Image Recognition using Machine Learning Application

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ABSTRACT

Image Recognition using Machine Learning is a Machine Learning application which can be used for many purposes. In today's era, we all know that social networking sites have reached its heights. And thus this raises many criminal cases too like hacking other's account etc. So, if the feature of face recognition during the login time will be implemented then those cybercrimes will be hampered. Therefore, Image Recognition will be helpful in the field Image and Face-recognition on social networking sites. In addition to that, Self-Driving Cars can also be benefited by Image Recognition as it will scan the images of the roads which will be helpful for determining the path towards the destination in those cars. Moreover, Image Recognition is also useful for making decisions over visual inputs. There can be more applications of the Image Recognition: in the field of Rescaling Image, Correcting Illumination, Detecting License Plate etc. Thus, this application of Machine Learning i.e. the Image Recognition is very much useful technique required by our society having very large number of advantages.

Keywords : Image Recognition, Machine Learning, Optical Character Recognition

I. INTRODUCTION

Machine Learning is an application of Artificial Intelligence that enables the software application to "learn" from data, without being explicitly programmed. Machine Learning allows software application to predict output without being explicitly programmed. The Machine Learning was evolved from the study of Pattern Recognition and Computational Learning Theory. And it was coined in the year 1959 by Arthur Samuel. Machine Learning explores the study and construction of algorithms that can learn from the data and also which can make predictions on data. Such algorithms overcome strictly static program instructions by making data-driven predictions or decisions, through building a model from sample inputs. [1]

Machine Learning is employed in a range computing tasks where designing and programming explicit algorithms with good performance is very difficult. Examples of Machine Learning includes Optical Character Recognition (OCR), email filtering, Data Breach etc.

Effective Machine Learning is difficult because finding patterns is hard and often not enough data are available.

Machine Learning algorithms can be classified into two categories: Supervised and Unsupervised Learning.

In Supervised Machine Learning, the computer system is presented with example inputs and their desired outputs. The objective is to generate a function that map inputs to desired outputs. The training continues until the model achieves a desired level of accuracy on the training data. Common algorithms of Supervised Machine Learning are

Linear regression, Decision Trees, Neural Networks, Random forest, Support Vector Machines.[8][9]

In Unsupervised Machine Learning, the computer system is trained with unlabeled data. There is no output categories or labels that can be used to generate a function that can model relationships between the input data and the output data. The system has to understand itself from the data presented to it. These are the family of machine learning algorithms which are mainly used in pattern detection and descriptive modeling. Common algorithms of Unsupervised Machine Learning are Clustering, Association. [8][9]

1.1 Image Recognition

Image recognition is the ability of software application to identify and detect places, people, writing and actions in a digital image or video. This concept is used in many applications like systems for factory automation, toll booth monitoring, and security surveillance.

The brains of human and animals recognize and interpret the visual world with ease. However, for a computer, recognizing a human being at all represents a difficult problem.

A machine learning approach to image recognition involves identifying and extracting key features from images and using them as input to a machine learning model. [10]

II. PREVIOUS WORK

These are some of the Machine Learning projects which have been developed earlier:

i. **Tensor Flow**

TensorFlow is an open source software library for numerical computation using data flow graphs. Nodes in the graph represent mathematical operations, while the graph edges represent the multidimensional data arrays (tensors) that flow between them.[2][3]

It is written in C++ and Python. Programmers can use TensorFlow in their application through its API which is available in C++, Python, Haskell, Java, Go and Rust. [2][3]

ii. **scikit-learn**

Scikit-learn is a free software machine learning library for Python programming language built on top of SciPy. Scikit-learn is largely written in Python, with some core algorithms written in Cython to achieve performance. [4][5]

iii. **Keras**

Keras is an open source neural network library written in Python. Keras allows users to productize deep models on smartphones (iOS and Android), on the web, or on the Java Virtual Machine. It also allows use of distributed training of deep learning models on clusters of Graphics Processing Units (GPU). [6][7]

III. METHODOLOGY

In this application, the main idea is to scan the input image and then to compare that scanned input image with the image which is already fed into the program in the computer system. After the comparison of both the image suitable actions will be performed according to the need of the situation.

i. First of all, we will take an input image of size 8 X 8 bits. Here, let us take an example of an image of a numeral digit Zero.
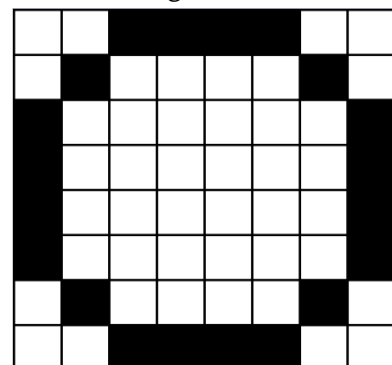

Figure 1. Numeral digit 0 as 8 X 8 bit image

ii. Now, we will convert this input image into Pixel array.

Figure 2. 3-d Pixel Array of image (in Fig1)

In the above Pixel Array, each P_{ij} represents a pixel of an 8 X 8 bit image where:

$P_{ij} = [R\ G\ B\ K]$

where,

R, G, B denote the corresponding Red, Green, Blue values of a pixel of an image.

K denotes the intensity of the pixel.

The Intensity (K), Red (R), Green (G) & Blue (B) values ranges from 0 to 255.

iii. Now, we have to convert the image to Black & White by following the below given steps:

a. Calculate the mean of a pixel P of the input image as:

$P_{(ij)mean}$ = Mean of RGB values of Pixel P_{ij}

b. Calculate the mean of all the pixels of the image as:

P_{mean} of all pixels = Mean of { $P_{(11)mean}$, $P_{(12)mean}$, $P_{(13)mean}$, …… $P_{(87)mean}$, $P_{(88)mean}$ }

c. If the mean of a pixel is greater than the average mean of all the pixels then convert that pixel to white else convert that pixel to black.

i.e.

if P_{mean} > Average P_{mean} of all pixels

then:

R=255, G=255, B=255 and K=255

else:

R=0, G=0, B=0 and K=255

d. Load images from the test examples which are already fed in the program into the computer system. For an instance, take an example of numeral digit 0 and 1 as follows:

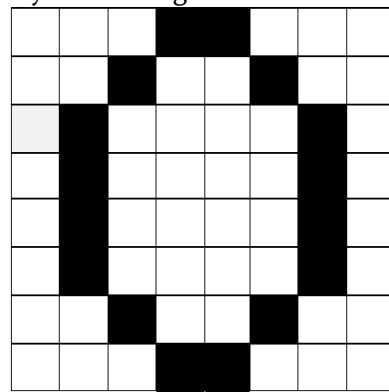Different ways of writing Zero in 8X8 bit pixel image.
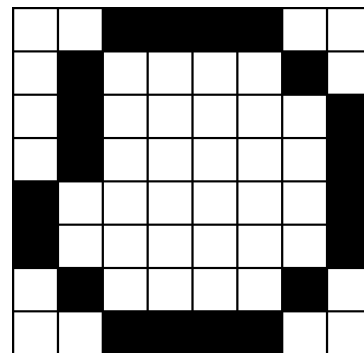

Figure 3. Digit 0 in way 1
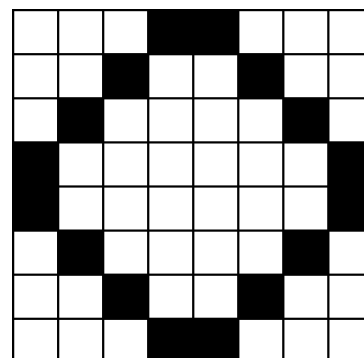

Figure 4. Digit 0 in way 2

Figure 5. Digit 0 in way 3

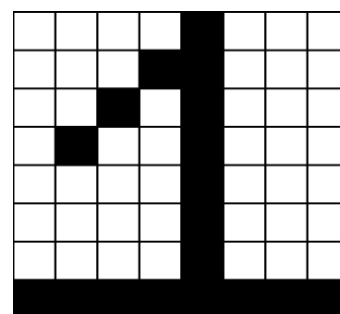Similarly, different ways of writing Zero in an 8X8 bit pixel image.
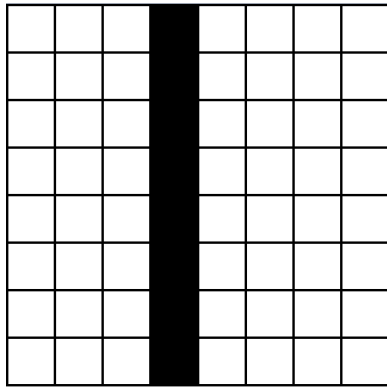

Figure 6. Digit 1 in way 1
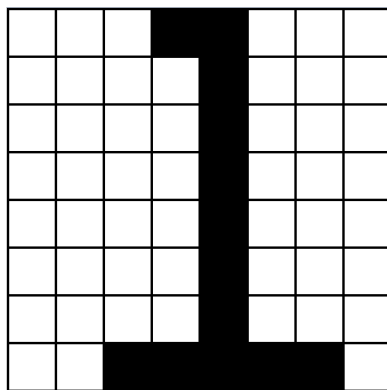
Figure 7. Digit 1 in way 2

Figure 8. Digit 1 in way 3

e. Now at this point, compare the pixel array of the input image (i.e. the image we want to check) with the pixel array of all the test samples.

f. After the matching process of both the input as well as the sample images, the image which has the largest number of pixel matched with the sample images must be the required answer.

Thus, the above mentioned procedure is the basic methodology for the purpose of Image Recognition through Machine Learning.

IV. RESULT

Image Recognition using Machine Learning is a Machine Learning application in which we have used various different mathematical algorithms for the processing of an image.

Here, we have used Supervised Machine Learning where we have taught the computer how to work. For an instance, let us consider that persons can write a numeral digit (say 0) in 10 different manners. So, at first, we have already fed all those 10 different possible ways in which the digit 0 can be written, into the program. And the pixel values of each images is being stored in a three-dimensional array. Now, the input image is matched with the already stored test samples by the help of pixel values of both the images.

Out of all the stored test samples, the one which matches efficiently with the input image is the required result of the Image Recognition process.

V. DISCUSSION & CONCLUSION

The Image Recognition using Machine Learning successfully recognizes the input image using some mathematical algorithm.

The main function of this application is that it can recognize digits in images. Even if the input signifies some handwritten images then also this Image Recognition system recognizes the correct image very easily. This feature is achieved because we have many numbers of test samples stored in the program itself.

The objective of the project was to recognize an input image for its further processing according to the situation which is successfully achieved.

VI. FUTURE SCOPE

At present the application only recognizes a number of single digit in an 8 X 8 image. But, in future, we will enhance the algorithm so that it can recognize numbers of multiple digits in the image and also different objects in the image. We also modify the algorithm so that it can work with the images of any size and shape.

VII. REFERENCES

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