Title: Convex Total Variation Denoising of Poisson Fluorescence Confocal Images With Anisotropic Filtering

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Abstract: Fluorescence confocal microscopy (FCM) is now one of the most important tools in biomedicine research. In fact, it makes it possible to accurately study the dynamic processes occurring inside the cell and its nucleus by following the motion of fluorescent molecules over time. Due to the small amount of acquired radiation and the huge optical and electronics amplification, the FCM images are usually corrupted by a severe type of Poisson noise. This noise may be even more damaging when very low intensity incident radiation is used to avoid phototoxicity. In this paper, a Bayesian algorithm is proposed to remove the Poisson intensity dependent noise corrupting the FCM image sequences. The observations are organized in a 3-D tensor where each plane is one of the images acquired along the time of a cell nucleus using the fluorescence loss in photobleaching (FLIP) technique. The method removes simultaneously the noise by considering different spatial and temporal correlations. This is accomplished by using an anisotropic 3-D filter that may be separately tuned in space and in time dimensions. Tests using synthetic and real data are described and presented to illustrate the application of the algorithm. A comparison with several state-of-the-art algorithms is also presented.

Author Keywords: Bayesian; Convex Optimization; Denoising; Laser Scanning Confocal Fluorescence Microscopy (LSCFM); Poisson

KeyWords Plus: Total-Variation Regularization; Noise Removal; EM Algorithm; Graph Cuts; Restoration; Minimization; Reconstruction; Tomography; Microscopy; Curvelets

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