Semantic Segmentation with Active Semi-Supervised Learning

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https://github.com/aneesh3108/S4AL

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Overview

- Active learning algorithms for semantic segmentation mostly focus on making the most out of the labeled data

- They do not (or are unable to) take into consideration the richness of information in the unlabeled data

- We combine semi-supervised learning with active learning to boost networks' learning potential

Student-Teacher Learning
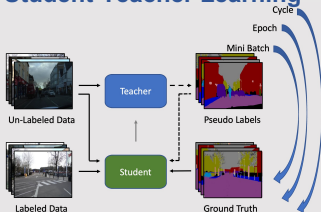
- Our baseline (starting point) is the segmentation network trained with naïve semi-supervision[6]

Improvements
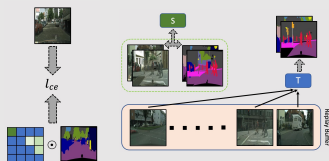
- Confidence weighting (left) ensures that unsure predictions from the teacher get relatively less weightage during student learning
- Balanced ClassMix (right) ensures that tail classes are seen more often during training than head classes[5]

Results
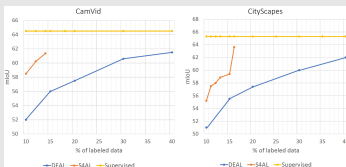
- We achieve significant increase in performance vs total labeled data as compared to DEAL[1], on the MobileNet backbone based DeepLabv3
- We also surpass EqualAL[2], RALIS[3], and VAAL[4], while using different network backbones and segmentation architectures

Future Work

- We strongly believe that knowledge distillation from a superior backbone will help improve performance further

References

[1] Xie, S., Feng, Z., Chen, Y., Sun, S., Ma, C. and Song, M., 2020. Deal: Difficulty-aware active learning for semantic segmentation. In *Proceedings of the Asian Conference on Computer Vision*, [2] Golestaneh, S.A. and Kitani, K.M., 2020, Importance of self-consistency in active learning for semantic segmentation. *arXiv preprint arXiv:2008.01860*, [3] Casanova, A., Pinheiro, P.O., Rostamzadeh, N. and Pal, C.J., 2020, Reinforced active learning for image segmentation. *arXiv preprint arXiv:2002.06583*, [4] Sinha, S., Ebrahimi, S. and Darrell, T., 2019. Variational adversarial active learning. In *Proceedings of the IEEE/CVF International Conference on Computer Vision* (pp. 5972-5981), [5] Olsson, V., Tranheden, W., Pinto, J. and Svensson, L., 2021. Classmix: Segmentation-based data augmentation for semi-supervised learning. In *Proceedings of the IEEE/CVF Winter Conference on Applications of Computer Vision* (pp. 1369-1378), [6] Tarvainen, A. and Valpola, H., 2017. Mean teachers are better role models: Weight-averaged consistency targets improve semi-supervised deep learning results. *Advances in neural information processing systems*, 30.