

Handwritten Text Recognition in Machine Learning

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Abstract: In this machine learning project, we will recognize handwriting text (single English alphabet) this we are going to achieve by modelling a neural network that will have to be trained over a dataset containing images of alphabets. And used CNN algorithm for external input image prediction.

Keywords: CNN, Handwriting recognition, Tensor Flow

I. INTRODUCTION

We Neural Networks are recently being used in various kind of pattern recognition. Handwrittens of different person are different; therefore it is very difficult to recognize the handwritten characters. Handwritten Character recognition is an area of pattern recognition that has become the subject of research during the last some decades. Neural network is playing an important role in handwritten character recognition. Many reports of character recognition in English have been published but still high recognition accuracy and minimum training time of handwritten English characters using neural network is an open problem. Therefore, it is a great important to develop an automatic handwritten character recognition system for English language . In this paper, efforts have been made to develop automatic handwritten character recognition system for English language with high recognition accuracy and minimum training and classification time. Experimental result shows that the approach used in this paper for English character recognition is giving high recognition accuracy and minimum training time. Splitting the data read into the images & their corresponding labels. The '0' contains the labels, & so we drop the '0' column from the data dataframe read & use it in the y to form the labels. We are splitting the data into training & testing dataset using train_test_split function.

Also, we are reshaping the train & test image data so that they can be displayed as an image, as initially in the CSV file they were present as 784 columns of pixel data. So we convert it to 28×28 pixels. All the labels are present in the form of floating point values, that we convert to integer values, & so we create a dictionary worddict to map the integer values with the characters. Here we are only describing the distribution of the alphabets.

Firstly we convert the labels into integer values and append into the count list according to the label. This count list has the number of images present in the dataset belonging to each alphabet.

Now we create a list – alphabets containing all the characters using the values() function of the dictionary.

Now using the count & alphabets lists we draw the horizontal bar plot

The shuffling is done using the shuffle function so that we can display some random images. We then create 9 plots in 3×3 shape & display the thresholded images of 9alphabet.

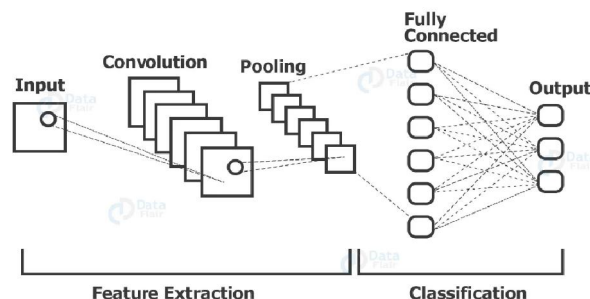


Fig.1 logical diagram for CNN

Convolutional Neural Network (CNN) architecture the diagram:

Feature Extraction:

Input: Represents the raw image data.

Convolution: Multiple layers apply filters to detect features (edges, textures, etc.) in the image.

Pooling: Reduces dimensionality while retaining important features.

Classification:

Fully Connected Layer: Nodes interconnected for classification.

Output: Produces the final classification (e.g., object recognition). This architecture is widely used for tasks like image recognition. It efficiently extracts relevant features from images and makes accurate predictions.

IMAGE DATASET :

Offline handwritten character recognition includes this stage .we have collected image data manually and stored it in the project file then we putted image link on the code . the image is captured by camera and moved to the project folder Gather a large dataset of handwritten English characters. Datasets like MNIST or Kaggle's handwriting datasets are commonly used. and Dataset taken from this website <https://data-flair.training/blogs/handwritten-character-recognition-neural-network/>

The dataset contains 26 folders (A-Z) containing handwritten images in size 28 by 28 pixels, each alphabet in the image is centre fitted to 20 by 20 pixel box Each image is stored as Gray-level

PRE-PROCESSING:

Preprocessing is a series of steps as result increases image accuracy. the following preprocessing techniques are used for handwritten character recognition process.

II. CLASSIFICATION:

The training would have ended by this point ,and the testing of the input data would have begun. the testing data would run through all of the aforementioned steps ,and different probabilities are given to the matching rules. The rule with the highest likelihood is chosen ,and the associated class-label is given recognizable character

III. RELATED WORK

Convolutional-Neural-Network-Based Handwritten Character Recognition:

This research proposes a custom-tailored CNN model for recognizing characters of the English alphabet using datasets: Kaggle and MNIST. The study focuses on achieving higher accuracies with lightweight models and discusses the performance matrices such as precision, recall, specificity.

Handwritten Character Recognition with Neural Network:

A project that recognizes handwritten English alphabets from A-Z by modeling a neural network trained over a dataset containing images of alphabets. The methodology includes data preprocessing, model training using frameworks like Keras and TensorFlow, and evaluation of the model's performance².

Handwriting Recognition using Neural Network:

This paper discusses a system for recognizing free handwritten characters, numerals, and special characters using neural networks. The recognition process involves training the neural network using the Back Propagation algorithm³.

Neural Networks for Handwritten English Alphabet Recognition

The paper demonstrates the use of neural networks to develop a system that can recognize hand-written English alphabets. It involves a simple feature extraction system whose output is fed to the neural network system⁴.

IV. METHODOLOGY

In this phase, the proposed reputation machine is described. An ordinary handwriting recognition gadget is composed of pre-processing, segmentation, classification

DATA COLLECTION

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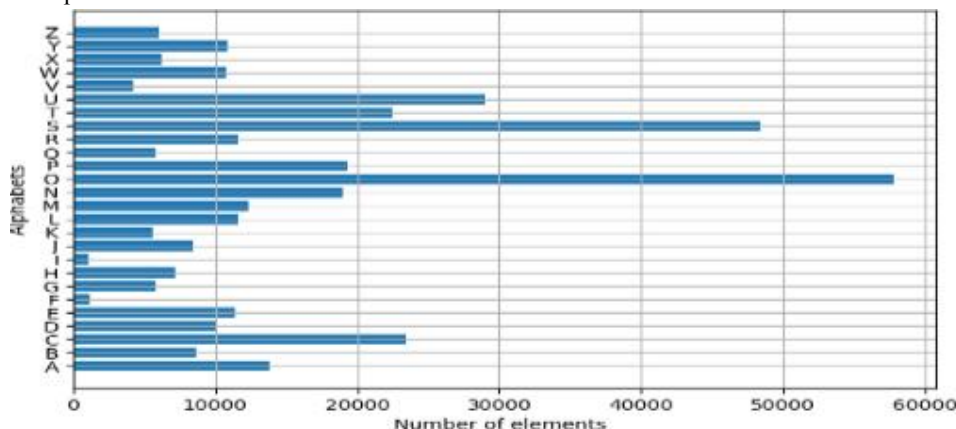


Fig.2 present data of alphabet in dataset

PREPROCESSING

The preprocessing is an arrangement of tasks performed on the filtered input photograph. It supplements the picture delivering it appropriate for division. The different assignments done at the photo in pre-handling level are displayed in fig. 2.

Binarization way changes a dim scale picture into a double picture utilizing the global thresholding method. Enlargement of edges inside the binarized photo played out the utilization of a well-known strategy.

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Noise reduction: Addictive noises of different sorts can contaminate pictures. Hence, there is a want to get rid of noise to enhance the great of the photo.

Binarization: This approach is used to transform the grayscale image and change it to black and white, significantly lowering the facts contained inside the photo from exceptional shapes of grey right into a binary picture.

V. CLASSIFICATION AND RECOGNITION

The classification stage is the dynamic piece of the acknowledgment framework. A feed-forward back engendering neural organization is utilized in this work for arranging and perceiving the written characters. The 600 pixels gotten from the resized character in the division stage structure the contribution to the classifier

After predicting the character we got the following accuracy and loss as below mentioned :

	Accuracy	Loss
Validation	0.9781715869903564	0.07791411751151837
Training	0.9566888	0.16048666509519255

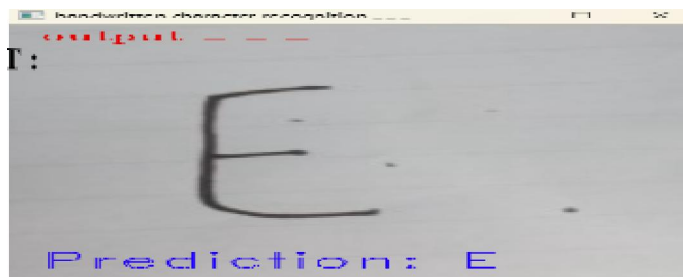
Table.1, show accuracy and loss for training and testing

After executing our project we got validation accuracy is 0.9781715869903564 and

Training accuracy is 0.9566888, then we got loss of validation are

0.07791411751151837 And training 0.16048666509519255

OUTPUT :



VI. CONCLUSION

We have successfully developed Handwritten character recognition (Text Recognition) with Python, and Machine Learning libraries . Handwritten characters have been recognized with more than 97% test accuracy. This can be also further extended to identifying the handwritten characters of other languages too.

We have proposed and developed a scheme for recognizing hand written English alphabets. We have tested our experiment over all English alphabets with several Hand writing styles. Experimental results shown that the machine has successfully recognized the alphabets with the average accuracy of 97%, which significant and may be acceptable in some applications. The machine found less accurate to classify similar alphabets and in future this misclassification of the similar patterns may improve and further a similar experiment can be tested over a large data set and with some other optimized networks parameters to improve the accuracy of the machine.

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