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Image Restoration via Bayesian Dictionary Learning with Nonlocal Structured Beta Process

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Abstract

Nonparametric Bayesian dictionary learning has shown a powerful potential in image restoration. However, it still lacks exploiting image structure to improve the performance. In this work, we propose a sparse Bayesian dictionary learning framework with structure prior called nonlocal structured beta process factor analysis (NLS-BPFA) which connects nonlocal self-similarity and sparse Bayesian dictionary learning. A nonlocal structured beta process is proposed to introduce the nonlocal self-similarity as a structure prior for image denoising and inpainting. Unlike most of the existing image denoising methods, our proposed method does not need to know noise variance in advance like an unsupervised learning. The experimental results demonstrate the effectiveness of our proposed model.

Keywords: Nonparametric Bayesian, Beta Process, Image Restoration, Nonlocal Structure Prior, Dictionary Learning.

1. Introduction

Image restoration is a fundamental problem in the field of computer vision and image processing. In recent years, sparse representation of natural image has been extensively studied for image restoration [1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11,

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