

A MUTUAL BOOTSTRAPPING MODEL FOR AUTOMATED SKIN LESION SEGMENTATION AND CLASSIFICATION

ABSTRACT

Automated skin lesion segmentation and classification are two most essential and related tasks in the computer aided diagnosis of skin cancer. Despite their prevalence, deep learning models are usually designed for only one task, ignoring the potential benefits in jointly performing both tasks. In this project, we propose the mutual bootstrapping deep convolutional neural networks (MB-DCNN) model for simultaneous skin lesion segmentation and classification. This model consists of a coarse segmentation network (coarse-SN), a mask-guided classification network (mask-CN), and an enhanced segmentation network (enhanced-SN). On one hand, the coarse-SN generates coarse lesion masks that provide a prior bootstrapping for mask-CN to help it locate and classify skin lesions accurately. On the other hand, the lesion localization maps produced by mask-CN are then fed into enhanced SN, aiming to transfer the localization information learned by mask-CN to enhanced SN for accurate lesion segmentation. In this way, both segmentation and classification networks mutually transfer knowledge between each other and facilitate each other in a bootstrapping way. Meanwhile, we also design a novel rank loss and jointly use it with the Dice loss in segmentation networks to address the issues caused by class imbalance and hard easy pixel imbalance. We evaluate the proposed MB-DCNN model on the ISIC-2017 and PH2 datasets, and achieve a Jaccard index of 80.4% and 89.4% in skin lesion segmentation and an average AUC of 93.8% and 97.7% in skin lesion classification, which are superior to the performance of representative state of the art skin lesion segmentation and classification methods. Our results suggest that it is possible to boost the performance of skin lesion segmentation and classification simultaneously via training a unified model to perform both tasks in a



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mutual bootstrapping way. This project is implemented with MATLAB software.

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