Critical Review: Iterative Multi-domain Regularized Deep Learning for Anatomical Structure Detection and Segmentation from Ultrasound Images

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Accurate detection and segmentation of anatomical struc- tures from ultrasound images are crucial for clinical diagnosis and bio- metric measurements. The ultrasound imaging has been a powerful tool for visualizing the complex anatomical structures due to its superior advantages, e.g., portability, real-time imaging, low-cost and free of radiation.

In this paper, a multi-domain regularized deep learning method has been proposed. With elegantly designed CNN architecture, the method harnesses the knowledge across the large amounts of cross-domain data for effective generic feature representations. Specifically a unified framework has been proposed that leverages fully convolutional networks for end-to-end learning and inference; hence the detection and segmentation efficiency has been greatly boosted. By leveraging the transfer learning from cross domains, the feature representations are effectively enhanced. The results are further improved by the iterative refinement. Moreover, the method is quite efficient by taking advantage of a fully convolutional network, which is formulated as an end-to-end learning framework of detection and segmentation. Extensive experimental results on a large-scale database corroborated that the method achieved a supe- rior detection and segmentation accuracy, outperforming other methods by a significant margin and demonstrating competitive capability even compared to human performance.

The method can detect and segment the anatomical structures despite the large variations of anatomical structures. It is also robust to the inferiorimage quality, even with artifacts such as shadows and speckle noise. Furthermore, the method can segment the anatomical structures accurately in the situation where the boundary is not clear, which is even challenging for experts.

In conclusion, it can be said that the proposed method has outperformed previous methods and seems promising in the future with incorporation of advanced shape regression methods to further improve the segmentation performance.