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Visualisation of Ultrasound Computer Tomography Breast Data Set

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Visualising volume images is a key factor in diagnosing and detecting early breast cancer. However, the standard visualisation approaches still revolve around 2D images slides. Although 3D visualisation is important in diagnosing and treating breast cancer, yet the potential is not entirely realized with slices based visualisation. In this paper, we present an interactive 3D web-based visualisation tool for the breast data set which overcomes this limitation and offers new possibilities.

(2) Material and Methods

Our approach focuses in efficient utilisation of 3D data. Thus, we based our implementation on WebGL technology which utilises the GPU parallel architecture. Our tool is a web-based platform which enables data sharing without extra tool installations. We render the data with state-of-the-art algorithms with a quality comparable to the desktop application. In particular, our tool performs the volume rendering and the multimodality fusion, i.e., normal fusion and intermixing approaches. Aside, our tool allows users to perform arbitrary view slicing, modality thresholding and multiple rendering modes. Also, an adaptive method was implemented which scales with client's hardware resources to retain an interactive response of the visualisation.

(3) Results

To measure the effectiveness and performance of our tool, we measure the frame rates of each visualisation method on various client devices. The visualisation methods are tested on (i) a mobile phone (Xiaomi Redmi Note 3), (ii) a standard desktop (integrated graphic card HD4000), (iii) a laptop (GT750M), and (iv) a powerful workstation (Tesla C2). Among the methods, the direct volume rendering method is the fastest and most efficient: (i) 12 fps, (ii) 58 fps, (iii) 105 fps, and (iv) 218 fps; followed by the intermixing approach: (i) 5 fps, (ii) 30 fps, (iii) 40 fps, and (iv) 104 fps; and lastly the normal fusion approach: (i) 2 fps, (ii) 37 fps, (iii) 60 fps, and (iv) 110 fps. Our tool maintains 30 fps and higher on standard desktops.

(4) Discussion and Conclusion

We presented a web-based 3D visualisation tool that adapts and scales automatically to a broad range of client and standard hardware devices. Our tool supports volume rendering, normal fusion, and intermixing methods. The web-based platform encourages collaborative research. The visual representations were promising and comparable to commercial applications. Currently, we are working on integrating our tool into the needs and infrastructure of a clinical workflow for radiologists.

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