Conv-MCD: A Plug-and-Play Multi-task Module for Medical Image Segmentation

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Introduction

Motivation
1. Encoder-decoder networks suffer from structural information loss due to downsampling operations performed via max-pooling layers.
2. Cross-entropy loss does not address the foreground-background class imbalance problem.
3. In the case of medical imaging, networks should be capable of producing smooth boundaries.

Related Work
2. DCTN [3]: Single encoder and two decoder architecture with cross entropy loss for mask and contour.
3. DMTN [4]: Single encoder and two decoder architecture with cross entropy loss for mask and distance map.

Contribution
1. We propose a novel module Conv-MCD (Figure 1) takes the feature maps from the deep learning networks as input and outputs mask, contour and distance map.
2. This module helps the network to learn the multiple related tasks in parallel, enabling the network to generalize well.

Methodology

Proposed Module
The proposed module Conv-MCD (Figure 1) takes the feature maps from the deep learning networks as input and outputs mask, contour and distance map.

This module helps the network to learn the multiple related tasks in parallel, enabling the network to generalize well.

The proposed module could be included at the end of a typical deep segmentation network.

Loss Function
The loss function consists of three components - Negative Log Likelihood (NLL) loss for mask and contour, Mean Square Error (MSE) loss for the distance. The total loss is given by:

Loss total = λ1Lmask + λ2Lcontour + λ3Ldistance

References