

Recognizing and digitizing human handwritten information Neural Network Optical Character recognizer to automate attendance record system of an organization

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Abstract: *In this highly competitive digital world handling a non-digital data and making value out of non-digital information for business use is a toughest challenge. In today's highly competitive business environment not considering or using non-digital information is not a very good choice. As the technology is growing and world shifting towards digitization it is not a tough task to digitizing non-digital (on paper) information. Artificial Neural Network (ANN) techniques which are capable of handling imprecise and complicated data are one of the solutions to solve such problem with minimum human interventions which are too complex to be understood and solved by other computer techniques or humans. In this paper we discuss about automating an attendance record system of an organization using Optical Character Recognition technique of a neural network. (Data sets will be the sample images of an attendance pages with different handwritings, more sample data more accurate results can be achieved).* ^{[1][2][3]}

Keywords: ANN, OCR, ROI, ICR

I. Introduction

Artificial Neural Network is a system which performs complex tasks intelligently like human brain and gains the knowledge through learning. The structure of the Artificial Neural Network system is similar to the structure found in human brain. It comprises inter connected neurons where knowledge is stored in input layer, hidden layer and output these three layers. All the nodes are interconnected to each other and assigned a weight which changes according to the knowledge the each network learns. The input layer will consist of nodes that will receive inputs from one or more sources or data fed into a network from external program. The input received by each neuron is then multiplied by a weight, the summations of these multiplications is passed to the hidden layer containing the activating function or another set of neurons. Activation function is used for setting bounds for the output neurons, selecting an activation function is crucial to the output from the neural network. Artificial neural network technique becomes very efficient and useful in pattern recognition or optical character recognition which recognizes the human written texts in the form of which machine can read and reduces possibilities of human errors. There is no specific pattern or procedure for human handwriting or any such specific font so it becomes very difficult to understand and recognize human handwritten text. Optical Character Recognizer technique using neural network is a powerful approach reduces a possible errors significantly and provides best results. The method used to recognize human handwriting in OCR is feature extraction with strict matching also known as Intelligent Character Recognition (ICR). Advantage of this approach is that we can train our model solution on sample images features and then the trained model can be used for the similar input to recognizing the handwriting ^{[1][4][6]}

Training an Artificial Neural Network

Training the ANN system is crucial and important part of the neural network model. While training the network since the output is known i.e. Each characters desired outcome is known therefore those values directly can be assigned in the training stage. To calculate the error at each node the difference between the input and output is calculated and the error outcome is used to adjust the weights in the hidden layer to achieve the better accuracy in future as the model trained for the more training features and it learns by itself. ^{[1][2]}

The Iterative Learning Process

The Iterative Training Process involves feeding the network with rows of data one at a time, and each time the weights are adjusted. During this process weights are updated according to the calculated error outcome as the network nodes learn from the training samples and then it predicts the correct character from the input samples. After the structure of the neural network been decided the training stage begins in which the weights are assigned randomly at the beginning.

Calculated errors in training stage are back propagated in result weights are updated for the next training iteration and this process repeats until the weights continually tweaked. While creating the Attendance Record system using OCR, the network will be structured to perceive characters depending on the enclosures. Once the network is structured characters and numbers will be fed into the system and the training process will be complete i.e. achieve maximum accuracy.^{[1][2]}

Feed forward, Back-Propagation

Identifying the errors and which node contributed the most to incorrect output is the most difficult part in the model, since neural network comprises of many input nodes and hidden nodes. The solution to this difficulty is achieved by computing output of each node layer by layer and the difference between desired output and calculated output is back propagated through several layers and accordingly weights adjustments happens.^{[1][2]}

Current System

The education systems in most of the countries follow a manual process to record attendance. The process begins when the faculty records student attendance at the end of the lecture and submits it to the data entry operator. The data entry operator then feeds the data into the system one by one and generates a spreadsheet for the same. There are few problems with such a system.

- 1) Since the data entry is a manual process, it is prone to errors.
- 2) The entire process is very time consuming as there is no automation at any step of the process.
- 3) Manpower needs to be employed to record attendance details.

Proposed System

To recognize characters 'P' (Present) and 'A' (Absent) along with the names of the students lecture details and the faculty details. The attendance first will be taken manually by the teacher whose format will be fixed later on it will be scanned into an optical image. The approach to character recognition will be finding Region Of Interest (ROI), Noise Removal, Integrated segmentation, and finally Recognizing characters.

Some form of automation should be done in order to make the process more efficient. The faculty after recording the system should scan the attendance sheet and create an optical image of the sheet. The OCR system than scans the image and stores the attendance details (Name of the student, UID and status) in a spreadsheet or some database. Later on the details can be posted online and made available to students on a monthly basis.

Sheet to image conversion

The attendance sheet is scanned through an optical scanner and an image for the corresponding sheet is generated. The image is then fed into the OCR system, which is programmed beforehand for a predefined format of attendance sheet.

Noise Elimination

The scanning process sometimes adds additional noise element to images which cannot be ignored as it adds up to the difficulty in character recognition. Noise causes pixels to deviate from their true values and reflect false intensities. A method for eliminating noise is to convert the digital color image into a black and white image and remove small intensity pixel values. The image of the attendance sheet will be converted into a black and white image. Noise from the image will be removed using some noise removal technique. After the image is free from noise we will convert the image back into its previous color scheme and move onto finding the Region Of Interest.

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Name of the Faculty		
Subject Name		
Prog & Sem		MCA - Sem III

Sr. No.	Roll No.	Name of the Student	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Date																	
Time																	
1	07-10-001	AKOLA VIRAL PARSHOTTAM															
2	07-10-002	APHALE LALIT RAJENDRA															
3	07-10-003	BUYA SWAPNIL DEEPAK															
4	07-10-004	CHAUDHARY RAHUL RAMNATH															
5	07-10-005	CHAUDHARY VANDANA SURESH															
6	07-10-006	CHAUGULE AISHWARYA JAYENDRA															
7	07-10-007	CHAUHAN NIKHIL JAGDISH															
8	07-10-008	CHAUHAN SANDEEPKUMAR CHHEDI															
9	07-10-009	DESHMUKH MAYURESH SAMIR															
10	07-10-010	DHUNVAVWALA MUZZAMMIL															
11	07-10-011	DIXIT SWAPNIL HEMANT															
12	07-10-012	FERNANDES ALLAN BENEDICT															
13	07-10-013	GANDHI PANKTI NIKHIL															
14	07-10-014	JADHAV SAURABH RAVINDRA															
15	07-10-015	JAGDALE ANIKET TANAJI															
16	07-10-016	JOSHI AKSHIT MANISH															
17	07-10-017	KARBHARI HARNISHA HARSHAD															

SIMSRI/MCA/Attendance Sheet / SEM III / 2015-18 / Version 1.0

Fig.1. Image with noise due to scanning

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Fig.2. Image after inverting greyscale.

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Fig.3. Image after removing Noise.

II. Finding the Region of Interest

Region of Interest involves locating the desired text from the scanned image which includes the name of the student{(381,535),(935,595)} and status of the student {(935,595),(1017,595)}using the pixel values in an image. The system will be developed to a predefined format of the attendance sheet, hence the system will have the *priori* knowledge of the required fields. The name of students will be in a single column, and each student name will be identified row wise between a certain range of pixels, similarly other student related information will be recorded and stored in some digital format.

Segmentation

The main objective of this step is to break down a string of characters into individual characters so as to identify each character this process is known as *Segmentation*. The complexity that is involved in the segmentation process depends on the quality and the string type, in case of the name of the student the attendance sheet will have fixed machine printed string hence it will be an easy task, however the status of the students will be manually recorded by the faculty hence we will perform component analysis.



Fig.4. Segmentation.

Recognizing characters

The final step involves recognizing each and every broken segment to a particular character, the accuracy of the system depends on how well the system is trained and which algorithm is used to achieve optimum results. ^{[1][2][4][6]}

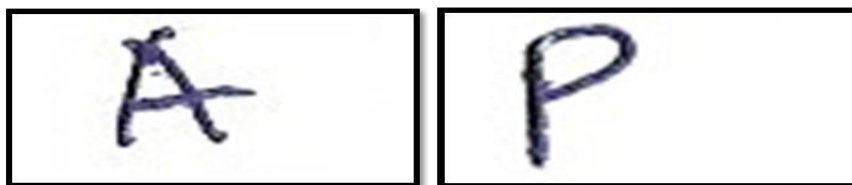


Fig.5. Recognizing characters

III. Future Scope

The OCR technology will efficiently record the student attendance details and store it in a digital format, this digital data can have a wide variety of applications like the data can be posted online on college website so that the students can have a weekly review of their attendance and if any error persists it can be changed before a monthly student report can be generated. Analysis can be done on monthly basis to find out average attendance, to understand student's behavior, course analytics and course design for each course.

IV. Conclusion

The above paper demonstrates the effective use of OCR to record attendance and convert into digital format. In order for the system to achieve maximum accuracy more and more training data should be fed to the system, the accuracy of the system is directly proportional to the amount of data that will be fed to the system(should have a large database for recognizing characters). However if there is any error in manual recording of data on attendance sheet(overwriting characters) the character will not be recognized, apart from that the system will recognize machine printed characters very efficiently (100 % accuracy).The system has a wide scope and can be extended further to perform a variety of tasks.

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