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# Digitalization of Medical Prescription

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**Abstract –** *Nowadays when a patient is consulting a doctor they are writing the prescriptions manually in a prescription pad which is not readable by normal people and the patient is supposed to carry this document to consult another doctor or to bring medicines from pharmacy they have to consult the doctor again if they have lost the prescription paper. In this era of digitalization doctors are still following this manual method of prescription writing. We are proposing a system which can transform this process into a digital, efficient and transparent way.*

*In the proposed system when doctors are writing the prescriptions the written text will be converted into digital readable from by comparing medicine database with the help of a Personal Digital Assistant(PDA), and this prescription will be saved in to patient's medical account in cloud. When patient is going to brought medicine they don't have to carry a physical prescription with them all they have to do is to give unique identity by which pharmacists can get the prescriptions. Also when a patient is visiting a new doctor by referring patients medical account the doctor can know all the medical procedures patient has gone through. Patient don't have to worry about losing the prescription.*

***Key Words***: Handwriting Recognition, Cloud Computing, Software as a Service, Medical Prescription, Convolutional Neural Network

## 1. INTRODUCTION

It is commonly known that doctors have illegible handwriting. The writer usually knows what is written, but when other parties are involved they often have problems with reading and interpreting the text. The following quote stresses the problem with illegible handwriting: 'Doctors' sloppy handwriting kills more than 7 000 people annually [1]. In this project we are trying to resolve this problem by recognizing doctor's handwriting using handwriting recognition and converting it into legible format by using a hardware device, that hardware device called PDA. Also we are trying to store all their prescriptions in a central storage to make sure that no medical details are missed , it also help patient that prescription is not necessarily carried also it cannot be forged. Doctor can get the history of medical details directly from the system. Pharmacist can get prescription directly from the system. The Patients can also see their medical reports and laboratory details as well.

By this system doctors are using a digitization device like PDA to write the prescription, The objective is to yield the best textual (Unicode) interpretation of a given sequence of handwritten strokes, as the domain (set of all medicines) is known and comparatively small, system will try to look for a match in the medicine database. Once found it can be uploaded to cloud after verified by the doctor. This will be available in every pharmacies worldwide and authorized pharmacies can get the list as per customer's request. In current scenario hospitals are trying to change into e-prescription but major challenges in this area is the handwriting recognition of doctors. In this paper we are discussing about the possibilities of implementing this system.

Automation should eliminate many of the errors that occur when pharmacists misunderstand or medication names or dosages conveyed messily on paper or hurriedly by phone. Given that there are more than 17,000 pharmaceutical brands and generics available [2], a spoken request for Celebrex, for example, can be mistaken for Celexa, or a notation requesting 150 milligrams of a drug might be read as 1500. In electronic systems, drugs and dosages are selected from menus to prevent input errors, and pharmacists don't need to re-enter information.

## 2. TECHNIQUES AND METHODOLOGY

The work is dividing into 3 parts. The first part is handwriting recognition which includes image pre-processing, thresholding and thinning. The second part is medicine prediction where the medicine is predicted from the doctors keypad by recognizing the characters .The third part is managing the central storage where the whole dataset is stored. That is where we can refer the medicine names for predictions. Block diagram of the proposed system is given in fig 1.

In fig 1 Doctor's PDA takes prescription in digital format which is given to the central system takes this input and it recognizes the text using learning algorithms. The medicine name in database compared with the recognized text and medicine generic name is retrieved from the database. It then added to patient's medical account in cloud. Pharmacist can access this data using patient's unique id and user can check their medicine list and verify the same.

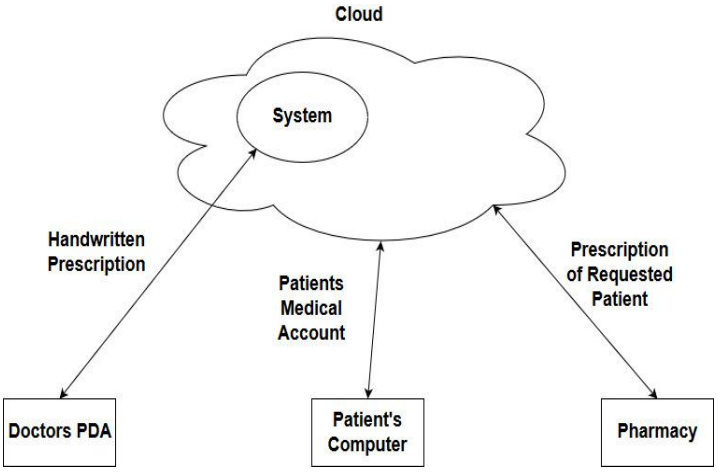


**Fig -1**: Proposed model

## 3. IMPLEMENTATION

The Digitalization of medical prescription starts with the input made on the stylus by doctors. This writings are read as an image. Image is undergoing preprocessing using open-CV functions. The aim of pre-processing is to eliminate the inconsistency that is inherent in cursive handwritten words. In pre-processing we will get separate medicine names from the whole dataset. In this phase of preprocessing, the RGB images is converted to grayscale format. This step is necessary so as to overcome the problems that may arise due to the use of pens of different colors and different intensities on various noisy and colored backgrounds. For thinning we have used morphological transformation where erosion operator is used.

### 3.1 Segmentation

After the preprocessing of the input handwritten word, the height and width of the word is calculated for the analysis of the ligatures in an accurate manner [3]. The word is scanned vertically, from top to bottom, column wise and the number of foreground pixels in the inverted word image are counted in each column. This will separate the columns which has less than one cross section as shown in fig 2.

**Fig -2**: Segmentation

Average of these columns are used as a margin for segmenting characters apart. Still it won't separate each characters. The recognized characters are separated from the word segment and taken as a separate character. Sometimes this may leads to over segmentation. The over-segmentation problem happens in two cases. First, when the two adjacent characters in the word image are not touching each other and the sum of foreground pixels of the columns in this area are zero. Second, when the two consecutive characters in the word image are connected by a ligature and the sum of foreground pixels in these columns crossing this ligature are one.

### 3.1 Character Recognition

After segmentation each character separated is feeding into a Convolutional Neural Network (CNN).Our system is using a Recurrent Convolutional Neural network inspired from Ming Liang's and Xiaolin Hu's work [4]. The models were evaluated using EMNIST datasets. The pioneering work from LeCun and his collaborators has making LeNet5 being widely used as the foundation architecture to develop more recent convolutional neural networks [5].

## 4. RESULT

MNIST is one of the most well-known datasets in the machine learning community. It consists of hand written digits of 0 to 9. There are 60000 training sets and 10000 testing sets. The images are in gray scale with size 28x28 pixels. Convolutional neural networks have exhibited an incremental learning behavior from a series of training starts from epoch 1-10. The LetNet5 achieved the best performance of 99.5% of recognition accuracy [5].when the system is considered as a whole accuracy is getting bit variant as the input images are not exact characters. Over segmentation problem also made prediction little bit complicated. Still as the domain is known and with the list of predicted medicines accuracy can be maintained.

## 5. CONCLUSION

We believe that this project can make an impact in the current medical field problems like prescription forgery, losing prescription, brand name usage in prescription etc. Major challenges in designing this system is the different handwriting styles of doctors and lack of enough training data. Hence at the beginning itself the product cannot give its full productivity. There can be problems like internet availability, reach to common people and others but within a span of time this product can make the changes it's expected to make

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