A neural network based efficient technique for Handwritten digit recognition process

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Abstract- *This paper describe the hand scripted number and character recognition process which is developed using feed forward back propagation neural network. There is various platform like record rooms, where it demand for handscripted alpha numerals recognition which make the work easy and fast. Unlike the other neural network, feed forward back propagation net handle errors effectively by propagate them towards next step. At next step processing is execute with considering that previous exception, hence at next subsequent step error is minimizes and output is become more accurate. This application allows the user to write alpha numerals in there handscript style, shape and outfilm, and system identify the accurate scripted character or number. This project application may used in record room, banks, administrative offices and various more.*

Keywords- Alpha numerals recognition, feed forward back propagation neural network, Hand scripted numbers, Exception, Outfilm.

I. INTRODUCTION

In today's world, there is numerous fields and various workstation where physically written document work is conducted based on handscripts and then scan for keep in record, and there is common problem of requirement of more speed, large storageand work efficiency. In our project work we try to solve this problem as much as correctly and effectively. Writing or drawing the character and numbers on canvas panel and recognized by system is implemented by numerous methods like pattern matching, fuzzy logic theory, neural network and so on. Among the all neural network based recognition is intelligent and more accurate approach to recognize the alpha numerals.

Used neural network based handscripted character recognition approach to improve work efficiency is best solution for ilementing character recognition. Character recognition process is implemented in two stage 1. Image preprocessing and 2. Apply neural network. In this paper we used here feed forward back propagation neural network for learning process which utilize supervised learning strategy. Once in the first stage,acquired character image is preprocessed and transformed into binarised data it is fed to next step i.e applying neural network to it. After character image acquisition, preprocessing operations like noise removal, thresholding, skeletonization, andnormalization are applied on it. Also topological, structural and geometrical properties of alpha numerals are refine and examine, then at end we get binarised image data, input for implementation neural network opearation.

Feed forward back propagation network received binary pattern as input at input layer, and performed subsequent operations on it. We provide some expected result sample for comparing with computed result to achieved more accuracy in resultant output, called as supervised learning. There are few middle layer in between input layer and output layer of neural network which called as hidden layer. Hidden layer process every input at each layer examine it with expected output and then fed to next layer as input for next layer. If there is any occurrence of error in between process of recognition at specific layer, then these raised error is feed forward to next layer. At next layer input from previous layer, previous layer raised error and expected output is computed and examine for desired targeted output. Once the final resultant output is achieved process is finish else it is become input data for next hidden layer for subsequent operation. Recognition process is continues until more accurate corresponding character depending on acquired character image is identified.

II. SCOPE & MOTIVATION

Its become more important at workstation to improve the work efficiency especially in government record room. Using this application users can identify and process the handscripted character and numbers on system and smartly performed record room like works, where documents are prepared based on handwritten scripts. Quality of service (QoS) of the project application is one of the key goal and advantage considered while designing and development of project. The crucial and complex and hard work performed at record room is key motivation of this project and theory. Using this project we just try soften and minimizes effort and hard work required at such work station. We can expand this project work for complete word recognition and then there may be for the whole sentence recognition, so that improve work efficiency more and more. Feed forward back propagation neural network include the advantage in this project work. Because of feed forward back propagation network with supervised learning concept improve the implementation efficiency and result accuracy of the project application.

III. SYSTEM DESIGN AND SPECIFICATION

This project application is standalone /desktop utility which is based on neural network architecture. It allows the user to write handscripted character and number on design canvas panel and then system can recognize which one that character or number. We can deploy this application in various workstation. Project application is design and developed with considering the end user writing abilities, style and shapes. We can enhanced this application by adding the external electronic writing pad for purposes of writing character or numbers by handscripts.Application run in following as first at user side it take input as character or number image i.e image acquisition, then at project application level it process the image for image preprocessing operations and then binarized image is produce. After that, this binarized data image is provided for neural network input data. Neural network operation including feed forward back propagation concept is applied on it, and finally we get corresponding recognize image.Front end of this project application is designing in java swing for user friendly GUI feel, and backend coding is implemented in J2SE and J2EE tools.

3.1 User Agents: Using the GUI based writing canvas panel we can provide the end user interaction panel. Through that panel we draw the character or number on canvas which become input for next step processing. And also at end there is result panel on which user get final result for corresponding input, then user can select expected result outcome from result panel.

3.2 Software Requirements:

Operating System: - Window XP/7/8.
Platform :-JDK 1.6 ,
Development Tool :-JCreator or MyEcllips
Programming Language:- Core &Advanced Java.
Designing software: Rational rose 98.
Hardware Requirement:

Intel Pentium 4 or higher (Processor), 512 MB RAM for Windows XP/ 7 & 1GB RAM for Windows 8. Minimum 20 GB HDD.

Connectivity or/and Internet Any compatible Keyboard Any compatible Mouse and Keyboard.

3.3 Feed Forward Back propagation Neural Network

To implement character recognition using feed forward back propagation neural network is applied in various ways. Back propagation neural network is network architecture which send raised error from specific hidden layer to exact previous to it, but with the feed forward functionality of back propagation this raised error are send to next hidden layer from current working layer.

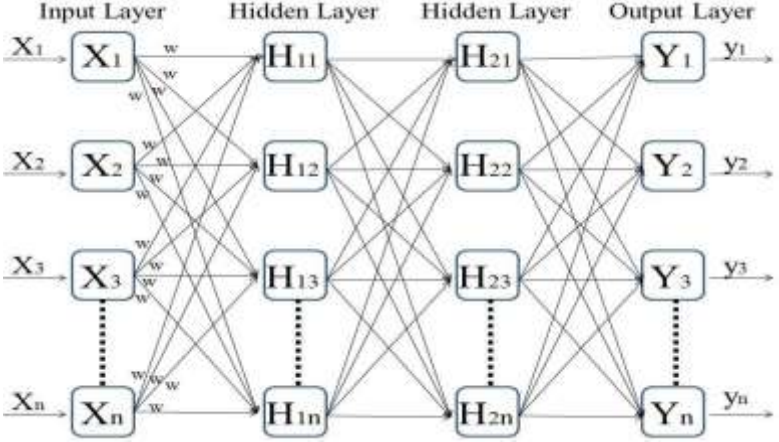

Fig.1: Feed Forward Back Propagation Network

At next layer this previous raised error play important role in supervision to execute process with reference of past layer process execution. Here with this whole process it become supervised learning neural network, at each step produce output is compare and examine with past resultant outcomes. When back propagation neural net is iterated, an input pattern schema is propagated forward to the output unit through the input layer to hidden layer and hidden layer to the output layer weight.

IV. SYSTEM IMPLEMENTATION & TESTING

Firstly, Reading an image file in binary format is done. Then threshold limits, skeletonization operations and Normalization operations are applied on the image containing text and then extracting the features of normalized binary image through Fourier Descriptor method. The process of handwritten character recognition can be divided into phases as shown in figure.

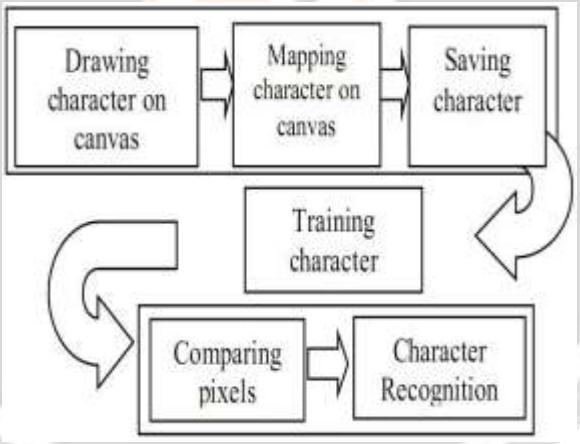

Fig.2: System Block Structure

As information moves through software, it is modified by a series of transformations. A data flow diagram is a graphical representation that depicts information flow and the transforms that are applied as data move from input to output. The basic form of a data flow diagram, also known as a data flow graph or a bubble chart. Figure 3 explain how the data flows in our project application.

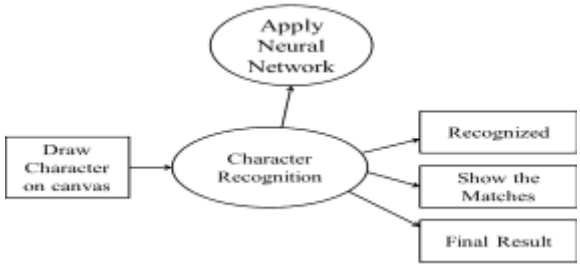

Fig.3: Project Data Flow Structure

A sequence diagram in figure 4 shows a project operationsequence, consisting of a set of objects and their relationships, including the messages that may be dispatched among them. A sequence diagram is an interaction diagram that emphasizes the time ordering of messages from the acquiring input image until the final recognition and output result. Graphically, a sequen ce diagram is a table that shows neural network arranged along the X axis and messages, ordered in increasing time, along the Y axis.

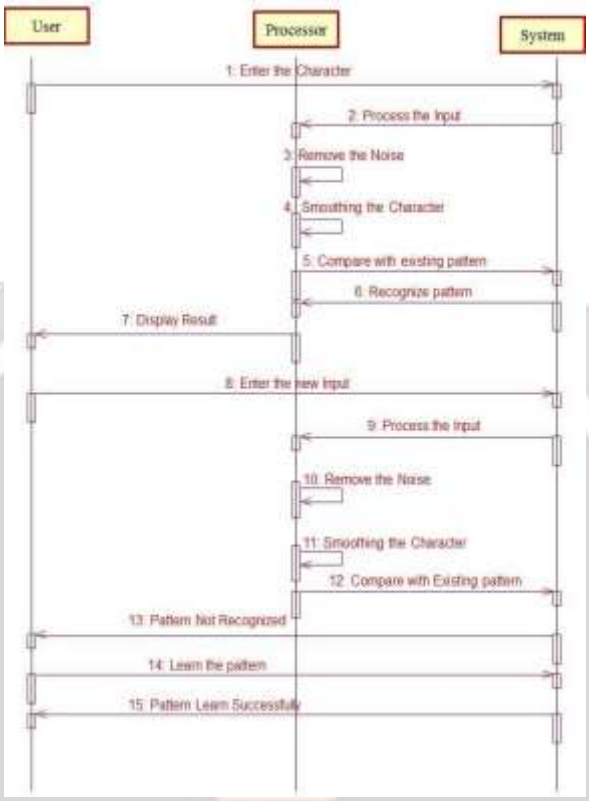

Fig.4: Project Sequence Diagram

Project Snapshot :

As we run the project application we get first empty canvas window as shown in figure 5 (A). On this panel we get option to add image through which we can add jpeg format captured image of handscriprted character or number.In figure 5 (B) is image process module through application can implement image processing. Figure 5 (C) is for Image initialization st ep for preprocessing of image. Once the image is initialized it is ready to performed image preprocessing on it. Figure 5 (D) is of gray scaled operation, first step of image preprocessing is make input image as gray scaled image so that it can make simple to use in subsequent processing steps.

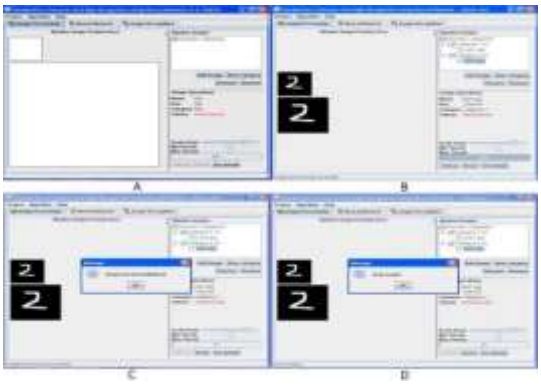

Fig.5: Project Application Snapshots

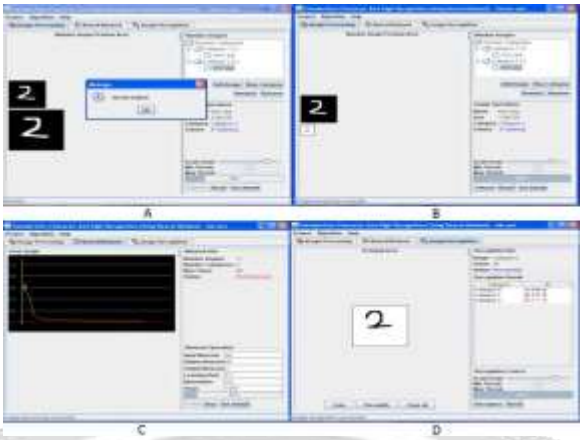

Fig.6: Project Application Snapshots

In figure 6 (A), gray scaled image is thresholdedi.eit calcite color intensity values and depending on that values graphical representation is build called as histogram. Figure 6
(B) is tokenized and scaled image of acquired image, once the image is tokenized it become easy to recognize because of stroke line of scripted character or number. Figure 6 (C) is neural network training window through which acquired image is actually train by neural network i.e recognize process is carried out. Figure 6 (D) is final window on we get resultant character output. Once we get final window with recognition successful message we need to select more accurate one. After selecting accurate expected character, we use it for later processing in our documentation.

Testing :

Aim of testing process is to identify all defects in a software product. Testing is any activity aimed at evaluating the software for quality results it produces and the quality of results it can handle. Testing is an operation to detect the differences between the expected (required) result and the actual result. Testing a program consists of subjecting the program to a test inputs or test cases and observing if the program behaves as expected. If the program fails to behave asexpected, then the condition under which failures noted for later debugging and correction. Our goal is to design a series of test cases that would have a high likelihood of finding errors. The software testing techniques provide a systematic guidance for designing tests that exercise the internal logic of software components and exercise the input & output domains of the program to uncover errors in program function, behavior and performance. There are number of rules that can serve well as testing objectives.

- Testing is a process of executing a program with the intent of finding an error.
- A good test case is one that as a high probability of finding an as yet undiscovered error.
- A successful test is one that uncovers an as-yet undiscovered error.
- If testing is conducted successful, it will uncover errors in the software.
- As secondary benefit testing explain and performance requirements appear to be working according to specification, that behavioral and performance requirements appear to have been met.

Testing Principles:

Before applying methods to design effective test cases, a software engineer must understand the basic principles that guide software testing. Some ofthe testing principles are as follows:

- Testing should begin in the small‖ and progress toward testing in the large‖.
- Exhaustive testing is not possible.
- All test should be traceable to customers requirements.
- Test should be long planned before testing begin.

To be most effective, testing should be conducted by independent third party. Internal program logic is exercised using "White Box" test case design techniques second Software requirements are exercised using "Black Box" test case design techniques. In both cases, the intent is to find maximum number of errors with minimum effort and time,

Sr. No.	Input	Expected Output	Actual Output
1	Valid Concepts	Tokens	Tokens
2	Not Valid Concepts	Error Message	Enter Valid Image
3	Valid Concepts	Input Neurons	Train Neurons
4	Not Valid Concepts	Error Message	Enter Valid Neurons
5	Valid Concepts	Show Results	Recognize Image

TestingProcedure

Test 1: To check whether imageis added or not Input:Image
Result:Image initiated or failure. Procedure: Add Image for processing.

Test 2: Check image is validor not Input:Image
Result: Valid or invalid
Procedure:click to process the added image.

Test 3: Check whether the Neural Network can betrained Input: Processed Image.
Result: Trained or not trained yet
Procedure: Check input tokens are not exceeding the values of neurons

V. FUTURE SCOPE

The application of neural network in character recognition has been a field of study recently. Neural networks are used to solve the tasks which are difficult for conventional computers or Human beings to solve. This paper aims at recognition of English numeral recognition using Gradient descent based back propagation training algorithm. The main aim of using this Algorithm is to reduce the error which is difference between the computed value of neural Network and desired value. By using artificial neural network methodology of English numeral Recognition, 99% accuracy is achieved. The method used in this paper can be further extended to Recognize multilingual characters. Also we can extends this concept up to complete word recognition and then more whole sentence recognition. Wemay usethis project in smart AI workstation for hand scripted work to speed up and impressive work.

V. CONCLUSION

Handscripted or typed character recognition is one of the important topics in application of artificial neural network. It improves the working capability of system to handle written work in various shape and writing style. Feed forward back propagation neural network add the advantage in the process of character /number recognition and increase the accuracy of detecting exact output correctly. There may be the situation where the Handscripted character image id complex to recognize, because to handle this problem of recognition we used supervised neural network learning, so that actual output and expected output should be matched for correctness of output.

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