A NOVEL METHOD FOR HANDWRITTEN DIGIT RECOGNITION WITH NEURAL NETWORKS

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Project Name	A Novel Method for Handwritten Digit Recognition with Neural Networks

HANDWRITTEN digit recognition is the ability of a computer system to recognize the handwritten inputs like digits, characters etc. from a wide variety of sources like emails, papers, images, letters etc. This has been a topic of research for decades. Some of the research areas include signature verification, bank check processing, postal address interpretation from envelopes etc. Here comes the use of Deep Learning. In the past decade, deep learning has become the hot tool for Image Processing, object detection, handwritten digit and character recognition etc. A lot of machine learning tools have been developed like scikit-learn, scipy-image etc. and pybrains, Keras, Theano, Tensorflow by Google, TFLearn etc. for Deep Learning. These tools make the applications robust and therefore more accurate. The Artificial Neural Networks can almost mimic the human brain and are a key ingredient in image processing field. For example, Convolutional Neural Networks with Back Propagation for Image Processing, Deep Mind by Google for creating Art by learning from existing artist styles etc..

Problem Statement:

The handwritten digit recognition is the capability of computer applications to recognize the human handwritten digits. It is a hard task for the machine because handwritten digits are not perfect and can be made with many different shapes and sizes. The handwritten digit recognition system is a way to tackle this problem which uses the image of a digit and recognizes the digit present in the image. Convolutional Neural Network model create

using PyTorch library over the MNIST dataset to recognize handwritten digits .

Handwritten Digit Recognition is the capability of a computer to fete the mortal handwritten integers from different sources like images, pa pers, touch defenses, etc, and classify. them into 10 predefined classes (0-9). This has been a Content of bottomless- exploration the field of deep literacy. Num ber recognition has numerous operations like number plate recognition, postal correspondence sorting, bank check processing, etc . (2). In Handwritten number recognition, we face numerous challenges . because of different styles of jotting of different peoples as it . is not an Optic character recognition. This exploration provides a comprehensive comparisonbetween different machine literacy and deep lite racy algorithms for the purpose of handwritten number recognition. For this, we've used Support . Vector Machine, Multilayer Perceptron, and Convolutional . Neural Network. The comparison between these algorithms is carried out on the base of their delicacy, crimes,and .testing- training time corroborated by plots and maps that have been constru cted using matplotlib for visualization.

Solution:

From the simulation, the training and testing results gives an accuracy rate of 99%. This is a high accuracy rate. From the results, we also realized that the system has trouble identifying numeral — 5“. This is probably caused by the — head“ of the numeral is not fully connected or maybe it looks like a numeral —6“. From Appendix B, we realize that the system is not very stable. Every day the system gives a different result for the training of each numeral. Therefore an average of training times was taken to produce the results. This should be improved by having a close look at the program and the system. The image-file produced does not show a clear numeral that was trained. The Unix‘s Editor Paint was used to open the image-file. This was not suitable software to open the image-file. We May try to find another way to open the file to improve the image.

Ideas to be Implemented:

- Download/Create Dataset
- Importing Relevant Libraries and Module
- Preparing Data
- Splitting Data into Train and Test
- Classifiers
- Support Vector Machine
- Gaussian Naïve Bayes
- Decision Trees
- Random Forest
- K Nearest Neighbours
- Stochastic Gradient Descent

SIMULATION AND RESULTS:

An image is fed into the network to train. Back-propagation neural network is used for training the network. Although it is only one

image, it contains 100 samples of the same number. For every 10 epochs, the information is saved into the network. After training, the network is tested and the accuracy rate reached to 99%. This is a very high accuracy rate. The network was not stable because the training results changes everyday. If we take numeral —2“ as an example, today we might have to train 20 times in order to reach 99% accuracy, but tomorrow we maybe have to train 25 times in order to reach 99% accuracy. The following graph is the average number of times that a data needs to be trained in order to reach 99% accuracy: Training times. Malothu Nagu et al, / (IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 2 (4) , 2011, 1685-1692

DISCUSSION AND FUTURE IMPROVEMENTS:

From the simulation, the training and testing results gives an accuracy rate of 99%. This is a high accuracy rate. From the results, we also realized that the system has trouble identifying numeral —5“. This is probably caused by the —head“of the numeral is not fully connected or maybe it looks like a numeral —6“. From Appendix B, we realize that the system is not very stable. Every day the system gives a different result for the training of each numeral. Therefore an average of training times was taken to produce the results. This should be improved by having a close look at the program and the system. The image-file produced does not show a clear numeral that was trained. The Unix‘s Editor Paint was used to open the image-file. This was not suitable software to open the image-file. We May try to find another way to open the file to improve the image.

CONCLUSION:

Using Neural Network system, back-propagation learning, to recognize handwritten digits was very successful. An image, which contained 100 samples of each number, was trained and tested. The accuracy rate of recognizing the number was 99%. This accuracy rate is very high. From the training and testing results, it was concluded that the system had more trouble identifying numeral —5“. This maybe caused by the fact that the digit is running together or maybe it is not fully connected. The system was not stable.

It gave different training and testing results every day for each numeral. It will need to take a close look at the system and should look for improvements for the future. From the net-file, the system was able to produce an image-file. The image-file produced showed the recognized number. By looking at figure 5.2, it is concluded that the image-file produced does not show the numberal —5“ clear enough. This part will also need more improvements. Apart from the above problems and parts that need improvements, the overall recognition system was successful. 8.REFERENCE 1. Bienenstock E., Doursat R. 1993, ”A shape recognition model using dynamical links‘ Neural: Computation in Neural Systems, Vol. 5, No. 2, pp. 241~258 2. Buffa F., Porceddu I. 1997 ”Temperature forecast and dome seeing minimization. A case study using neural network model‘, http://www.pd.astro.it/TNG/TechRep/rep67/rep67.html 3. Chang H., Fu H., Xu Y. 1990, ”Recognition of handwritten similar Chinese characters by self-growing probabilistic decision-based neural network‘ International Journal of Neural Parallel & Science Co.

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