Paper Title:
Automatic Skin Lesion Segmentation Using Deep Fully Convolutional Networks With Jaccard Distance

Paper Link:
https://ieeexplore.ieee.org/document/7903636

1 Summary

1.1 Motivation

Skin lesions, especially melanoma, are one of the deadliest forms of skin cancer. Early detection of this deadly disease helps increase the survival rate, making precise skin lesion segmentation a critical task in medical imaging. Traditional segmentation methods fail for challenges like low contrast, irregular lesion shapes and visual artifacts, motivating the authors to prepare a fully automated deep learning solution.

1.2 Contribution

The authors designed a 19-layer FCN (fully convolutional network) with a novel loss function derived using Jaccard distance, which eliminated the requirement for sample re-weighting in imbalanced datasets.

1.3 Methodology

The authors have modified VGG-16 by replacing fully connected layers with convolutions and adding unsampling layers converting it into a fully convolutional network. Furthermore, a new loss function utilizing Jaccard distance has been developed to optimize performance and address class imbalance without the need for re-weighting. In addition, the model undergoes end-to-end training and is assessed on the ISBI 2016 and PH2 datasets without any preprocessing steps.

1.4 Conclusion

The model proposed by the authors achieves state-of-the-art performance on benchmark datasets, showing its capability to segment skin lesions efficiently without any preprocessing steps.

2 Limitations

2.1 First Limitation

The model is troubled by lesions that are too small or highly irregular, particularly in cases where more detailed boundary information is significant.

2.2 Second Limitation

The system requires a large number of labeled images to be well-trained, which restricts its usage for uncommon or peculiar lesion types without retraining.

3 Synthesis

The authors make an important contribution to the automatic skin lesion segmentation task with a customized FCN utilizing a Jaccard-based novel loss function. Although it demonstrates high effectiveness on conventional datasets, there is still room for improvement in its performance concerning exceptionally rare or complex detailed lesions. Future research may focus on enhancing the detail preservation while reducing the large dependence on highly labeled datasets.