

# Tracking 'developing' Focal Densities in Breast Quadrants

Faraz Janan <sup>1</sup>, Sir Michael Brady FRS FREng, FMedSci <sup>2</sup>

1. University of Lincoln; 2. University of Oxford

## Background

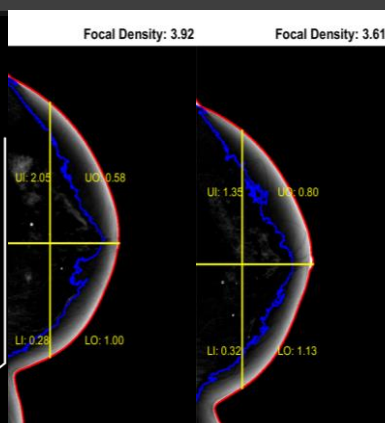
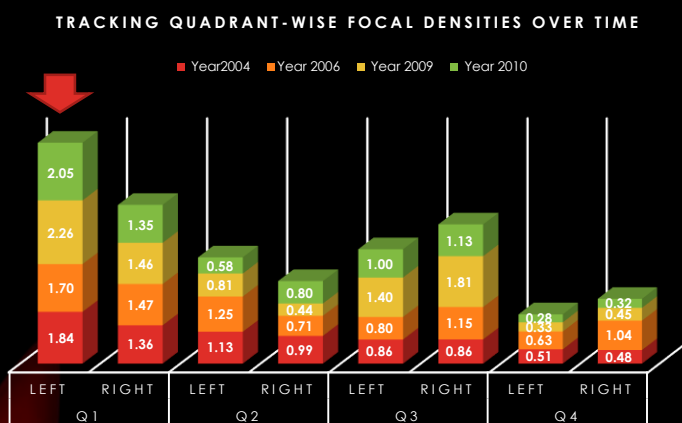
Focal density (FD) is a dense mammographic region that cannot be accurately identified as a mass without further examination. If a particular breast quadrant is significantly denser than others or has an increase in density over time, this could be associated with neoplasm especially in the presence of a tangible mass. We have developed a method to study and track quadrant-wise increase in FD over time.

## Methods

A set of 10 temporal patient cases collected over a period of up to 6 years were used. Each quarter of the breast is assigned a FD score, where quadrants are defined by first differentiating a border between the breast region and skin line. Then a nipple detection method is used to correctly identify nipples, including those 'not in profile'. Afterwards, the nipple location is used as a reference point to divide the breast into four quarters (see Figure 2). Further on, FDs are quantified [1] and a score assigned to each quadrant of the breast, and to the breast as a whole.

## Results

Results show that our method can detect increase in FD over time in some quarters of breast; a finding that can be verified by Volpara density grade [2]. It can be seen (Figure-2) that Q1-left (upper-interior-UI) has a significantly higher FD score as compared others. Clinical evaluation for this BIRADS-C mammogram confirms the presence of 6mm grade-4 screen detected invasive lobular carcinoma in the left UI quadrant of the breast. Figure-1 shows a FD comparison of all quadrants of the bilateral pair over the course of 6 years. Q1-left remained the densest throughout.



**Figure 1:** A full tracking of fd in all quadrants of bilateral mammos over a number of years. The blue arrow indicates the quadrant with cancer.

**Figure 2:** Focal density scored assigned to each breast quadrant, and to each of the bilateral mammograms

## Conclusions

The study suggests that tracking FD (both 'developing' and 'stable') over time could potentially help in better understanding of the risk of breast cancer development in any particular quadrant of the breast.

[1] F. Janan, M. Brady, R. H.-P. MICCAI-BIA, and 2015, "RICE: Region of Interest Contrast Enhancement of Mammographic Density Maps," 2015.  
 [2] R. Highnam, M. Brady, M. J. Yaffe, N. K.-... workshop on digital ..., and 2010, "Robust breast composition measurement-VolparaTM," 2010.