

A framework to visualize 3D breast tumor using x-ray vision technique in mobile augmented reality

ABSTRACT

Breast cancer patients who require breast biopsy have increased over the past years and Stereotactic Biopsy uses series of images to carefully position the imaging equipment and target the area of concern. However, it has the constraint of accurate 3D Tumor visualization. An Augmented Reality (AR) Guidance Biopsy system of breast has become the method of choice for researchers, yet this AR tumor visualization has limitation to the extent of superimposing the 3D Imaging Data only. In this paper, a framework to visualize 3D breast tumor technique is being introduced to accurately visualize 3D tumor to see through the skin of US-9 Opaque breast phantom on a mobile display. This mobile AR visualization technique consists of 4 phases where it initially acquires the image from Computed Tomography (CT) or Magnetic Resonance Images (MRI) and processes the medical images into 3D slices, secondly, it will purify these 3D grayscale slices into 3D breast tumor model using 3D modeling reconstruction technique. Furthermore, in visualization processing, this virtual 3D breast tumor model is enhanced using X-Ray Visualization technique to only see through the skin of the phantom for better visualization. Finally, the composition of it is displayed on a smartphone device with an optimized accuracy of the 3D tumor visualization in a six degree of freedom (6DOF). The experiment was made to test the visualization accuracy on US-9 breast phantom which has 12 tumors in different sizes and categorized in 3 levels. Our frame shows the 3D tumor visualization accuracy, however, the accuracy comparison is pending. The two radiologists from Hospital Serdang performed successful visualization of a 3D tumor in an X-ray vision. The framework is perceived as an improved visualization experience because the AR X-ray visualization allowed direct understanding of the breast tumor beyond the visible surface towards accurate biopsy targets.

Keyword: Augmented Reality; Biopsy; Breast Cancer; Visualization