The Experiment Report of Deep Learning

SCHOOL: SCHOOL OF SOFTWARE ENGINEERING

SUBJECT: SOFTWARE ENGINEERING

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Handwritten digit recognition based on shallow neural network

Abstract—Handwritten character recognition is a very important and active research in pat tern recognition. Theoretically, it is not an is olated technique. It concerns with the proble m that all the other areas of pattern recogniti on must confronted; practically, being a kind of information processing measured, chara cter recognition has a very broad application background and vast need of market. Thus, it is of both theoretical and practical signific ance. Artificial neural network recognition method is a new method of the research field in recent years, and this method has some m erit that traditional technique do not have; g ood tolerance for error, strong sorting ability , strong parallel handling ability and strong s elf-learning ability as well as its off-line trai ning and on-line recognizing. All these merit s contribute its perfect performance in handli ng vast data set and handling in timely mann er.

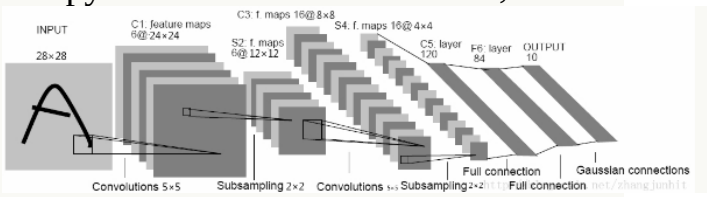
I. Introduction

In order for us to learn deep neural network construction process and use and understand deep learning framework pytorch and preliminary use.Also we experience neutral network training and testing process and we deepen understanding of convolution pooling ,ReLu,fully connected and other network layers.Futhermore,we use handwritten digital data set –MNIST,which contains 60000 hand-written digital images for training and 10000 hand-written digital images for validation.Each image is 28*28 pixels in size.We need to operations such downloading dataset and reading images can be done using pytorch.We do this experience in Linux,because pytorch framework can not be installed on Windows,with using python3 and package:numpy,flask,pytorch.

II. Methods and Theory

According to the methods provided by teacher Tan (Steps 1-4 below)and we do it.

1. Build shallow neural network LeNet5 (A class inheriting from nn.Module. You are supposed to at least implement init and forward function) in model.py. Network structure is as follows:
   Use pytorch to build this network,



2. Complete the network training and validation process in train.py:

   2.1 Use torch.utils.data.DataLoader, torchvision.datasets.MNIST and torchvision.transforms to load dataset.
   2.2 Instantiate torch.optim.SGD to get the optimizer
   2.3 Instantiate LeNet5 to get net.
   2.4 Input data, which size is batch size,

into the network for forward propagation to get predict target.
2.5 Use torch.nn.CrossEntropyLoss to calculate the loss between predict target and ground truth target.
2.6 Calculate gradient using loss.backward and optimize the net using optimizer.step.
2.7 Calculate accuracy of recognition.
2.8 Repeat step 2.4 to 2.7 until all data are inputed to the net.
2.9 Define the number of selected training epoch, repeat the training process 2.5--2.9
2.10 Save the best model as a .pkl file

3. Compared with the training , there is no optimization process in validation. The other processes between training and validation are basically the same.
4. Load the trained model (.pkl file) into the main.py application. The implementation of main.py can test the model's performance on the web page.

The artificial neural network is first studied by a certain learning criterion before it can work.Now, the artificial neural network opponents write "A" and "B" for the recognition of the two letters, which stipulates that when "A" enters the network, it should output "1", and when the input is "B", the output is "0".

III. EXPERIMENT

net.trainParam.show= 50 ； %displays the interval number of training results

net.trainParam.epochs ＝ 1000 ； ％ The maximum number of training steps

net.trainParam.goal ＝ le-3 ； %training target error

net.trainParam.mu = 0.9 ； %The initial value of the learning coefficient, Marquardt adjustment parameter

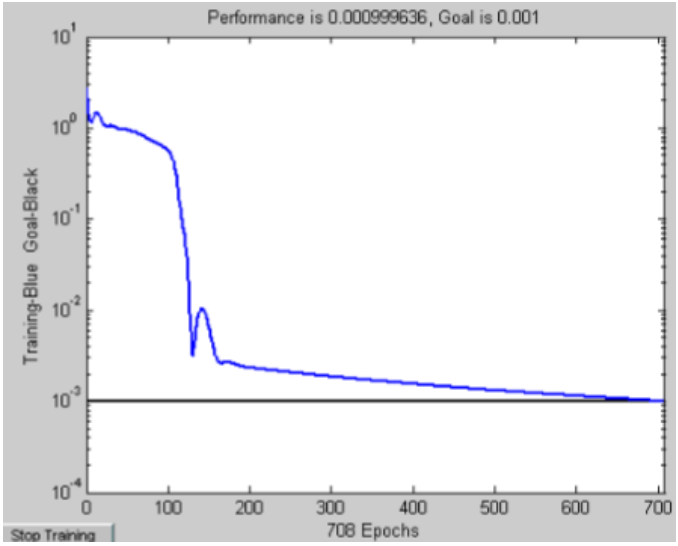
net.trainParam.mu_dec=1.0 ； %Decrease factor of % learning coefficient

net.trainParam.mu_inc= 1.0 ； %Increase factor of % learning coefficient

net.trainParam.mu_max=5 ； %Maximum of % learning coefficient

net.trainParam.min_grad=10； %Minimum allowable gradient in % training

```
% 调用 TRAINGDM 算法训练 BP 网络
[net,tr]=train(net,P,T);
TRAINGDM, Epoch 0/1000, MSE 2.75792/0.001, Gradient 3.59874/1e-010
TRAINGDM, Epoch 50/1000, MSE 0.955012/0.001, Gradient 0.441127/1e-010
TRAINGDM, Epoch 100/1000, MSE 0.57074/0.001, Gradient 0.612887/1e-010
TRAINGDM, Epoch 150/1000, MSE 0.00677345/0.001, Gradient 0.130159/1e-010
TRAINGDM, Epoch 200/1000, MSE 0.00233508/0.001, Gradient 0.011879/1e-010
TRAINGDM, Epoch 250/1000, MSE 0.00206892/0.001, Gradient 0.00951254/1e-010
TRAINGDM, Epoch 300/1000, MSE 0.00186094/0.001, Gradient 0.00858886/1e-010
TRAINGDM, Epoch 350/1000, MSE 0.00168952/0.001, Gradient 0.00784352/1e-010
TRAINGDM, Epoch 400/1000, MSE 0.00154566/0.001, Gradient 0.00721873/1e-010
TRAINGDM, Epoch 450/1000, MSE 0.00142318/0.001, Gradient 0.00668715/1e-010
TRAINGDM, Epoch 500/1000, MSE 0.00131759/0.001, Gradient 0.00622922/1e-010
TRAINGDM, Epoch 550/1000, MSE 0.00122563/0.001, Gradient 0.00583052/1e-010
TRAINGDM, Epoch 600/1000, MSE 0.00114478/0.001, Gradient 0.00548021/1e-010
TRAINGDM, Epoch 650/1000, MSE 0.00107315/0.001, Gradient 0.00516994/1e-010
TRAINGDM, Epoch 700/1000, MSE 0.00100923/0.001, Gradient 0.00489321/1e-010
TRAINGDM, Epoch 708/1000, MSE 0.000999636/0.001, Gradient 0.00485169/1e-010
```



IV. CONCLUSION

Neural network is a feature recognizer with good performance. It combines with the correct feature extraction method to achieve satisfactory recognition effect.In this experiment, BP neural network was used for learning and training, and the free handwritten digital recognition system was realized by MATLAB.In order to improve

the recognition rate and reliability, in addition to enhance's ability to filter out the noise, but also increase the knowledge base, in order to solve the problem of structure distortion in refining, these are to be our further research.In addition, the initial value of the network is improved, and the network stability and fast convergence are improved.