

Role of Offline Handwritten Character Recognition System in Various Applications

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ABSTRACT

Offline handwritten character recognition system recognizes characters from images. Since the past few decades, many researchers have been developing various handwritten recognition systems for various languages. This paper demonstrates the role and significance of an offline handwritten character recognition system in various applications.

General Terms

Offline Handwritten Recognition System, Pattern Recognition, Image Processing

Keywords

Applications, Offline, Handwritten, Recognition, Characters, Role.

1. INTRODUCTION

Handwritten recognition is becoming a part of pattern recognition. A handwritten recognition system obtains input data from different physical devices and recognized data are given as output. Many researchers have researched and developed different handwritten recognition systems for different languages.

The first optical character recognition system was developed by Emanuel Goldberg in 1914 [1].

The printed character recognition system almost reached to the final development stage; however, the handwritten recognition process is still in progress.

In this paper, we discuss various applications, which demonstrate the significance of the offline handwritten character recognition system. These applications help the developers to develop applications for different languages. Various handwritten recognition systems were discussed in [6, 7, 10].

The remainder of this paper is organized as follows: Section 2 describes a handwritten recognition system. Section 3 demonstrates the role of an offline handwritten character recognition system in various applications; this section is further divided into seven subsections, which present seven applications. The final section presents the conclusion.

2. HANDWRITTEN CHARACTER RECOGNITION SYSTEM

Fig.1 illustrates the two types of handwritten character recognition systems: offline and online systems.

The offline handwritten recognition system accepts images of handwritten documents as input and the recognized characters from document image are outputted.

The online handwritten recognition system dynamically receives signals from electronic devices, such as smartphone and tablet, and recognized characters are displayed as output.

The offline handwritten character recognition system performs the toughest task among both types of systems because the provided inputs do not contain any dynamic information.

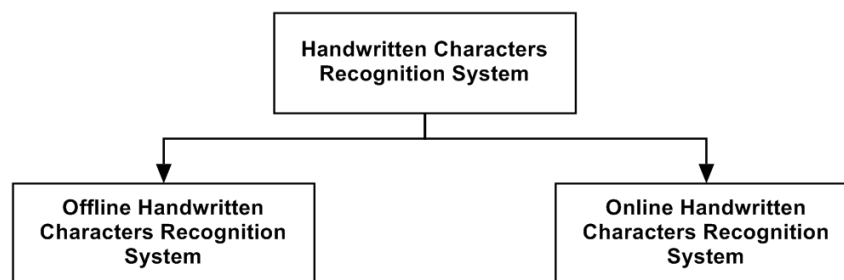


Fig 1: Block Diagram of Handwritten Characters Recognition Systems

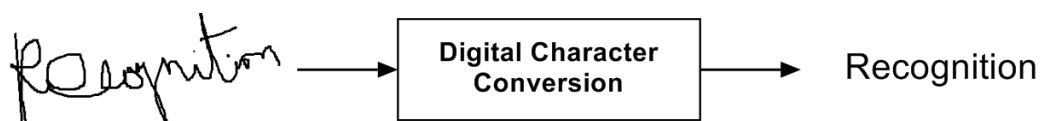


Fig 2: Block Diagram of Digital Character Conversion

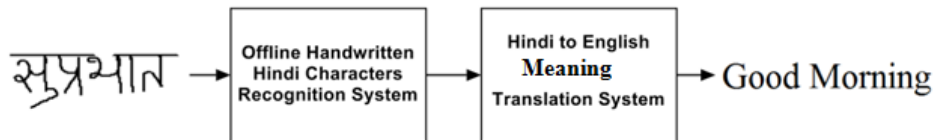


Fig 3: Block diagram of Hindi to English Meaning Translation Application

3. APPLICATIONS

In this section, the details of the following seven types of applications for handwritten recognition systems are presented:

- 3.1 Digital Character Conversion
- 3.2 Meaning Translation
- 3.3 Content Based Image Retrieval
- 3.4 Keyword Spotting
- 3.5 Signboard Translation
- 3.6 Text-to-Speech Conversion
- 3.7 Scene Image Analysis

3.1 Digital Character Conversion

Each person has a unique handwriting. Some people have handwritings that are difficult to recognize the characters. Some documents may damage therefore unable to recognize the characters in those documents. Alfons Juan et. al. [2] recognized the handwritten characters from ancient documents.

A digital character conversion system identifies characters easily and converts them into a people-readable format. Fig. 2 shows that a handwritten word “Recognition” contains some letters that are unreadable by humans. In such situations, a digital character conversion system can convert the text into a readable format. This application facilitates humanoid robots to read handwritten characters and words.

3.2 Meaning Translation

With the help of handwritten recognition system, one language can be converted into another language. Many people wrote stories, documents, novels, research works in their own languages. This meaning translation system can be used to convert these images into another language. Fig. 3 illustrates Hindi to English meaning Translation System. This offline handwritten character recognition system can be used

to recognize characters from Hindi-based document images and translate them into English meaning.

3.3 Content Based Image Retrieval

Many researchers are developing various content-based image retrieval methods, such as those based on text and color.

Fig. 4 displays an example of content based image retrieval based on text, in which the user enters a word in the search box; that is “image”. The search engine then retrieves the document images that contain the search word “image”.

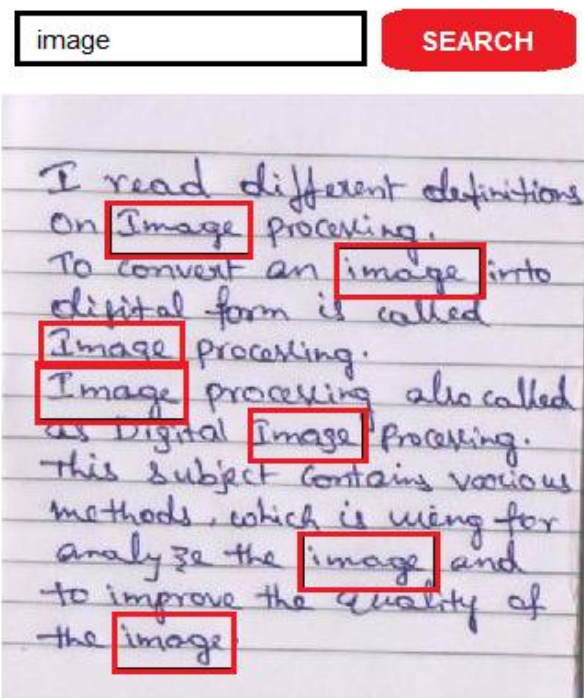


Fig 4: Content Based Image Retrieval

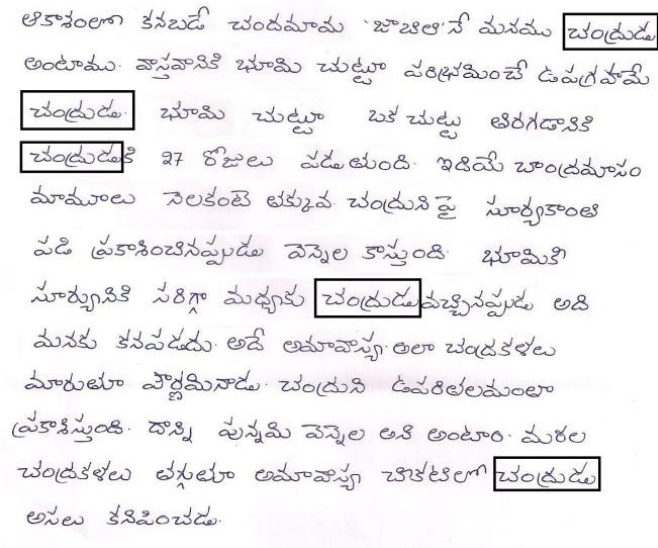


Fig 5: Keyword Spotting in Telugu Handwritten Document Image

3.4 Keyword Spotting

For the purpose of improve the efficiency of the document image retrieval system, keyword spotting are developing. Keyword spotting system extracts the most repeated word in the document image and identified as keyword of that document image.

Fig.5 illustrates keyword spotting in a Telugu document image. This application is useful for search engines.

3.5 Signboard Translation

Signboard Translation is necessary to translate one language to another language. In many countries, public display boards are in their native languages. When people from other countries need to understand these display boards, they use this Signboard Translations system.

Rafeeq Abdul Rahman A et. al. [4] developed an Arabic instant translation system for recognizing printed characters on signboards. Er.Puneet kaur et. al. [9] recognized Gurmukhi script from signboards.

In signboard translation, character-by-character translation is necessary in order for the original meaning to stay unchanged. In India some village’s names may have other meaning, therefore, character-by-character translation is necessary. Fig.6 displays the signboard translation process.

3.6 Text-to-Speech Conversion

Converting the text of any handwritten document image into speech is called text-to-speech conversion. Vijayaditya Peddinti et. al. [5] has described vowel epenthesis significance in Telugu text-to-speech synthesis.

This application is very useful for visually handicapped people.

Fig.7 depicts diagram in which the document image contains “Image Processing.” The Text to Speech Conversion application is used to convert the image to audio form. The application takes help of offline handwritten characters recognition system to convert the text to speech format. It is also useful in public announcement systems for announcing handwritten format of data.

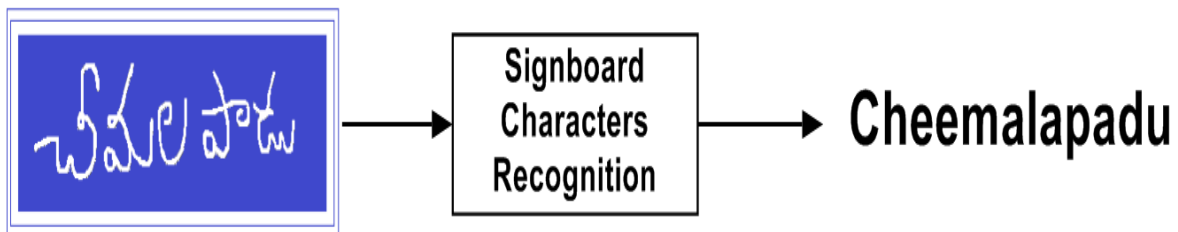


Fig 6: Signboard Translation System

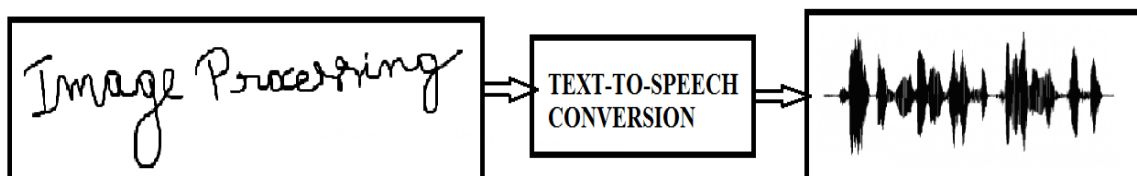


Fig 7: Text-to-Speech Conversion System

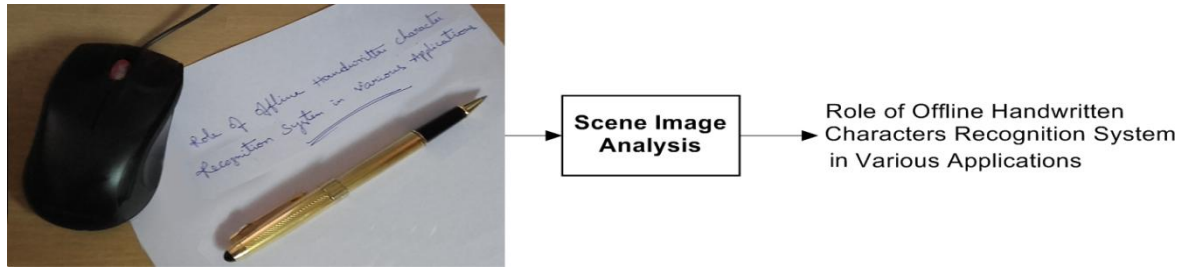


Fig 8: Scene Image Analysis

3.7 Scene Image Analysis

In the scene image analysis, the handwritten character recognition process plays an important role by identifying characters among different objects. Junhua Mao et al [3] have described the scale-based region growth for text in the scene. Adam Coates et. al. [8] has described character recognition from scene images.

Fig. 8 shows the Scene Image Analysis application. The scene images may contain different objects. The scene image analysis extracts characters from among the objects of the scene image, and those characters can be recognized by an offline handwritten character recognition system.

4. CONCLUSION

Recognition of offline handwritten characters is a difficult task. In this paper, various applications were discussed for offline handwritten character recognition systems. This paper described seven applications based on offline handwritten characters recognition system. This paper may give the significance of an offline handwritten character recognition system in various applications, and may help to give different ideas to researchers for developing different research applications.

This paper has opened numerous areas for future work which could be done to better understand the performance of the offline handwritten character recognition systems.

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