



# Optical Character Recognition System in Healthcare and Hospital Management

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## Abstract

In this review, we propose an innovative Optical Character Recognition (OCR) model tailored for the healthcare domain, integrating cutting-edge Machine Learning and Deep Learning techniques. Our focus is on the seamless extraction of textual information from diverse medical documents, including records, claims, EOBs, and various forms. By leveraging OCR, our model accelerates the accessibility of medical records, ensuring swift and accurate digitization. A key challenge addressed is the development of an application capable of recognizing characters from scanned medical images, effectively converting paper records into electronic formats. Moreover, our model is designed to accommodate input from both digital images and scanned text, facilitating versatile usability. To augment its utility, the model extends its capabilities to recognize alphabets from multiple languages. Beyond OCR, our review encompasses the integration of Text-to-Speech functionality, enhancing accessibility and user experience. We also conduct a comprehensive survey of methodologies and algorithms employed in previous studies, providing a holistic view of advancements in OCR and Text-to-Speech technologies.

## Introduction

Optical Character Recognition (OCR) technology has evolved into a pivotal realm of research, offering myriad applications across diverse sectors such as healthcare, finance, and administration. In the context of the healthcare industry, where copious amounts of medical records are generated and processed annually, the integration of OCR presents a transformative solution.

Optical Character Recognition, leveraging the power of both Machine Learning and Deep Learning methodologies. The healthcare sector, amidst its laudable efforts to transition from paper-based to electronic medical records, grapples with challenges of manual processing, potential errors, and the daunting task of handling extensive paperwork.

Our proposed OCR system, underpinned by Neural Network technologies, aims to alleviate these challenges by automating the extraction of textual information from medical images. The significance of this endeavor lies in the enhancement of operational efficiency and the mitigation of manual errors.

As medical entities strive towards a fully digitized ecosystem, the OCR system becomes a pivotal tool for streamlining processes, facilitating accurate record-

keeping, and paving the way for future data analyses and insights.

This paper presents a focused exploration of Optical Character Recognition in the healthcare domain, emphasizing the utilization of Artificial Neural Networks (ANN). The expertise embedded in this system promises not only character recognition but also envisions the seamless conversion of text to speech, offering a comprehensive solution for digital document editing, compact data storage, and accessibility for future analytical endeavors.

## Literature Survey

Optical Recognition of Digital Characters Using Machine Learning (IJRSCSE | 2018):

Pros: This model excels in presenting printed texts within a text box, accompanied by voice synthesis for each character, benefiting the visually impaired. It offers extensibility to recognize alphabets of various languages and can be trained for handwritten characters, reducing manpower in organizations. The prediction accuracy can be enhanced with more trained images.

Cons: The same pros are mentioned as cons, suggesting potential redundancy.

OCR-Based Facilitator for the Visually Challenged (ICEECCOT | 2017):

Pros: Implemented on an embedded platform, this project integrates OCR, image processing, and text-to-speech technologies, providing an affordable handheld device for the blind.

Cons: Limited effectiveness with noisy images and challenges in word segmentation for cluttered images. The OCR struggles with accuracy when presented with italicized text.

Text extraction using OCR: A Systematic Review (ICIRCA | 2020):

Pros: Enables text extraction from historical documents, television, and vehicle identification through Number Plate Recognition.

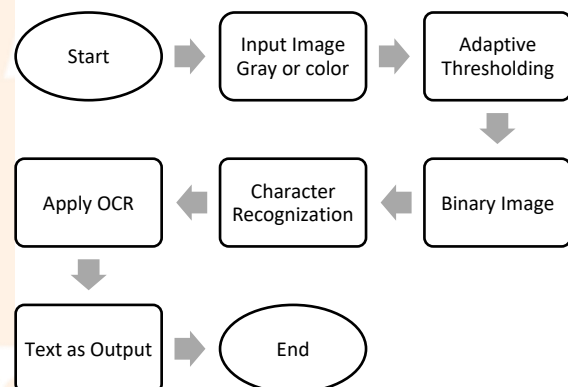
Cons: Faces challenges in filtered picture quality, recognizing Chinese and Arabic characters, and handling handwritten records. Suggests the need to enhance OCR accuracy for specific languages or fonts.

SMART VEHICLE IDENTIFICATION SYSTEM USING OCR (IEEE-CICT 2017):

Pros: Efficiently detects number plates of any color, overcoming a drawback in many existing systems. Applicable to all vehicles, not just cars, and functions well on both desktops and handheld devices.

Cons: Struggles with accurate structure storage for vehicles and has slower operations on desktops. The proposed system works solely for handheld devices, limiting its desktop applicability.

## Proposed System



The proposed OCR system for healthcare aims to revolutionize document processing by seamlessly converting medical images into text and subsequently into audible information. Employing advanced technologies such as Convolutional Neural Networks (CNN) and Recurrent Neural Networks (RNN) for character recognition ensures robust performance in deciphering intricate medical handwriting.

The application of Tesseract OCR further enhances the system's accuracy in translating segmented characters into meaningful text, catering specifically to healthcare documents. Leveraging the power of Natural Language Processing (NLP) in post-processing guarantees refined textual output, addressing nuances

like medical term normalization and ensuring the utmost precision in medical information extraction.

This comprehensive system, adept at handling grayscale or color medical images, not only streamlines administrative tasks but also holds immense potential in enhancing accessibility for visually impaired individuals within healthcare settings.

### Image Processing

In the initial stage of image processing, the input image undergoes crucial steps to prepare it for effective segmentation. The first step involves converting the color image to grayscale. This process is executed by mapping the intensities of the red, green, and blue channels into a single grayscale value, creating a more uniform representation. The algorithm employed for this operation is the "Grey Scale Conversion."

- Algorithm: Grey Scale Conversion
- Input: Scanned Optical Document Image
- Output: Greyscaled Document Image

Subsequently, the greyscaled image undergoes a pivotal transformation through "Image Binarization." This step converts the image, which initially contains up to 256 grey levels, into a binary black and white image. The algorithm sets a threshold value, classifying pixels with intensities higher than the threshold as black and the rest as white.

- Algorithm: Image Binarization (Thresholding)
- Input: Greyscaled Image
- Output: Black and White Image

### Segmentation

Upon completing image preprocessing, the document image is segmented into lines, words, and characters. The segmentation process involves three crucial steps: Line

Segmentation, Word Segmentation, and Character Segmentation.

**Line Segmentation:** During Line Segmentation, horizontal pixels are scanned row by row from the top of the document. Segmentation occurs where rows with no black pixels are detected.

- Algorithm: Line Segmentation
- Input: Binarized Document Image
- Output: Segmented lines from Document Image

**Word Segmentation:** Word Segmentation entails scanning vertical pixel columns from the left of each line. Words are separated where columns with no black pixels are found for a predefined number of columns.

- Algorithm: Word Segmentation
- Input: Segmented lines from Image and average pixel breadth for word separation
- Output: Segmented words from line

**Character Segmentation:** For Character Segmentation, vertical pixel columns are scanned from the left of each word. Characters are separated where columns with no black pixels are detected, acting as a division between two characters.

- Algorithm: Character Segmentation
- Input: Segmented Words from lines
- Output: Segmented Characters from words

### Feature Extraction

After individual characters are isolated, their images are resized to 15 x 20 pixels. This resizing is crucial for creating a feature vector of 300 pixels, enhancing the accuracy of recognition. The extracted features are stored in a .dat file.

### Training And Recognition

The features extracted from the previous modules serve as input for a Neural Network. The Korhonen algorithm,

originating from Self-Organizing Maps (SOM), is employed for automatic classification, facilitating training and recognition processes.

## Conclusion

In conclusion, the Optical Character Recognition (OCR) applied to healthcare, specifically the transformation of images to text and subsequently to speech. The proposed system, outlined in detail, employs a robust combination of algorithms and methodologies, including Convolutional Neural Networks (CNN), Recurrent Neural Networks (RNN), Tesseract OCR, and Natural Language Processing (NLP). Through a meticulous image preprocessing pipeline, encompassing greyscale conversion, binarization, and segmentation into lines, words, and characters, the system addresses the unique challenges posed by medical documents. The feature extraction and training phases, powered by the Kohonen algorithm and CNN, contribute to the system's adaptability and precision. The integration of Tesseract OCR ensures accurate text extraction, while NLP adds a layer of sophistication in post-processing, refining the recognized text. This comprehensive approach not only streamlines document processing in healthcare but also holds significant potential for enhancing accessibility and reducing errors in critical medical information interpretation. As we navigate the evolving landscape of OCR technology, this project serves as a testament to its capacity to revolutionize information extraction and dissemination in healthcare, fostering efficiency and accessibility in the digital age.

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