A

Project Report

On

MEDICINE BOX: HANDWRITING RECOGNITION USING DEEP CONVOLUTION NEURAL NETWORKS

Submitted in partial fulfillment of the requirements for the Award of the Degree

of

Master of Computer Applications

of

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Submitted by

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CERTIFICATE

Certified that the Seminar report entitled **"MEDICINE BOX: HANDWRITING RECOGNITION USING DEEP CONVOLUTION NEURAL NETWORKS"** is presented by **"SILPA S PILLAI" (Reg No: TVE20MCA-2050)** in partial fulfillment of the requirements for the award of the degree of Master of Computer Applications of APJ Abdul Kalam Technological University during the year 2022.

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First and formost I thank **GOD** almighty and to my parents for the success of my project. I owe a sincere gratitude and heart full thanks to everyone who shared their precious time and knowledge for the successful completion of my project.

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ABSTRACT

The handwriting recognition problem becomes one of the most famous problems in machine learning and computer vision applications. Handwriting varies from person to person. It is more difficult to teach computers to recognize general handwriting. More people use images to represent and transmit information. It is also popular to extract important information from images. A doctors prescription is a handwritten document in the form of instructions that describes list of drugs for patients. While receiving a new prescription from doctor, it is unable to understand what drug name is prescribed on it. In most cases, however, we wouldn't be able to read it anyway because doctors use Latin abbreviations and medical terminologies on prescriptions that are not understandable by the general persons which make reading it very difficult. According to the National Academy of Sciences estimates that at least 1.5 million peoples are sickened, injured or killed each year by errors while reading prescription. The proposed system tries to resolve the problems in doctors prescription through Medicine Box that uses Convolutional Neural Network (CNN) to recognize handwritten medicine names.So this project tries to develop an application where we can upload a prescription note from which we extract medicine name and will display the drug name. It can be effectively used in medical fields. This makes the ordinary persons to understand what doctor is prescribed in the prescription and also help for pharmacists

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Chapter 1

INTRODUCTION

1.1 Aim

This project aims at developing a cost-effective web-based Handwriting Recognition application, Medicine Box, using neural network. 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. A Doctor's prescription is a handwritten document written by doctors in the form of instructions that describes list of drugs for patients in time sickness, injuries and other disability problems. While we receiving a new prescription from doctor, it is unable to understand what drug name is prescribed on it. In most cases, however, we wouldn't be able to read it anyway because doctors use Latin abbreviations and medical terminologies on prescriptions that are not understandable by the general persons which make reading it very difficult. Medicine Box application can easily be used by both medicine field and common people. Ease of use, availability, low cost of operation are the features that make Medicine Box a useful application for handwriting recognition. So this project tries to develop an application where we can upload a prescription note from which we extract medicine name and display it. The project aims at handwriting recognition of doctors prescription based on deep learning algorithms. I 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. 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

1.2 Objective

- The objective of this project is to implement handwriting recognition of doctors
- It provides low cost, deep learning mechanism for handwriting recognition
- It decrease the cases of misinterpretation of medicine names.
- It helps ordinary people to understand doctors prescription.

1.3 Project Description

The handwriting recognition problem becomes one of the most famous problems in machine learning and computer vision applications. Handwriting varies from person to person. It is more difficult to teach computers to recognize general handwriting. More people use images to represent and transmit information. It is also popular to extract important information from images. So this project tries to develop an application where we can upload a prescription note from which we extract medicine name and will display it. It can be effectively used in medical fields. A doctors prescription is a handwritten document in the form of instructions that describes list of drugs for patients. While receiving a new prescription from doctor, it is unable to understand what drug name is prescribed on it. . In most cases, however, we wouldn't be able to read it anyway because doctors use Latin abbreviations and medical terminologies on prescriptions that are not understandable by the general persons which make reading it very difficult.The proposed system tries to resolve the problems in doctors prescription through Medicine Box that uses Convolutional Neural Network (CNN) to recognize handwritten medicine names. In the day by day human life the medicine and treatment are mandatory factors. In such cases, reading the doctor prescription always a big problem because the doctor prescription is written in the combination of Latin abbreviations and medical terminologies. Normally, prescriptions are only read by other doctors or pharmacists. Ordinary person can't understand what is in the prescription; they had big anxiety while seeing the doctor prescription. To solve this problem and making the ordinary person to understand the handwriting of doctors prescription and to get knowledge about the medicines a deep machine learning approach through the TensorFlow is used. TensorFlow is a free software library used for providing immense performance in the computation of numerical data. 4 TensorFlow is used to build a Conventional Neural Network

with the help of collection of dataset. In addition, CNN is used to perform intelligent calculating network for recognizing doctor's prescription. To build a CNN model a handwritten dataset is used. The most challenging part of this system is pattern recognition and classification. In the classification part, the characters are extracted from each word image. Then it classified each character independently to reconstruct a word. To accomplish this task, it has to analyze a match between the features extracted from the given characters image and the library of various image models which has proposed to identify or recognize the handwritten characters and it would give the output of digital text. This application is useful for recognizing all handwritten given as in input image. Once input image of character is given to proposed system, then it will recognize input character which is given in image. Recognition and classification of characters are done by Neural Network . The main aim of this project is to effectively recognize a doctors prescription of the format using the Convolutional Neural Network.

1.4 Benefits Of Handwriting Recognition

- The idea of Neural Network in handwritten recognition will brings us the reading of various combined style of writing a prescription
- In forensic application handwritten recognition will be an effective method for evidence collection.
- It will also help to reduce noise from the original character.
- The method develop accuracy in recognizing handwriting in divert font and size.
- More set of sample invites more accuracy rate because of heavy training and testing.

Chapter 2

LITERATURE SURVEY

2.1 Existing System

Deep learning algorithms to handwritten digit recognition using Deep Belief Network(DBN)

The handwritten digit recognition problem becomes one of the most famous problems in machine learning and computer vision applications. Many machine learning techniques have been employed to solve the handwritten digit recognition problem.

Deep learning algorithms to handwritten digit recognition using Deep Neural Network(DNN)

In this paper, we apply deep learning algorithms to handwritten digit recognition, and explore the three mainstream algorithms of deep learning- Deep Neural Network (DNN).

Deep learning algorithm to the real-word handwritten character recognition using CNN and DBN

Wu et al. have applied deep learning to the real-word handwritten character recognition, and obtained good performance for image recognition. They analyzed the different between CNN and DBN by comparing the experiment results. Deep learning can approximate the complex function through deep nonlinear network model. It does not only avoid the large workload of manually extract features, but also it is better to describe potential information of the data [13]. However, they did not consider the evaluation factors as execution time

Recognition rate for handwritten digit recognition.

"Kaensar et al. have concluded that different classifier affects the recognition rate for handwritten digit recognition. Accordingly, they applied three classification techniques by using the open source Weka tool kit for training and testing the dataset which was obtained from the UCI repository. The presented results show that SVM is the best classifier to recognize handwritten digits. However, the main problem of the SVM classifier is the time consuming of the training process

DISADVANTAGE:

- Time consuming
- Less accuracy
- Poor performance
- Did not consider evaluation factors as execution time

2.2 Proposed System

- A doctors prescription is a handwritten document written by doctors in the form of instructions that describes list of drugs for patients. While receiving a new prescription from doctor, it is unable to understand what drug name is prescribed on it. In most cases, however, we wouldn't be able to read it anyway because doctors use Latin abbreviations and medical terminologies on prescriptions that are not understandable by the general persons which make reading it very difficult
- I 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.
- In this proposed system, I provide a smart way to recognize the doctor's prescription using deep machine learning. The more accuracy of training data increases the performance of the application.This application will help for those people who suffer while seeing the doctor's prescriptions.

- With Medicine Box, cases of misinterpretation of medicine names can be decreased. This makes the ordinary persons to understand what doctor is prescribed in the prescription and also help for pharmacist

ADVANTAGE:

- Takes less time for training compared to existing system.
- More accuracy expecting than the existed system.
- User friendly.

Chapter 3

METHODOLOGY

Our proposed system could be divided into five main steps

- Preprocessing
- Segmentation
- Feature Extraction
- Training
- Testing and Detection

3.1 Preprocessing

Preprocessing is required to clean image data for model input. Adjusting existing training data to generalize to other situations allows the model to learn from a wider array of situations.

ALGORITHM

- Read the picture files (stored in data folder).
- Decode the JPEG content to RGB grids of pixels with channels.
- Convert these into floating-point tensors for input to neural nets
- Rescale the pixel values (between 0 and 255) to the [0, 1] interval (as training neural networks with this range gets efficient).

3.2 Segmentation

After the preprocessing step, an image of medicine is decomposed into sub-images of individual medicines. Preprocessed input image is segmented into isolated medicine name using a labeling process. This labeling provides information about number of medicine names in the image. Each individual digit is uniformly resized into 100 X 70 pixels for classification and recognition stage.

3.3 Training and Testing

After segmentation, CNN algorithm is trained separately with the training images

3.3.1 Convolutional Neural Network

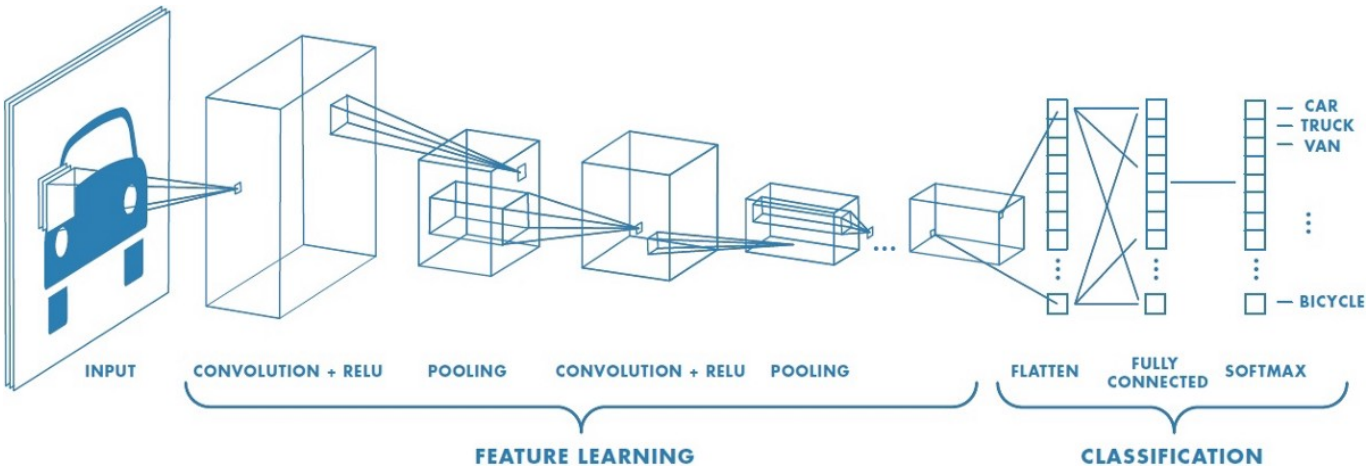

Figure 3.1: A simple structure of CNN

A Convolutional Neural Network (ConvNet/CNN) is a Deep Learning algorithm which can take in an input image, assign importance (learnable weights and biases) to various aspects/objects in the image and be able to differentiate one from the other. The pre-processing required in a ConvNet is much lower as compared to other classification algorithms. While in primitive methods filters are hand-engineered, with enough training, ConvNets have the ability to learn these filters/characteristics.

3.3.2 Convolution Layer — The Kernel

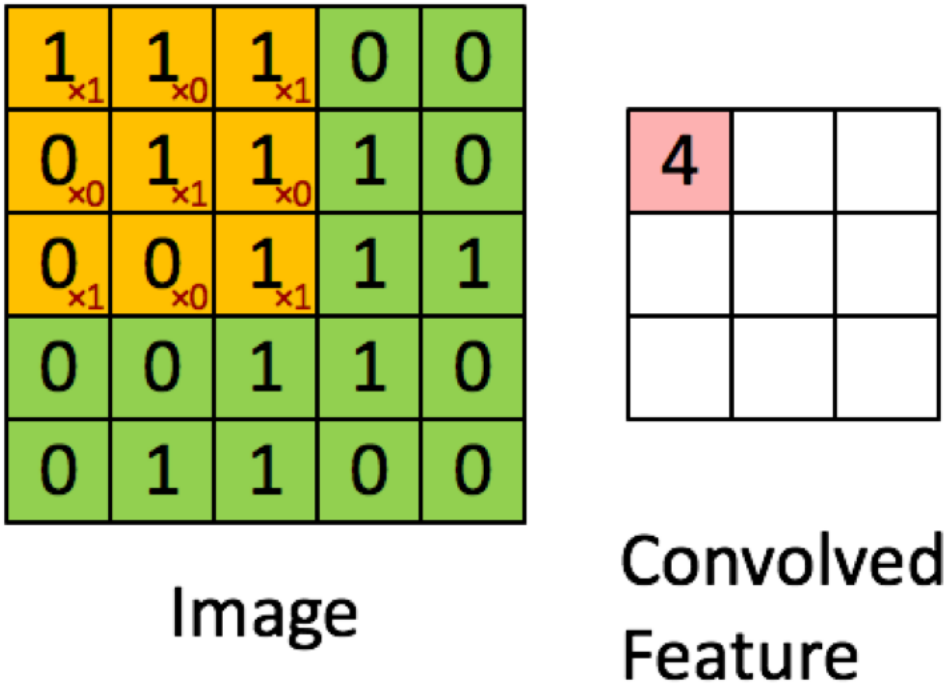

Figure 3.2: Convolved layer-The Kernel

In the above demonstration, the green section resembles our input image. The element involved in carrying out the convolution operation in the first part of a Convolutional Layer is called the Kernel/Filter, K, represented in the color yellow. We have selected K as a 3x3x1 matrix. The objective ofthe Convolution Operation is to extract the high-level features such as edges, from the input image. ConvNets need not be limited to only one Convolutional Layer.Conventionally, the first ConvLayer is responsible for capturing the Low-Level features such as edges, color, gradient orientation, etc. With added layers, the architecture adapts to the High-Level features as well, giving us a network which has the wholesome understanding of images in the dataset, similar to how we would.

3.3.3 Pooling

Similar to the Convolutional Layer, the Pooling layer is responsible for reducing the spatial size of the Convolved Feature. This is to decrease the computational power required to process the 13 data through dimensionality reduction. Furthermore, it is useful for extracting dominant features which are rotational and positional invariant, thus maintaining the process of effectively training of the model. There are two types of Pooling: Max Pooling and Average Pooling. Max Pooling returns the maximum value from the portion of the image covered by the Kernel. On the other hand, Average Pooling returns the average of all the values from the portion of the image covered by the Kernel. Max Pooling also performs as a Noise Suppressant. It discards the noisy activations altogether and also performs de-noising along with dimensionality reduction. On the other hand, Average Pooling simply performs dimensionality reduction as a noise suppressing mechanism. Hence, we can say that Max Pooling performs a lot better than Average Pooling.

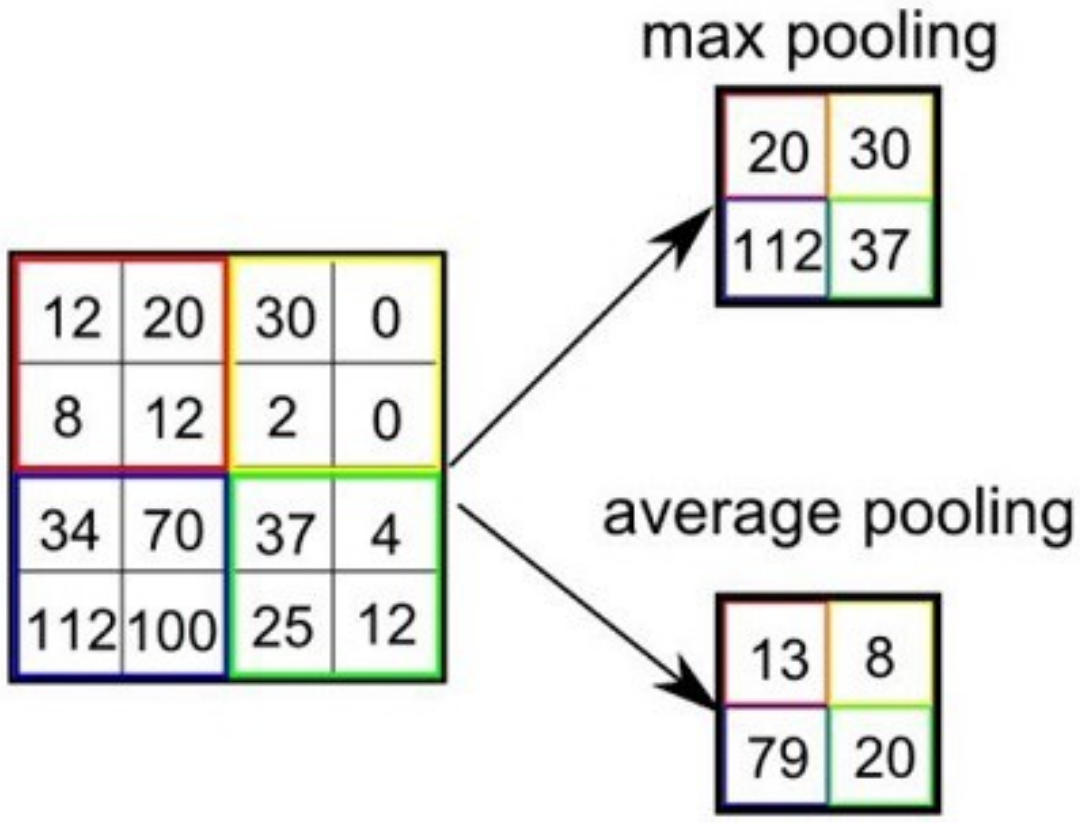

Figure 3.3: Different types of Pooling

The Convolutional Layer and the Pooling Layer, together form the i-th layer of a Convolutional Neural Network. Depending on the complexities in the images, the number of such

layers may be increased for capturing low-levels details even further, but at the cost of more computational power. After going through the above process, we have successfully enabled the model to understand the features. Moving on, we are going to flatten the final output and feed it to a regular Neural Network for classification purposes.

3.3.4 Classification — Fully Connected Layer (FC Layer)

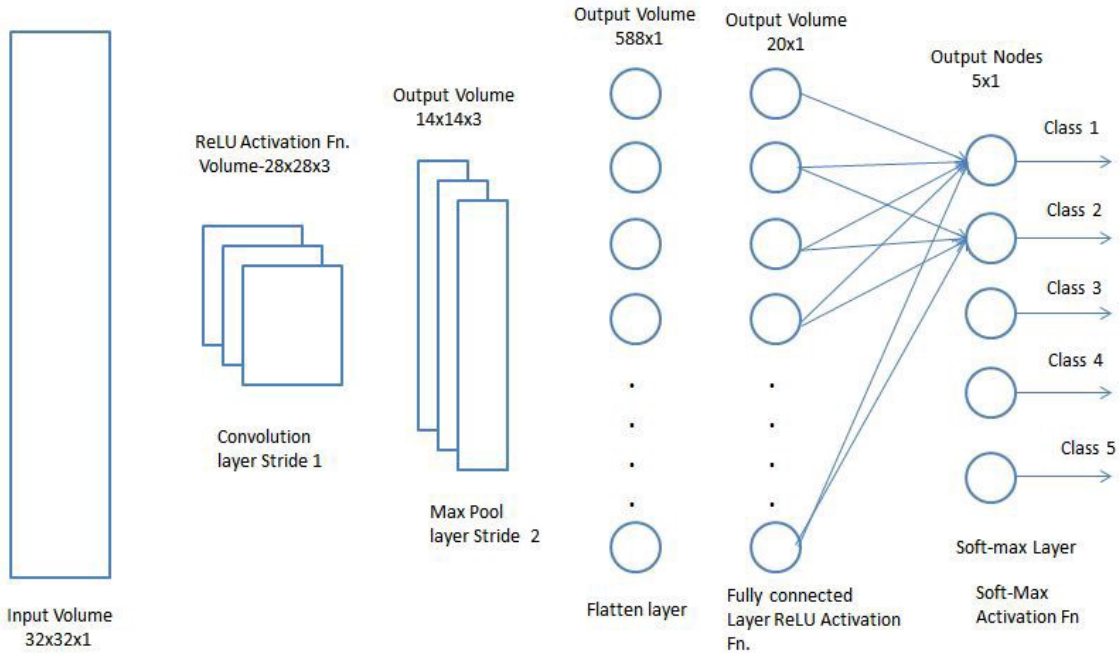

Figure 3.4: Classification -fully connected layer(FC Layer)

Adding a Fully-Connected layer is a (usually) cheap way of learning non-linear combinations of the high-level features as represented by the output of the convolutional layer. The Fully-Connected layer is learning a possibly non-linear function in that space. Now that we have converted our input image into a suitable form for our Multi-Level Perceptron, we shall flatten the image into a column vector. The flattened output is fed to a feed-forward neural network and back propagation applied to every iteration of training. Over a series of epochs, the model is able to distinguish between dominating and certain low-level features in images and classify them using the Softmax Classification technique. The first layer is the input layer; the size of the input image is 28×28. The second layer is the convolution layer C2, it can obtain four different feature maps by convolution with the input image. The third layer is the pooling layer P3. It computes the local average or maximum of the input feature maps . The next convolution layer

and pooling layer operate in the same way, except the number and size of convolution kernels. The output layer is full connection; the maximum value of output neurons is the result of the classifier in end .

Chapter 4

IMPLEMENTATION

4.1 System Architecture

An architectural diagram is a diagram of a system that is used to abstract the overall outline of the software system and the relationships, constraints, and boundaries between components. It is an important tool as it provides an overall view of the physical deployment of the software system and its evolution road map.

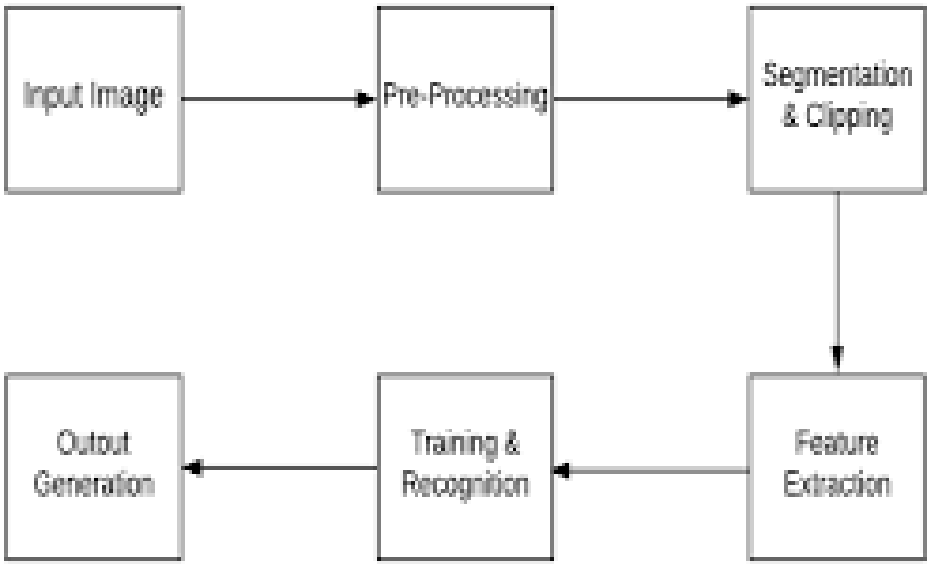

Figure 4.1: System Architecture

4.2 Software Implementation

We have used the Windows 10 operating system for the implementation of the project. However you can also use windows7 or above operating system with the suitable hardware specifications (Intel Core i5, 1.60 GHz processor along with 8GB RAM and 117 GB storage).

4.3 System Requirements

For the implementation of project, we need to install some software dependencies

4.3.1 Python

Python is a high-level, interpreted and dynamically typed programming language created by Guido Van Rossum. Python are multi paradigm ie ,it supports both object oriented and procedural programming. It is one of the fastest growing language in terms of no. of developers who are using it and in terms of no. of libraries they have. Python is a general purpose programming language because it can be applied in so many fields such as machine learning, GUI, software development, web development etc. And it is the easiest language available in the market

Installation

Navigate to https://www.python.org/downloads/ in the web browser. You can see all the versions available here. The latest version available here is python3.10. For the implementation of the project we need python 3.6 version. So select it, Then follow the normal installation steps in Windows after downloading it. To verify the installation just go to windows and search for python. You can see python setup and python IDLE there.

4.3.2 Visual Studio Code

Visual Studio Code is a source-code editor that can be used with a variety of programming languages, including Java, JavaScript, Go, Node.js, Python and C++. It is based on the Electron frame- work, which is used to develop Node.js Web applications that run on the Blink layout engine. Visual Studio Code employs the same editor component (code named "Monaco") used in Azure DevOps (for- merely called Visual Studio Online and Visual Studio Team Services). Instead of a project system, it allows users to open one or more directories, which can 36 then be

saved in work spaces for future reuse. This allows it to operate as a languageagnostic code editor for any language. It supports a number of programming languages and a set of features that differs per language. Unwanted files and folders can be excluded from the project tree via the settings. Many Visual Studio Code features are not exposed through menus or the user interface but can be accessed via the command palette. It can be extended via extensions, available through a central repository. This includes additions to the editor and language support. A notable feature is the ability to create extensions that add support for new languages, themes, and debuggers, perform static code analysis, and add code linters using the Language Server Protocol.

Installation

VS Code releases a new version each month with new features and important bug fixes. Most platforms support auto updating and you will be prompted to install the new release when it becomes available. You can also manually check for updates by running Help ¿ Check for Updates on Linux and Windows or running Code ¿ Check for Updates on macOS.

4.3.3 Django

Django is a free and open source web application framework written in Python. A framework is nothing more than a collection of modules that make development easier. They are grouped together, and allow you to create applications or websites from an existing source, instead of from scratch. This is how websites - even simple ones designed by a single person - can still include advanced functionality like authentication support, management and admin panels, contact forms, comment boxes, file upload support, and more. In other words, if you were creating a website from scratch you would need to develop these components yourself. By using a framework instead, these components are already built, you just need to configure them properly to match your site.The official project site describes Django as "a high-level Python Web framework that encourages rapid development and clean, pragmatic design. Built by experienced developers, it takes care of much of the hassle of Web development, so you can focus on writing your app without needing to reinvent the wheel. It's free and open source." Django offers a big collection of modules which you can use in your own projects. Primarily, frameworks exist to save 38 developers a lot of wasted time and headaches and Django is no different. You might also be interested in learning that Django was created with front-end developers in mind. "Django's

template language is designed to feel comfortable and easy-to-learn to those used to working with HTML, like designers and frontend developers. But it is also flexible and highly extensible, allowing developers to augment the template language as needed."

Chapter 5

DATA SETS AND RESULTS

DATA SETS AND RESULTS

Data set of total 272 images of five different medicines collected from various resources like "www.kaggle.com" and so on.It's highly hectic to collect drug names in different handwriting styles.Online websites provides different collections of data set helped a lot for the successful completion of this project.Also collected doctor's prescription samples for uploading purposes.

5.1 Data Sets and Results

Figure 5.1: Collection of medicines in different handwriting style

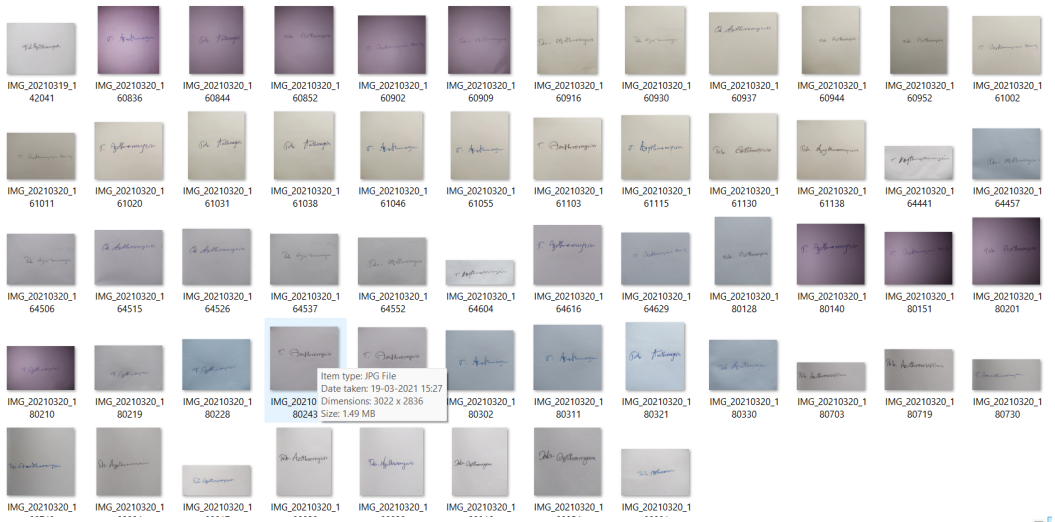

Figure 5.2: Collection of medicines in different handwriting style

Figure 5.3: Collection of medicines in different handwriting style

Figure 5.4: Collection of medicines in different handwriting style

Prescriptions with medicine names such as Cefixime, Dicloflex, Rostar, Xylometazoline nasal drops, Razod, Norflox.

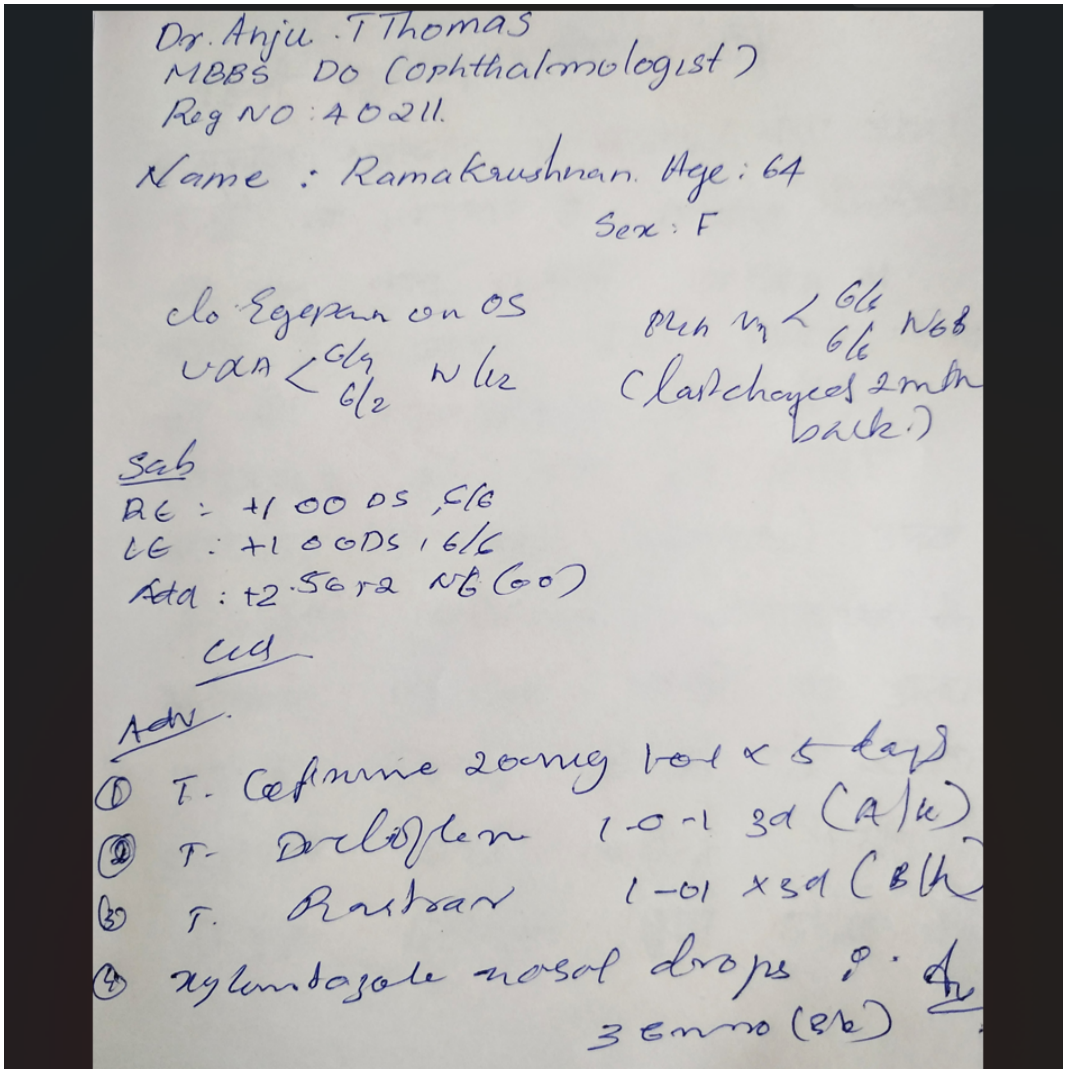

Figure 5.5: Doctor's Prescription 1 sample

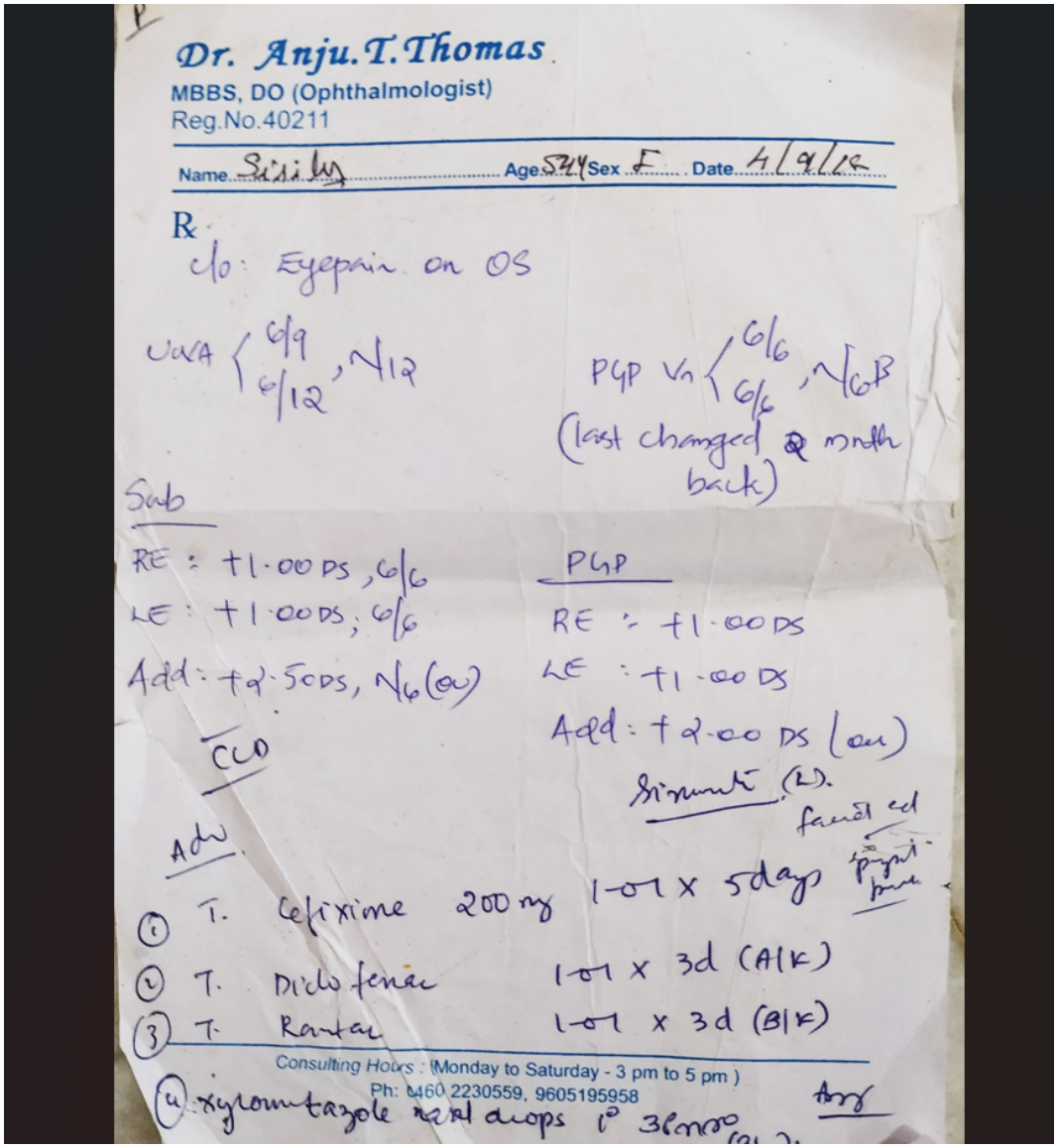

Figure 5.6: Doctor's Prescription 2 sample

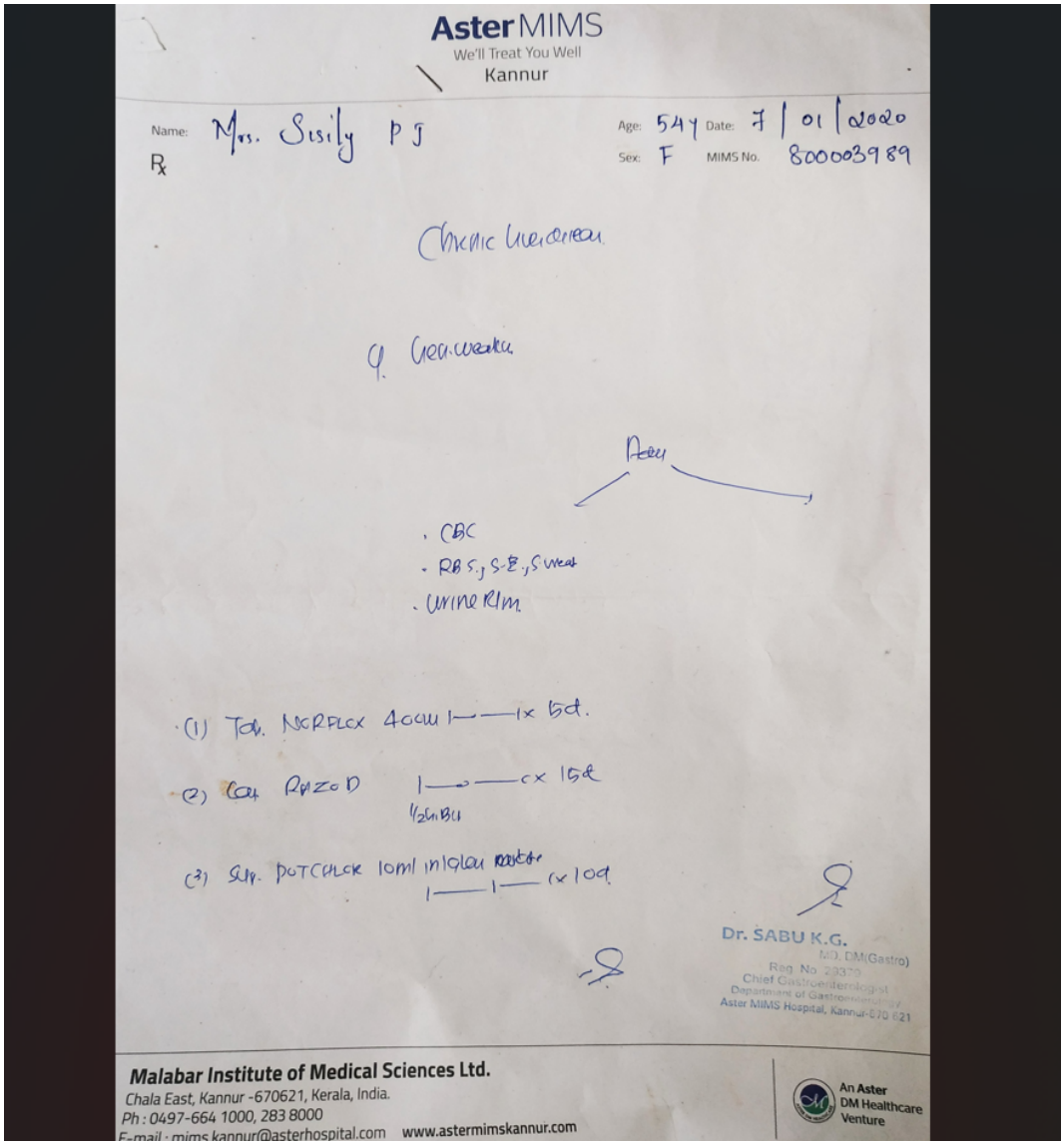

Figure 5.7: Doctor's Prescription 3 sample

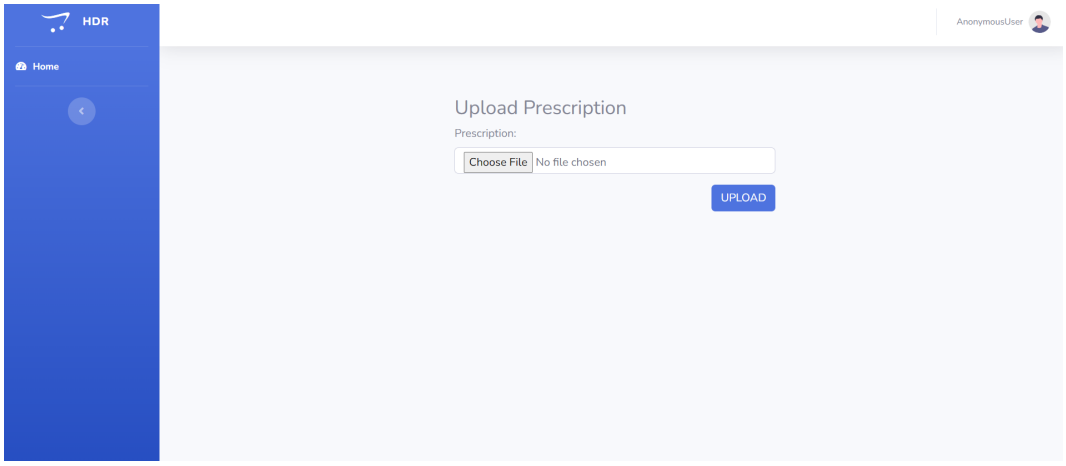

Figure 5.8: User page

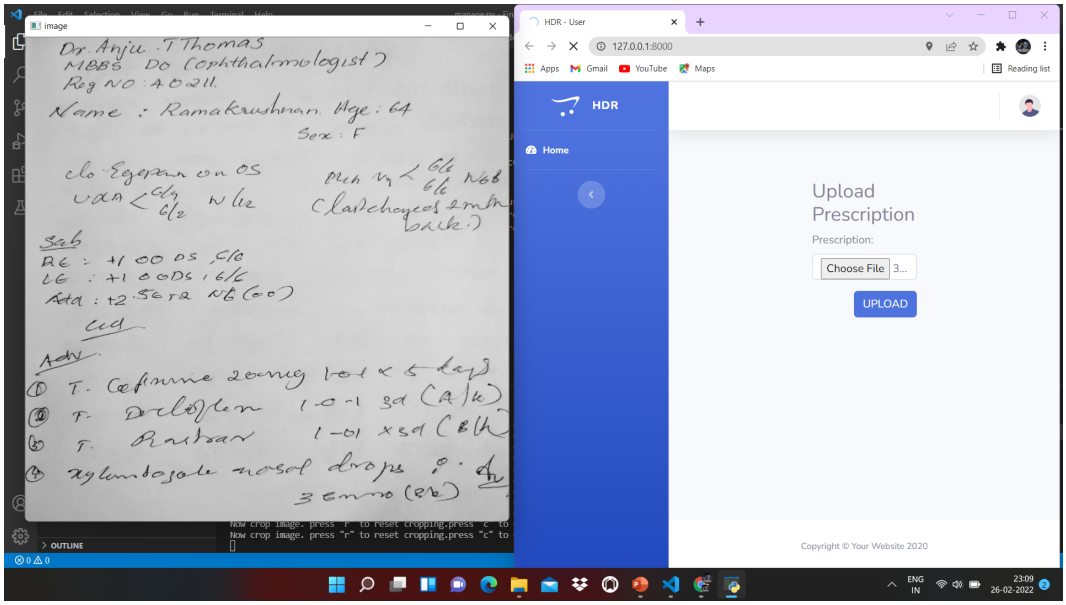

Figure 5.9: Prescription Uploaded User Interface

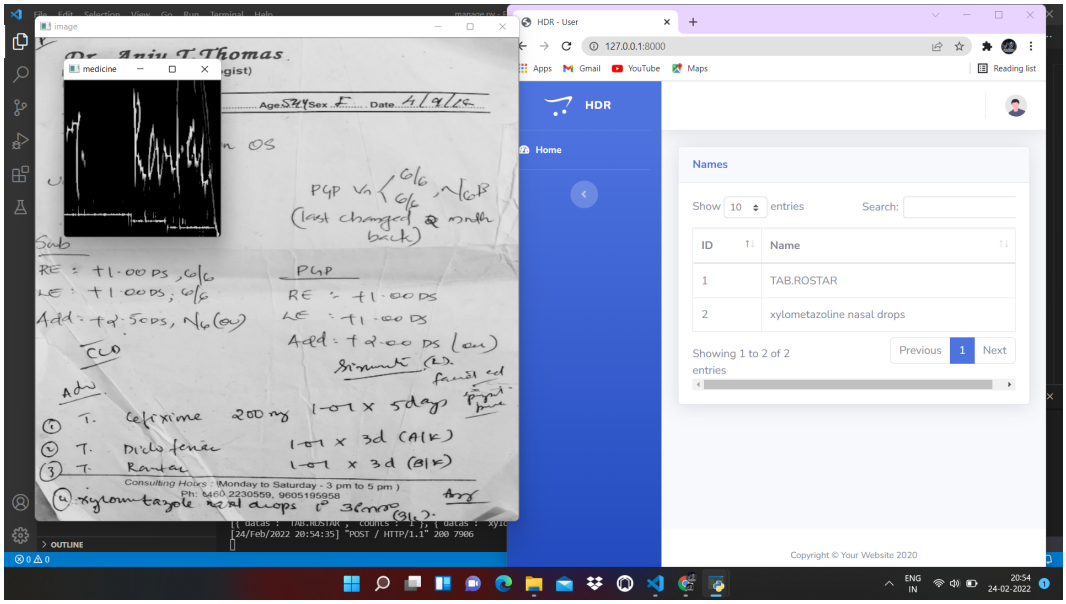

Figure 5.10: Detection of medicine name

Chapter 6

FUTURE SCOPE

The proposed system of handwriting recognition is concentrated only in medical field. Handwriting Recognition can be effectively used in other fields like Insurance, banking etc.It can be used in post office for reading postal address. The system can be further developed into an android application. The data in this system is small, in the future ,aim to validate our results by using big data set and we can use another algorithm and compare the results and to predict more accurate results. This work further extended to the character recognition for other languages. It can be used to convert the fax and news papers into text format. In order to recognize words, sentences or paragraphs we can use multiple ANN for classification. It can be used in post office for reading postal address. In forensic application handwritten recognition will be an effective method for evidence collection.

Chapter 7

CONCLUSION

In this proposed system we provide a smart way to recognize the doctors prescription using deep machine learning. This application will help for those people who suffer while seeing the doctors prescriptions. The key role of this paper lies on data used for training purpose. The more accuracy of training data increases the performance of the application. By training the large data with large iteration we can perform the application efficiently. 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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