

Weakly Supervised Histopathology Image Segmentation

김태미
2021.11.05.

Classification with VGG-16

Malignant

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

Normal

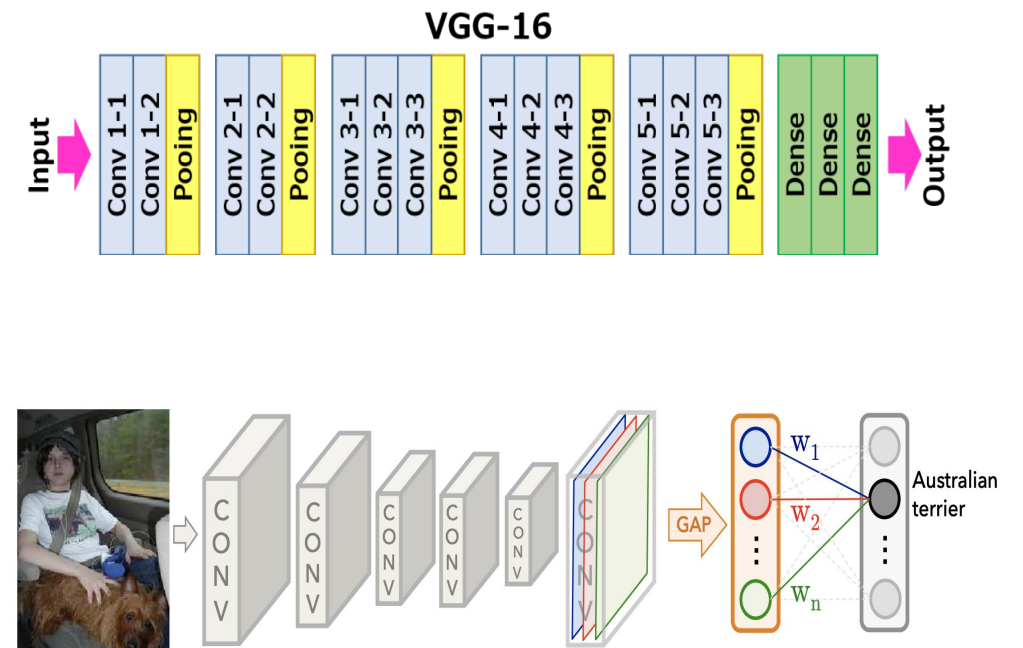
- 9 patients (1106 Images)
- train: 8 patients (960 Images)
- valid: 1 patients (146 Images)

- train: 2212 Images
- valid: 318 Images

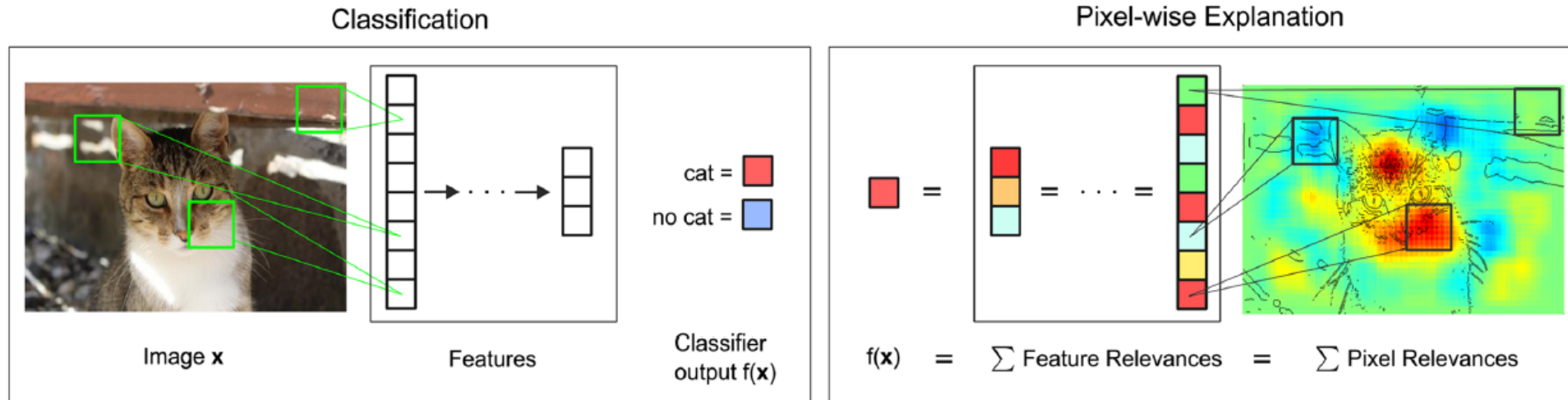
Classification

Generate
pseudo
Segmentation label

Segmentation



Layer-Wise Relevance Propagation (LRP)



Pixel-wise decomposition

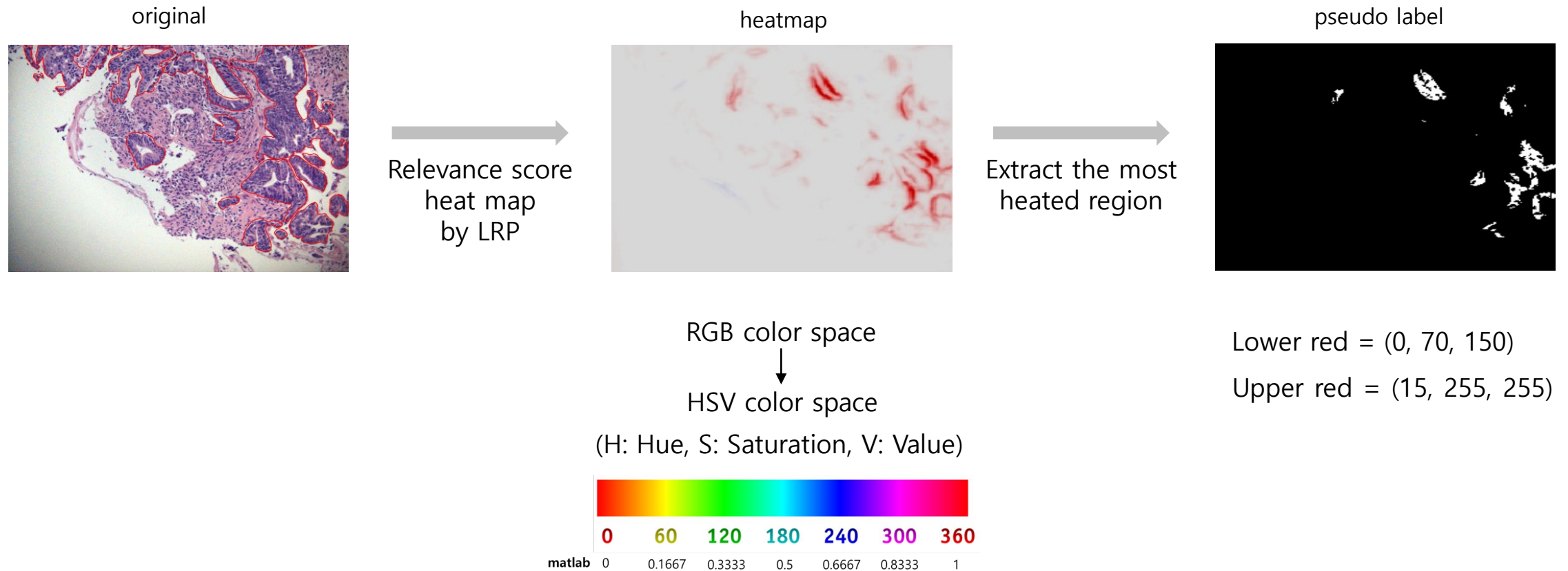
- Decomposes the classification output $f(x)$ into sums of feature and pixel relevance score
- Relevance score: contribution of a single pixel of an image x to the prediction $f(x)$ made by a classifier f in an image classification task

$$f(x) \approx \sum_{d=1}^V R_d \quad , \quad \text{if } f(x) > 0: \text{malignant}$$

$$f(x) < 0: \text{no malignant}$$

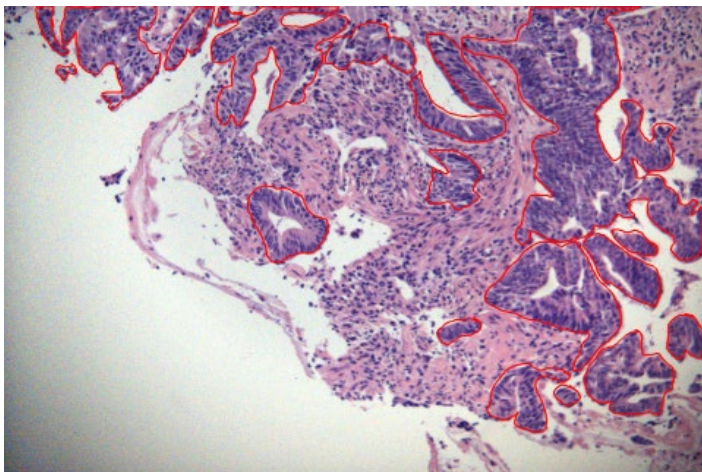
$$f(x) = \dots = \sum_{d \in l+1} R_d^{(l+1)} = \sum_{d \in l} R_d^{(l)} = \dots = \sum_d R_d^{(1)}$$

Pseudo Label Generation

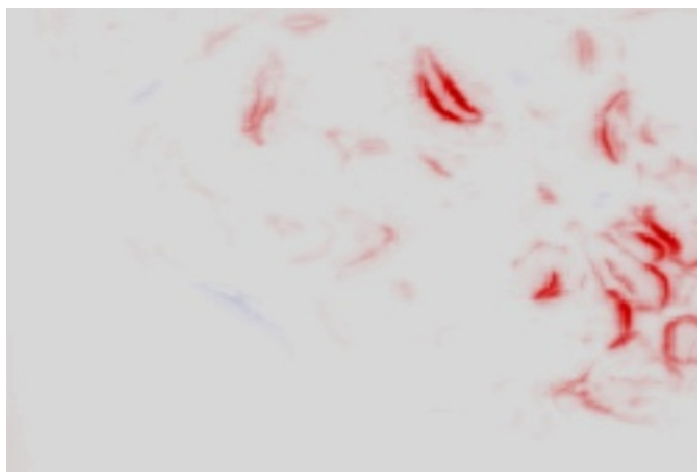


Results1 (DeepLab V3+ with pseudo labels)

original



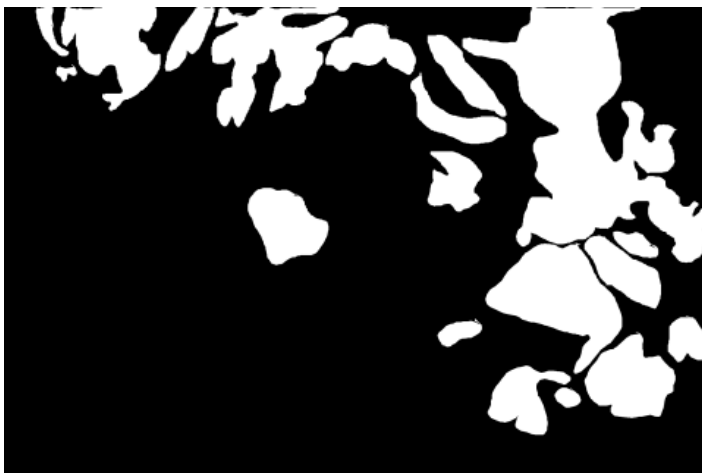
heatmap



pseudo label



Ground truth



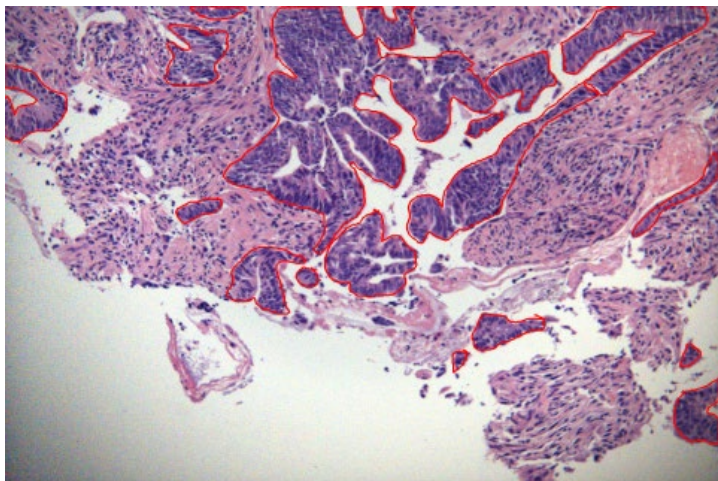
prediction



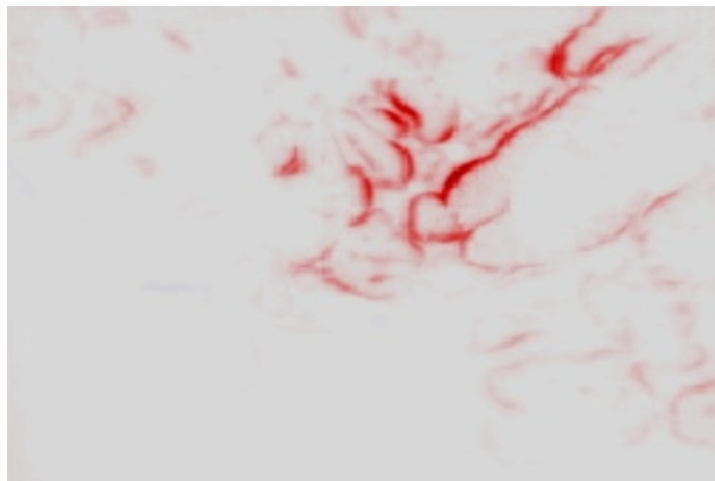
The heatmap on the border line
tends to be strong
→ Capture the change at the boundary
between the normal and abnormal parts?

Results1

original



heatmap



pseudo label



Ground truth

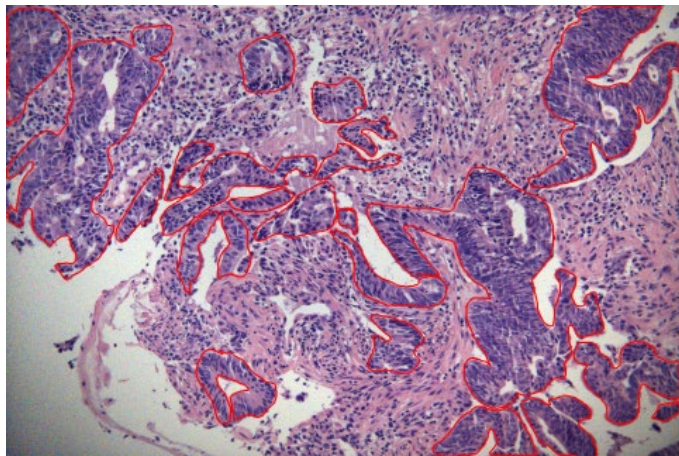


prediction

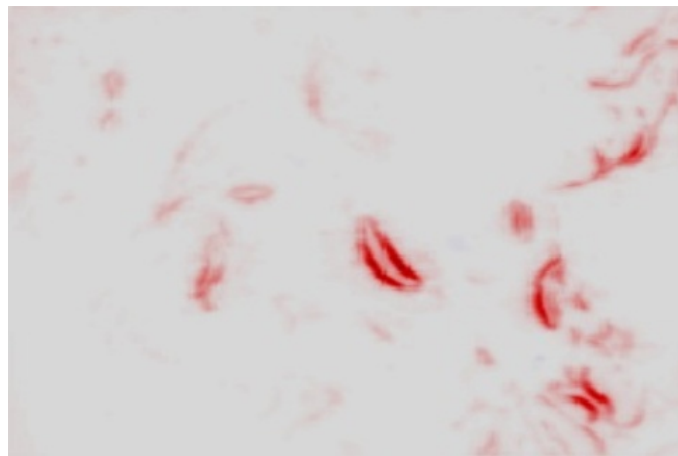


Results1

original



heatmap



pseudo label



Ground truth

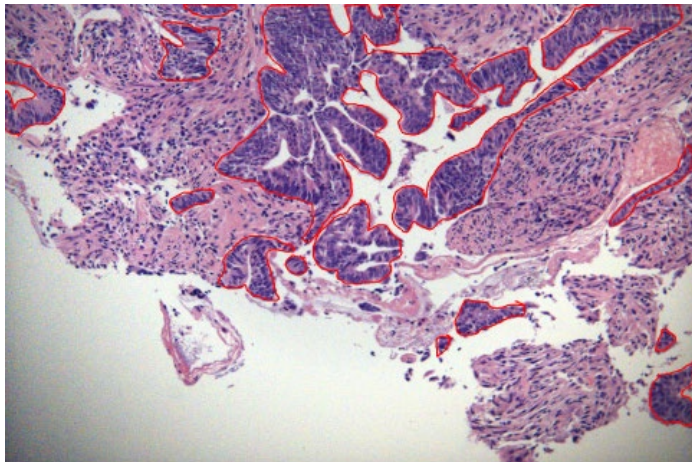


prediction

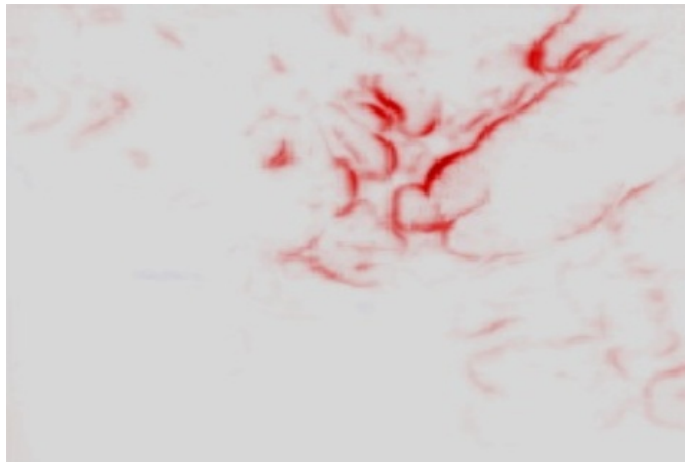


Results1

original



heatmap



pseudo label



Ground truth

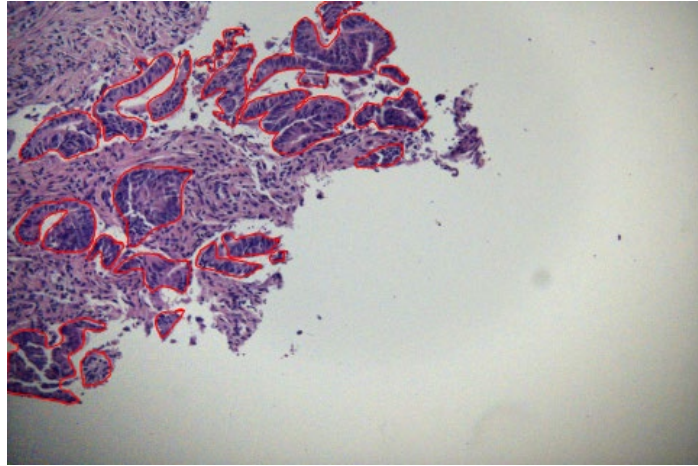


prediction

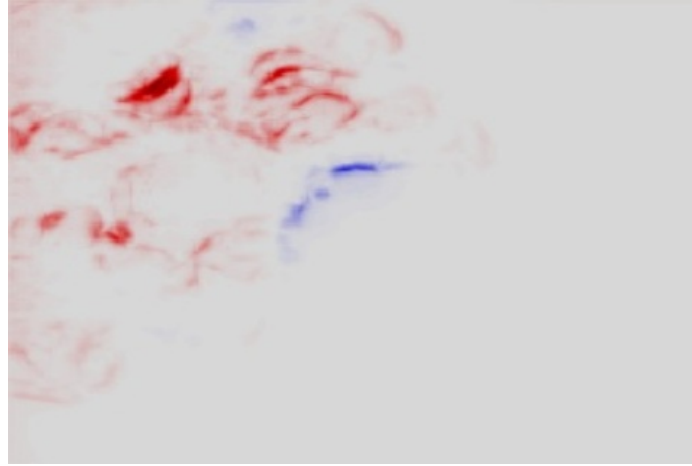


Results1

original



heatmap



pseudo label



Ground truth

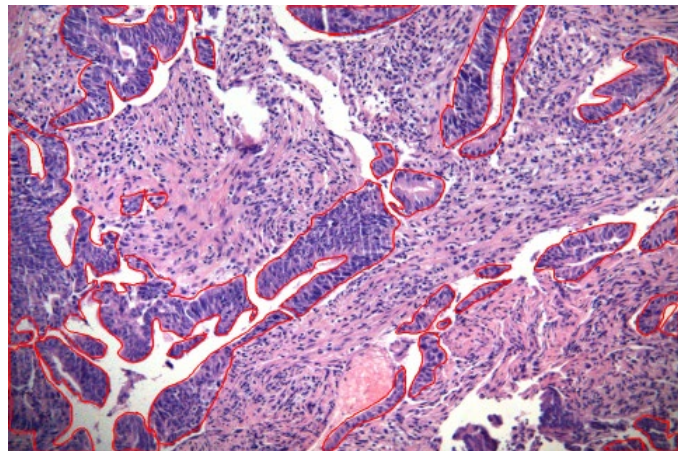


prediction

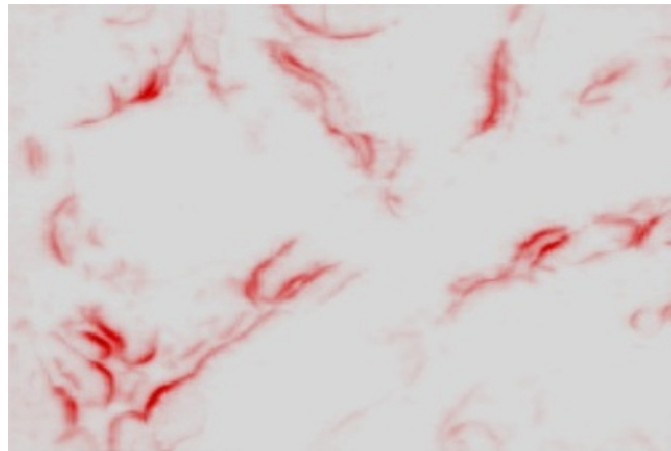


Results1

original



heatmap



pseudo label



Ground truth

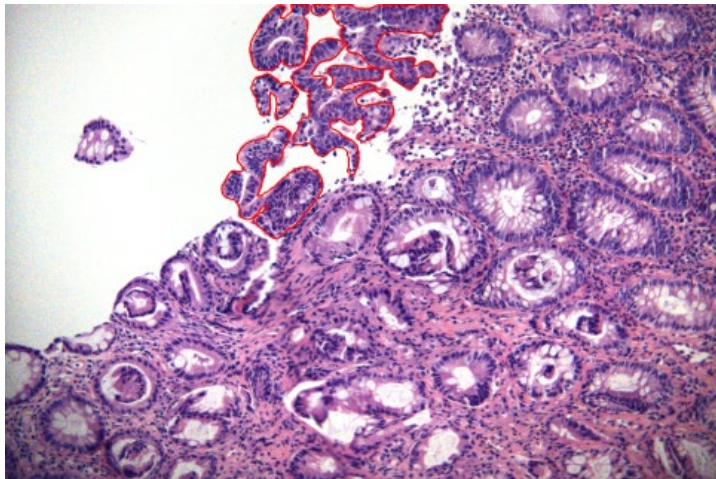


prediction

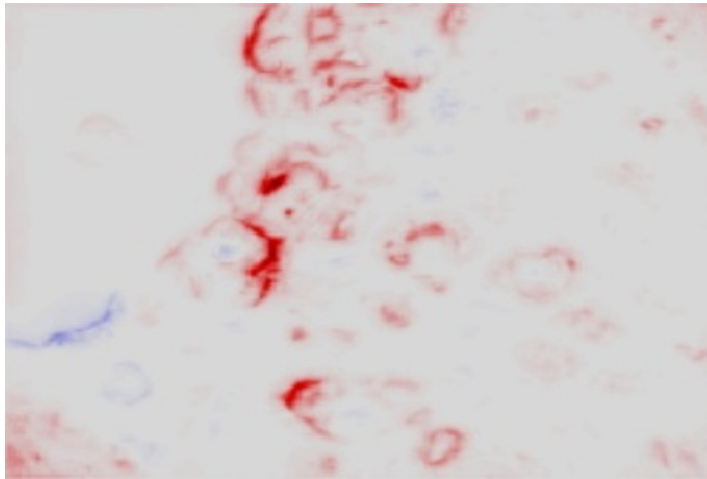


Results2

original



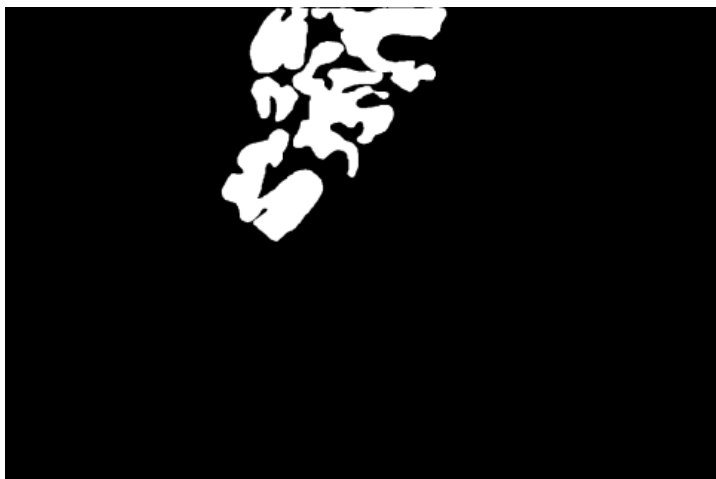
heatmap



pseudo label



Ground truth



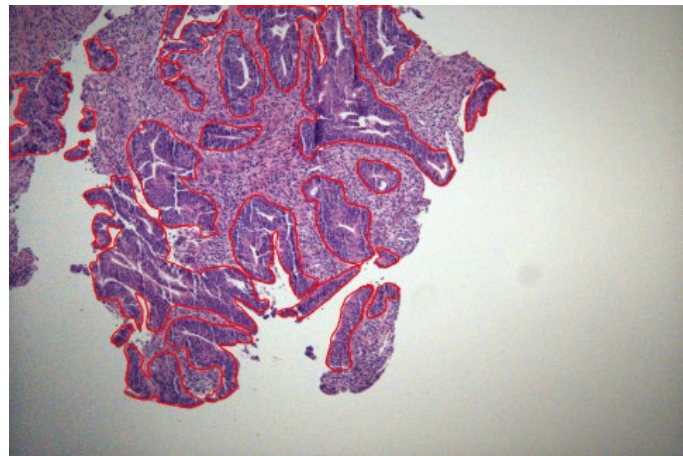
prediction



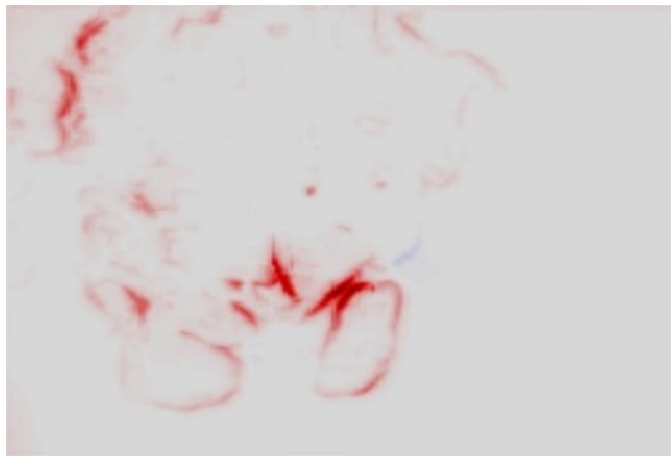
The tendency to segment
the gland part

Results2

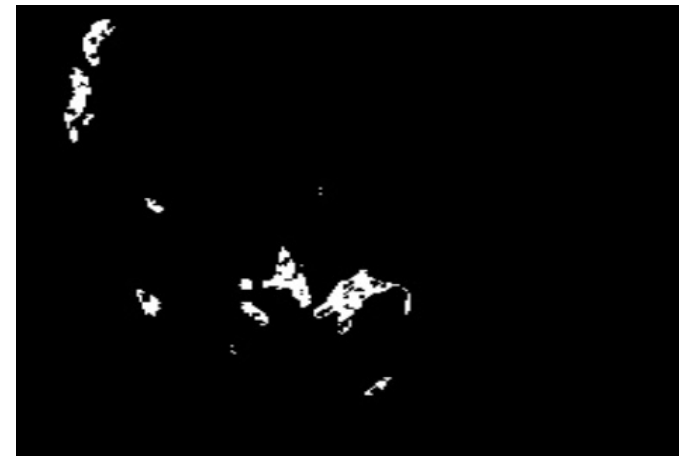
original



heatmap



pseudo label



Ground truth



prediction

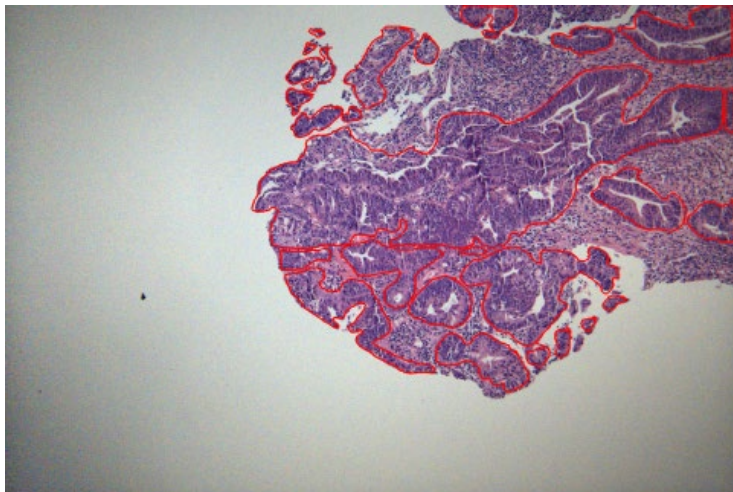


limitation of Relevance score map

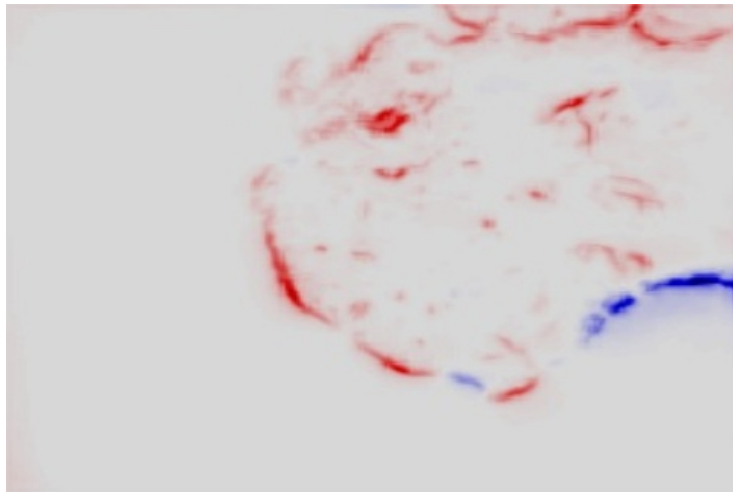
→ model for expanding the
relevance score map

Results2

original



heatmap



pseudo label



Ground truth



prediction



To do...

- ✓ Graph CNN with super-pixels in the image
- ✓ Improve the LRP model with more training images
- ✓ Relevance map → pseudo label
 - : inter-pixel relation?
 - : deep seeded region growing?
 - : random dropout?
- ✓ Segmentation: data augmentation