HANDWRITING DETECTION USING CNN

Project Synopsis

Of Mini Project

Bachelor of Technology

CSE-AI

Submitted by

Prerna Dobriyal (2001331520084)

Rakshit Sangal (2001331520085)

April 2023

Under the supervision of

Mr. Vikas Tripathi , Ms Divya Raj

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY (NIET)

GREATER NOIDA, INDIA

Index

Handwriting detection using CNN

Supervisor Sign:

Mr. Vikas Tripathi , Ms Divya Raj

NIET, Gr .NOIDA

Introduction

Handwritten character recognition is an area of pattern recognition which defines an ability of a machine to analyze patterns and identify the character. Pattern recognition is the science of making inferences from perceptual data based on either a priori knowledge or on statistical information. Handwriting detection is the technique or ability of the computer to receive interpret intelligible handwriting from source such as paper document touch screen or photograph.

The basic function of pattern recognition system is to detect and extract common features from the patterns describing the objects that belong to the same pattern classes and to recognize the pattern and classify it as a member of the pattern class under consideration. Since last few decades and advancement in technology, computers interact more effectively with humans and with the natural world e.g. speech recognition, handwritten recognition, gesture recognition etc. However, Humans are outperforming far better than machines in recognizing patterns. Deep Learning has emerged as a central tool for self-perception problems like understanding images, voice from humans, robots exploring the world. The project aims to implement the concept of Convolution Neural Network which is one of the important architecture of deep learning. Understanding CNN and applying it to the handwritten recognition system, is the major target of the proposed system.

The system is tested on MNIST dataset and result are verified and compared with existing system.

There have been major breakthroughs in image labeling, object detection, scene classification, areas reported by different researchers across the world.

This leads to making it possible to formulate approaches concerning object detection and scene classification, especially convolution neural networks (CNN), this work focuses on identifying the best network for this purpose. Feature extraction is a key step of such algorithms. Feature extraction from image involves extracting a minimal set of features containing a high amount of object or scene information from low level image pixel values, therefore capturing the differences among the object categories involved.

 Some of traditional feature extraction techniques used on images are Scale-invariant feature transform(SIFT),histogram of oriented gradients(HOG),local binary patterns(LBP).Content Based Image Retrieval(CBIR).One features are extracted their classification is done based on objects present in an image .

A few examples of classifier are Support vector Machine(SVM),Logistic Regression.CNN has achieved detection rates (CDRs) of 99.77% using the MNIST database of handwritten digits.CNN has well known trained networks that uses these datasets available in open source networks and increases its efficiency of classification after getting trained over millions of images contained in the datasets of .The datasets used are composed of millions of tiny images.

It is important to note that neural network classification and prediction accuracy and error rates are all most comparable to that of humans when such comparisons are made on large datasets such as image –net, CIFAR10, 100 etc. These networks are constructed using existing neural networks and each of these networks has different layers.

Problem Statement

To recognize handwriting or text from an image using CNN algorithm

➢ In this project our main aim is to take an input from the user either in the form of offline mode that is scanned images or online mode

➢ We will train our software from the inputs taken from the users and prepare a training data set

➢ Then if the input is image we will perform some preprocessing, segmentation and feature extraction

➢ Apply classifiers such as CNN classifiers

➢ And then by using the model we will try to recognize the digits alphabets letter etc to achieve maximum accuracy possible

➢ Model will be examined on the MNIST dataset of handwritten character of 60000 images.

Proposed Methodology

The objective of the work is to develop a model that will classify a picture of a handwritten digit according to pre-trained labels, for this we found relevant image database for training the given model Engineer features that will be used for learning lay down the feature extraction mechanism.

Methodology

Understanding CNN and applying it to the handwritten recognition system, is the major target of the proposed system. Let us consider a multi-layer feed forward neural network to be applied on MNIST dataset which contains images of size 28×28 pixels (roughly 784 pixels). So if a hidden layer has about 100 units, then the first layer weights come up to about 78k parameters, which is large but manageable. However, in the natural world the size of the image is much larger. If we consider the size of the typical image which is around 256×256 pixels (roughly about 56,000 pixels), then the first layer weights will have about 560k parameters! So that becomes too many parameters and hence makes it unscalable for real images. Hence, it will be so large that it will become very difficult to generalize the new data fed into the network. Convolution Neural Network extracts the feature maps from the 2D images by applying filters and hence making the task of feature extraction from the images easier.

Architecture of the Proposed System
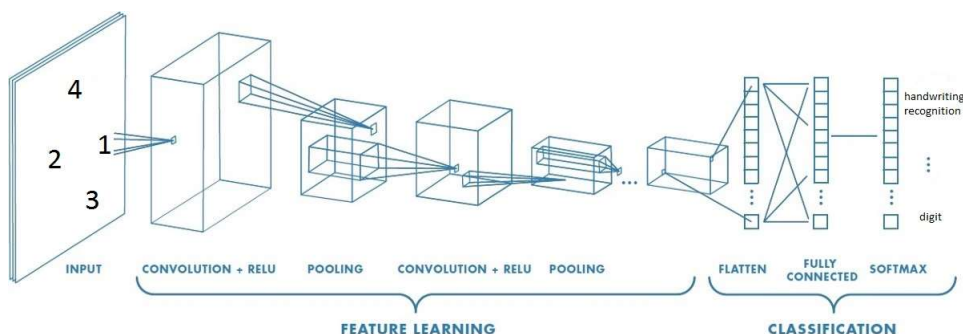
How it works:

➢ Neural Networks receive an input, and transform it through a series of *hidden layers*.
➢ Each hidden layer is made up of a set of neurons, where each neuron is fully connected to all neurons in the previous layer.
➢ Neurons in a single layer function completely independently.
➢ The last fully-connected layer is called the "output layer".

The different layers of convolutional neural network used are:

• Input layer
• Convolution layer
• Pooling layer

- Rectified Linear Unit Layer
- Fully connected Layer

The steps of proposed method are as follows:

1. **Creating training and testing datasets:** the super classes images used for training is resized, and the dataset is divided into two categories i.e. training and validating data sets.
2. **Modifying CNNs network:** replace the last three layers of the network with fully connected layer, a soft-max layer and a classification output layer. Set the final fully connected layer to have same sizes as the number of classes in the training datasets. Increase the learning rate factors of the fully connected layer to train network faster.
3. **Train the network:** set the training options including learning rate mini batch size and validation data according to GPU specifications of the system. Train the network using the training data.
4. **Test the accuracy of the network:** Classify the validation images using the fine tuned network and calculate the classification accuracy. Similarly testing the fine tune network on real time video feeds for accuracy results

Dataset used: The dataset used is the MNIST database of handwritten digits. It consists of a training set of 60,000 examples, and a test set of 10,000 examples. The digits have been size-normalized and centered in a fixed-size image. The images are of size 28*28 pixels. It is a good database for people who want to try learning techniques and pattern recognition methods on real-world data while spending minimal efforts on preprocessing and formatting.

Feasibility Study

The handwriting detection is very important application of machine learning. Offline handwriting text recognition system. The CNN provide more accuracy almost comparable to human beings The NN training is feasible on CPU but more complex neural network will require more CPU capability minimum of 8GB RAM and external GPU will make the processing fast and more complex may be solved more easily and will provide more accurate results.

Need:

The handwriting detection is used at many places like

1. Signature matching
2. Reducing the more and more paper works
3. Preserving old documents
4. Cheating detection
5. Virtual notes making
6. More organized document in government organization and educational organizations

Significance:

The model machine learning is most developing branch or most researched field in computer science because today's world is of fully automated machines. The machine learning is future of our world. The more and more complex and accurate model is needed to improve the feasibility and to reduce the time of recognition. It is also used in other detection such as recognizing objects which may be very useful in online marketing.

Resource requirement

Min-Hardware requirements

- 8GB RAM or higher

- Hard drive 500GB or higher

- CPU core i3

- GPU(increasing result accuracy)

Software requirements

- Python

- Python libraries

- Database

- Web browsers (IE8,google chrome)

References

[1] Diego J.Romero, Letecia M., "A Comparative study of GABOR feature and gradient feature for handwritten chinese character recognition", International Conference on Wavelet Analysis and Pattern Recognition, pp. 1182-1186, Beijing, China, 2-4 Nov. 2007.

[2] Anita Pal & Dayashankar Singh, "Handwritten English Character Recognition Using Neural," Network International Journal of Computer Science & Communication. Vol. 1, No. 2, July-December 2010, pp. 141-144.

[3] Salvador España-Boquera, Maria J. C. B., Jorge G. M. and Francisco Z. M., "Improving Offline Handwritten Text Recognition with Hybrid HMM/ANN Models", IEEE Transactions on Pattern Analysis and Machine Intelligence, Vol. 33, No. 4, April 2011.

[4] Pranob K Charles, V.Harish, M.Swathi, CH. Deepthi, "A Review on the Various Techniques used for Optical Character Recognition", International Journal of Engineering Research and Applications, Vol. 2, Issue 1, pp. 659-662, Jan-Feb 2012.

[5] K. Gaurav and Bhatia P. K., "Analytical Review of Preprocessing Techniques for Offline Handwritten Character Recognition", 2nd International Conference on Emerging Trends in Engineering & Management, ICETEM, 2013

[6]Neha Sharma,Vibhor Jin,Anju Mishra, "An Analysis Of Convolutional Neural Network For Image Classification", International Conference on Computational Intelligence and Data Science, 2018