基于数据增强与模型融合的病理性近视识别算法

一. 成果完成人及所在单位：张晓云/杨伟斌 光电与通信工程学院 指导教师：熊飞兵/崔建峰

二. 成果简介：

1、Automatic Disease Diagnosis from Fundus Photography.

2、Data Augmentation (DA). Standard Data Augmentation Method; Data Disrupting Method; Data Mixing Method; Data Augmentation Method Based on Reinforcement Learning; Fusion-Based Image Augmentation Method.

三. 主要研究内容及创新点：

The in-depth analysis of the discussed image DA techniques based on fusion has taken Pathologic myopia (PM) images as the research object and convincingly displayed their wide variety of applications.

DA strategy based on multimodal fusion (DAMF) has the advantage of effectively improving the accuracy of model training, and the optimal enhanced set of different datasets can be matched through this strategy. By analyzing the image DA method proposed in this paper, DAMF proves to be better and more effective than other methods. The experiment results have shown that DA still has an optimal complexity in the combination of DAMF. Otherwise, too much complexity may destroy the original features. DAMF can effectively find the best combination of DA, which retains the input images' characteristics and provides better contrast through 12 contrast combinations. It has also been observed that DAMF can train the model to satisfactory results without using transfer learning or other methods. Arguably, DAMF can be used as an effective DA method during the training of CNNs in fundus image processing.

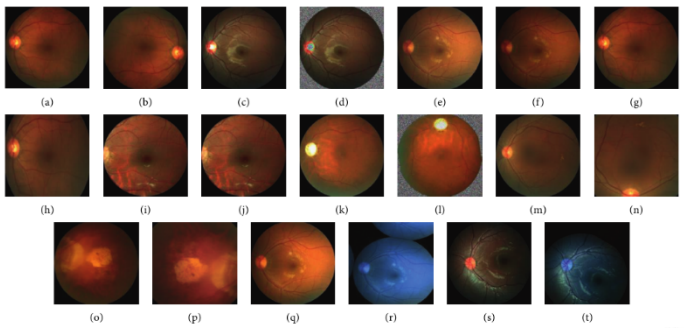
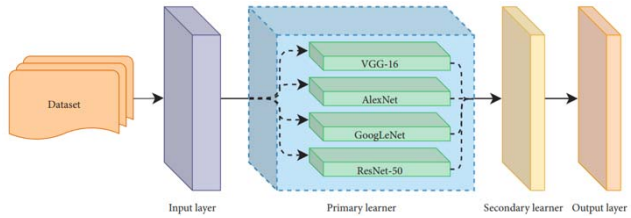
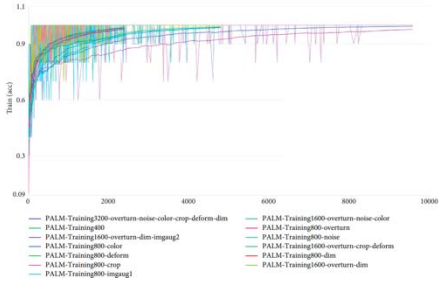


Table 1: 12 DAMFs.

No.	Training set name	DA method	Quantity
1	PALM-Training800-overturning	Original dataset + random flip (4 directions: up, down, left, and right)	800
2	PALM-Training800-noise	Original dataset + Gaussian white noise	800
3	PALM-Training800-color	Original dataset + randomly changing colors (brightness, contrast, saturation)	800
4	PALM-Training800-cropping	Original dataset + random cropping	800
5	PALM-Training800-deforming	Original dataset + random scaling, stretching (stretched into a square by the length or width of the images)	800
6	PALM-Training800-dimming	Original dataset + change clarity	800
7	PALM-Training1600-overturning-noise-color	Randomly stack method 3 or 4 (serial number) on the basis of PALM-Training800-overturning	1600
8	PALM-Training1600-overturning-cropping-deforming	Randomly stack method 5 or 6 (serial number) on the basis of PALM-Training800-overturning	1600
9	PALM-Training1600-overturning-dimming	Randomly stack method 7 (serial number) on the basis of PALM-Training800-overturning	1600
10	PALM-Training3200-overturning-noise-color-cropping-deforming-dimming	Randomly superimpose method 5 or 6 or 7 (serial number) on the basis of PALM-Training800-overturning-noise-color	3200
11	PALM-Training800-imgaug1	Original dataset + random cropping with 0–50 pixels around, 50% probability horizontal flip, Gaussian blur (sigma = 0 to 3.0)	800
12	PALM-Training1600-overturning-dimming-imgaug2	PALM-Training800-overturning-dimming dataset + multiple mixed random overlay	1600





Model input:
Training set $D = \{(x_1, y_1), (x_2, y_2), \ldots, (x_m, y_m)\}$
Primary learner $\mathcal{L}_1, \mathcal{L}_2, \ldots, \mathcal{L}_T$
Secondary learner $\mathcal{L}$
Process:
1: **for** $t = 1, 2, \ldots, T$ **do**
2: $h_t = \mathcal{L}_T(D)$
3: **end for**
4: $D = \emptyset$;
5: **for** $t = 1, 2, \ldots, m$ **do**
6: **for** $t = 1, 2, \ldots, T$ **do**
7: $Z_{it} = h_t(x_i)$;
8: **end for**
9: $D_j = D \cup \{(z_i1, z_i2, \ldots, z_{iT}), y_i\}$
10: $h_t = (D_j)$
11: **end for**
Output: $H(x) = h_j(h_1(x), h_2(x), h_3(x), \ldots, h_T(x))$

四. 主要研究成果及应用情况

发表 SCI 论文 1 篇：《Pathological Myopia Image Recognition Strategy Based on Data Augmentation and Model Fusion》

申请公开发明专利 1 项：专利号 202011578831.9《一种基于数据增强与模型融合的病理性近视识别方法》

联系人：张晓云 杨伟斌 电话：15359262280/15880278729 Email: 18030043877@163.com