Abstract

Most existing image denoising methods assume to know the noise distributions, e.g., Gaussian noise, impulse noise, etc. However, in practice the noise distribution is usually unknown and is more complex, making image denoising still a challenging problem. In this paper, we propose a novel blind image denoising method under the Bayesian learning framework, which automatically performs noise inference and reconstructs the latent clean image. By utilizing the patch group (PG) based image nonlocal self-similarity prior, we model the PG variations as Mixture of Gaussians, whose parameters, including the number of components, are automatically inferred by variational Bayesian method. We then employ nonparametric Bayesian dictionary learning to extract the latent clean structures from the PG variations. The dictionaries and coefficients are automatically inferred by Gibbs sampling. The proposed method is evaluated on images with Gaussian noise, images with mixed Gaussian and impulse noise, and real noisy photographed images, in comparison with state-of-the-art denoising methods. Experimental results show that our proposed method performs consistently well on all types of noisy images in terms of both quantitative measure and visual quality, while those competing methods can only work well on the specific type of noisy images they are designed for and perform poorly on other types of noisy images. The proposed method provides a good solution to blind image denoising.