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Towards the development of non-invasive measures of breast cancer risk: image analysis of digital breast tomosynthesis mammograms and tissue lobule content

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Introduction

The acquisition of high-quality digital images from mammography and breast tissue, presents an opportunity to obtain biologically relevant markers. Terminal duct lobular units (TDLUs, also known as lobules) are the predominant normal structures where breast cancers originate. Data show that women with higher lobular content are at higher risk for breast cancer and higher lobular content is associated with more aggressive breast cancers. However, few studies have evaluated the relationship of image features from digital breast tomosynthesis (DBT) alongside lobule measures from paired breast tissue specimens.

Methods

Using a first breast cancer case recruited for the University of Dundee's "Medical imaging markers of cancer initiation, progression and therapeutic response in the breast, based on tissue microstructure" study, we are using DBT mammography images from Siemens Mamomat Inspiration and paired digital images of breast tissue haematoxylin and eosin stained sections. Areas of breast cancer lesion are segmented using ANALYZE software 12.0 (Biomedical Imaging Resource, Mayo Foundation, Rochester, MN) by an experienced breast radiologist and excluded from the image analysis. Regional analysis is performed using Matlab (MathWorks Inc., Natick, MA) segmenting the surrounding non-malignant tissue to extract image features including intensity and texture metrics, which may correspond to lobular content. Lobule content in tissue specimens is assessed visually and calculated using Aperio Scanscope.

Results

Data on the correlations between image features from DBT (e.g. intensity, texture, and/or shape) and relationships with lobular content from breast tissues will be presented.

Conclusions

Given that lobules are the source of future breast cancers, identification of features in digital mammograms related to their presence may provide clinically relevant intermediate measures, which may lead to non-invasive methods for tailoring breast cancer screening, risk assessment and monitoring of treatment responses. Future work, evaluating how reconstructed DBT images using filtered back projection type algorithms adapted to the limited angle tomography setting influence image features for DBT related to TDLU measures will be pursued and discussed.

Figueroa JD, et al. Standardized measures of lobular involution and subsequent breast cancer risk among women with benign breast disease. Breast Cancer Res and Treat 2016 Aug;159(1):163-72.; Figueroa JD, et al. Terminal duct lobular unit involution of the normal breast: implications for breast cancer etiology. J Natl Cancer Inst 2014; 106(10). Victor Gonzalez-Castro, et al., Texture descriptors based on adaptive neighborhoods for classification of pigmented skin lesions. Journal of Electronic Imaging 24(6), 061104-1 – 061104-8 (2014).