
Project: Part I

Traffic Signs Classification



Pattern Recognition & Machine Learning Laboratory

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Data

■ Data characteristic

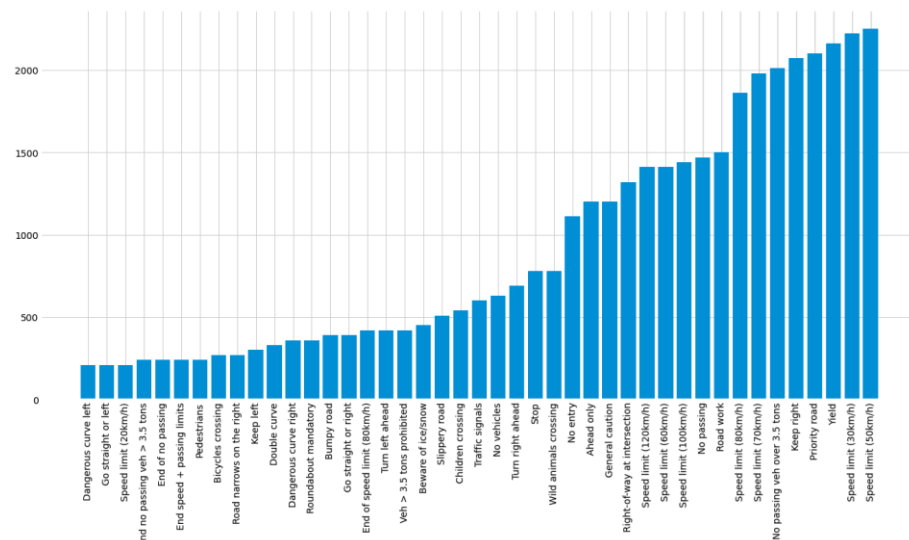
- Low resolution
 - 32×32 pixels
- Data unbalancing

■ Following problem

- Overfitting
 - Especially, deep neural network (deep layer model)



Example of dataset



Number of images in each class



Baseline Model

■ Resnet

➤ Goal

- Prevented gradient vanishing and exploding problems in deep neural networks

➤ Methods

- Skip connection in the residual network
 - Solved gradient vanishing problem
- Bottleneck design
 - Solved time-consuming problem

➤ Result

- A lower error rate in deep neural networks (34-layer) compared to lighter neural networks (18-layer)

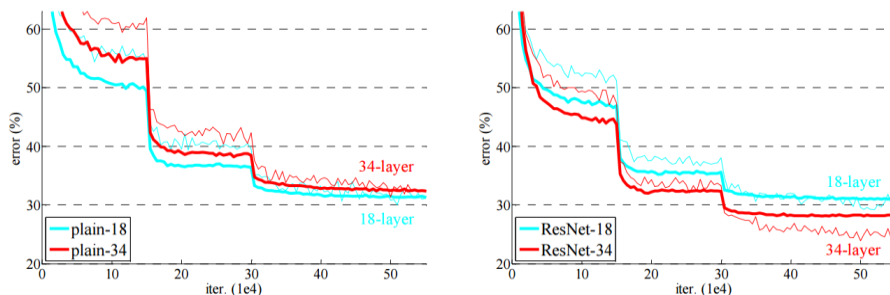


Figure 4. Training on **ImageNet**. Thin curves denote training error, and bold curves denote validation error of the center crops. Left: plain networks of 18 and 34 layers. Right: ResNets of 18 and 34 layers. In this plot, the residual networks have no extra parameter compared to their plain counterparts.

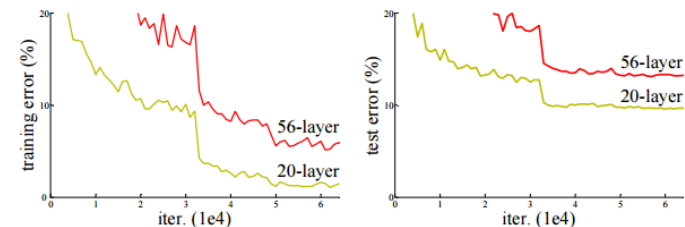


Figure 1. Training error (left) and test error (right) on CIFAR-10 with 20-layer and 56-layer “plain” networks. The deeper network has higher training error, and thus test error. Similar phenomena on ImageNet is presented in Fig. 4.

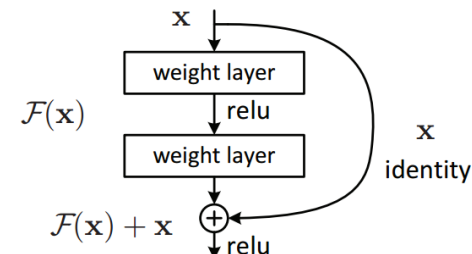


Figure 2. Residual learning: a building block.

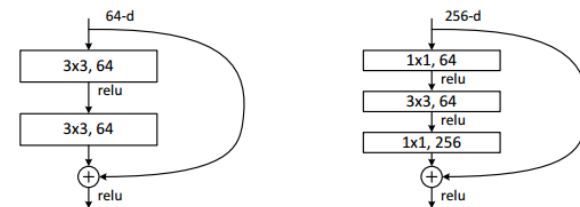


Figure 5. A deeper residual function \mathcal{F} for ImageNet. Left: a building block (on 56×56 feature maps) as in Fig. 3 for ResNet-34. Right: a “bottleneck” building block for ResNet-50/101/152.



Results

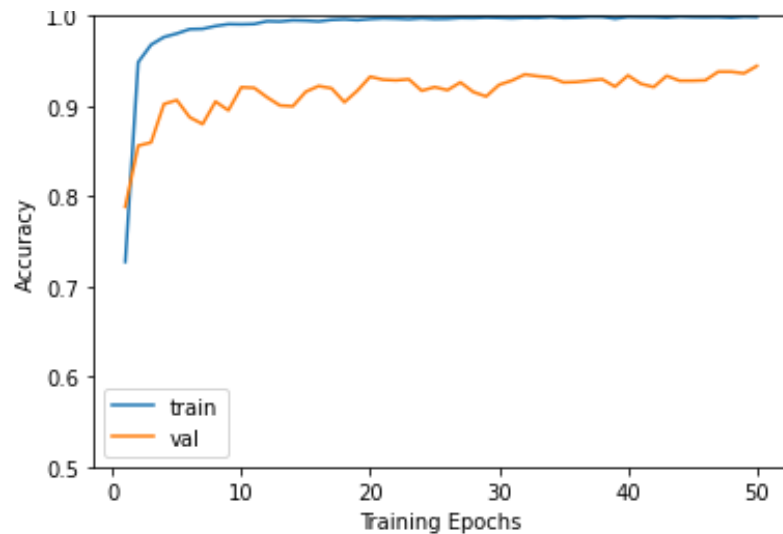
Model

➤ Resnet 34-layer using basic block

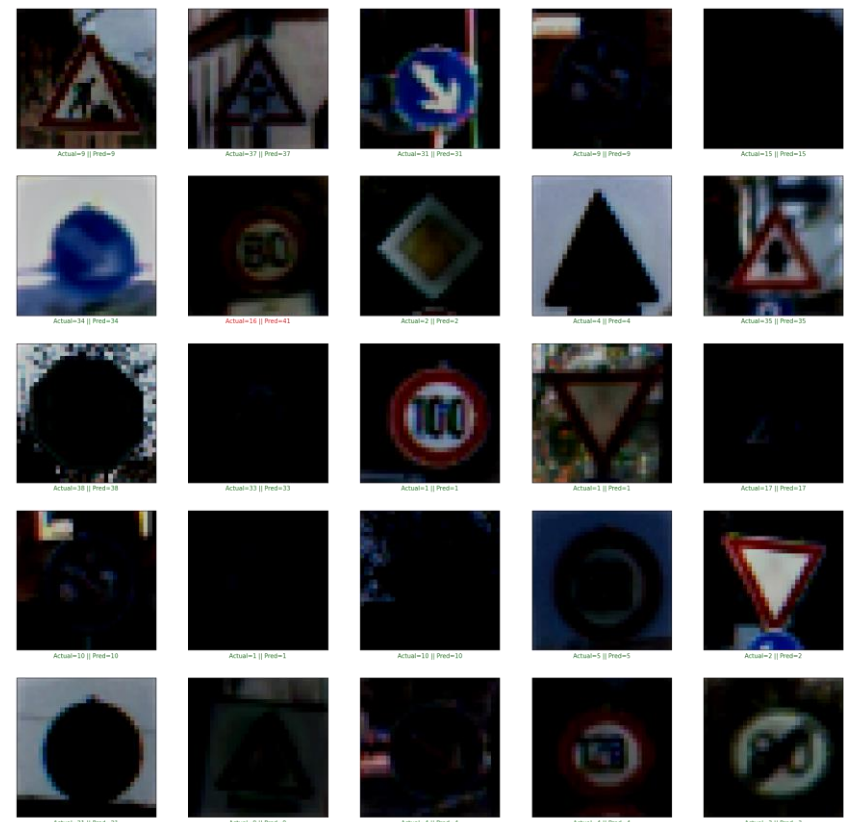
- Batch size: 100, epoch: 50,
learning rate: 0.001

Result

- Learning time: 20m
- 99.9 % accuracy for the training
- 94.8 % accuracy for the validation



Train and validation accuracy graph



Example of prediction result