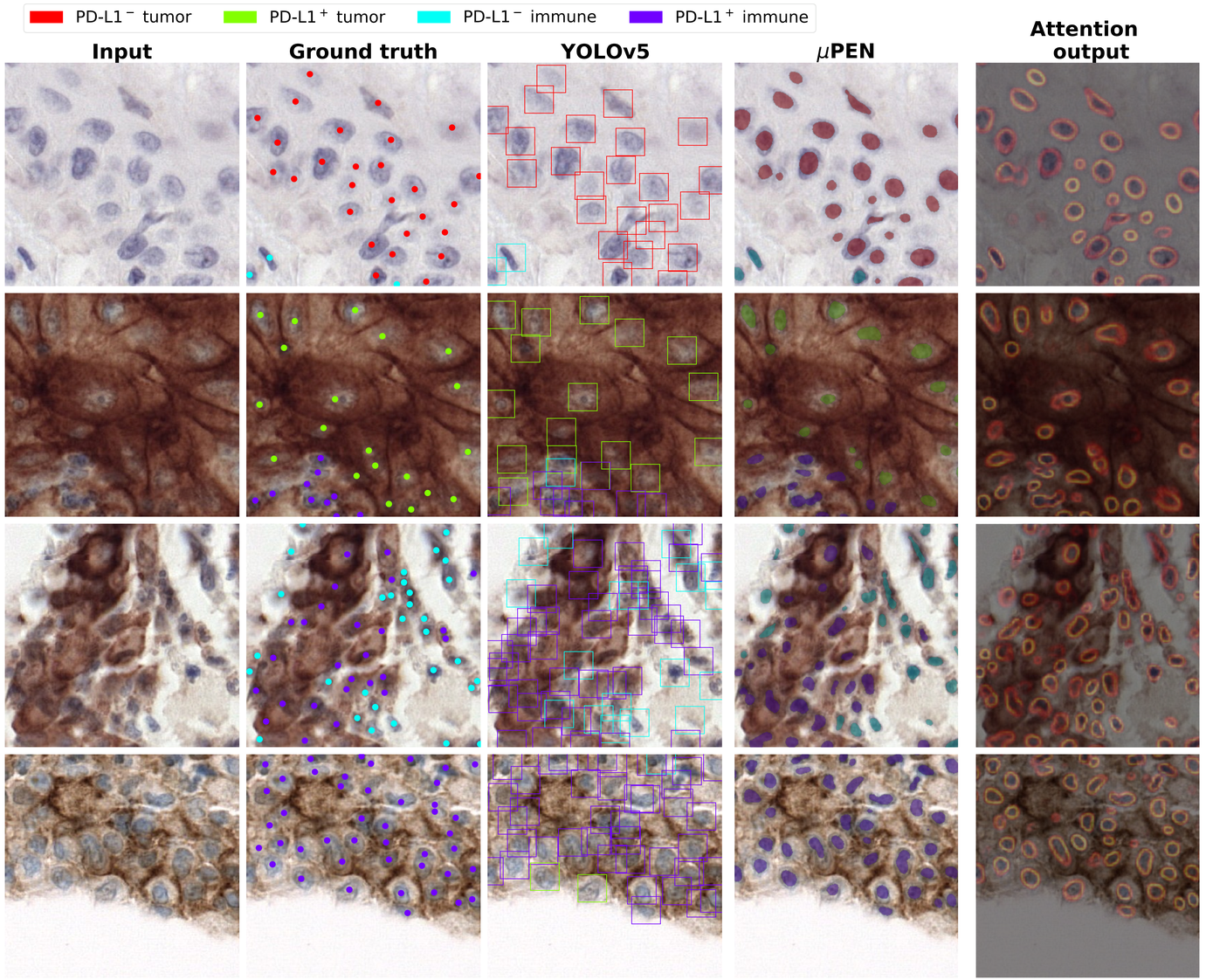
We show that the output of a

multi-class PseudoEdgeNet

can be leveraged for **detecting** cells with **PD-L1 expression** in lung cancer histopathology images.

Detection results



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Institute for Health Sciences
Radboudumc

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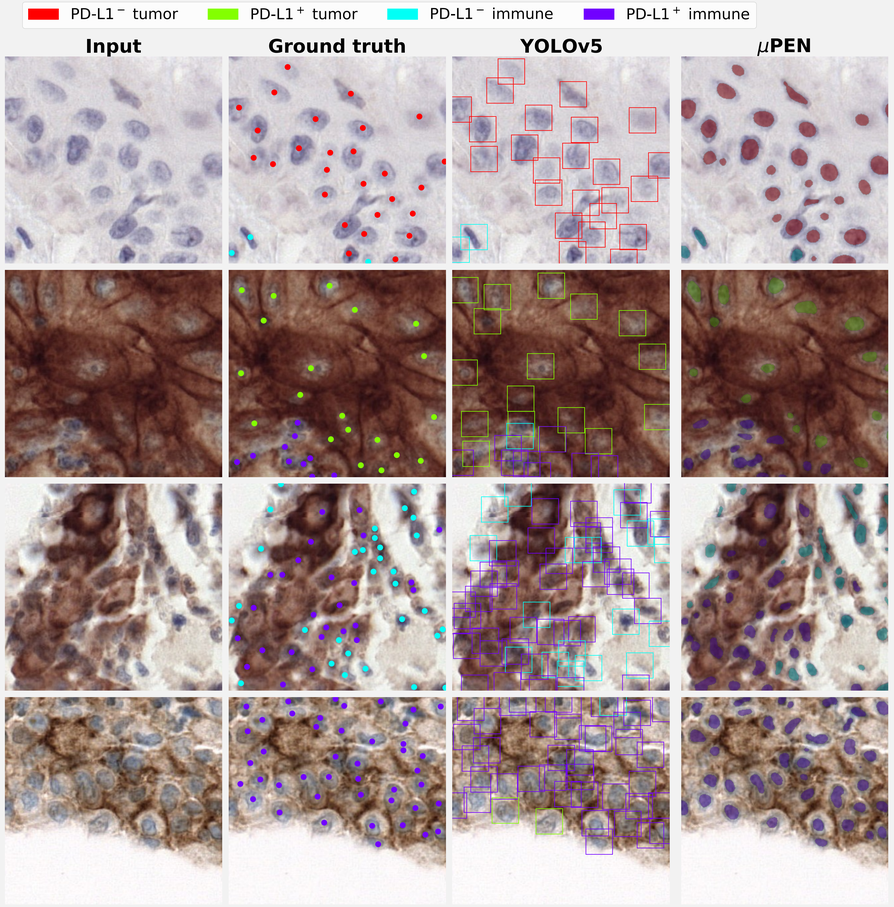
*μ*PEN: Multi-class PseudoEdgeNet for PD-L1 assessment

Towards automatic tumor proportion score estimation in lung cancer histopathology

Jeroen Vermazeren, Leander van Eekelen, Luca Dulce Meesters, Monika Looijen-Salamon, Shoko Vos, Enrico Munari, Caner Mercan, Francesco Ciompi

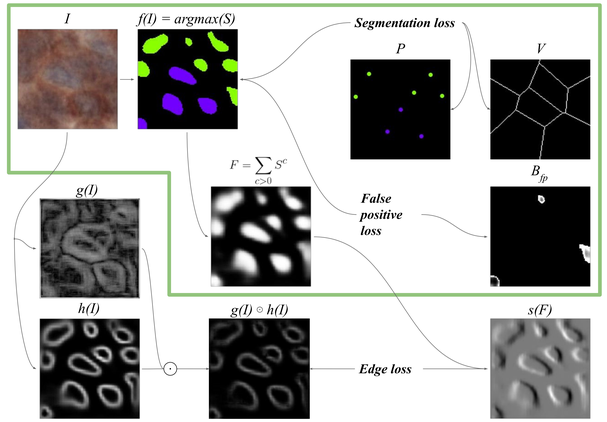
Detection results



Introduction

We take the recently presented **PseudoEdgeNet** model to the level of multi-class cell segmentation in histopathology images solely trained with **point annotations**.

We tailor its loss function to the challenges of **multi-class segmentation** and equip it with an additional false positive loss term. We evaluate it on the detection of tumor and immune cells in **PD-L1** stained non-small cell lung cancer (NSCLC) histopathology images, and compare it with a 'off-the-shelf' **YOLOv5**.



Method

We updated PseudoEdgeNet (PEN) to multi-class and expanded by introducing a false-positive loss term. Similar to PEN, our network consists of a segmentation network *f*, edge network *g*, and attention network *h*.

Inspired by previous work, we introduced the false-positive loss that promotes specificity. We evaluated our method on the assessment of tumor and immune cells in PD-L1 stained lung cancer images and compare it with YOLOv5 using the F1 score. A detection is a hit when an annotation is within a 4μm distance.

Data

- ❑ N=39 whole-slide NSCLC histopathology images from 33 patients, stained for PD-L1 and digitized at 40x magnification
- ❑ 87 point-wise annotated regions of interest of 250 x 250 μm
- ❑ 4 classes
- ❑ Input patches of 512 x 512px at 0.25 μm/px

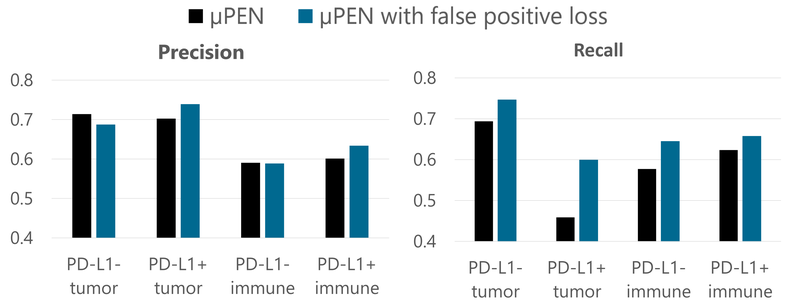
Results

Method	F1 macro average
*μ*PEN	0.611
*μ*PEN with false positive loss	0.653
YOLOv5	0.598

Discussion

Our results show that *μ*PEN employed with a false positive loss term performs best with respect to multi-class cell detection and thus outperforms YOLOv5.

The output of *μ*PEN can potentially power automated TPS assessment via cell localization and classification, as well as future biomarker research based on spatial interaction, size and morphology of different cell types without the need to train with manual annotations of cell boundaries.



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