

CVPR 2019

Collaborative Learning of Semi-Supervised Segmentation and Classification for Medical Images

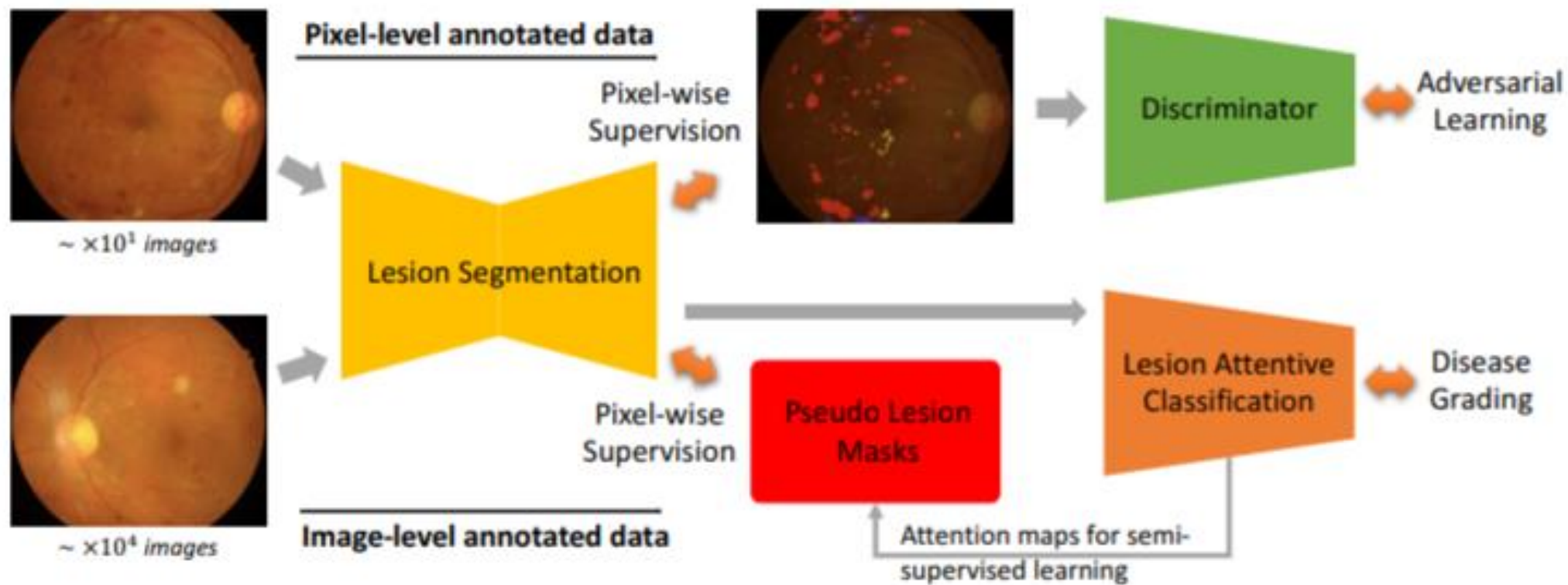
https://openaccess.thecvf.com/content_CVPR_2019/html/Zhou_Collaborative_Learning_of_Semi-Supervised_Segmentation_and_Classification_for_Medical_Images_CVPR_2019_paper.html

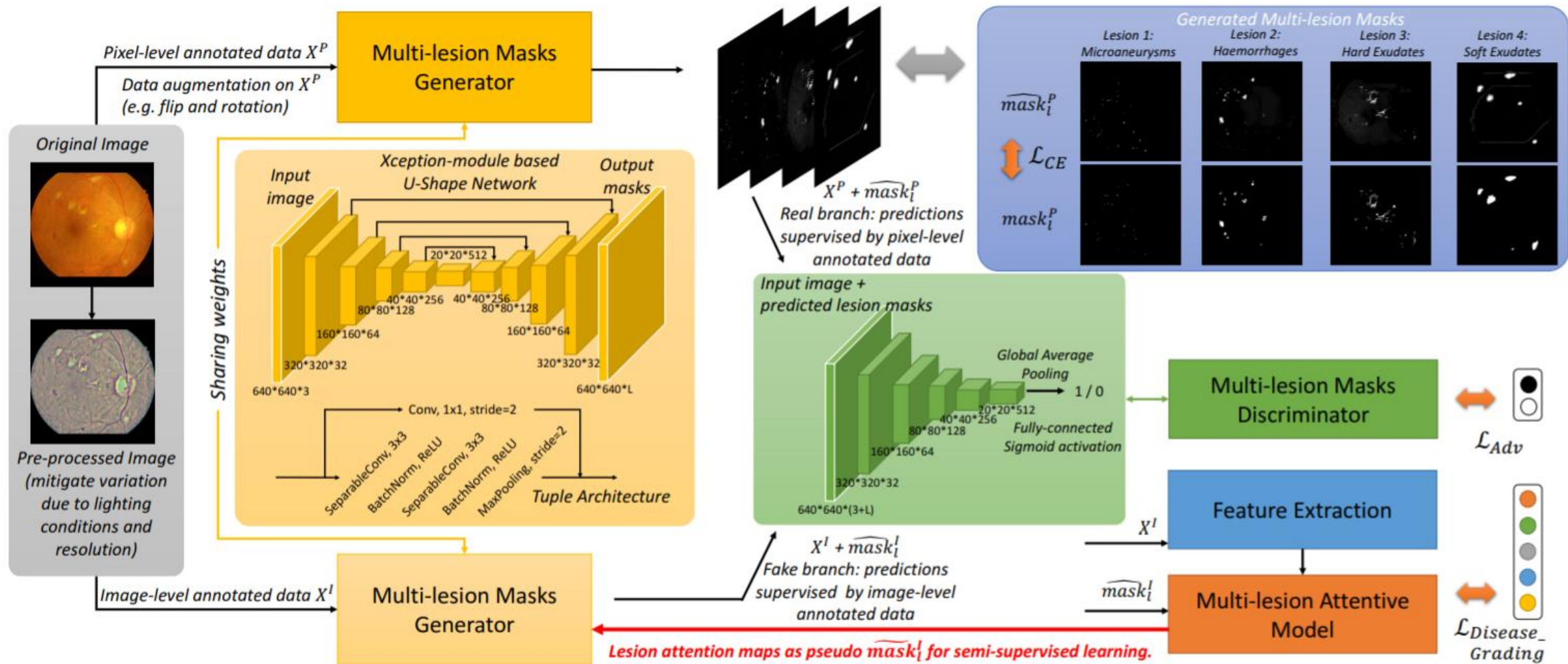
Diabetic Retinopathy (DR)

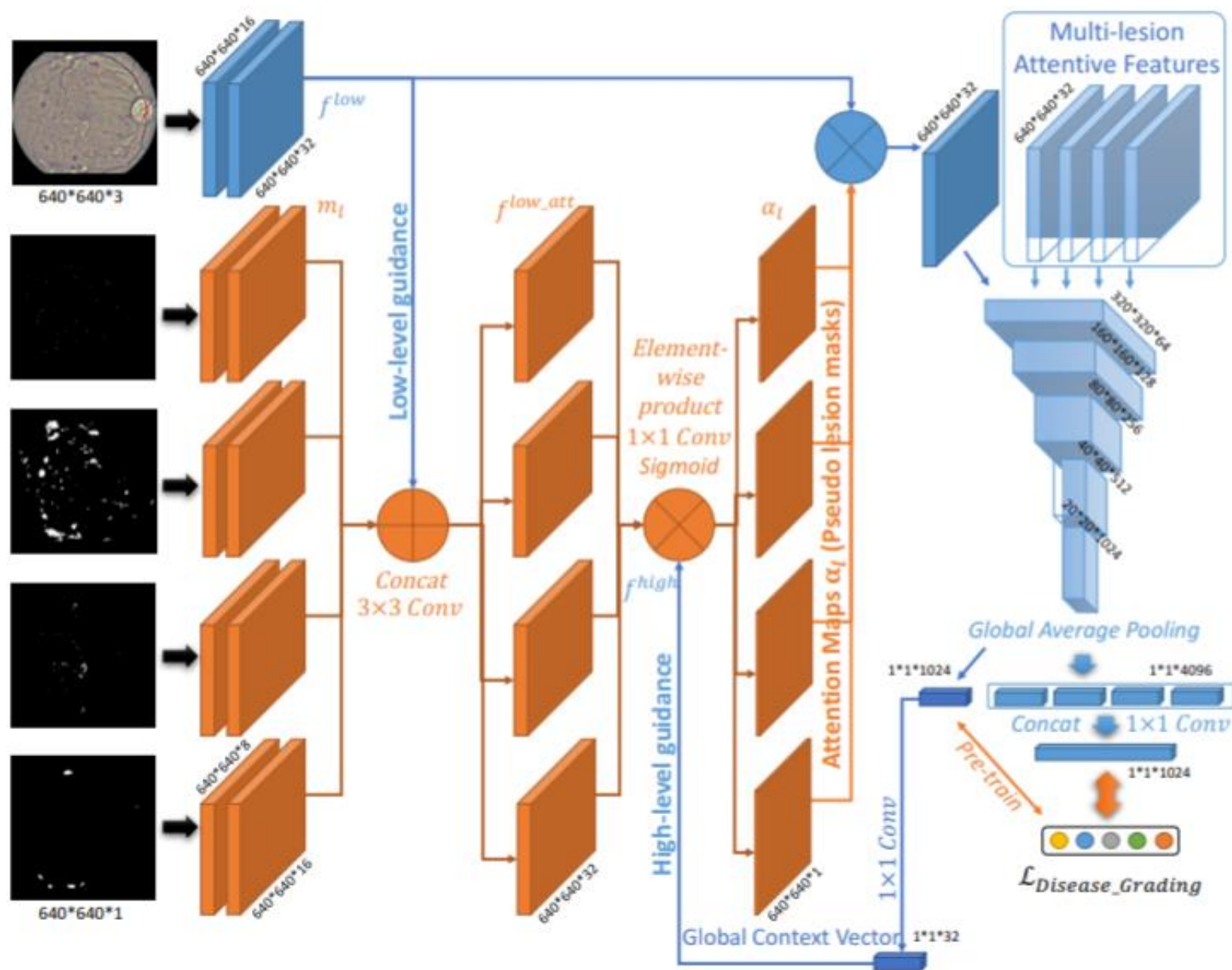
- 糖尿病性视网膜病变
- DR is an eye disease that results from diabetes mellitus, and can lead to blindness. The severity of DR can be graded into **five stages**: normal, mild, moderate, severe non-proliferative and proliferative.
- a collaborative learning method for **disease grading** and **lesion segmentation**

Data Pre-Processing and Augmentation

- unify the image quality
- sharpen the texture details
- horizontal flips
- vertical flips
- rotations







$$\min_G \sum_{l=1}^L \mathcal{L}_{Seg}(G(\mathbf{X}^P), G(\mathbf{X}^I), \mathbf{s}_l^P, \tilde{\mathbf{s}}_l^I),$$

where s_l^P denotes the ground-truth of pixel-level annotated images and \tilde{s}_l^I is the pseudo masks of image-level annotated images learned by the lesion attentive grading model. L is the total number of lesion varieties related to a particular disease.

$$\min_{C, att} \mathcal{L}_{Cls}(C(\mathbf{X}^I) \cdot att(G(\mathbf{X}^I)), \mathbf{y}^I),$$

where $att(\cdot)$ indicates the lesion attention model and \mathbf{y}^I is the disease severity classification label for image-level annotated data.

$$\begin{aligned}
\mathcal{L}_{Seg} &= \mathcal{L}_{Adv} + \lambda \mathcal{L}_{CE} \tag{3} \\
&= \mathbb{E}[\log(D(\mathbf{X}^P, G(\mathbf{X}^P)))] + \mathbb{E}[\log(1 - D(\mathbf{X}^I, G(\mathbf{X}^I)))] \\
&+ \lambda \mathbb{E}[-\mathbf{s} \cdot \log G(\mathbf{X}^{(P,I)}) - (1 - \mathbf{s}) \cdot \log(1 - G(\mathbf{X}^{(P,I)}))],
\end{aligned}$$

where \mathbf{s} is a brief expression of s_l^P and \tilde{s}_l^I for the groundtruths of pixel-level and image-level annotated data, respectively. λ is the balance weight of two objective functions.