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"Zero-Shot," Super-Resolution using Deep Internal Learning

Abstract:

Deep Learning has led to a dramatic leap in Super-Resolution (SR) performance in the past few years. However, being supervised, these SR methods are restricted to specific training data, where the acquisition of the low-resolution (LR) images from their high-resolution (HR) counterparts is predetermined (e.g., bicubic downscaling), without any distracting artifacts (e.g., sensor noise, image compression, non-ideal PSF, etc). Real LR images, however, rarely obey these restrictions, resulting in poor SR results by SotA (State of the Art) methods. In this paper we introduce "Zero-Shot" SR, which exploits the power of Deep Learning, but does not rely on prior training. We exploit the internal recurrence of information inside a single image, and train a small image-specific CNN at test time, on examples extracted solely from the input image itself. As such, it can adapt itself to different settings per image. This allows to perform SR of real old photos, noisy images, biological data, and other images where the acquisition process is unknown or non-ideal. On such images, our method outperforms SotA CNN-based SR methods, as well as previous unsupervised SR methods. To the best of our knowledge, this is the first unsupervised CNN-based SR method.