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Non-Linear Polynomial Filters for Edge Enhancement of Mammogram Lesions

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Abstract

Background and Objectives: Computer aided analysis of mammograms has been employed by radiologists as a vital tool to increase the precision in the diagnosis of breast cancer. The efficiency of such an analysis is dependent on the employed mammogram enhancement approach; as its major role is to yield a visually improved image for radiologists.

Methods: Non-linear Polynomial Filtering (NPF) framework has been explored previously as a robust approach for contrast improvement of mammographic images. This paper presents the extension of NPF framework for sharpening and edge enhancement of mammogram lesions. Proposed NPF serves to provide enhancement of edges and sharpness of the lesion region (region-of-interest) in mammograms, in a manner to minimize the dependencies on pre-selected thresholds. In the present work, Logarithmic Image Processing (LIP) model has been employed for the purpose of improvement in visualization of mammograms based on Human Visual System (HVS) characteristics.

Results: The proposed NPF filtering framework yields mammograms with significant improvement in contrast, edges as well as sharpness of the lesion region. The performance of the proposed approach has been validated using state-of-art objective evaluation measures (of mammogram enhancement) like Contrast Improvement Index (CII), Peak Signal-to-Noise Ratio (PSNR), Average Signal-to-Noise Ratio (ASNR) and Combined Enhancement Measure (CEM); as well as subjective evaluation by radiologists' opinions.