A NOVEL METHOD FOR HANDWRITTEN DIGIT RECOGNITION SYSTEM

ABSTRACT

There are many difficulties facing a handwritten Arabic recognition system such as unlimited variation in human handwriting, similarities of distinct character shapes, interconnections of neighbouring characters and their position in the word. The typical Optical Character Recognition (OCR) systems are based mainly on three stages, preprocessing, features extraction and recognition. This paper proposes new methods for handwritten Arabic character recognition which is based on novel preprocessing operations including different kinds of noise removal also different kind of features like structural, Statistical and Morphological features from the main body of the character and also from the secondary components. Evaluation of the accuracy of the selected features is made. The system was trained and tested by back propagation neural network with CENPRMI dataset. The proposed algorithm obtained promising results as it is able to recognize 88% of our test set accurately. In Comparable with other related works we find that our result is the highest among other published works.

KEYWORDS

Handwritten Arabic Characters, noise removal, Secondary component

- **INTRODUCTION**

A Novel Method for Handwritten Digit Recognition System
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. MNIST data set is widely used for this recognition process and it has 70000 handwritten digits. We use Artificial neural networks to train these images and build a deep learning model. Web application is created where the user can upload an image of a handwritten digit. this image is analyzed by the model and the detected result is returned on to UI

INTERNA
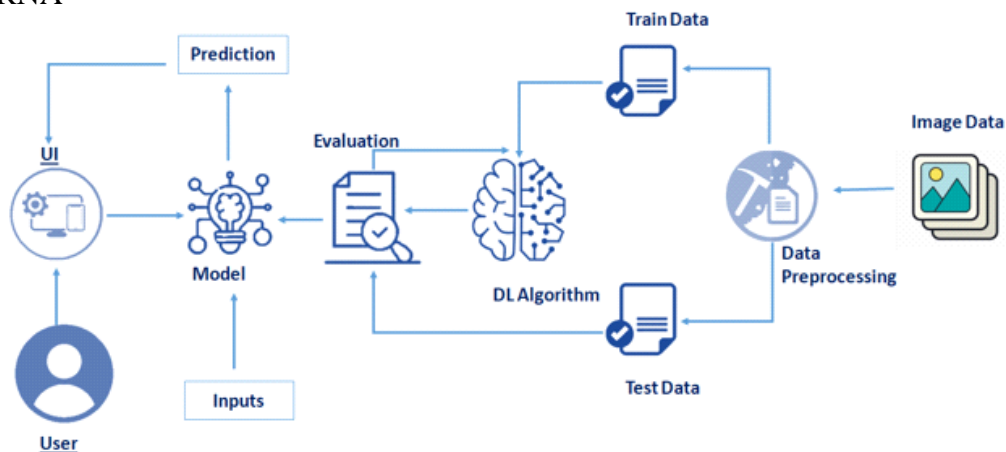
METHODOLOGY

However, as we began deveDeep Learning has emerged as a central tool for self-perception problems like understandingimages, 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 .

There is a reason behind using CNN for handwritten digit recognition. Let us consider a multi-layer feedforward 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 comes up to about78k parameters, which is large but manageable. However, in the natural world the size of theimage is much larger . If we consider the size of the typical image which is around 256×256pixels (roughly about 56,000 pixels), then the first layer weights will have about 560kparameters! So that becomes too many parameters and hence make it unscalable forreal images. Hence, it will be so large that it will become very difficult to generalize the newdata fed into the network. Convolution Neural Network extracts the feature maps from the 2Dimages by applying filters and hence making the task of feature extraction from the imageseasier. Basically, convolution neural network considers the mapping of image pixels with theneighbourhood space rather than having a fully connected layer of neurons. Convolution NeuralNetworks has been proved to be a very important and powerful tool in signal and imageprocessing. Even in the fields of computer vision such has handwriting recognition, naturalobject classification and segmentation, CNN has been a much better tool compared to allother previously implemented tools .

EXPLANATION OF THE PROPOSED
SYSTEM

• The first layer of the architecture is the Userlayer. User layer will comprise of the people
who interacts with the app and for the requiredresults.

• The next three layers is the frontendarchitecture of the application. The application
will be developed using Boot strap which is theopen source platform for HTML, CSS and
JavaScript. The application is deployed in thelocalhost which is shown on the browser.
Through the app, the user will be able to uploadpictures of the handwritten digits and convert it
into the digitalized form.

• The one in between the database and viewlayer is the business layer which is the logical
calculations on the basis of the request from theclient side. It also has the service interface.

• The backend layer consists of two datasets:Training Data and Test Data. The MNIST
database has been used for that which is alrea dydivided into training set of 60,000 examples and
test of 10,000 examples.

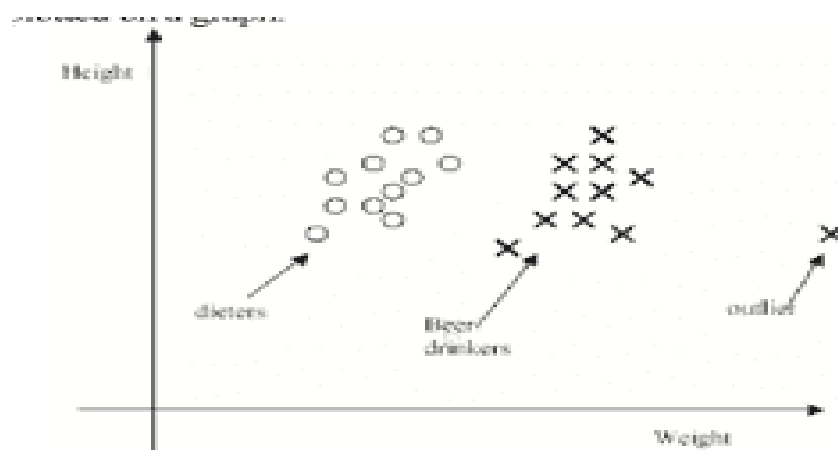• The training algorithm used is Convolution Neural Network. This will prepare the trained

Figure 2.1 Two classes fully separated

Architecture:

Below shown is a small workflow of how CNNmodule will extract the features and classify the
image based on it. The architecture shows theinput layer, hidden layers and output layer of
the network. There are many layers involved in the feature extraction phase of the network
which involves convolution and subsampling . Fig.2: Architecture of CNN.

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".

A.CONVOLUTION LAYER

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 input volume. During the forward pass, each filter is convolved across the width and height of the input volume, computing the dot product between the entries of the filter and the input and producing a 2 dimensional activation map of that filter. As a result, the network learns filters that activate when they see some specific type of feature at some spatial position in the input.. Feature Extraction:All neurons in a feature share the same weights .In this way all neurons detect the same feature at different positions in the input image. Reduce the number of free parameters. Subsampling Layer: Subsampling, or downsampling, refers to reducing the overall size of a signal .The subsampling layers reduce the spatial resolution of each feature map. Reduce the effect of noises and shift or distortion invariance is achieved. Pooling layer:It is common to periodically insert a Pooling layer in-between successive Conv layers in a ConvNet architecture. Its function is to progressively reduce the spatial size of the representation to reduce the amountof parameters and computation in the network, and hence to also control overfitting. The Pooling Layer operates independently on every depth slice of the input and resizes it spatially susing the MAX operation.

B.TENSORFLOW

TensorFlow is an open-source machine learning library for research and production. TensorFlow offers APIs for beginners and experts to develop for desktop, mobile, web, and cloud. See the sections below to get started.By scanning the numerical digit and convert

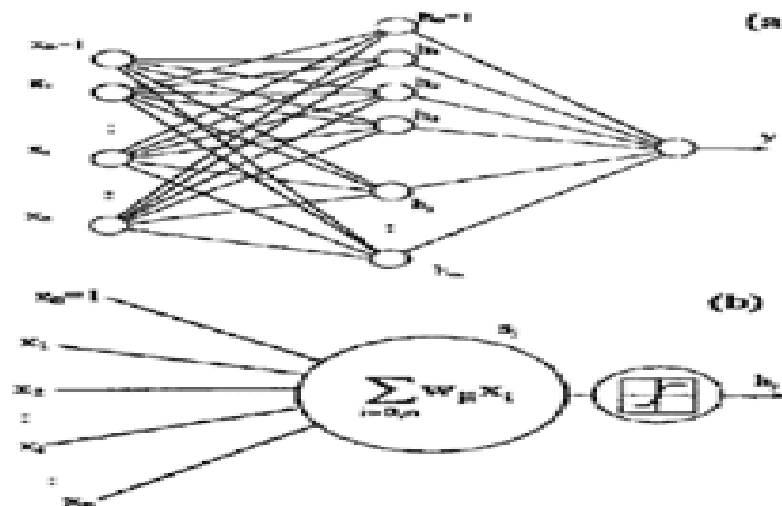into png format using python3 command interminal we can get text output and sound output.

Figure 3.3 (a) Three layers feed-forward neural net,
(b) Processing unit element.

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In business, System Analysis and Design refers to the process of examining a business situation with the intent of improving it through better procedures and methods. System analysis and design relates to shaping organizations, improving performance and achieving objectives for profitability and growth. The emphasis is on systems in action, the relationships among subsystems and their contribution to meeting a common goal. Looking at a system and determining how adequately it functions, the changes to be made and the quality of the output are parts of system analysis. Organizations are complex systems that consist of interrelated and interlocking subsystems. Changes in one part of the system have both anticipated and unanticipated consequences in other parts of the system. The systems approval is a way of

thinking about the analysis and design of computer based applications. It provides a framework for visualizing the organizational and environmental factors that operate on a system. Proposed Application Module: The proposed application has been implemented using Python on terminal. The user is given two options in the home image: Simple Upload, Model Form Upload. Simple Upload will allow the user to upload the image and predict it then and there. After navigating away from that page, the link to the uploaded image is lost. The Model Form Upload will allow the user to upload the image with description. With this link, the user will be able to store the image and see its link on the home page itself. By clicking on the link, the user will be able to get the result from the CNN

C.DATASET USED

As with any work or project taken up in the field of machine learning and image processing we are not considering our results to be perfect Machine learning is a constantly evolving field and there is always room for improvement in your methodology; there is always going to be another new approach that gives better results for the same problem. The application has been tested using three models: Multi-Layer Perceptron (MLP), Convolution Neural Network (CNN).

Output of digit recognition of numerical '6'The results of training the network is stored in .npz format so that whenever a user tries to recognize the digit, the application does not go into the training loop again. For classification, we have used logistic classifier, softmax function, one hot encoding, cross entropy and loss minimization using mini batch gradient descent. These are some of the basics of Neural Network which are required to process the output from the network and display in the form the user can understand.

An implementation of Handwritten Digit

D.CONCLUSION

Recognition using Deep Learning has been implemented in this paper. Additionally, some of the most widely used Machine Learning algorithms i.e. CNN using Tensorflowhave been trained and tested on the same data to draw a comparison as to why we require deep learning methods in critical applications like Handwritten Digit Recognition. In this paper, I

have shown that that using Deep Learning techniques, a very high amount of accuracy can be achieved. Using the Convolutional Neuraln Network with Keras and Theano as backend, I am able to get an accuracy of 95.72%. Every tool has its own complexity and accuracy. Although, we see that the complexity of the code and the process is bit more as compared to normal Machine Learning algorithms but looking at the accuracy achieved, it can be said that it is worth it. Also, the current implementation is done only using the CPU

Thus we settled on classifying a given handwritten digit image as the required digit using three different algorithms and consequently testing its accuracy. In future we