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Photographic Image Priors in the Era of Machine Learning

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Inverse problems in image processing and computer vision are often solved using prior probability densities, such as spectral or sparsity models. In recent years, machine learning has provided dramatic improvements in most of these problems using artificial neural networks, which are typically optimized using nonlinear regression to provide direct solutions for each specific task. As such, the prior probabilities are implicit and intertwined with the tasks for which they are optimized. I'll describe properties of priors implicitly embedded in denoising networks, and describe methods for drawing samples from them. Extensions of these sampling methods enable the use of the implicit prior to solve any deterministic linear inverse problem, with no additional training, thus extending the power of a supervised learning for denoising to a much broader set of problems. The method relies on minimal assumptions, exhibits robust convergence over a wide range of parameter choices, and achieves state-of-the-art levels of unsupervised performance for deblurring, super-resolution, and compressive sensing.

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