-GAN

Abstract:

Super resolution (SR) methods typically assume that the low-resolution (LR) image was downscaled from the unknown high-resolution (HR) image by a fixed "ideal" downsampling kernel (e.g., Bicubic downsampling). However, this is rarely the case in real LR images, in contrast to synthetically generated SR datasets. When the assumed downsampling kernel deviates from the true one, the performance of SR methods significantly deteriorates. This gave rise to Blind-SR - namely, SR when the downsampling kernel ("SR-kernel") is unknown. It was further shown that the true SR-kernel is the one that maximizes the recurrence of patches across scales of the LR image. In this paper we show how this powerful cross-scale recurrence property can be realized using Deep Internal Learning. We introduce "KernelGAN", an image-specific Internal-GAN, which trains solely on the LR test image at test time, and learns its internal distribution of patches. Its Generator is trained to produce a downscaled version of the LR test image, such that its Discriminator cannot distinguish between the patch distribution of the downscaled image, and the patch distribution of the original LR image. The Generator, once trained, constitutes the downsampling operation with the correct image-specific SR-kernel. KernelGAN is fully unsupervised, requires no training data other than the input image itself, and leads to state-of-the-art results in Blind-SR when plugged into existing SR algorithms.