

# HANDWRITTEN DIGIT RECOGNITION USING MACHINE LEARNING

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**Abstract-** The task of digitally recognizing handwriting has been difficult due to the variety of writing styles. Therefore, we have tried to build a foundation for future research in the area so that researchers can overcome the existing problems. Existing methods and methods of digital recognition manuscripts have been reviewed and understood to analyze the most appropriate and effective digital recognition method. More than 60,000 images were used as photo training sets with a resolution of  $28 \times 28$  pixels. Photos / training sets are matched to a real photo. It was found after a thorough analysis and review that the integrated integration system had a minimum error rate of 0.32%. In this paper, a review of various handwritten digital recognition methods was observed and analyzed.

## 1. INTRODUCTION

The project comes with an OCR (Optical Character Recognition) approach that integrates various aspects of computer science research. The project is to take a picture of a character and process it to see the image of that character as the human brain to see the various digits. This project contains an in-depth picture of the Image Analysis techniques as well as a large machine learning area and machine learning structure called the Neural Network. There are two different parts of the project 1) Training part 2) Evaluation part. Part of the training comes with the idea of training a child by giving different sets of the same characters but not completely different from telling them that the result of this "this". According to this theory one has to train a newly formed neural network with many characters. This section contains a new algorithm that they created for themselves and was developed according to the need of the project. The test section contains a new database test. This part always comes after the training part. First one has to teach the child how to recognize the character. Then one should check to see if you have given the correct answer or not. If not, one should train him a lot by providing a new database and new entries. As such one should check the algorithm again. There are many parts of modeling and working methods that come to a project that require a lot of mathematical modeling techniques such as optimization and filtering process, how to calculate (How to use neural intermezzo 2 Peter Relents (2016)) and prediction (Kaiming He et al)) after that filter or algorithms come to the background or the result one really needs and finally predict the creation of a predictable model. The machine learning algorithm is made up of concepts of prediction and planning.

## 2. PROBLEM DEFINITION AND FEASIBILITY ANALYSIS

The world as a whole is working on a variety of machine learning problems. The goal of machine learning is to manipulate and manipulate real-life data and the real-life component of human interaction or complex ideas or real-life problems. What you really want to know about this is the Handwriting Recognition because it is the structure of a certified person and the interaction of categories between other people.

### 2.1 PROBLEM DEFINITION

The goal was to create a suitable algorithm that could deliver the output of a handwritten character by simply taking a picture of that character. When someone asks about image processing it means that the problem cannot be solved because there can be a lot of noise in that photo taken that cannot be controlled by the person. The main thing when a person writes a handwritten letter or digit of our case, he does not have a single idea that he should draw it with broadcast pixels or just like a normal picture given. The machine can do that but not the person. Therefore, by comparing only pixels one can not see that. The concept of machine learning is supervised data. The machine learning algorithm relies entirely on model data. If someone modifies the Image directly, the model will get a lot of flat values because that image can be painted in a variety of RGB formats or with various pixels that can be accurately modeled due to sound. Therefore, in this project one has to build a model by analyzing images and learning by machine. Both methods will be needed because these two methods will improve machine learning and can shape the project.

### 2.2 FEASIBILITY ANALYSIS

There is more that can happen. Let's discuss one at a time

- **Technical Performance:** -The software used in this project is open source and one can connect to it whenever he or she wish. The concept of python and open CV another side the The concept of image processing and machine learning is a very popular topic these days. Apart from that the whole working environment of the software Google Colab is open source and can be easily accessed where the internet is. The user can also become an editor and by clicking the start button can set the digit on the webcam screen and see the output.

- Seasonal Occurrence: - This activity can be done on time which means the project started on a specific day and was completed on time. It was a successful effort that led to the timely completion of the project.

- Economic viability: - This project is economically free because all open-source software has been used which is why no charge or funding has been made. Only reading materials on the part of the developer or designer are not available for free. The software or program is completely free of cost.

### 3. PROCESSING MODEL

Image processing technique has been implemented extensively at the very first part of the project. So, what is Image Processing? Image processing is a method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it. It is a type of signal processing in which input is an image and output may be image or features or characteristics associated with that image. Nowadays, image processing is among rapidly growing technologies. It forms core research area within engineering and computer science disciplines too.

#### 3.1 Image processing in training data

In the training database the neural network model is trained in two different databases.

i) MNIST database (Modified National Institute of Standards and Technology).

The MNIST (Modified National Institute of Standards and Technology database) is a large handwritten website. The database is also widely used in training and testing in the field of machine learning. It is composed of "re-mixing" samples from the original NIST database. The creators felt that since the NIST training data set was taken from the staff of the American Census Bureau, while the test data was taken from American high school students, it was not well suited for machine learning tests. In addition, black and white images from NIST were customized to fit in a 28x28 pixel binding box with anti-aliased, which introduces grayscale levels.

ii) The data collection is self-contained. These two databases almost 60500 entries in the training model and train the model in beauty about 5 times for repetition.

The handwritten characters created this database themselves almost add 500 entries to the database training. This works much better than the MNIST data set for this project and works in the last part of the training model as it may face many problems like this after testing. This database has its own features

#### 3.2 Image processing in Testing Data

In the case of previewing data, I thought it would be an image that would already exist in a man-made database. To make the test part more attractive, a real-time image is captured by a computer webcam. This section has increased the complexity of the program and the project but has made it even more interesting. Then three components such as a digital manuscript removal database are applied to those. In this process there are two main components.

1. Log in to the webcam and take a picture
2. Noise reduction and resize and measurement.

#### 3.3 THE NEURAL NETWORK MODEL

The neural network lies in the concept of machine learning. At first he made a model like a brain unit and then as a child he trained that model as a brain with multiple data sets, in my digital project. There are two parts to the neural network model.

- Training Section
- TestSection

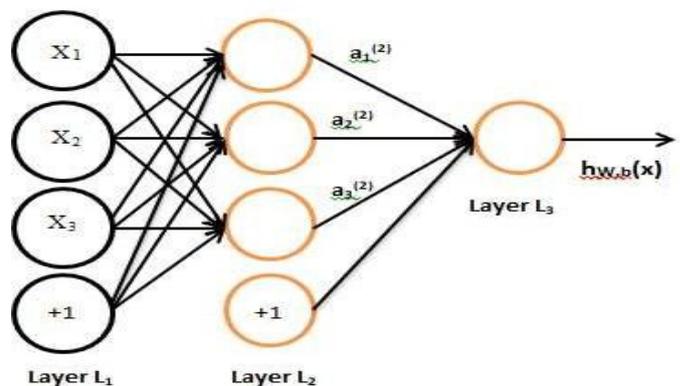


Fig- Neural Network Model

### 4. PROCESSING MODEL

A flowchart is a type of diagram that represents a workflow or process. A flowchart can also be defined as diagrammatic representation of an algorithm, a step-by-step approach.

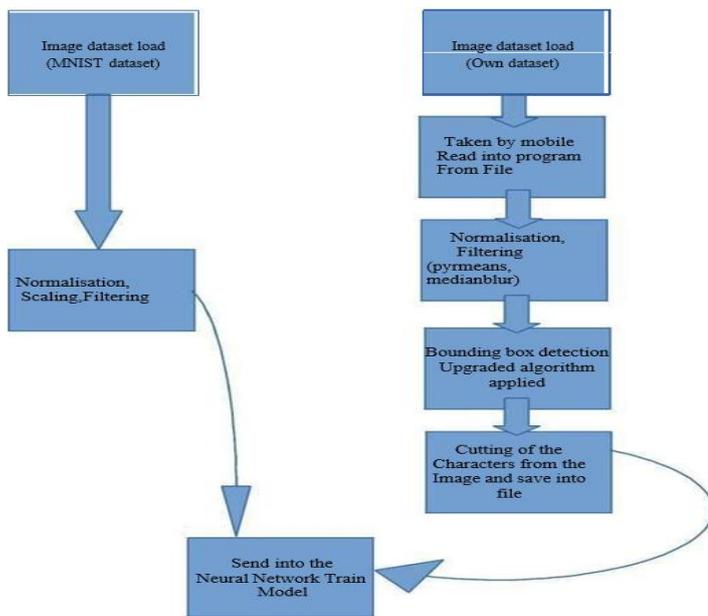


Fig - Image processing for Training Data

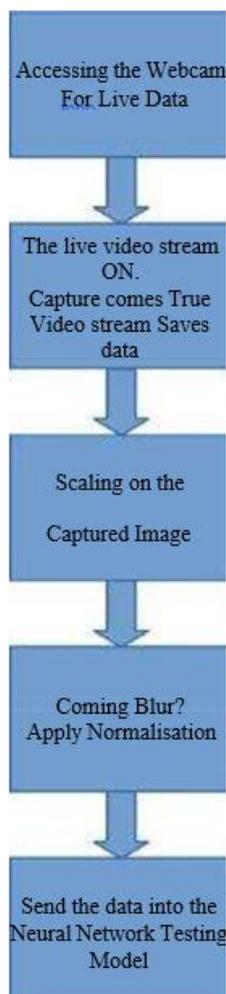


Fig -Image Processing for Testing data

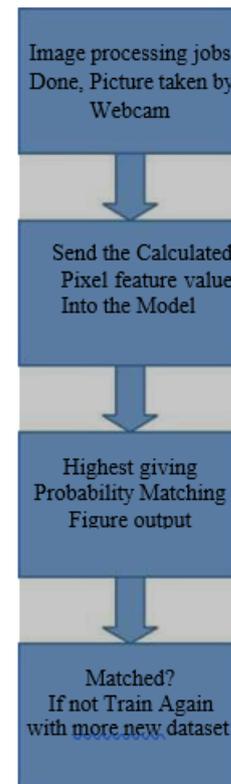


Fig-Neural Network Model for Testing Data

The Neural Network Model gets a prediction on the test image. Thanks to the processing component The test image actually converts the data in the image into pixels calculated by the possible values by sending it to the neural network. When compared it means it is successful or otherwise it is a mistake. Maybe training will be done with it later.

### 5. TESTING

Testing is defined as the task of testing whether the actual results are the same as the expected results and to ensure that the software system is flawless. Includes the use of a software component or system component to test one or more features. Software testing also helps identify errors, gaps, or needs that are not in conflict with the actual requirement

### 6. CONCLUSIONS

This is a project in OCR (Lighting Recognition). This project is an unreadable project and is designed with full interest that incorporates the external concept of mathematical modeling and development methods. In these days of real-time analysis, the data has been greatly increased. Small analysis means the size of the increase of all data in the real world.

Year Range	Size of data(exabyte)
Up to 2005	130
2005-2010	1200
2010-2015	7900
2015-2020	40,900

Table -Range of Data

Machine learning is a way to get real-life data into action through human analysis. This project aims to achieve that goal because all machine learning algorithms aim to go in a better way than man. This project is the very first project based on those. This world offers daily Google services that also have not yet accessed so much data. This project offers a variety of new ideas

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**REFERENCES**

- [1] Non-recursive Thinning Algorithms using Chain Codes Paul C K Mwok Department of Computer Science The University of Calgary Calgary, Canada T2N 1N4
- [2] A dynamic shape preserving thinning algorithm Louisa Lam and Ching Y. Suen Centre for Pattern Recognition and Machine Intelligence and Department of Computer Science, Concordia University, 1455 de Maisonneuve Blvd. W., Montrdal, Qudbec H3G 1MS, Canada
- [3] Object Contour Detection with a Fully Convolutional Encoder-Decoder Network JimeiYang Adobe Research jimyang@adobe.com Brian Price Adobe Research bprice@adobe.com Scott Cohen Adobe Research scohen@adobe.com Honglak Lee University of Michigan, Ann Arbor honglak@umich.edu Ming-Hsuan Yang UC Merced mhyang@u

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