Automatic Volumetric Breast Density Assessment in the eXtensible Imaging Platform

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The breast is composed of fibroglandular tissue embedded in a background of fatty tissue. The amount of fibroglandular tissue and fat varies among women. Breast cancer arises in this fibroglandular tissue. In mammograms, dense tissue attenuates more radiation then does fat. Breast density refers to the appearance of fibroglandular (dense) tissue on a mammographic image. Previous studies show that the percent of breast tissue density is positively correlated with breast cancer. Radiologist perform a mandatory visual assessment in which they subjectively score the breast on a four category scale in the Breast Imaging-Reporting and Data System (BIRADS), based on patterns developed by Wolfe. A number of quantitative, area-based methods have been developed for use in research. These methods show limitations because they are using calculations based on a two dimensional area on the breast, a three dimensional object. In 1996, Highnam et al. introduced the Standard Mammogram Form (SMF), a volumetric approach which was improved upon in 2006 by van Engeland et al. Our application implements a volumetric breast density assessment program in the eXtensible Imaging Platform.

Also known as XIP, the eXtensible Imaging Platform is an open source environment which allows researchers and clinicians to rapidly develop medical imaging applications. The applications developed in the XIP environment encourage translational research because programs can be easily implemented and evaluated in order to go from a research to a clinical setting. These applications used for image processing, evaluation, and visualization can easily be created and adapted due to the 'plug-in' nature of its modules. XIPBuilder, a workstation in which XIP pipelines can be built, contains toolkits as well as the capability to create custom modules. This paper describes our efforts to implement van Engeland et al.'s volumetric approach to calculating breast density, in the XIP environment. Our preliminary results show promising evidence that an eXtensible Imaging Platform Volumetric Breast Density Assessment would be a reliable method for assessing breast density. In finding Kendell's Coefficient of Concordance, our method's evaluation of breast density was in agreement with two previously accepted techniques. Ground truth is difficult to obtain when assessing mammograms volumetrically. In order to validate our technique, as well as others, we would like to compare our results to the assessment of a Breast MRI.

Keywords: breast density, eXtensible Imaging Platform, volumetric, breast cancer