Weakly Supervised Histopathology Image Segmentation

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2021.10.08.

Classification with VGG-16

Classification	Generate CAM	Generate pseudo Segmentation label	Segmentation

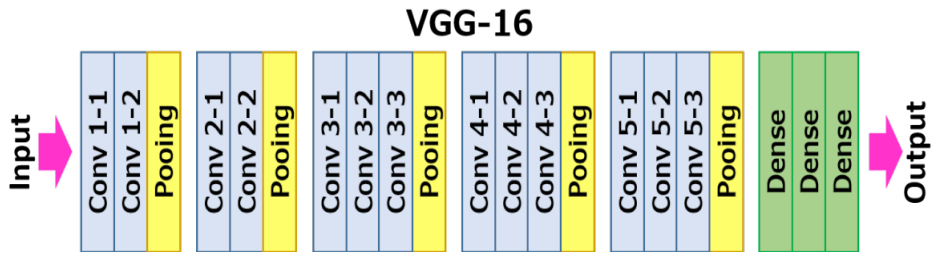
Malignant

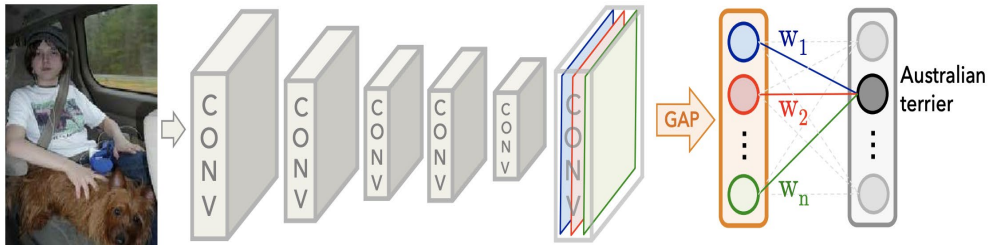
- 9 patients (1424 Images)
- train: 8 patients (1252 Images)
- valid: 1 patients (172 Images)

Normal

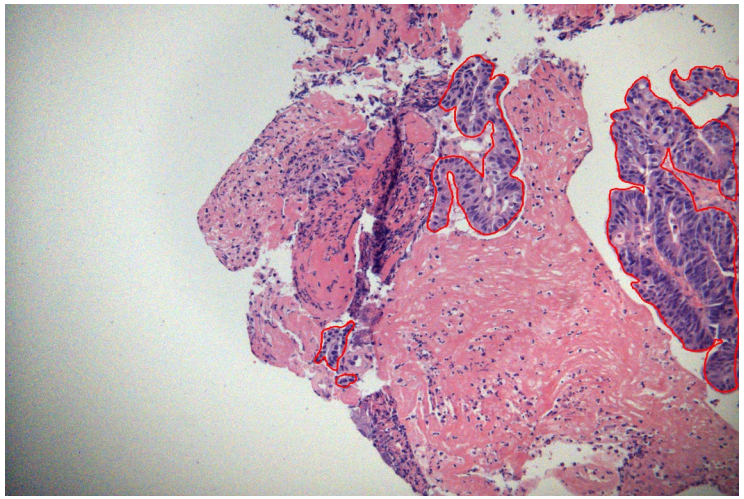
- 9 patients (1106 Images)
- train: 8 patients (960 Images)
- valid: 1 patients (146 Images)

- train: 2212 Images
- valid: 318 Images

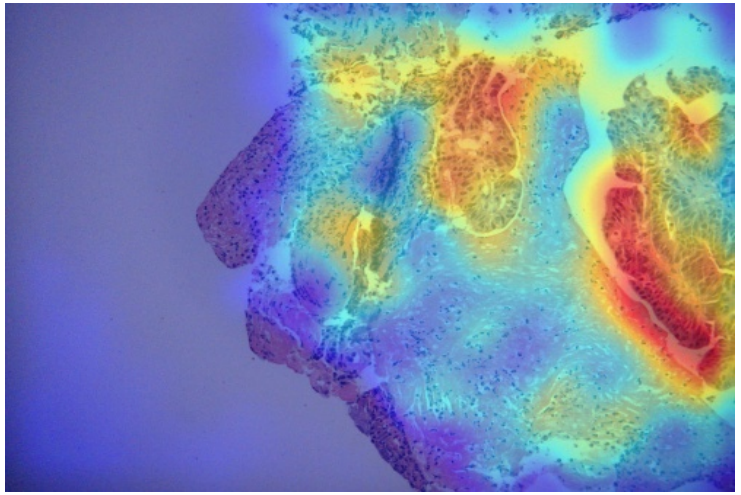




CAM (Class Activation Map) + Pseudo Label Generation



Ground Truth



CAM

Ground Truth

Pseudo Label

Most weakly supervised models tried to expand the region of CAM because it is discriminative and sparse.

→ However, these models tend to grab all of the inner area as a label.

Class Activation Map

↓

Confidence threshold

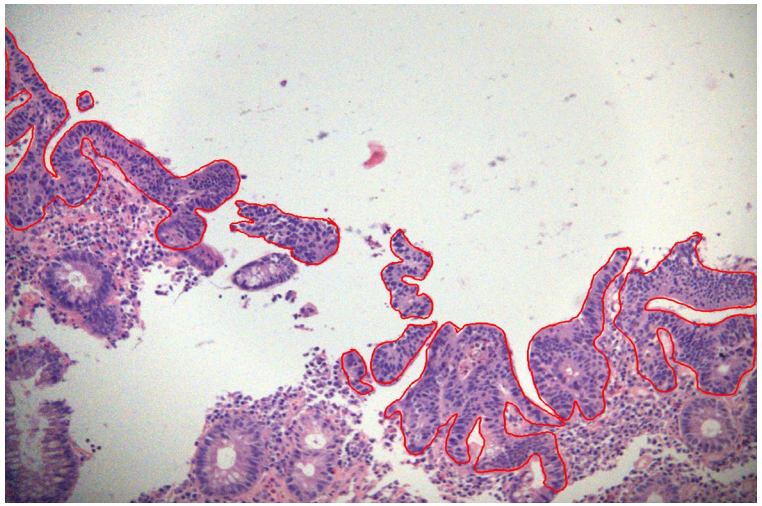
↓

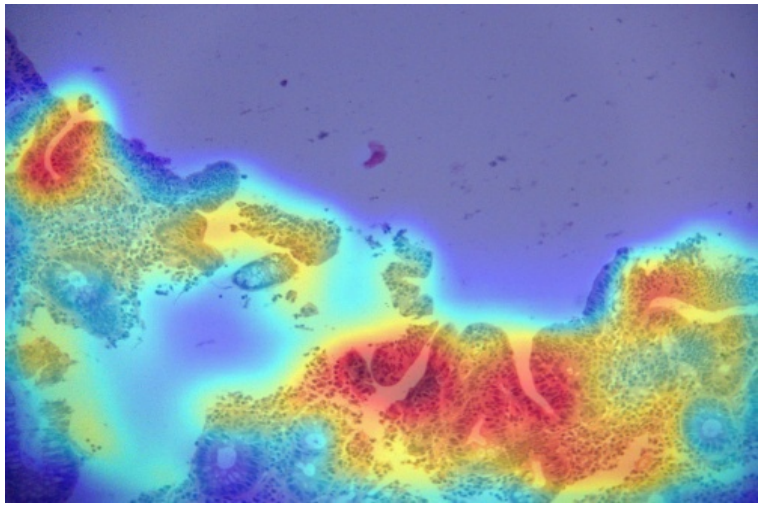
Confident activation map

↓

Generate pseudo segmentation label

CAM (Class Activation Map) + Pseudo Label Generation





Class Activation Map

↓

Confidence threshold (= 0.70)

↓

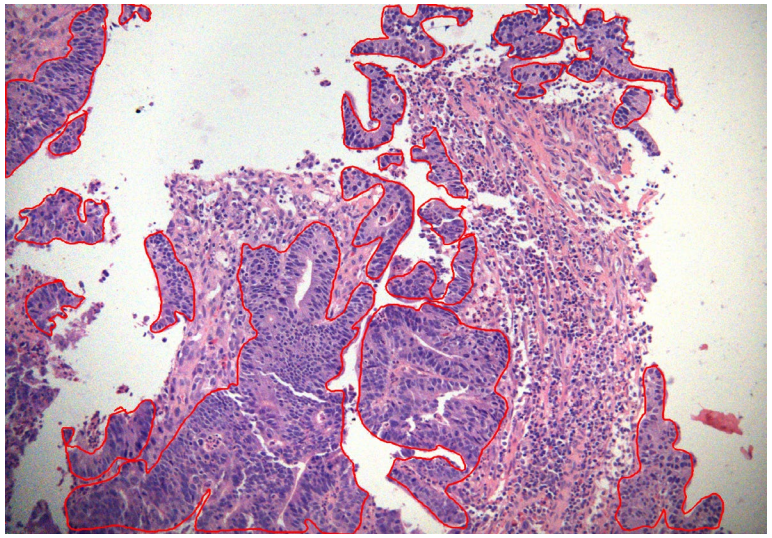
Confident activation map

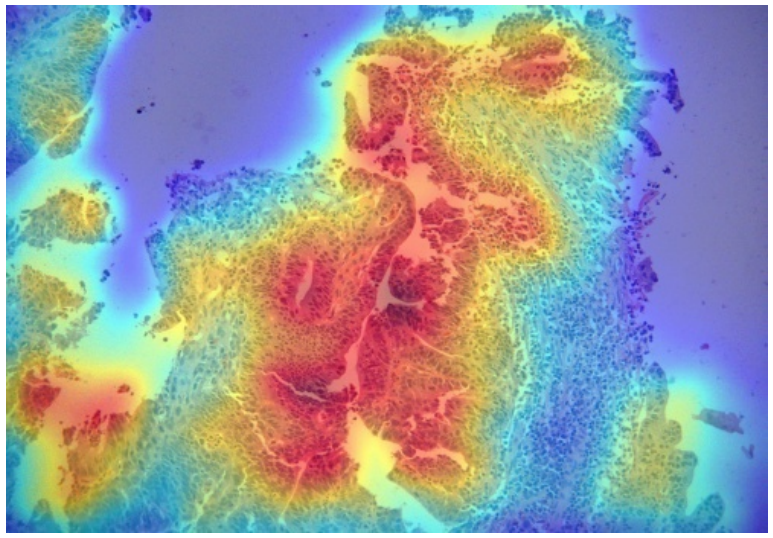
↓

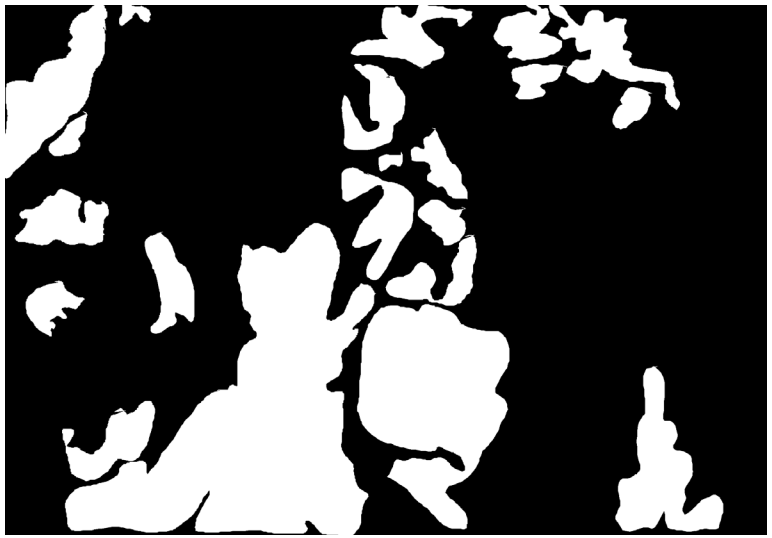
Generate

pseudo segmentation label

CAM (Class Activation Map) + Pseudo Label Generation







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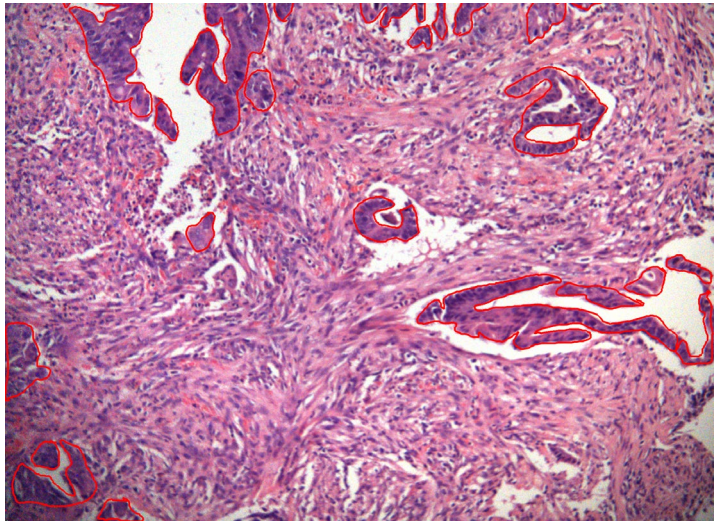

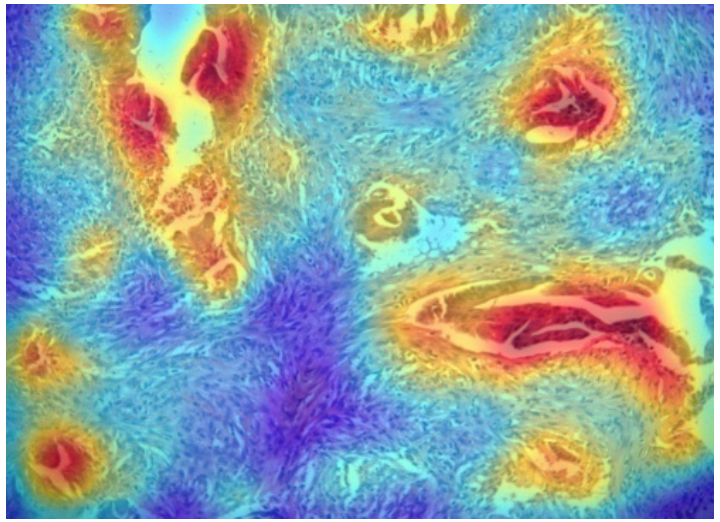

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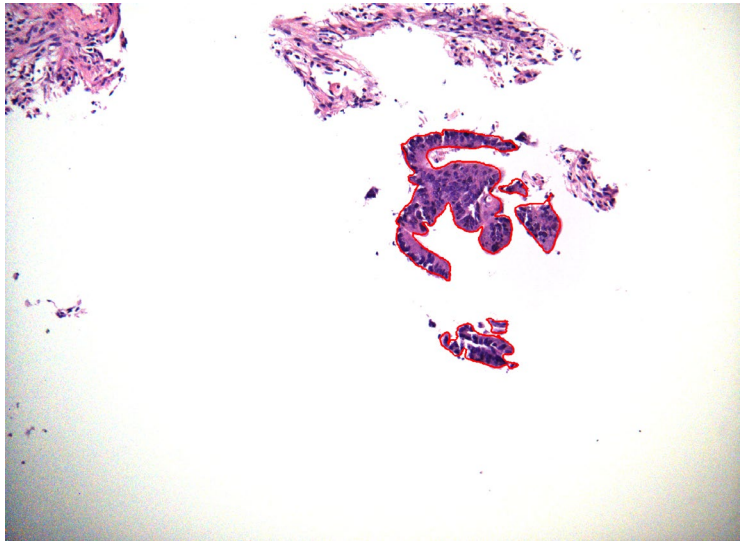

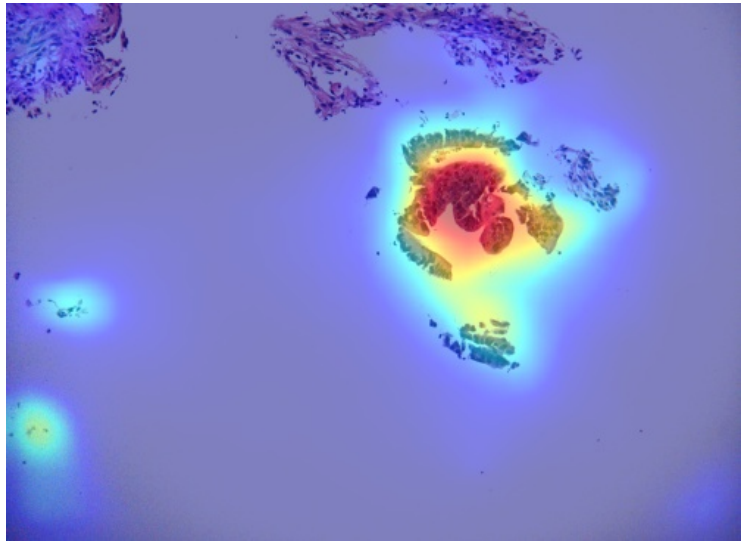

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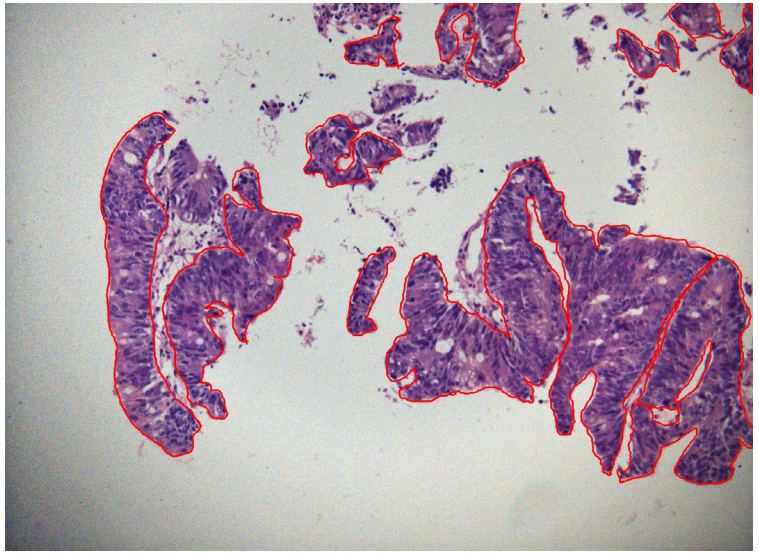
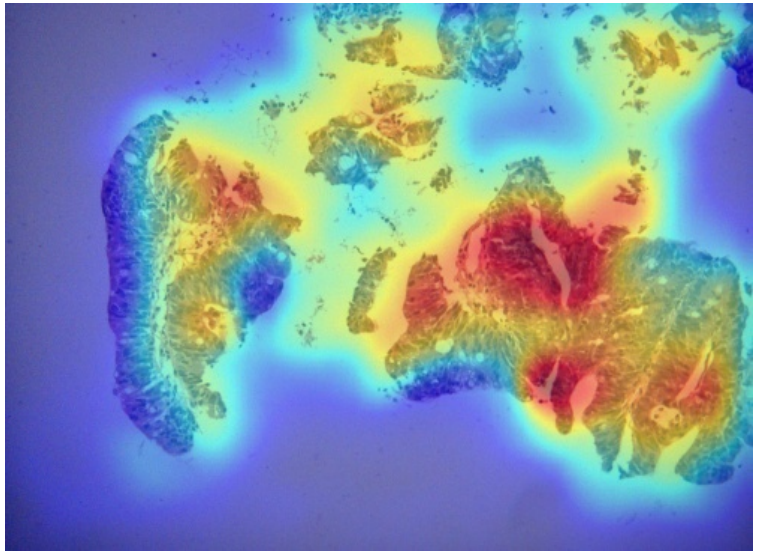
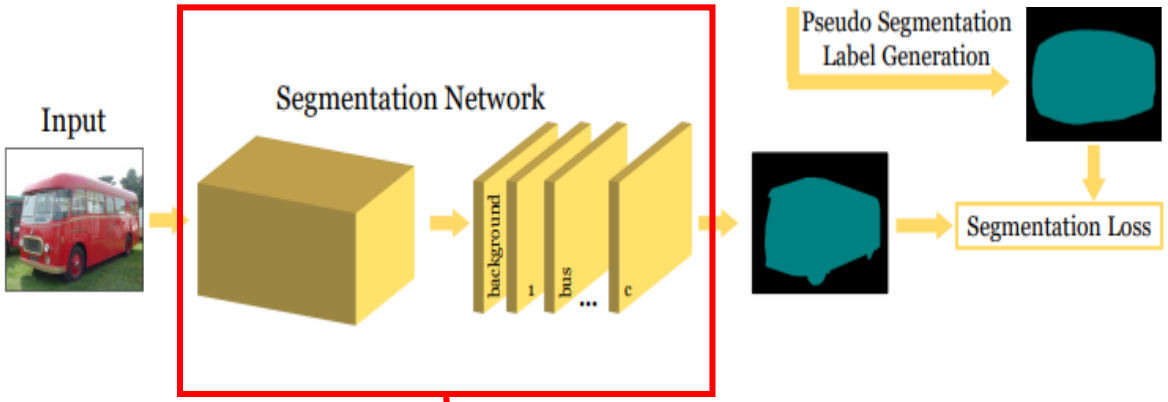
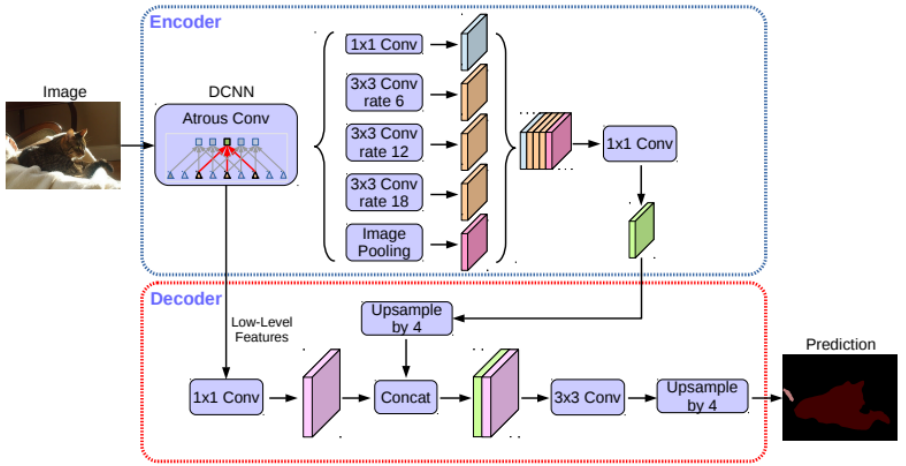




Training DeepLab V3+ with pseudo segmentation labels





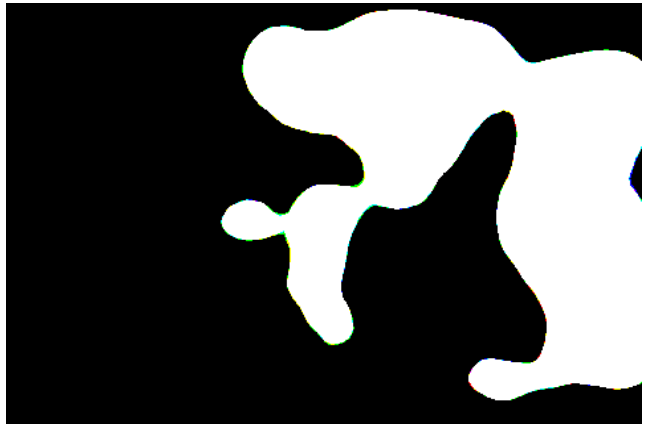
DeepLab V3 +

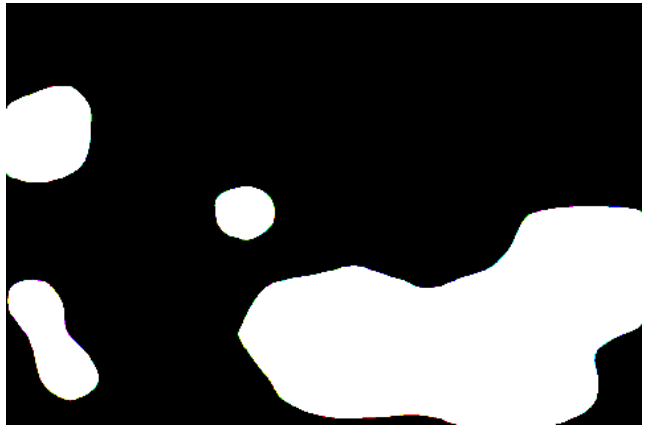
Training DeepLab V3+ with pseudo segmentation labels

Ground Truth

Pseudo Label

Prediction





Training DeepLab V3+ with pseudo segmentation labels

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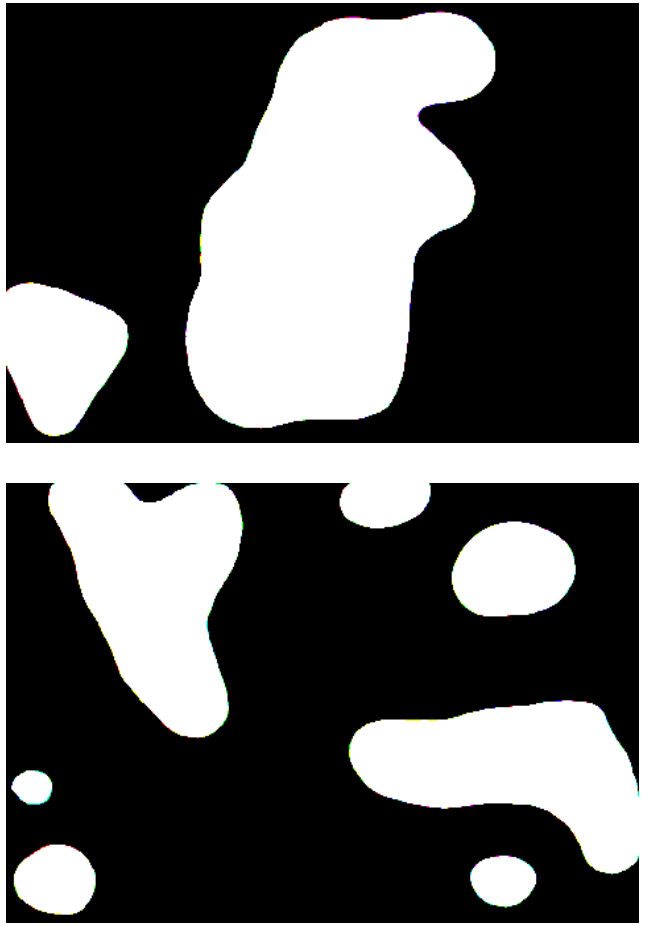

Training DeepLab V3+ with pseudo segmentation labels

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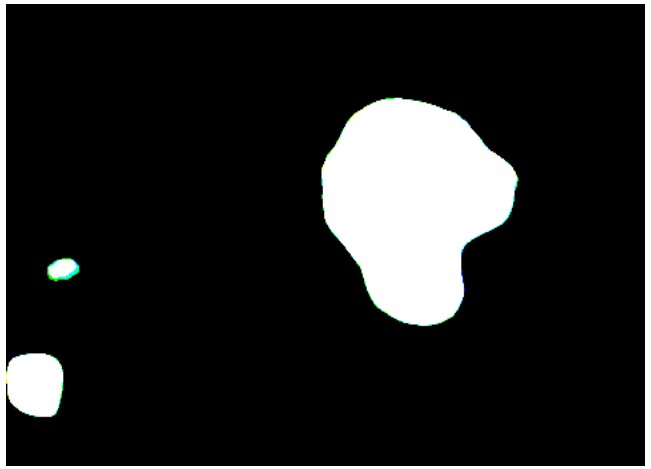

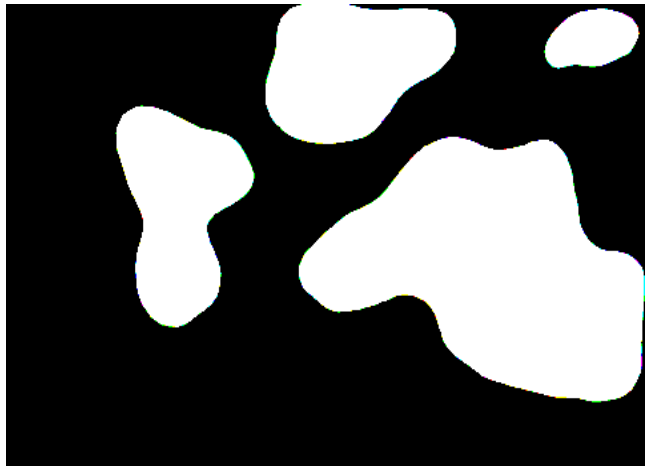

Main Points

- ✓ **Classification quality**
  - → Evidence accuracy is as important as classification accuracy
  - → Define new loss
- ✓ **Analysis of misclassified cases**
  - → improve classification accuracy and CAM
- ✓ **Region of CAM is too broad**
  - → Decreased detail of boundaries
- ✓ **Do not use Class Activation Map**
  - → Graph Convolutional Network