Nonlocal Approaches for Poisson Noise Removal

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Abstract—A common problem to applications such as positron emission tomography, low-exposure X-ray imaging, fluorescence microscopy, optical and infrared astronomy, and others, is the degradation of the acquired signal by Poisson Noise. This problem arises in applications in which the image acquisition process is based on counting photons reaching a detector surface during a given exposure time. Recently, a new algorithm for image denoising, called Nonlocal-Means (NLM), was proposed. The NLM algorithm consists of a nonlocal approach that explores the inherent image redundancy for denoising. NLM was originally proposed for additive noise reduction. The goal of this research 1 was to extend the NLM algorithm for Poisson noise filtering. To achieve this goal, symmetric divergences, also known as stochastic distances, have been applied as similarity metrics to the NLM algorithm. Since stochastic distances assume a parametric model for the data distribution, knowledge of the model parameters is necessary. We have proposed two approaches to estimate the model parameters, a two-stage algorithm and an iterative approach. The experiment results demonstrate that the proposed approaches are competitive with respect to the state-of-the-art algorithms.

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