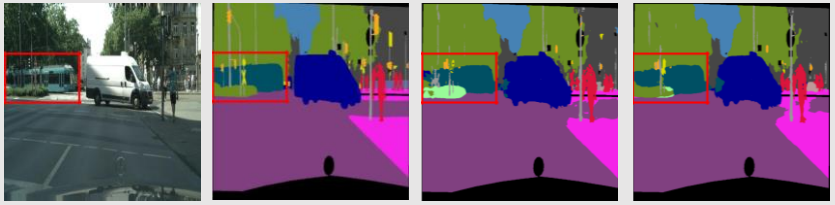
Semantic Segmentation with Active Semi-Supervised Representation Learning

Aneesh Rangnekar, Christopher Kanan, Matthew Hoffman

Rochester Institute of Technology

BMVC 2022

Overview

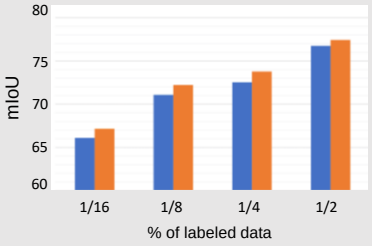


(a) (b) (c) (d)

- Cross entropy operates on an individual pixels of the semantic map without considering possible cues of similarity and differences in areas throughout the entire image or set of images to strengthen its learning potential
- We approach active learning for semantic segmentation by combining semi-supervised learning (SSL) with representation learning to achieve superior results
- (a) – Original image, (b) – Ground truth, (c) – output by conventional teacher-student learning, (d) – output by our method

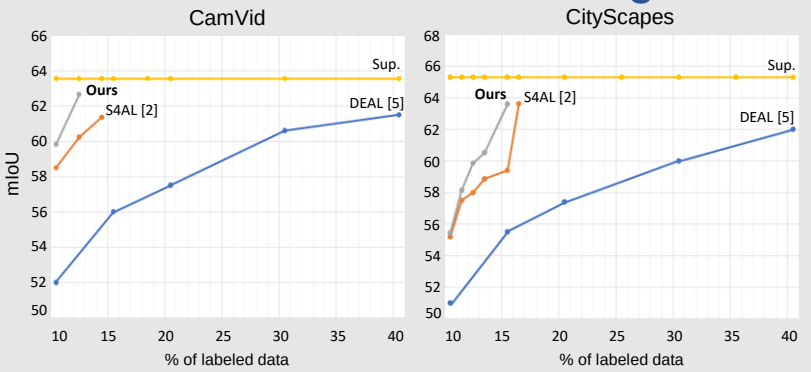
S4AL+

- We observe complex data augmentations, e.g., ClassMix, affect the reproducibility for semi-supervision aided active learning
- We replace teacher-student learning for SSL with self-training with an intent to reduce augmentation workload [3]



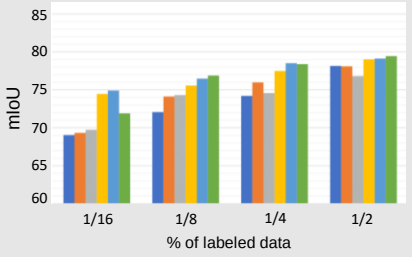
- We also replace conventional cross-entropy ( ) with contrastive embeddings, with Regional Contrast [4], to learn improved representations ( ) for long-tail classes through the dataset

Results: Active Learning



- Using self-learning with contrastive embeddings reduce the quantity of labeled data points during active learning

Results: Semi-Supervised Learning



- Ours ( ) outperforms all existing semi-supervised learning approaches with minimal efforts (e.g.[1])
- There is scope for improvement in the cases of extreme limited labeled data (1/16)

References

[1] Hanzhe Hu, Fangyun Wei, Han Hu, Qiwei Ye, Jinshi Cui, and Liwei Wang. Semi supervised semantic segmentation via adaptive equalization learning. Advances in Neural Information Processing Systems, 2021, [2] Aneesh Rangnekar, Christopher Kanan, and Matthew Hoffman. Semantic segmentation with active semi-supervised learning. IEEE/CVF Winter Conference on Applications of Computer Vision, 2023, [3] Lihe Yang, Wei Zhuo, Lei Qi, Yinghuan Shi, and Yang Gao. St++: Make selftraining work better for semi-supervised semantic segmentation. IEEE/CVF International Conference on Computer Vision and Pattern Recognition (CVPR), 2022, [4] Shikun Liu, Shuaifeng Zhi, Edward Johns, and Andrew J Davison. Bootstrapping semantic segmentation with regional contrast. International Conference on Learning Representations, 2022, [5] Xie, S., Feng, Z., Chen, Y., Sun, S., Ma, C. and Song, M. Deal: Difficulty-aware active learning for semantic segmentation. Asian Conference on Computer Vision, 2020