

Comparison of Improved Semi-Automated Segmentation Technique with Manual Segmentation: Data from the Osteoarthritis Initiative

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Abstract

Manual segmentation is the standard procedure in osteoarthritis study. However, this method is infamous for being excessive, time consuming and exhaustive. In this study, we overcame the problem of excessive expert interaction reported in manual segmentation by developing a semi-automated random walks technique with computer-aided labelling system. To minimize expert interaction, non-cartilage seeds were generated by using computer. Then, random walks algorithm would segment knee cartilage based on cartilage seeds and non-cartilage seeds. Finally, segmentation results were revised and refined accordingly. A total of 15 normal images and 10 osteoarthritic images were used in this study. In term of efficiency, we have reduced the processing time to segment normal cartilage by 47.5% (93 ± 21 s; $P = 0.0000019$) for observer 1 and 44% (61 ± 8 s; $P = 3.52 \times 10^{-5}$) for observer 2. We also reduced the processing time to segment diseased cartilage by 48.1% (56 ± 16 s; $P = 0.00014$) for observer 1 and 30.3% (62 ± 14 s; $P = 0.0070$) for observer 2. Besides, the proposed technique have produced good reproducibility in both normal (0.83 ± 0.028 for observer 1 and 0.80 ± 0.040 for observer 2) and diseased (0.80 ± 0.060 for observer 1 and 0.82 ± 0.043 for observer 2) cartilage segmentations. In conclusion, the combination of computer generated seeds and user-friendly random walks method have reduced the amount of expert interaction to necessary level without compromising the accuracy of results. © 2016 Hong -Seng, Gan and Khairil Amir Sayuti.

Keywords: Semi-Automated Segmentation, MR Image, Seeds, Osteoarthritis, Knee Cartilage

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