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Recognition of Handwritten Digits using Machine Learning

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Abstract: *It is computer technology releted to computer vision and image processing. This paper illustrates the application of object character recognition (OCR) using template matching and machine learning techniques. The solution of paper we perform the recognition task using Template Matching, Support VectorMachine (SVM), and Feed Forward Neural Network. Templatematching is an image processing technique to break the image into small parts and then match the other image to a template image. The use a Multi Class SVM classifier and Neural Network to classify the image. The use the dataset to train the classifier followed by feature extraction and finally applying the classifiers to recognize the digits.*

Keywords: Vector Machine, Template, Neural Networks, Feature Extraction, TensorFlow, Machine Learning, YOLO.

I. INTRODUCTION

Handwritten image recognition is probably one of the most interesting and challenging applications in the image processing field of pattern recognition. Recognation of Handwritten Digit/ Character Using is divided into two types of techniques: on-line and off-line. Off-line techniques include reading the character using an image capture device, such as a camera etc. are using in offline techniques while the technique which is being dealt here is Off-line which means to convert a handwritten image into a machine form.

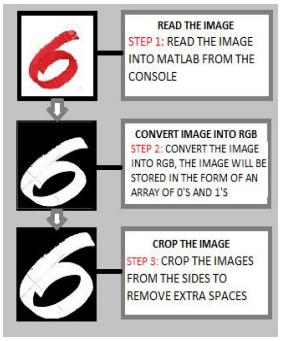
The major factor behind choosing this particular application is its number applications such as Automatic Number Plate Recognition, assisting blind and visually impaired people, automatic check processing for banks, and to process huge number of documents in industries like healthcare, legal, education, Hospitals and finance the focus if the work described in this paper is on handwritten digits. This paper will further into different types be covering data collection, image pre-processing, feature extraction, and finally classification.

II. ACQATUISITIODN

The data is used in this project is a set of handwritten digits from 1 to 10 number. This data has been divided into two categories which form the training set and the test set. The Sets of data were collected are which are the phone numbers, zip-codes, and address plates for testing purpose etc.

2.1 Image - Preprocessing

This Project the image size used is this project is 25 by 25 pixels. The steps used in pre-processing the image is



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2.2 Feature Extraction

Blob Analysis: This Project We use the Blob or Binary Large Object is a large image which needs to be managed, and consists of binary data. The image is then converted into a binary image using the bwlabel image function in matlab image where the image is processed according to the connected components concept.

Connected Components: This concept is based on grouping similar pixels according to the pixel connectivity. The main connected components have similar levels of pixel intensity, and then grouping, each pixel is labelled according to the component it belongs to each other. This Project we use process of classification is performed using template matching, SVM and Neural Network approach

2.3 Template Matching

Template Matching is a computer vision technique which is used to recognize the elements in the image by matching it with a predefined template using Machine learning. The process is elaborated in the flow diagram in fig2

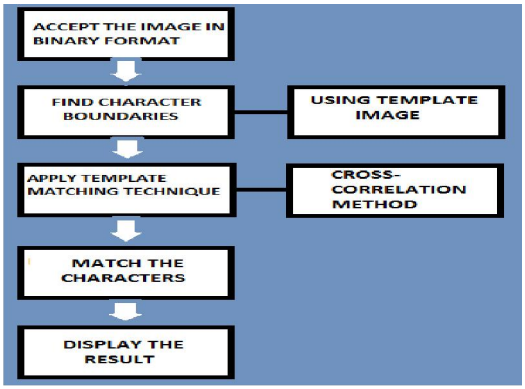

Figure 2: Flow Diagram for Template Matching Technique

Image Correlation: The main goal of this technique is to find similarity between images of equal dimensions process. This technique is used to perform this task is Cross-Correlation, and it is defined to be the sum of pairwise multiplications of corresponding pixel values form. The major disadvantage of this technique is initial cost is high upon the system used as shown in fig

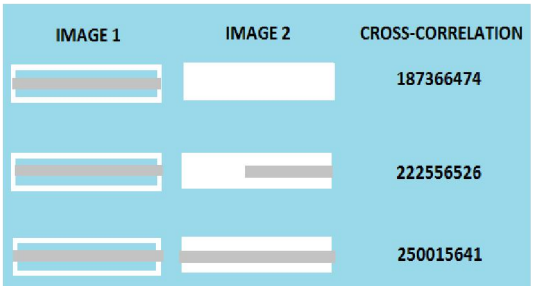

Figure 3: Cross-Correlation Depending on Brightness of the Image

2.4 Support Vector Machine

Support Vector Machine (SVM) is one of the most Popular and supervised machine learning classification algorithms Support vector machine was initially built to perform binary class classification, and that is one of most against all other classes one SVM per class to other. This the technique used is one- against-one which builds one SVM for each pair of classes to other This project we use this method use to constructs n(n-1)/2 classifiers following binate classification inspiration. If sign suggests that x is in the ith class, then the votes for the ith class is incremented by one. Otherwise, the votes for the jth class are increamented by to. Then, we use If sign suggests that x is in the ith class, then the votes for the ith class is incremented by one. After that which the votes for the jth class are increamented by one. Then, we show x is in the class with the longest number of votes in this project. In case that two classes have identical first number of votes we simply select the one with the smaller index. where the number of parameter is same, Hence, if on average each class has

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(l/n)th of the data points, we have to solve n(n-1) rectangular programming difficulties where each of them has about 2/n variables.

For cast x is in the class with the larges number of votes. The voting is de known as "Max Wins" strategy. In this project we have to use two classes have identical number of vote simply select the one with the smaller index . where the number of variables is same as the number of data points in the two classes we use, Hence, if on average each class has (l/n)th of the data points, then we have to solve n(n-1)/2 quadratic programming difficulties where each of them has about 2/n variables.

III. NEURAL NETWORK

This project we talk about here is known as Artifical Neural Network(ANN)and ANN a model is in machine learning which consists of a large number into of artificial neurons connected to each other. Then structure of neural network is Computation model that recive inputs and deliver output in resembles axons in the human brain. The motivate behind selecting this type of architecture is to confect an bright model with function similar to that of a human brain. The structure of a neural network structure made up of layers of connected input units and output .shown in Fig

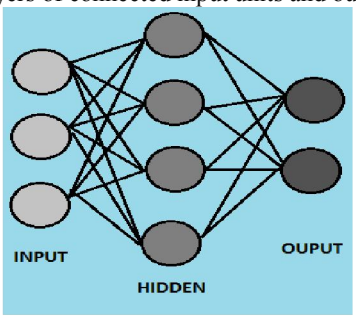


Figure 5: Structure Of Neural Network

Multilayer Perceptron (MLP): A MLP is a feed ahead ANN which maps the input data to the communicate output. There are include a several layer of nodes, with each layer is Attached to the following layer through a set of controled edges. Every one neuron in the network is assigned an activation function which maps the burdened input to the output.

The MLP network is trained using the error correction algorithm used in this project.

Backpropagation Algorithm: Below are the equation which clarify the error correction algorithm.

Phase 1: Absolute the error in output layer δL: The components of δL are given by $\delta Lj=\partial C/\partial aLj\sigma'$ *(zLj). The term $\partial C/\partial aLj$ is the rate of change of the cost function with respect to the output activation function.

Phase 2: Absoulte the error δl in terms of the error in the next layer, δl+1:

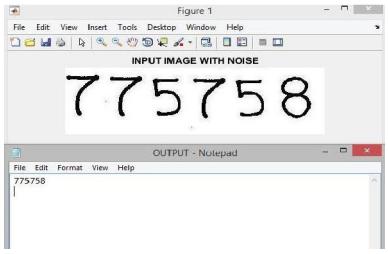
$$\delta l=((wl+1)T\ \delta l+1)\odot \sigma'\ (zl)$$

Suppose we know the error δl+1 at the l+1th layer. When we put in the invert and reverse the weight matrix, (wl+1)T, we can think of this as moving the error reverse through the network, giving us a measure of the error at the output of the lth layer. We then take the Hadamard product $\odot \sigma'$ (zl). This moves the error backward through the activation function in layer l, giving us the error δ l in the weighted input to layer l.

Combining phase 1 and phase 2 we can compute error δl for any layer.

IV. RESULT ANALYSIS

Template Matching



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Support Vector Machine

The results from the SVM algorithm are the numbers contained in the input image The accuracy obtained on the training data set was 76.7%. Below are the ROC and Confusion Matrix for SVM.

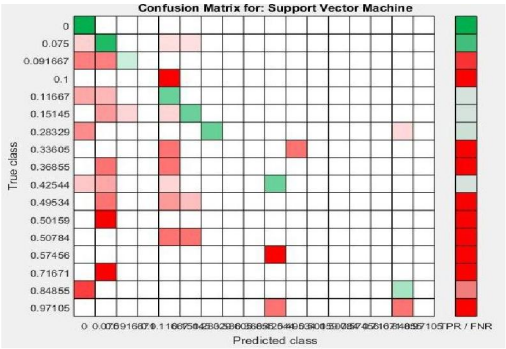


Figure 7: Confusion Matrix

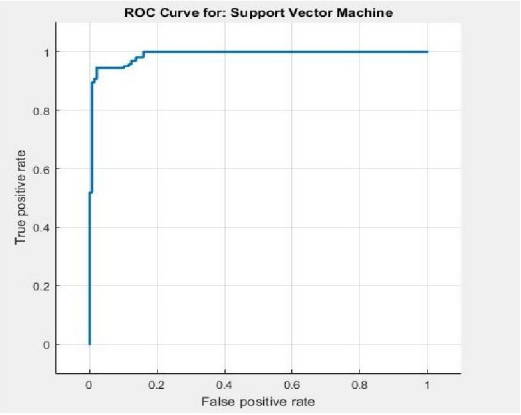
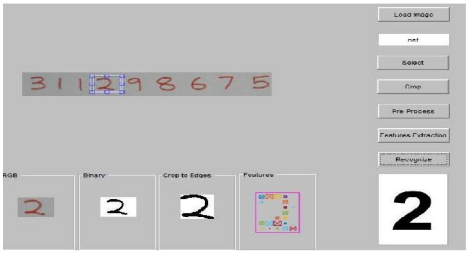


Figure 8: Roc Curve



Below are the confusion matrix and training performance for the neural network.

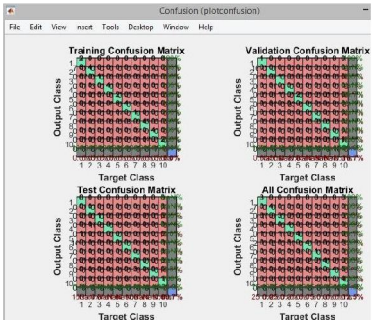


Figure 10: Confusion Matrix For Neural Networks

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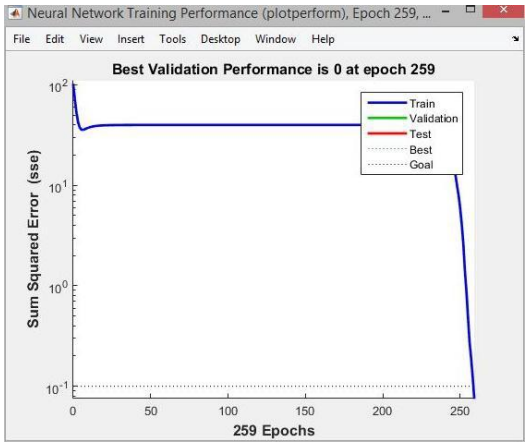

Figure 11: Training Performance for Neural Networks

V. CONCLUSION

In this project we tend to purpose ideal, Support Vector Machine,(SVM) and Artificial Neural Network for digit recognition in machine learning . It rotated out that all the three types were very good but Neural Networks was very testing to apply and very good results, followed by SVM and Template Matching. This time check our project was confined to digits, and for future work it will be impressing to look over characters and more extra applications could involve facial or handwriting recognition.

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REFERENCES

[1]. F. Bastien, P. Lamblin, R. Pascanu, J. Bergstra, I. J. Goodfellow,A. Bergeron, N. Bouchard, and Y. Bengio.Theano: new featuresand speed improvements. Deep Learning and Unsupervised Feature Learning NIPS 2012 Workshop, 2012

[2]. Qiao Tan, Yuanlin Wen , Chenyue Meng Learning of Visualization of Object Recognition Features and Image Reconstruction

[3]. Žiga Zadnik, Handwritten character Recognition: Training a Simple NN for classification using MATLAB)

[4]. J.Pradeep, E.Srinivasan, and S.Himavathi, Diagonal Based Feature Extraction For Handwritten Character Recognition System Using Neural Network

[5]. O. Matan, J. Bromley, C. J. Burges, J. S. Denker, L. D. Jackel, Y. LeCun, E. P. Pednault, W. D. Satterfield, C. E. Stenard, T. J. Thompson, Reading Handwritten Digits: A Zip Code Recognition Sy

[6]. C-L. Liu and K. Marukawa, "Normalization Ensemble for Handwritten Character Recognition", The Ninth International Workshop on Frontiers in Handwriting Recognition (IWFHR 9), Tokyo, Japan, pp. 69-74, 2004

[7]. https://www.elen.ucl.ac.be/Proceedings/esann/esannpdf/es1999-461

[8]. Vanderbrug, G.J, Rosenfeld, ―Two-Stage Template Matching,‖ IEEE Transactions on Computers,Vol. 60, Issue 11, 1977

[9]. P. Weinzaepfel, H. Jegou, and P. Perez. Reconstructing an image from its local descriptors. In Computer Vision and Pattern Recognition,2011, pages 337 – 344. IEEE.

[10]. [D. M. Zeiler and R. Fergus. Visualizing and understanding convolutional networks. In Computer Vision and Pattern Recognition,2013.

[11]. M. Zeiler and R. Fergus. Visualizing and understanding convolutional networks. In arXiv:1311.2901, 2013.

[12]. M. D. Zeiler and R. Fergus. Visualizing and understanding convolutional networks. In Computer Visio