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Construction of a hybrid convolutional network using residual and pyramidal architectures

A propose of a new hybrid architecture of deep pyramidal residual neural networks based on Deep ResNet and PyraNet for image identification. The results and graphs are based on the CIRFAR-10 image class.

Introduction

Nowadays, much attention is paid to image processing, especially in medicine, transport, logistics, agriculture and other very important areas of human life. In image processing, the most powerful tool is neural networks, primarily convoluted neural networks that are trained using an error backpropagation algorithm. Training of convolutional neural networks in this way is computationally expensive and has not very high accuracy, which is associated with the drop of the local gradient from layer to layer, so the most promising today is the use of hybrid convolutional neural networks which include residual blocks.

Formulation of the problem

Build a hybrid convolutional neural network based on a training sample for image processing tasks, which includes residual and pyramidal blocks

Review of existing works

At the moment there are works with residual neural networks with different number of layers (ResNet-20, ResNet-32, ResNet-44, ResNet-50), but they do not meet the needs and have many disadvantages such as increasing layers, the error becomes worse, with as the depth increases, the accuracy becomes better, but on validation results it drops sharply and it is very difficult to optimize it Fig.1. Therefore, in this work we consider a new type of neural network Deep Residual Pyramidal Neural Network. First of all, let's look at the Residual Neural Network and the Pyramidal Network results separately.
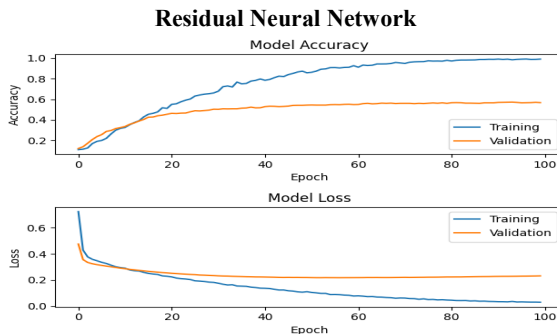
Residual Neural Network
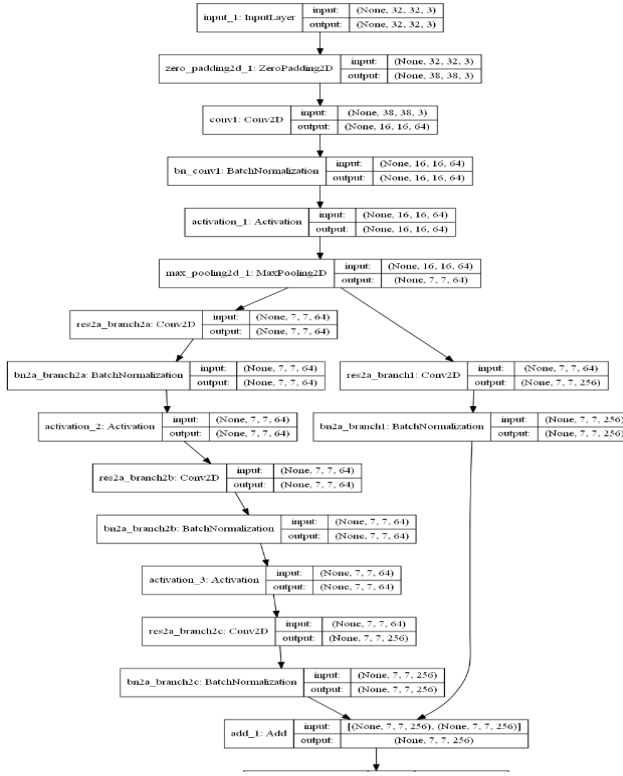

Fig. 1. Results of ResNet Neural Network

Fig. 2 Topology of ResNet block [1]

Pyramidal Neural Network

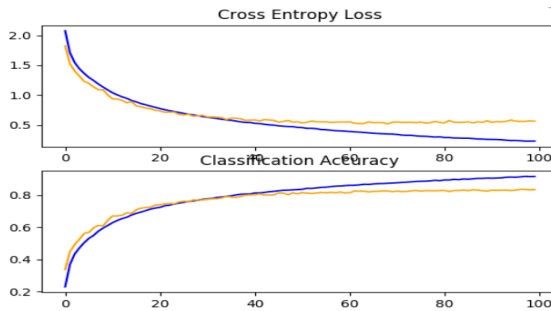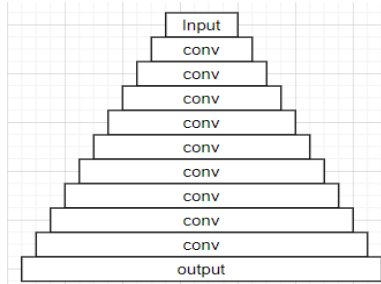
Fig. 3. Results of Pyramidal Neural Network

Fig. 4. Topology of Pyramidal Neural Network

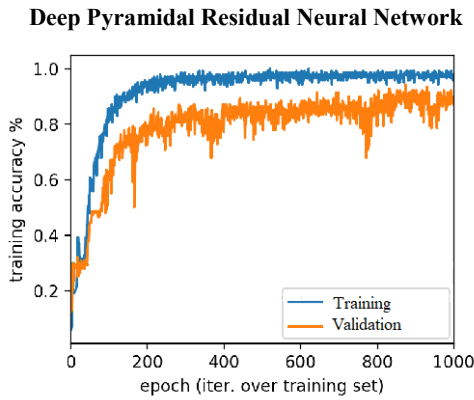**Deep Pyramidal Residual Neural Network**

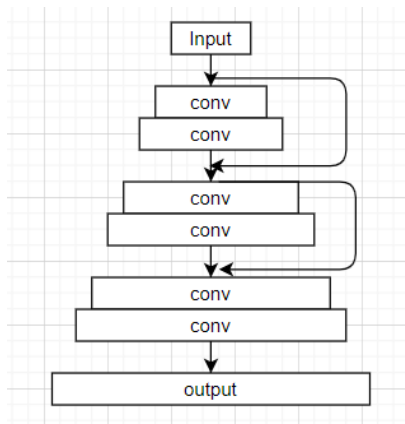Fig. 5. Results of Deep Pyramidal Residual Neural Network

Fig.6. Topology of Deep Pyramidal Residual Neural Network

In this study, instead of using downsampling to achieve a sharp increase at each residual unit, or using pyramidal block to achieve better results, the size of the object map on all units was gradually increased to take up as many locations as possible.

Conclusion

With a combination of the ResNet and Pyramidal blocks, was created neural network which is easier to optimize and it has more result accuracy on test set in cifar-10 combination of images.

References

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