Susan G. Komen
Research Grants – Fiscal Year 2013

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Next-Generation Digital Breast Tomosynthesis for Superior Calcification Imaging

Investigator(s): Andrew Maidment, Ph.D.
Lead Organization: University of Pennsylvania
Grant Mechanism: Investigator-Initiated Research Grant

Awarded: $1,000,000.00
Grant ID: IIR13264610

Public Abstract:
In the past year, nearly 36 million women have had screening mammograms in the United States alone. Of these, roughly 10% where “called back” for further diagnostic imaging. Based on statistics from the University of Pennsylvania, we estimate that in the US approximately 2 million women are called back for additional x-ray imaging (mainly for calcifications), while the remainder will have ultrasound, MR or a combination of imaging procedures (mainly for noncalcifications). Digital breast tomosynthesis (DBT) is an emerging screening technology that has been commercially available for about two years. A number of reports have shown that DBT can increase cancer detection while reducing call back rates by about 30%. However, multiple studies have shown that this improvement is limited to noncalcification cases. Several studies have now reported that current DBT systems blur calcifications. In this grant application, we report on a method to improve the visibility of calcifications significantly in DBT. Using this method, we propose to design, fabricate and test a second-generation DBT system that optimally images calcifications. The system uses dynamic reconstruction and rendering (DRR) to achieve super-resolution and to enable advanced display modes including multi-planar reconstruction which will improve the diagnosis of both calcification and non-calcification cases. This approach is distinct from the existing paradigm in that the image data acquired during the screening exam is sufficient to allow a definitive diagnosis using the DRR method—without the need for any additional radiation. If our hypothesis holds true, this would eliminate the need to call back many patients for diagnostic x-ray exams. This would help a large number of women by eliminating the anxiety accompanying a call back, eliminating the need for repeated x-ray imaging, and consequently reducing the exposure of women to ionizing radiation. The project combines the strengths of two groups with an excellent collaborative history: the University of Pennsylvania (UPenn) and Real-Time Tomography, LLC (RTT). UPenn has developed a sophisticated model to simulate DBT imaging systems. Using this model, UPenn will design a novel DBT acquisition geometry to optimize the super-resolution effect. RTT will adapt their existing DRR reconstruction software to this novel geometry. Based upon these results, an imaging system will be constructed at UPenn to match this geometry. RTT will construct the acquisition workstation and workstation software. Together, UPenn and RTT will evaluate and optimize the system through a combination of phantom and specimen imaging. If successful, there will be strong evidence in support of DRR and super-resolution, and a candidate design for manufacturers would exist. In this way, we would hope to achieve the goal of having a significant impact on breast cancer diagnosis within the next decade.