EVIDENCE BASED DETECTION OF SPICULATED LESIONS AND ARCHITECTURAL DISTORTIONS

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Screening mammography, x-ray imaging of the breast, is currently the most effective tool for early detection of breast cancer. However mammography is not perfect. Detection of suspicious abnormalities is a repetitive, fatiguing and extremely difficult task for radiologists. A number of computer-aided detection (CAD) systems have been developed to aid radiologists to detect the common signs of breast cancer. However these systems have much higher detection accuracy for calcifications than for masses or architectural distortions. Thus, there is a need for improvement in the detection of these abnormalities. In this work we present a new technique for the detection of spiculated masses (SM) and architectural distortions (AD).

Mass detection algorithms generally consist of two stages. The aim of the first stage is to detect all potential masses. In the second stage, the aim is to reduce the false-positives by classifying the detected objects as masses or normal tissue. We have developed a new evidence based, stage-one algorithm for the detection of SM and AD. By evidence based, we mean that we use the statistics of the physical characteristics of these abnormalities to determine the parameters of the detection algorithm. Our stage-one algorithm consists of two steps, an enhancement step followed by a filtering step. In the first step, we propose a new technique for the enhancement of spiculations in which a linear filter is applied to the Radon transform of the image. In the second step, we filter the enhanced images with a new class of filters called Radial Spiculation Filters. We have invented these filters specifically for detecting SM and AD that are marked by converging lines or spiculations. A key aspect of this work is that each parameter of the filter has been incorporated to capture the variation in physical characteristics of SM and AD and that the parameters of the stage-one detection algorithm are determined by the physical measurements.

The results for a detection algorithm are typically reported by the sensitivity and the corresponding number of false positives per image (FPI). The results of our preliminary experiments on a set of 45 SM and 45 AD are as follows: We achieved a sensitivity of 91% at 12 FPI for SM detection and a sensitivity of 80% at 14 FPI for AD detection. Currently, the number of FPI are high and we are working on reducing them.

In conclusion we have presented preliminary results in support of our development of an evidence based framework for the detection of SM and AD based on their physical characteristics. Improvements in the detection of SM and AD will help increase the accuracy of CAD systems. This work has the potential to significantly improve the detection accuracy of breast cancer and to thus increase the survival rate and treatment options for those inflicted with this disease.

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