CS 466/566 Assignment 1 Report

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Network Designs

Network 1:

Layer 1 *: 5x5 Convolution with 32 feature maps stride 1*

Layer 2 : *Rectified Linear Unit :ReLU*

Layer 3 : *Maxpooling 2x2 with stride 2*

Layer 4 : *5x5 Convolution with 64 feature maps stride 1*

Layer 5 : *Rectified Linear Unit :ReLU*

Layer 6 : *Maxpooling 2x2 with stride 2*

Layer 7 : *Fully Connected Layer, and dropout with 50% prob.*

Layer 8: *Fully Connected layer , output layer*

Network 2:

Layer 1 *: 3x3 Convolution with 64 feature maps stride 1*

Layer 2 : *Rectified Linear Unit :ReLU*

Layer 3 : *Maxpooling 2x2 with stride 2*

Layer 4 : *3x3 Convolution with 128 feature maps stride 1*

Layer 5 : *Rectified Linear Unit :ReLU*

Layer 6 : *Maxpooling 2x2 with stride 2*

Layer 7 : *Fully Connected Layer, and dropout with 50% prob.*

Layer 8: *Fully Connected layer , output layer*

Network Layout	
Network 1	***Network 2***
Conv 5x5x32-s-1	*Conv 3x3x64-s-1*
ReLu	*ReLu*
Maxpool 2x2-s-2	*Maxpool 2x2-s-2*
Conv 5x5x64-s-1	*Conv 3x3x128-s-1*
ReLu	*ReLu*
Maxpool 2x2-s-2	*Maxpool 2x2-s-2*
Fc	*Fc*
Fc	*Fc*

Training Description

For 28x28 and 14x14 datasets there are total 180 iterations , for augmented datasets there are total 720 iterations. Mini batch size 50 is used for all of them. For both networks Adam Optimizer is used with a value (1e – 4)

Data Augmentation

First augmentation: *Rotating images to the right by 10 degrees, Italic*

Second Augmentation: *Rotating images with random degrees between 0-15 degrees*

Third Augmentation: *Shifting images randomly*

Experimental Results

Experimental Results	***Performance in %***	
Data Set	***Network 1***	***Network 2***
28x28_dataset	*87.3%*	*89.1%*
14x14_dataset	*84.4%*	*86.0%*
14x14_augmented_dataset	*88.2%*	*90.8%*

Discussion

For first network, I tried to use similar values with tensorflow MNIST tutorial. For second network, I reduced the convolution window size and increased number of feature maps to get more precise results. I used dropout with 50% keep probability for both networks to reduce the chance of overfitting.

Overall, Network2 gave better training results for all datasets. This can be caused by higher number of feature maps and smaller convolution window in network2.

Downsampling the data reduced the accuracy of both networks as expected. Both networks' accuracy declined at almost same rate.

For first augmentation, I thought rotating images to the right and give them an Italic look will result with better training results because not all people write digits upright. I tried to rotate 5,8,10,12 degrees and the best result were given at 10 degrees.

For second augmentation, I thought rotating images randomly both to right and left may help model to handle rotations. But, I did not want to rotate too much because digits might be meaningless. I tried 60,30 and 15 degrees to limit random value, the best results were given at 15 degree.

Not all images are centered in MNIST dataset, so I thought shifted images in training will give better results. This was the final augmentation

As expected, augmented datasets gave the best results and increase rate was higher for second network because of high number of feature maps