Widening the Focus: Biomedical Image Segmentation Challenges and the Underestimated Role of Patch Sampling and Inference Strategies

Frederic Madesta[1,3,4], Rüdiger Schmitz[1,2,3,4], Thomas Rösch[2], René Werner[1,3]

[1]Department of Computational Neuroscience, UKE, Hamburg, Germany
[2]Department for Interdisciplinary Endoscopy, UKE, Hamburg, Germany
[3]Center for Biomedical Artificial Intelligence (bAIome), Hamburg, Germany
[4]Equal contribution
f.madesta@uke.de

The field of biomedical computer vision has considerably been influenced by image analysis challenges, which are mainly dominated by deep learning-based approaches. Much effort is put into challenge-specific optimization of model design, training schemes and data augmentation techniques. The paper [1] aims to widen the focus beyond model architecture and training pipeline design by shedding a light on inference efficiency and the role of patch sampling strategies for large images that cannot be processed at once. First, examining MICCAI challenge datasets of previous years, we demonstrate that inference patch overlap can considerably influence segmentation performance. This is contrasted with the status quo in challenge reporting, with inference strategies being rarely detailed at all. Second, dataset-specific patch overlap effects are shown to be aetiologically related to varying intra-patch segmentation accuracy. Third, we introduce novel strategies for inference-time patch sampling that outperform the de facto standard, namely ordered, sliding window-like cropping, in terms of convergence speed and stability (Fig. 1). The proposed Monte Carlo-based strategies are built on uncertainty mechanisms and local image entropy. Finally, we provide practical guidance on inference strategy optimization.

References

1. Madesta F, Schmitz R, Rösch T, et al. Widening the Focus: Biomedical Image Segmentation Challenges and the Underestimated Role of Patch Sampling and Inference Strategies. In: MICCAI 2020. Springer; 2020. p. 289–298.

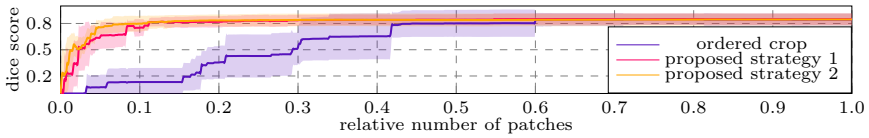

Fig. 1. Dice convergence curves for different patch sampling strategies (mean ± SD).