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A Wavelet-Assisted Subband Denoising for Tomographic Image Reconstruction

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Abstract

Many methods of image acquisition from medical multidimensional data rely on continuous techniques whereas in fact they are used in a finite discrete field. The discretization step is often accompanied by residuals diminishing the quality of the produced images. In addition, the acquisition phase does not occur in an ideal way and may cause artifacts and nonstandard noise. Therefore, denoising is mandatory for many algorithms in computer vision and image processing. In this paper, we propose a new denoising strategy for the tomographic image reconstruction. The method is based on a coupling of the wavelet techniques with the well-known Non Local Means (NLM) filter and operates adaptively during the data acquisition stage. Unlike other well-known denoising techniques, which are mainly based on the smoothing of the resultant image, this approach is instead based on the sinogram preprocessing. The numerical simulations show that the tomographic reconstruction based on the new denoising strategy is able to reduce enough noises present in various forms in the data. Additional robustness tests prove that the proposed approach is more stable than the basic NLM and other homologous methods.

Keywords: Denoising; Wavelets; Non-local means; Radon transform; Tomography; Medical imaging; Simulation.

1. Introduction

Emission Computed Tomography (ECT) is a set of techniques used in the medical imaging field intended to provide information about biochemical processes taking place in a living tissue over time. There is a growing interest in the dynamic information that is provided by ECT, and in its value with respect to medical diagnosis and monitoring the response to therapy. Over the last half-century, tomography has evolved to become one of the cornerstones of

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