CSE 352 Final Project Report

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**Catalogue:**

Abstract

Techniques:

ResNet

Over-sampling/Under-Sampling

Transfer Learning (VGG)

Application Description

Research (Layers/ResNeXt)

Citations

Abstract

In this project, we defined a neural network architecture which can help us to do better classification on image data. We used ResNet as our base model with transfer learning and fine tuning to help us to distinguish rock paper scissors mimic by human hands. For further approach, we used some factory method on our data which is over-sampling.

**Techniques**

ResNet:

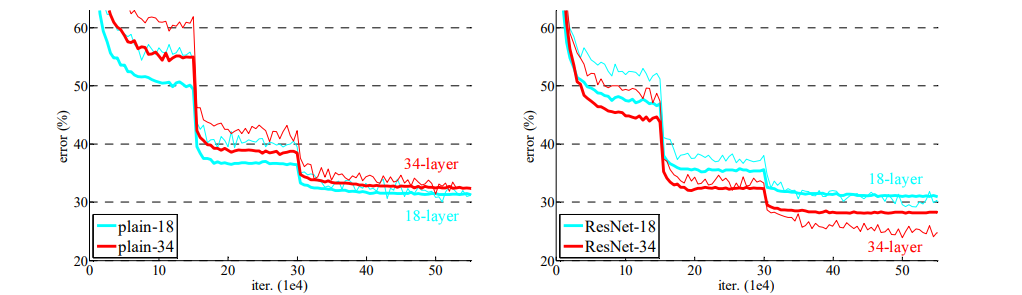
ResNet is a modern neural network architecture and has been defined in 2015. The reason why it has been invented is that, after Alexnet and VGG network published, all people is trying to develop their neural network in two ways: deeper or wider, or both. But nothing has really constructive under such circumstance. This bring us to a concept of Gradient Vanishing/Explosion. In 2014’s Kaggle competition, two networks stood out: 1st GoogleNet and 2nd VGG. VGG mainly talking about how neural network can have better performance with deep layers. GoogleNet is trying to create deep complex architecture that can prevent gradient vanishing and achieve high accuracy at the same time. The first version of GoogleNet (Inception v1) has two support classifier to help back propagation to avoid gradient vanishing (Szegedy, 2015). In the paper of ResNet, these four computer scientists created an experiment on VGG. And the result shows a highly disappointing result: on CIFAR-10, 56 layer network’s error was higher than 20 layer network.

ResNet prevent gradient vanishing by adding it’s own original parameter back after each convolution step:

Output = F(x) + x

(Where F is convolution layers and x is original weight)

At very end of this paper, authors designed an experiment on comparing plain 18/34 layer network with ResNet 18/34 network under same training circumstance. We can see from Figure 4 that although Resnet converge slower than normal network but it keep decreasing it’s error rate along with increasing of it’s layers.



ResNet is a framework that truly establish the concept of deep learning.

**Feature Engineering**

In our project, we used several feature engineering techniques to create better representation of our data.

The first technique we used is Over/Under sampling. Our data only come with around no more than 2000 images. We choose around 100 of them as our test set and all classes (train/test) are approximately balanced. For a deeper neural network we need more images to maintain it’s functionality or we stuck in under-fitting issue. To avoid class imbalance, we random selected 20-40% of from each of our training images and make a copy of them and put them back into set. At this point, we have another 600-800 images to train our model. This technique is widely use in factory environment because extra data is not always available for us and we might limited to our expanse which can buy more accessories to data. One thing that need to notice is that Oversampling is not always easy as what we did in this project. It can be complex when encountering real life problem. For example, fraud detection and cancer prediction. Under these circumstances, data will not be balance any time and our model will spend more time on fitting positive samples others those significant negative samples. This time we do need to create our own negative samples to let our model perform better on such important predictions.

**Transfer Learning & Fine Tuning**

Citation

He, K. (2015, December 10). *Deep Residual Learning for Image Recognition*. ArXiv.Org. https://arxiv.org/abs/1512.03385

Szegedy, C. (2015). *Going Deeper with Convolutions –*. Google Research. https://research.google/pubs/pub43022/