Semantic Segmentation in Aerial Imagery Using Multi-level Contrastive Learning with Local Consistency

Supplementary Material

1 Pseudo-cloud Augmentation

One of the contribution of our paper is to propose the pseudo cloud noise method as an addition of data augmentation. The details of this algorithm has been showed in Algorithm 1. The random functions (denoted with random.int (rand.int) for random integer in range (x,y) or random float (rand.float) which returns a random float, if parameters are provided then argument 1 is the center of the distribution, argument 2 is the standard deviation, and argument 3 is the number of samples) were used from numpy.

Algorithm 1 Pseudo-cloud noise algorithm

$cluster \leftarrow 10$
$cluster_{size} \leftarrow 250$
$cluster_{samples} \leftarrow 1000$
$max_x, max_y \leftarrow 256, 256$
$cent_x \leftarrow rand.int(0, max_x)$
$cent_y \leftarrow rand.int(0, max_y)$
$scale_x \leftarrow rand.int(10, cluster_{size})$
$scale_y \leftarrow rand.int(10, cluster_{size})$
while $cluster \neq 0$ **do**
  $sample_x \leftarrow rand.float(cent_x, scale_x, cluster_{size})$
  $sample_y \leftarrow rand.float(cent_y, scale_y, cluster_{size})$
  if $sample_y or sample_x \geq 255$ **then**
    $sample_y or sample_x \leftarrow 255$
  end if
  for $i \leftarrow 1$ in $cluster_{samples}$ **do**
    if N is odd **then**
      $Pixel_{RBG} * rand.float(0.5, 1)$
      if $Pixel_{RBG} \geq 255$ **then**
        $Pixel_{RBG} \leftarrow 255$
      end if
    end if
  end for
  $cluster \leftarrow cluster - 1$
end while

2 Segmentation Results in 4.2

Here, we show more details, the semantic segmentation results, about the experiments for Comparison with State-of-the-Art. In following contents, we showed the raw image; ground truth; the supervised semantic segmentation results with DeepLab V3+; the best result among the contrastive learning methods for natural images, including MoCo V2, SimCLR, BYOL, SimSiam; the result of GLCNet; and the result of the proposed method mCL-LC.

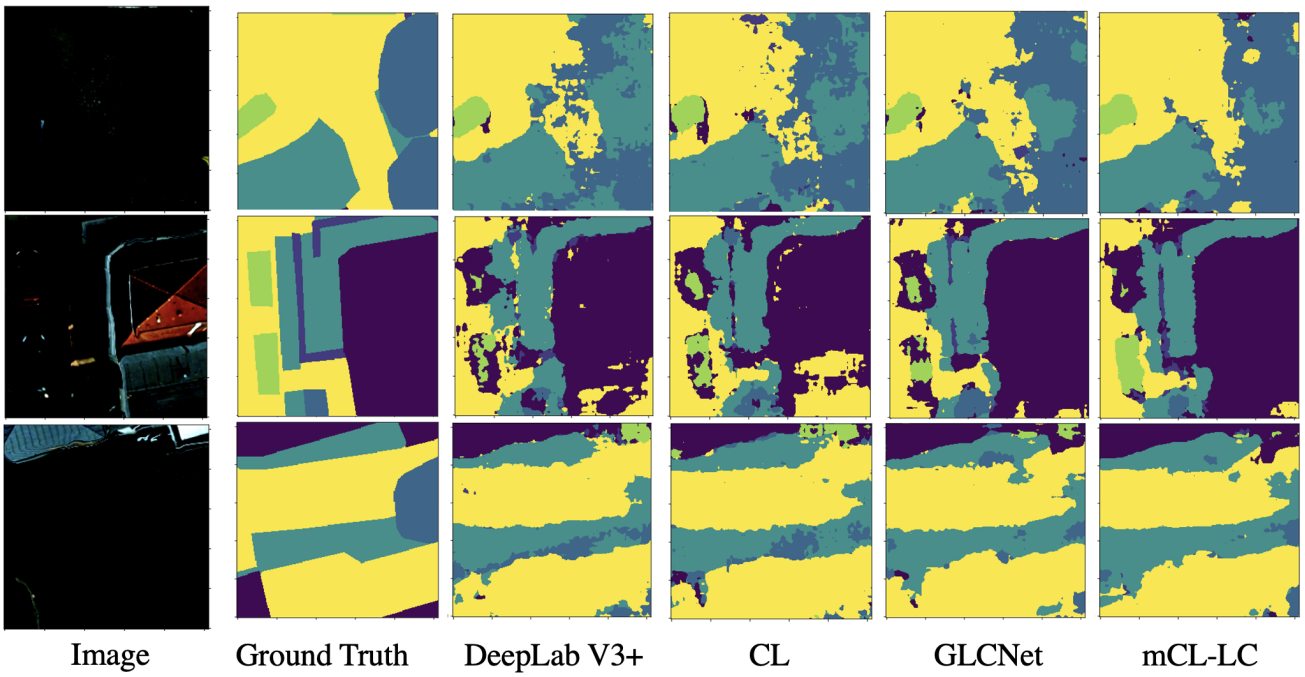

Figure 1: Segmentation results in Potsdam dataset

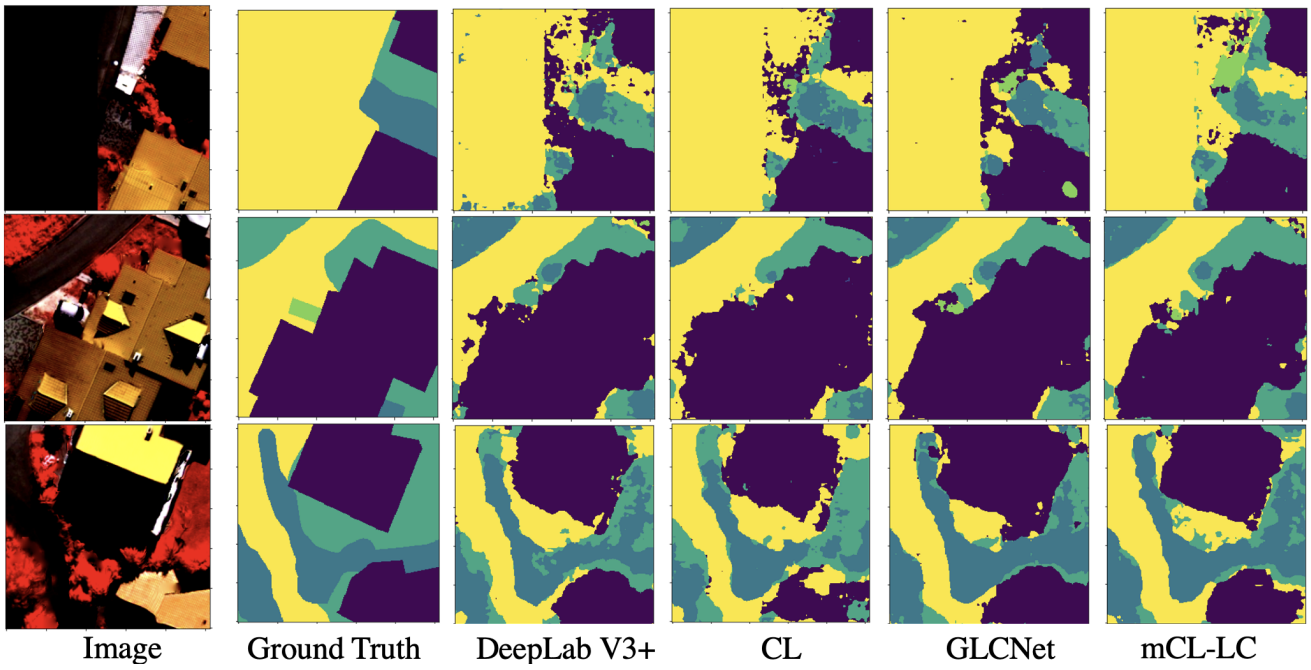

Figure 2: Segmentation results in Vaihingen dataset

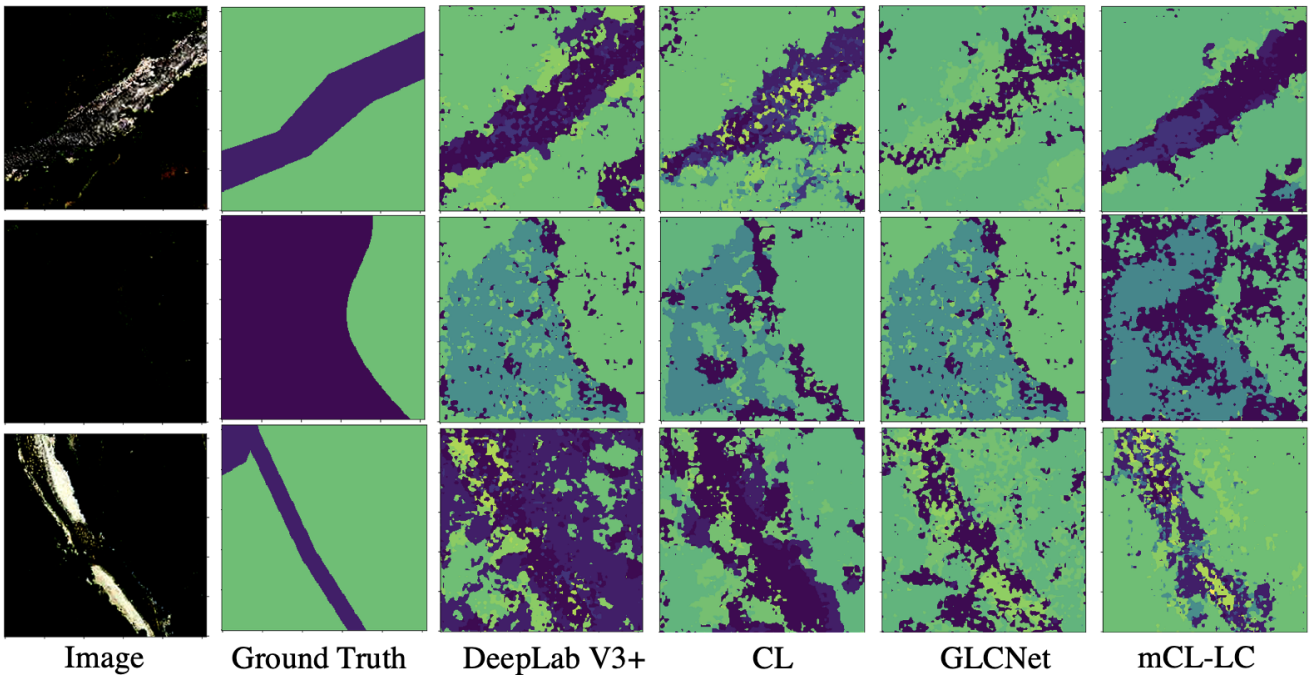

Figure 3: Segmentation results in Nice dataset

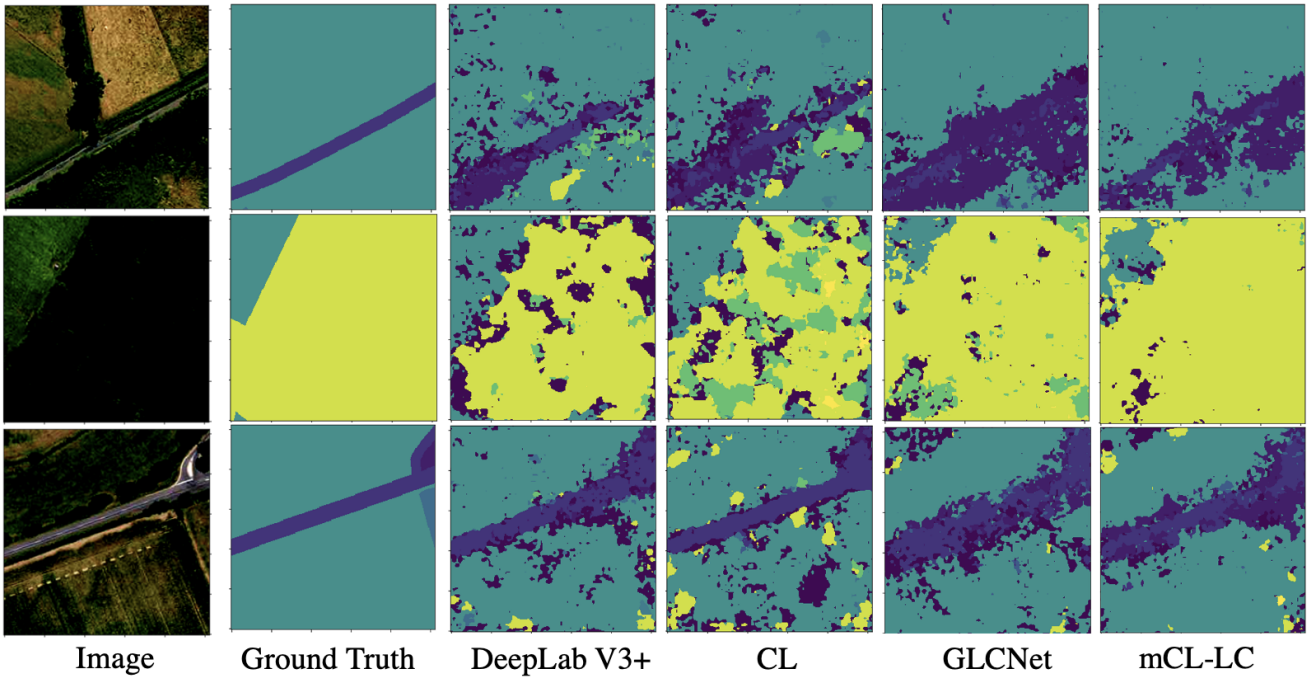

Figure 4: Segmentation results in Nantes Saint dataset