Semi-supervised Segmentation Based on Error-Correcting Supervision

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Abstract. Pixel-level classification is an essential part of computer vision. For learning from labeled data, many powerful deep learning models have been developed recently. In this work, we augment such supervised segmentation models by allowing them to learn from unlabeled data. Our semi-supervised approach, termed Error-Correcting Supervision, leverages a collaborative strategy. Apart from the supervised training on the labeled data, the segmentation network is judged by an additional network. The secondary correction network learns on the labeled data to optimally spot correct predictions, as well as to amend incorrect ones. As auxiliary regularization term, the corrector directly influences the supervised training of the segmentation network. On unlabeled data, the output of the correction network is essential to create a proxy for the unknown truth. The corrector's output is combined with the segmentation network's prediction to form the new target. We propose a loss function that incorporates both the pseudo-labels as well as the predictive certainty of the correction network. Our approach can easily be added to supervised segmentation models. We show consistent improvements over a supervised baseline on experiments on both the Pascal VOC 2012 and the Cityscapes datasets with varying amounts of labeled data. This work was was presented at the European Conference on Computer Vision 2020 [1].

Semi-supervised learning is especially important in domains where labeled data is sparse. Although this work did not specifically focus on medical imaging, we believe that the proposed method can be valuable for the community, and applications in the medical image segmentation setting should be considered.

References

1. Mendel R, de Souza LA, Rauber D, et al. Semi-supervised Segmentation Based on Error-Correcting Supervision. In: Computer Vision – ECCV 2020; 2020. p. 141–157.