Diabetic Retinopathy Progression Recognition Using Deep Learning Method

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CS231n: Convolutional Neural Networks for Visual Recognition

What is Diabetic Retinopathy?

A common complication of diabetes.

Can progress to irreversible vision damage or vision loss.

One of the leading causes of vision loss.

Many patients globally lack medical resources for manual based detection.

Problem Statement

Classifying the level of diabetic retinopathy given patients' fungus images.

Based on Standard of American Academy of Ophthalmology.

Level of severity:
- -0: No risk of DR
- -1: Mild nonproliferative DR
- -2: Moderate nonproliferative DR
- -3: Severe nonproliferative DR
- -4: Proliferative DR

Data Augmentation

Random horizontal and vertical flip

Crop to 224 * 224 pixels

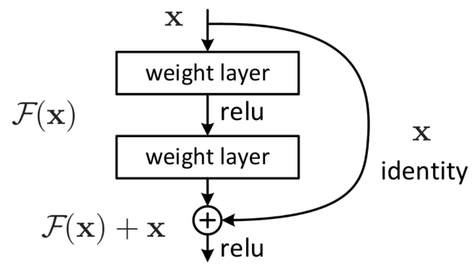
Random adjustment of brightness with coefficients between 0.8 and 1.2

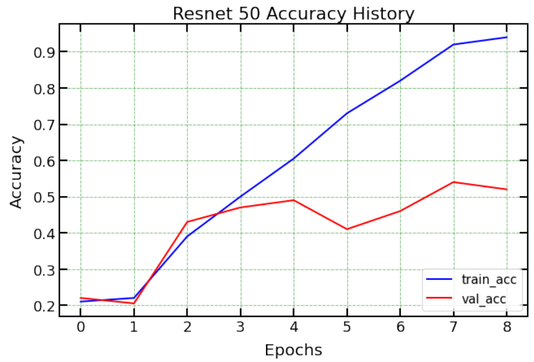
Level 0 Level 2 Level 4

Resent 50

Fine tuning the Resnet 50 Model pretrained on ImageNet with transfer learning.

50 layers widely used CNN architecture using residual connections to skip between layers.



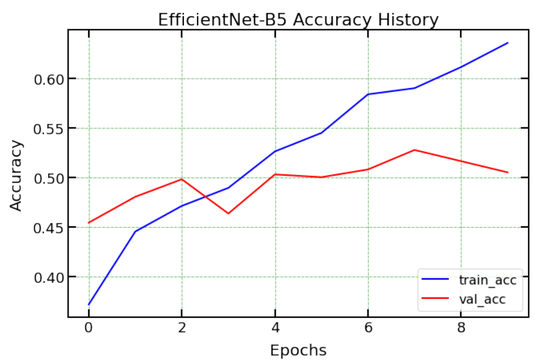


Efficient Net

Fine tuning the EfficientNet-B5 Model pretrained on ImageNet with transfer learning.

The core idea of EfficientNet is uniformly scaling up on all depth/width/resolution dimensions with fixed scaling coefficients - compound scaling.

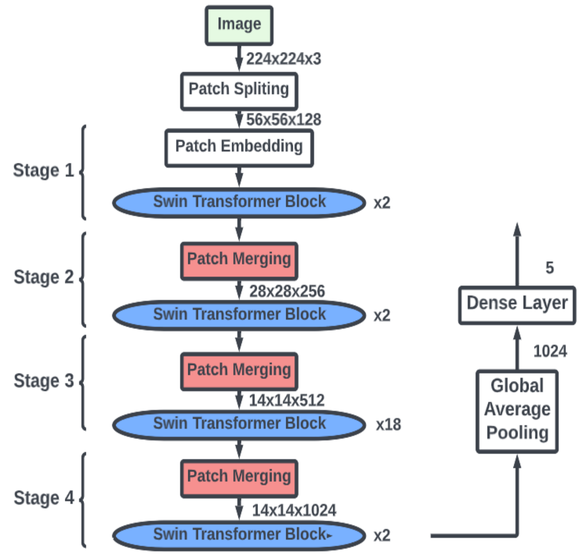
Stage i	Operator $\hat{\mathcal{F}}_i$	Resolution $\hat{H}_i \times \hat{W}_i$	#Channels $\hat{C}_i$	#Layers $\hat{L}_i$
1	Conv3x3	224 × 224	32	1
2	MBConv1, k3x3	112 × 112	16	1
3	MBConv6, k3x3	112 × 112	24	2
4	MBConv6, k5x5	56 × 56	40	2
5	MBConv6, k3x3	28 × 28	80	3
6	MBConv6, k5x5	14 × 14	112	3
7	MBConv6, k5x5	14 × 14	192	4
8	MBConv6, k3x3	7 × 7	320	1
9	Conv1x1 & Pooling & FC	7 × 7	1280	1

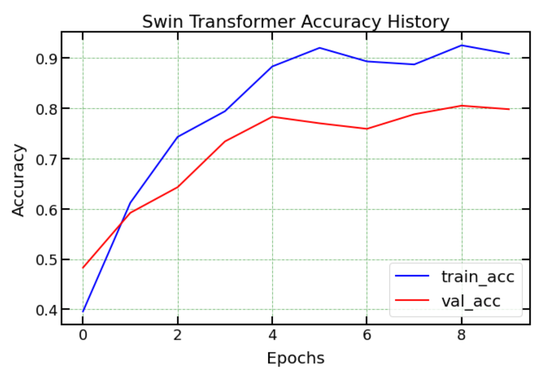


Swin Transformer

Swin-B Architeccture with C=128 and layer number = {2,2,18,2}.

Integrate the advantages of CNNs in vision tasks with the powerful architecture of Transformer. (Shifted Window Partition/ hierarchical representation)





Comparison & Conclusion

	# Param.	Test Acc	Balanced Acc
ResNet 50	27.794,309	53.10%	38.43%
EfficientNet-B5	32,720,117	51.05%	43.56%
Swin-B Tansformer	88,109,369	76.35%	71.23%