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Prescription Recognition System

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Abstract: *An overview of prescription recognition systems, which automate the process of extracting and deciphering data from prescription paperwork, is given in this research study. The paper examines the potential uses of these systems in healthcare as well as the difficulties connected with prescription recognition, such as precise identification and interpretation of medical terminology. The main elements of prescription identification systems are described, including machine learning, natural language processing, and optical character recognition. Future research directions are indicated after reviewing recent works in the area. For researchers, medical experts, and politicians interested in this quickly developing technology, this report is an invaluable resource.*

Keywords: *OCR, Tesseract OCR, Microsoft Azure, Image Pre-Processing.*

I. INTRODUCTION

Our application uses image recognition and OCR technology to identify the names and descriptions of prescribed medications from images of prescriptions. Our application can certainly be useful for patients and pharmacists, as it can help to reduce the risk of misinterpreting handwritten prescriptions and improve the accuracy and efficiency of prescribing and dispensing medications. Optical character recognition (OCR) is a technology that enables the conversion of scanned or digital images of text into machine-readable text. It is often used to extract and repurpose data from documents, such as scanned paper documents, camera images, and image-only PDFs. [1]

Prescription recognition systems are computer-based systems designed to automate the process of extracting and interpreting relevant information from prescription documents. These systems have the potential to greatly improve the efficiency and accuracy of the prescription filling process, while also reducing medication errors and improving patient safety. The use of prescription recognition systems is becoming increasingly important in the healthcare industry. With the rapid growth in the number of prescriptions being filled each year, there is a growing need for technologies that can streamline the prescription filling process and reduce errors. Prescription recognition systems can help achieve these goals by automating the process of identifying and interpreting prescription data.

In this research paper, we provide an overview of prescription recognition systems, their development, current techniques, and potential applications in healthcare. We also explore the challenges associated with prescription recognition systems, such as the need for accurate identification and interpretation of complex medical terminology, as well as the need to ensure patient privacy and data security. The paper reviews the key components of a prescription recognition system, including optical character recognition (OCR), natural language processing (NLP), and machine learning techniques. We discuss how these components are utilized in the system, and their roles in improving the accuracy and efficiency of the prescription filling process. Furthermore, we review recent research studies in the field of prescription recognition systems, and highlight the advancements and current limitations in this area.

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Additionally, we provide insights into future research directions that can help address the current challenges and limitations in prescription recognition systems, and improve the technology's impact on the healthcare industry.

Computers are used in almost every domain of daily life, like businesses, industries, entertainment, education, personal management, and research activities. Data can be processed and reproduced in a speedy way using computers. Patient record management helps practitioners to diagnose and continue the care timely. Computerized patient record management systems are used to maintain the record of patients and employees working in the hospital [1, 2]. Health care is a broad area that deals with health care information, medical device information, pharmaceutical information, hospital management, and biological system. In the health care system, patient's precaution and patient care are the major goals [3, 4].

In developing countries like Pakistan, most hospitals, especially in the public sector, are not computerized. Due to a high patient-to-doctor ratio, doctors have a hectic schedule where they have to prescribe or take notes while standing or in walking conditions in emergency cases. Handwritten prescriptions are widely used in the tropical areas of mid-Asia. Especially in Pakistan, doctors mostly prefer to write handwritten prescriptions because they feel comfortable writing the prescription manually, even if they have enough time to access and use a computer. Handwritten prescriptions have several potential threats associated with them. Unreadable handwriting prescription and the incapability of pharmacists to understand medicine names in medical prescriptions are causing a notable number of patients to expire [5]. Patients may get delayed o.

II. LITERATURE REVIEW

"Utkarsh Shaw; Tania; Rishab Mamgai; Isha Malhotra", "Medical Handwritten Prescription Recognition and Information Retrieval using Neural Network", Publisher: IEEE, Date Added to IEEE Xplore: 18 November 2021, PP: The automatic interpretation of handwritten documents is one of the popular research areas over the last few decades because of the huge scope of its practical applications such as automatic reading of address, bank cheque processing, and hand written text recognition filled on forms. Moreover, information retrieval in offline doctor's prescription images was not being focused prior the Covid - 19 pandemic. However, over the last two years such prescription images are extensively being exchanged by the patients among offline medical consultants for useful advice. Therefore, in this paper the potential concern has been expressed on using computer technology to assess handwriting. Character recognition from the connected alphabets of a word (cursive writing) is a real time challenge.[2] For this, the usage of Extended MNIST has been explored and the results support the efficiency of proposed model to identify the poor legibility of handwriting and transform it into readable correct text recognition.

"Roger Achkar; Khodor Ghayad; Rayan Haidar; Sawsan Saleh; Rana Al Hajj", "Medical Handwritten Prescription Recognition Using CRNN", Published in: 2019 International Conference on Computer, Information and Telecommunication Systems (CITS), Published on: 11 October 2019, reading a doctor's handwritten prescription is a challenge that most patients and some pharmacists face; an issue that, in some cases, lead to negative consequences due to wrong deciphering of the prescription. Part of the reason why doctor's prescriptions are so difficult to decipher is that doctors make use of Latin abbreviations and medical terminology that most people don't understand. This paper demonstrates how Artificial Neural Networks (ANN) is used to develop a system that can recognize handwritten English medical prescriptions.[3] Using the Deep Convolution Recurrent Neural Network to train this supervised system, input images are segmented and processed to detect characters and classify them into the 64 different predefined characters. The results show that the proposed system yields good recognition rates and an accuracy of 98%.

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G. Pirlo and D. Impedovo in his work on [4], presented a new class of membership functions, which are called Fuzzy- membership functions (FMFs), for zoning-based classification. These FMFs can be easily adapted to the specific characteristics of a classification problem in order to maximize classification performance. In this research, a real- coded genetic algorithm is presented to find, in a single optimization procedure, the optimal FMF, together with the optimal zoning described by Voronoi tessellation. The experimental results, which are carried out in the field of handwritten digit and character recognition, indicate that optimal FMF performs better than other membership functions based on abstract level, ranked-level, and measurement-level weighting models, which can be found in the literature.

III. EXISTING SYSTEMS FOR ONLINE PRESCRIPTION RECOGNITION SYSTEM

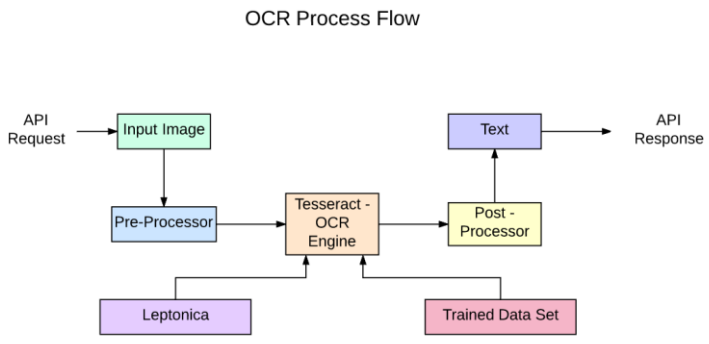
OCR experts are likely to view the proposed project as a valuable application of OCR technology. as it could enable the automated extraction of prescription information from images and PDFs, potentially saving time and reducing errors associated with manual data entry. NLP experts are likely to view the project as a promising application of NLP techniques for extracting and analysing medication information from unstructured text, which could have implications beyond prescription recognition. The goal of the proposed online medical prescription recognition system is to automate the prescription information extraction process and provide patients and medical practitioners with accurate and timely prescription information.[5] Specifically, the project aims to:

Utilize OCR technology to extract prescription information from images or PDFs of prescriptions. Utilize NLP techniques to extract medication information such as dosages, frequencies, and side effects:

1. Implement an information module to display the extracted medication information in a clear and understandable format for patients and medical practitioners.
2. Provide patients with access to their prescription information and enable them to manage their medication information more effectively.
3. Provide medical practitioners with accurate and up-to-date prescription information, reducing the risk of medication errors and improving the quality of patient care. The following technologies are used as,

Tesseract OCR

Tesseract is an open-source text recognition (OCR) Engine, available under the Apache 2.0 license. It can be used directly, or (for programmers) using an API to extract printed text from images. It supports a wide variety of languages. Tesseract doesn't have a built-in GUI, but there are several available from the 3rdPartypage.Tesseract is compatible with many programming languages and frameworks through wrappers that can be found here. It can be used with the existing layout analysis to recognize text within a large document, or it can be used in conjunction with an external text detector to recognize text from an image of a single text line.



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Microsoft Azure:

Microsoft Azure is a cloud computing platform that provides a wide range of services for building, deploying, and managing applications and services. In simple terms, cloud computing means that instead of running software and storing data on your own computer or servers, you can use Microsoft's servers located in data centres around the world. Azure offers a variety of services including computing, storage, networking, databases, and AI/ML capabilities.[6] This means you can use Azure to build and run your applications, store and manage your data, and use advanced technologies like machine learning and artificial intelligence to make your applications smarter. For example, if you wanted to build a website or a mobile app, you could use Azure to create and host the backend of your application. This would include storing and managing user data, as well as running the code that processes user requests and returns data to the user interface. [7] You could also use Azure to add features like chatbots, image recognition, and speech recognition to your application using Azure's AI/ML capabilities.

Azure also offers security and compliance features, so you can be sure that your data and applications are protected from cyber threats and that your application meets industry standards for compliance. Overall, Azure provides a flexible and scalable platform for building and running your applications in the cloud.[8] Overall, the project aims to leverage advanced OCR and NLP technologies to simplify the prescription management process and enhance healthcare efficiency.

IV. METHODOLOGY

The purpose of this project is to develop an online medical prescription recognition system that can extract information from an image of a medical prescription and display the relevant information about the medicine such as its uses, side effects and suitability. To achieve this goal, we will use the Python Tesseract library for text extraction and create an information module to display the extracted information. Methodology:

1. **Image Processing:** The first step in this project is to process the image of the prescription to improve its quality and make it easier to extract information. This can be done using OpenCV library in Python. The following image processing techniques will be used
   - Image resizing to reduce the size of the image.
   - Gray scaling the image to remove any colour noise and convert it into a grayscale image.
   - Applying thresholding to the image to separate the background and foreground pixels.
   - Removing any unwanted noise and smoothing the edges.

2. **Text Extraction:** After pre-processing the image, we can now use the Tesseract library to extract the text from the image. This library uses Optical Character Recognition (OCR) to convert the image into machine-readable text. The extracted text can be stored in a text file or a database.

3. **Information Extraction:** Once we have the text from the prescription, we can use Natural Language Processing (NLP) techniques to extract the relevant information about the medicine such as its uses, side effects, and suitability. We can use the NLTK library in Python for this purpose.

4. **Information Module:** Finally, we can create an information module that will display the extracted information about the medicine. The module can be created using a web framework such as Flask or Django. The module will receive the extracted information and display it in a user-friendly format.[9]

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V. WORKING PRINCIPLE

Normally handwritten recognition is divided into six phases which are image acquisition, pre-processing, segmentation, feature extraction, classification and post processing. The block diagram of the basic character recognition is shown in figure 1.

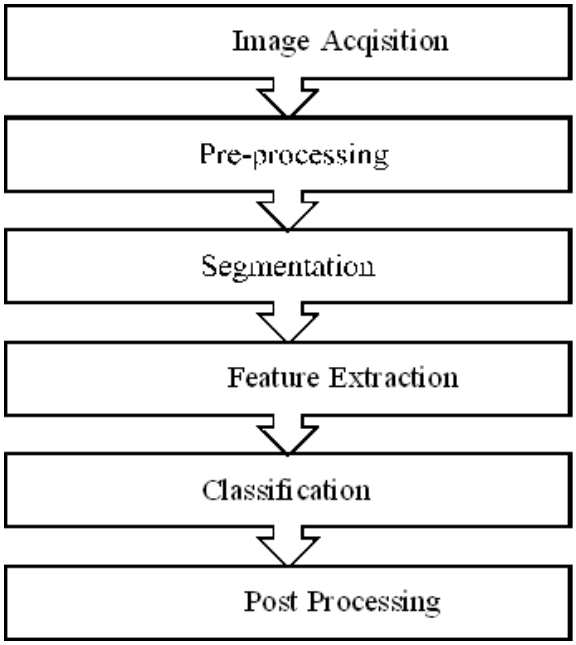

Figure 1: Block Diagram of Character Recognition

a. Image Acquisition

Digitized/Digital Image is initially taken as input. The most common of these devices is the electronic tablet or digitizer. These devices use a pen that is digital in nature. Input images for handwritten characters can also be taken by using other methods such as scanners, photographs or by directly writing in the computer by using a stylus.

b. Pre-processing

Pre-processing is the basic phase of character recognition and it's crucial for good recognition rate. The main objective of pre-processing steps is to normalize strokes and remove variations that would otherwise complicate recognition and reduce the recognition rate. These variations or distortions include the irregular size of text, missing points during pen movement collections, jitter present in text, left or right bend in handwriting and uneven distances of points from neighbouring positions. Pre-processing includes five common steps, namely, size normalization and centering, interpolating missing points, smoothing, slant correction and resampling of points.

c. Segmentation

Segmentation is done by separation of the individual characters of an image. Generally, document is processed in a hierarchical way. At first level lines are segmented using row histogram. From each row, words are extracted using column histogram and finally characters are extracted from words.

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d. Feature Extraction

The main aim of feature extraction phase is to extract that pattern which is most pertinent for classification. Feature extraction techniques like Principal Component Analysis (PCA), Linear Discriminant Analysis (LDA), Chain Code (CC), Scale Invariant Feature Extraction (SIFT), zoning, Gradient based features, Histogram might be applied to extract the features of individual characters. These features are used to train the system.

e. Classification

When input image is presented to HCR system, its features are extracted and given as an input to the trained classifier like artificial neural network or support vector machine. Classifiers compare the input feature with stored pattern and find out the best matching class for input.

f. Post Processing

Post-processing refers to the procedure of correcting misclassified results by applying linguistic knowledge. Post- processing is processing of the output from shape recognition. Language information can increase the accuracy obtained by pure shape recognition. For handwriting input, some shape recognizers yield a single string of characters, while others yield a number of alternatives for each character, often with a measure of confidence for each alternative.

VI. RESULT

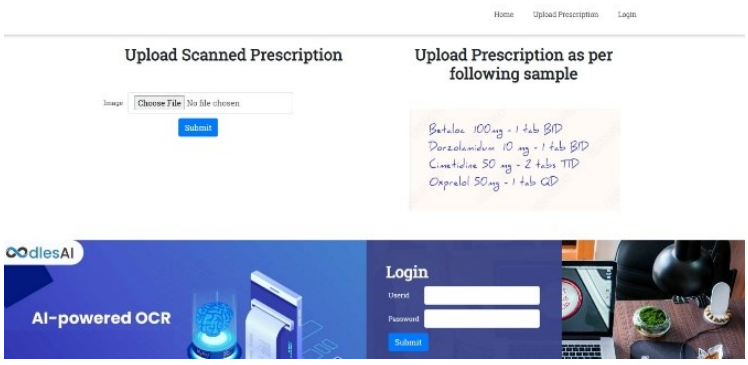

Figure 2: Upload Prescription

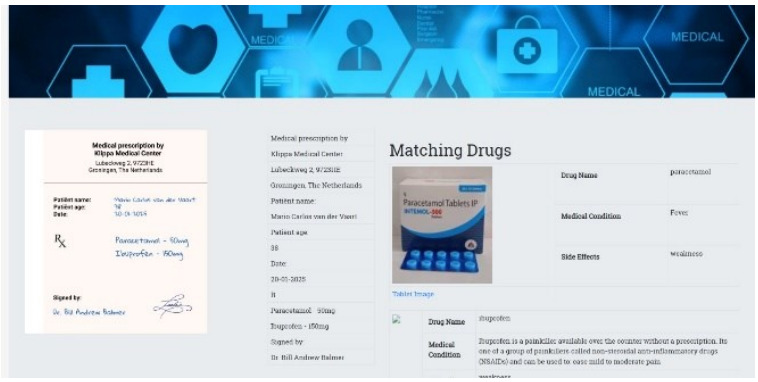

Figure 3: Extraction of Text and Showing Result

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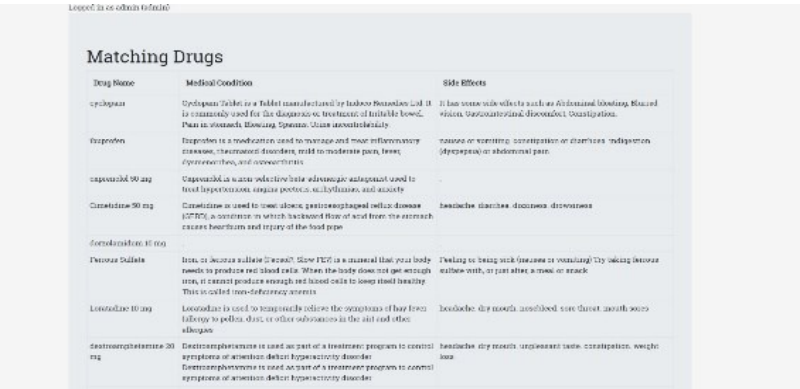

Figure 4: Medicine Dataset

VII. CONCLUSION

In conclusion, the development of an online medical prescription recognition system using Python Tesseract library, Flask framework, MySQL, Hibernate ORM, Bootstrap, jQuery, and Amazon Web Services provides a viable solution for automating the process of recognizing medical prescriptions and extracting information from them. By leveraging the power of image processing and natural language processing technologies, the system can accurately recognize and extract important information from medical prescriptions, such as the name of the medicine, dosage, and frequency. The system also provides additional information about the medicine, such as its uses, side effects, and suitability. The hardware and software used in the implementation of the project provide a reliable and efficient platform for the system to run on JBoss AS7. Apache Tomcat, and GlassFish are powerful application servers that provide the necessary infrastructure for the system to run on JavaEE. Servlets & JSP, Java Beans, Spring Boot, MySQL, JDBC, XML, HTML, DHTML, Javascript, AJAX, and Eclipse IDE are robust software technologies that provide the necessary functionality and support for the system to be developed. Overall, this project demonstrates the potential of image processing and natural language processing technologies in the field of medicine and healthcare. The system provides a practical and efficient solution for managing medical prescriptions and can help to improve the overall quality of patient care.

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