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Smart Cheque Text Extractor using Keras/CNN

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Abstract:
Predictive analytics using machine learning is a much active field of research in today's era. In this paper we present the handwriting recognition system. The system basically takes as input a handwritten text as input, performs segmentation on it and then predicts the output according to the trained model through CNN. The experiments were carried out after training the dataset and were able to achieve an accuracy of Promising results are found and this model is beneficial as this will help to easy recognize text i.e. digits as well as characters from a given sample image.

Keywords: *CNN, RNN, Machine Learning, Extraction*

I. INTRODUCTION

The human visual System is one of the wonders of the world. Most people can effortlessly recognise the digits as well as the characters. The difficulty of visual pattern recognition becomes apparent if we try to write a computer program to recognise digits and characters like those above. What seems easy suddenly becomes difficult for us. Handwriting recognition is a great challenge since there is a great variation in the style of writing from person to person. A system is built that is able to acquire and detect characters in paper documents, pictures, touch-screen devices and other sources and convert them into some sort of machine-encoded form [1]. In this project the main task is to recognize the digits as well as the characters in a cheque book. We are going to implement the project using deep learning as we are implementing neural networks. Handwriting recognition can be thought as a subset of image recognition system [2]. Basic algorithm is that the image of a handwritten text is taken as input and it outputs the likelihood that the image belongs to different classes. First of all the characters or digits will be selected from that portion of cheque on which they are written. The text will be segmented further. It is done because storing a word or sentence is difficult so the whole sentence is broken into characters and from that a string will be made by comparing it with the trained models using CNN. Till now we found this to be a better alternative then storing the whole sentence. The neural network formed will be able to recognise the handwritten text from the given input.

The rest part of the paper includes the following: Section 2 discusses about the related work. Section 3 presents brief discussion about the proposed work. Section 4 gives details about the methodology which includes the information about the data, methods followed etc. Section 5 explains summary and future scope of the project.

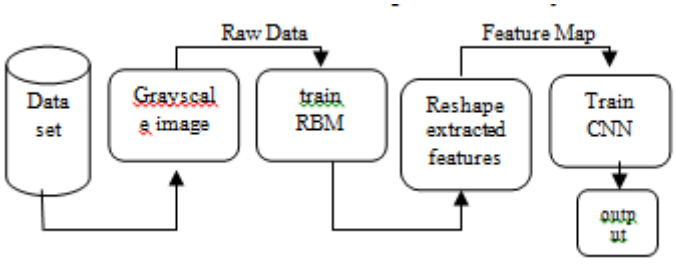

FIGURE 1: FLOW DIAGRAM

II. LITERATURE REVIEW

According to the research work done by Posnanski, it was found that IAM, RIMES and IFN/ENIT are

January-February 2020
ISSN: 0193-4120 Page No. 16075 - 16079

the current leading benchmarks in the field of handwriting recognition. The Recurrent Neural Networks (RNNs) and its extensions such as Long-Short-Term-Memory (LSTM) networks, Hidden Markov Models (HMMs), and various combinations of these methods are currently dominating the performance charts of these given datasets . The major drawback of this model was that CNN was absent from the project [3]. The work by Almanza's et al. makes the use of Fisher Vectors (FV) to encode the word input image which is an aggregation of the gradients of a Gaussian Mixture Model (GMM) over some low-level descriptors, SIFT in this case. It then trains a set of linear SVM classifiers, one per each binary attribute contained in a set of word properties. Canonical Correlation Analysis (CCA) is used to link the vector of predicted attributes and the binary attributes vector generated from the actual word [4]. Another related work is the work by Jaderberg et al. which uses CNNs trained on synthetic data for Scene Text Recognition. Although they get state of the art results on the

SVT dataset, their method is not evaluated on handwriting recognition since, unlike for scene text, synthetic fonts lack the full variability which handwritten text poses [5]. In their work, three different CNNs are presented, one of which is trained on words encoded as bag-of-n-grams. That n-gram based CNN achieves inferior results, compared to their other CNNs, on both SVT and SVT-50. Our n-gram based method, when applied outside our main scope of handwriting recognition, achieves results better than their best network on SVT. This is done, when training on the same synthetic dataset used for training the system [6].

III. PROPOSED WORK

In the previous papers only the character or the digit is recognised. We are recognising the digits as well as the alphabetical characters written by humans on paper. Here we are initially classifying whether the given image is that of a digit or a character. If it is an alpha character then we further characterise it into capital or small characters. After this the model combines the results to make a word and finally combing the word would lead to sentences. In this the words would be detected using object detection. Then that very segmentation would be cropped to extract the phrases out. This is how we would extract text from a handwritten page.

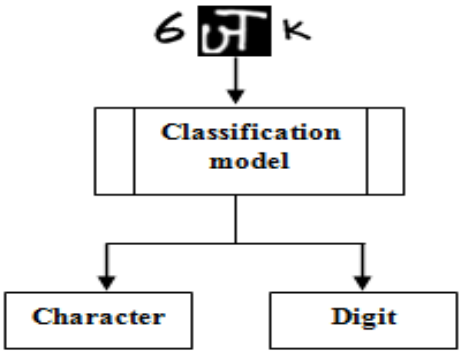

Figure 2: Proposed prediction Framework

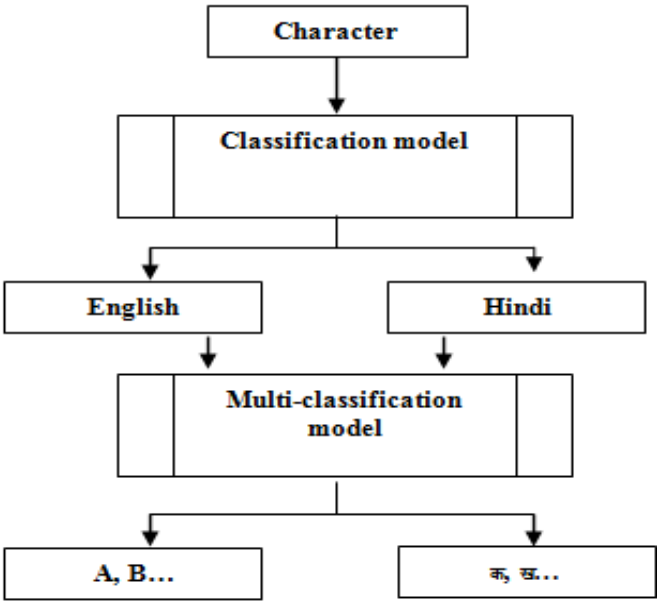

Figure 3: Detailed Framework

METHODOLOGY

The main idea behind the whole project is that it will take a dataset consisting of a very large amount of handwritten text specifically digits and characters. This dataset of handwritten text will be known as the training example.

January-February 2020
ISSN: 0193-4120 Page No. 16075 - 16079

Figure 4 : Sample training example

In accordance to this, a system will be developed which will learn from the training sample [7]. In other words, the neural network uses the examples to automatically infer rules for recognizing handwritten digits. Furthermore, by increasing the number of training examples, the network can learn more about handwriting, and so improve its accuracy.

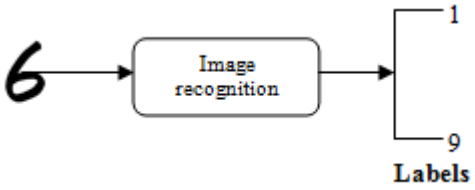

Figure 5: Image recognition flow diagram

Dataset

- The dataset of English handwritten characters has been obtained from MNIST [8]. Approximately 2 lakh grayscale images of shape (28x28 pixels) are used.
- The dataset of handwritten digits has been obtained from MNIST [9]. Approximately 60000 black and white images of shape (28x28 pixels) are used.
- The dataset of Hindi handwritten characters has been obtained from UCI repository [10]. Approximately 60000 images of shape (28x28 pixels) are used.

Used Models

i. Classification:

We have used two classification models. The classification models are made using CNN [13]. Initially we classified between characters or digits. Once it is determined that a given image is of character or digit, a further classification is done to check whether the given input image is in English or Hindi language.

ii. Multiple classification:

With the help of CNN models, we were able to classify and recognize each digit. Further after the initial classification was done, we were able to distinguish between each English alphabet as well as Hindi alphabet.

IV. EXPERIMENTAL SETTING

The Anaconda framework has been used, as it contains all the necessary libraries such as Keras, TensorFlow, CV2 and matplotlib etc. [11]. The deep learning models have been trained using Keras. The deep learning models learn by back-propagating and updating the weight values after every epoch. Moreover to increase the accuracy the images were normalized. Matplotlib was used to visualize the images and take care that the images were not distorted [12].

The images were read in form of matrix using Cv2. Furthermore they were resized using the same library and the input image was read in grayscale.

V. RESULTS AND DISCUSSION

This section discusses the results and evaluation of the various models that are trained and compare them using various parameters. For this project, we have trained almost 170 machine learning models on various parameters. We have used “ 2-conv-64-nodes-0-dense “ layer to get our Result.We have Tested on each and every layer to gain our Accuracy to most as much as we can.

January-February 2020
ISSN: 0193-4120 Page No. 16075 - 16079

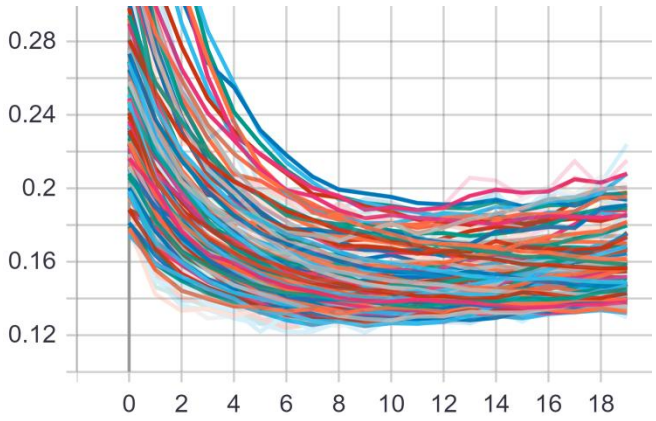

Figure 6: Graph of validation loss

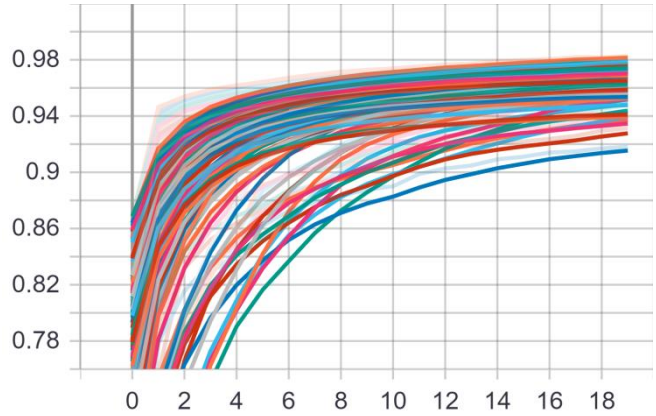

Figure 7: Graph of accuracy

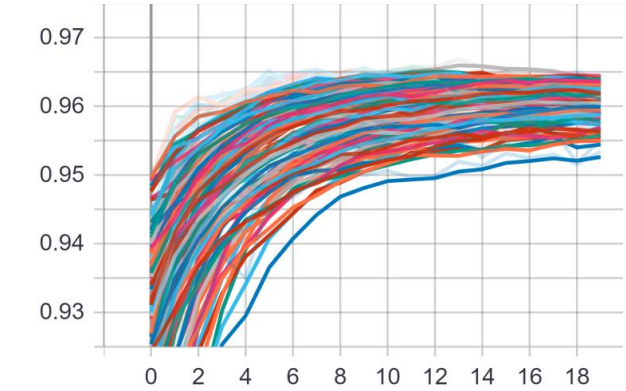

Figure 8: Graph of validation accuracy

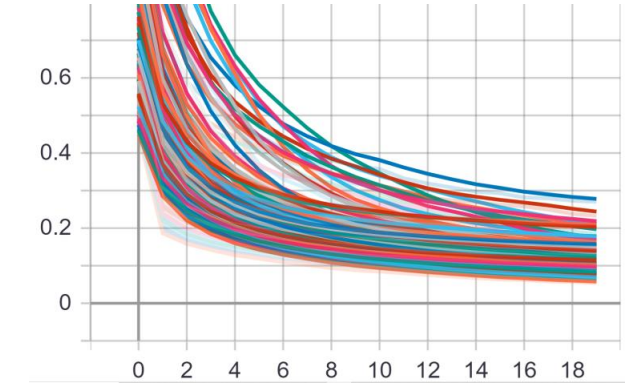

Figure 9: Graph of loss

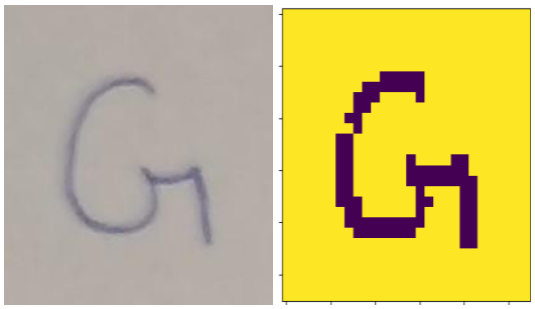

Fig 10 (a): Sample image Fig 10 (b): Processed image

The fig 10 (a) is an image that was clicked from a white page on which the chrater was written. As the image was having a lot of noise in it moreover the dimensions of the image were not same as that were requred by the model to predict. So the image was resize kepping the ratio of the imge in mind so that the image does not gets distorted. Then the noise was reduced by using the "Adaptive Gaussian" function [14] of OpenCv library, the image passed to this function was in greyscale format. After this ignoring the ratio of the image the image was again resized into 28*28 pixel size using the resize function of OpenCV library. Now if the image was not a square image then the image might get distorted, so as to take care of it we again applied the Gaussian function. Then the fig 10 (b) was fed to the model to predict the result. Finally the model gave the expected result i.e it predicted the chracter in the image as "G".

VI. CONCLUSION AND FUTURE SCOPE

Handwriting recognition is one of the most vast topic in research. As we know that different people have different writing style, so this makes the work far more difficult, to collect dataset of such diverse calligraphy. Till now we are able to achieve the accuracy of 96% on the dataset with images of dimension 28*28 pixels. Our validation loss is just 12%.

The future scope of this project is that we can use object detection to detect words from a given image. Further the image of word could be cropped into various characters. Thus giving an efficient way to

January-February 2020
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extract handwritten-text from various forms. This would make easier to extract information from forms or cheques used in various public sectors like banks. As this process is really time consuming, our project would help make the process convenient, faster, better and reliable.

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