Statistics of Natural Stochastic Textures and Their Application in Image De-noising.

Natural stochastic textures (NSTs), characterized by their fine details, are prone to corruption by artifacts, introduced during the image acquisition process by the combined effect of blur and noise. While many successful algorithms exist for image restoration and enhancement, the restoration of natural textures and textured images based on suitable statistical models has yet to be further improved. We examine the statistical properties of NST using three image databases. We show that the Gaussian distribution is suitable for many NST, while other natural textures can be properly represented by a model that separates the image into two layers; one of these layers contains the structural elements of smooth areas and edges, while the other contains the statistically Gaussian textural details. Based on these statistical properties, an algorithm for the denoising of natural images containing NST is proposed, using patch-based fractional Brownian motion model and regularization by means of anisotropic diffusion. It is illustrated that this algorithm successfully recovers both missing textural details and structural attributes that characterize natural images. The algorithm is compared with classical as well as the state-of-the-art denoising algorithms.