Abstract: Adaptive Region Selection for Active Learning in Whole Slide Image Semantic Segmentation

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The annotation of gigapixel-sized whole slide images (WSI) in digital pathology can be time-intensive, especially when generating annotations for training deep segmentation models. Instead of requesting annotations for the full WSI, region-based active learning (AL) allows to specify selected regions for annotation in an iterative process, reducing annotation while maintaining segmentation performance. Existing methods for section selection on WSI evaluate the informativeness of a quadratic grid of a predefined size of $l \times l$ pixels according to a suitable informativeness criterion and then select the k most informative regions. Our experiments show that the benefit of this method strongly depends on the choice of these two hyperparameters, i.e., the AL step size, and that a suboptimal AL step size can result in uninformative or redundant annotation requests [1]. We evaluate our approach on the publicly available CAMELYON16 dataset and show that it consistently achieves higher sampling efficiency measured by annotated area compared to the reference approach across various AL step sizes. With only 2.6% of tissue area annotated, we achieve the same performance compared to a full annotation setting and thereby substantially reduce the costs of annotating a WSI dataset for the task of segmentation. Our approach can in theory be applied with any informativeness measure, with future work looking closer into an improved characterization of annotation effort. The source code is available at https://github.com/DeepMicroscopy/AdaptiveRegionSelection.

References

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Informatik aktuell, https://doi.org/10.1007/978-3-658-44037-4_6