A NOVEL METHOD FOR HANDWRITTEN DIGIT RECOGNITION SYSTEM

PROBLEM STATEMENT

In this digital world, everything including documents, notes is kept in digital form. The requirement of converting these digital documents into processed information is in demand. Handwriting recognition is one of the compelling research works going on because every individual in this world has their own style of writing. It is the capability of the computer to identify and understand handwritten digits or characters automatically. Because of the progress in the field of science and technology, everything is being digitalized to reduce human effort. Hence, there comes a need for handwritten digit recognition in many real-time applications.

SOLUTION DESCRIPTION

Convolutional Neural Networks (CNN) becomes one of the most appealing approaches and has been an ultimate factor in a variety of recent success and challenging machine learning applications such as challenge ImageNet object Detection image segmentation and face recognition. Therefore, we choose CNN for our challenging tasks of image classification. We can use it for handwriting digits recognition which is one of high academic and business transactions. There are many applications of handwriting digit recognition in our real life purposes. Precisely, we can use it in banks for reading checks, post offices for sorting letter, and many other related works.

MNIST database

The MNIST database (Modified National Institute of Standards and Technology database) is a handwritten digits dataset. We can use it for training various image processing systems [11]. The database is also widely used for training and testing in the field of machine learning. It has 60,000 training and 10,000 testing examples. Each image has fixed size. The images are of size 28*28 pixels. It is a database for people who want to try learning techniques and pattern recognition methods on

real-world data while spending minimal efforts on pre-processing and formatting. We will use this database in our experiment.

Convolutional Neural Networks

Convolutional neural networks are deep artificial neural networks. We can use it to classify images (e.g., name what they see), cluster them by similarity (photo search) and perform object recognition within scenes. It can be used to identify faces, individuals, street signs, tumors, platypuses and many other aspects of visual data. The convolutional layer is the core building block of a CNN. The layer's parameters consist of a set of learnable filters (or kernels) which have a small receptive field but extend through the full depth of the inputvolume. During the forward pass, each filter is convolved across the width and height of the input volume, computing the dot product, and producing a 2-dimensional activation map of that filter. As a result, the network learns when they see some specific type of feature at some spatial position in the input. Then the activation maps are fed into a downsampling layer, and like convolutions, this method is applied one patch at a time. CNN has also fully connected layer that classifies output with one label per node

Methodology

Deep Learning has emerged as a central tool for self-perception problems like understanding images, a voice from humans, robots exploring the world. We aim to implement the concept of Convolutional Neural Network for digit recognition. Understanding CNN and applying it to the handwritten digit recognition system is the target of the proposed model. Convolutional Neural Network extracts the features maps from the 2D images.Then it can classify the images using the features maps. The convolutional neural network considers the mapping of image pixels with the neighbourhood space rather than having a fully connected layer of neurons. The convolutional neural network is a powerful tool in signal and image processing. Even in the fields of computer vision such as handwriting recognition, natural object classification, and segmentation, CNN has been much better tool compared to all other previously implemented tools. The broader aim may betodevelop a machine learning model that could recognize people's handwriting.

Libraries Required

Make sure that the following libraries are installed on your working machine before proceeding further

- Keras
- Tensorflow
- Numpy

NOVELTY

The handwritten digit recognition is the capability of computer applications to recognize the human handwritten digits. It is a hard task for the machine because handwritten digits are not perfect and can be made with many different shapes and sizes. The handwritten digit recognition system is a way to tackle this problem which uses the image of a digit and recognizes the digit present in the image.Handwritten Digit Recognition is the capability of a computer to fete the mortal handwritten integers from different sources like images, papers, touch defenses, etc. And classify them into 10 predefined classes(0-9).

This is the existing method along with this we add some features to make our project unique among them. We create a model that recognize multiple-digits present in the image in a offline mode. The future scope of this method is, we can recognize number in License plate, bank cheques and postal mail sorting.

We get a predicted result in two mannerone is, the recognized digits is showned in the interface and the another manner is, we can get a predicted result through voice mode. This means the model tell the multiple-digit in voice mode. This feature helps the old age people they are difficult in understanding handwritten digits, blind people and who contain eye sight issues.

SOCIAL IMPACT

Digit recognition plays an role in the modern world. ‘Digits’ are a part of our everyday life, be it License plate on our cars or bike, the price of a product, speed limit plate on our cars or bike, the price of a product, speed limit on a road, or details associated with a

bank account. In the case of a text which is unclear, it is easier to guess the digits in comparison to the alphabets.

Machine Learning and Deep Learning are reducing human efforts in almost every field. Moreover, a solution achieved using ML and DL can power various applications at the same time, thereby reducing human effort and increasing the flexibility to use the solution. One such solution is a handwritten digit recognition system that can be used in postal mail sorting, bank check processing, form data entry, etc.

- It can solve more complex problems and makes humans job easier. This type of system can be widely use in the world to recognize zip code or postal code for mail sorting.
- In banking sector too where more handwritten numbers are involved like account number, figure of cash and checks
- In banking system it is used to recognizing written digits on cash deposit/withdrawal/and other transaction which is also able to recognize the handwritten account number and amount on the cash deposit slip and thus automate the cash deposit process at the bank counter.
- Postal department and courier services can easily find the digits written.
- Old people who will have eye sight issues with handwritten digits.

BUSINESS MODEL

Digit recognition plays an important roles in many places. It is independent of environment, while using the recognizer we don’t need the network. The benefits of hand written digit recognizer is high. In banking sector, it is very useful. It is used to recognize the account number, figure of cash and checks. It is also used to recognize the written digits on cash, deposit /withdrawal. So, the requirement of manpower is less, because the machine done the work of bank employees. So, we can earn the profit by using the hand written digit recognizer.

The hand written digit recognizer is used in postal department it recognize the pin codes, zip codes. It reduce the required amount of man power. It gives more accuracy. By using this handwritten digit recognizer postal department earn the profit /revenue. Because of the required man power is less and it also gives the better accuracy. This recognizer is widely

used in many places, such as mail sorting, form data entry etc... Whenever the demand arises for digital recognizer, on that place we can use it and earn the profit by this handwritten digit recognizer.

SCALABILITY OF SOLUTION

To make the path toward digitalization clearer by providing high accuracy and faster computational for recognizing the handwritten digits. The present Neural network as classifier, MNIST as dataset with suitable parameters for training and testing and frame work for hand written digit recognition .The aforementioned system successfully imparts accuracy up to 99.20% which is higher than formally proposed schemes. In addition, the proposed system reduces computational time significantly for training and testing due to which algorithm become efficient.

Thus the CNN architecture is proposed in order to achieve accuracy even better than that of ensemble architectures, along with reduced operational complexity and cost. Moreover, we also present an appropriate combination of learning parameters in designing a CNN that leads us to reach a new absolute record in classifying MNIST handwritten digits. We carried out extensive experiments and achieved a recognition accuracy of 99.87% for a MNIST dataset.