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A SURVEY ON OPTICAL CHARACTER RECOGNITION TECHNIQUES

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ABSTRACT

Today, character recognition software that can import scanned paper documents into a digital database is in high demand. The area of Optical Character Recognition is extensively reviewed in this work. Multiple methods are identified that have been offered to implement the OCR system's core functionality. OCR (Optical Character Recognition) converts scanned images of typed or handwritten text into a computer-editable format while maintaining the original text's font attributes. In this study, we take a look back at the various preprocessing and segmentation approaches that have been developed and discussed them.

Keywords: System for Recognizing Characters, Image Segmentation, Optical Character Recognition, Preprocessing, Skew Correction, Classifier.

INTRODUCTION

Using a process called optical character recognition, photographs of typed or handwritten text may be converted into a machine-readable format. The best possible interpretation of a damaged or low-quality code is returned by OCR. It is often used to enter data from paper documents such as passports, invoices, bank statements, electronic receipts, business cards, mail, printouts of static data, and so on. In terms of character quality and legibility, OCR is agnostic. For reasons beyond OCR's control OCV, a novel strategy, enters the picture. Segmenting the text in a document picture into lines, words, and characters is a breeze with the help of Projection Profile-based approaches. At each intermediate step of OCR, a new set of techniques is used. The Projection Profile technique is used for text segmentation. One of their suggestions was an algorithm to fix the document's tilt. The main enemy of OCR accuracy is blur. This study proposes a technique for prediction that uses a local estimate of blur. That connection investigation on the relationship between blur effect and character size provides valuable information for the classifier. Using predetermined criteria, Classifier divides the input material into three categories: read, intermediate, and unreadable [2].

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1.1 Digitization

The term "digitization" refers to the process by which a handwritten paper document is transformed into an electronic one. Every record in this system consists of a single symbol. Scanning the paper document results in an electronic version of the document in the form of an image file, which is then used to do the electronic conversion. Several types of scanners were employed by the author in order to digitally

The picture was proceeding to the preprocessing stage.

1.2 Pre-processing An array of procedures are applied to the scanned input picture as part of the pre-processing step. To make the picture more appropriate for segmentation, its gray-level character image is normalized into a window size. After the noise in the picture has been reduced, a bitmap is created. After that, the bitmap was converted into a reduced-size version of itself.

1.3 Segmentation Probably the most crucial step is the segmentation phase. To segment a picture, one must first isolate its constituent parts. In comparison to ordinary printed papers, handwritten ones are more difficult to segment into zones (upper, middle, and lower zone) and characters. Because paragraphs, lines, and letters may all have different lengths, widths, angles, and shapes, this is often the case. Segmentation might be challenging when parts of two neighboring characters touch or overlap. Touching or overlapping happens often as a result of upper-zone and lower-zone characters that have been updated.

1.4.1 Feature Extraction and Classification It is at this stage known as feature extraction that the character's pertinent shape is evaluated. A variety of text levels (character, word, and line)

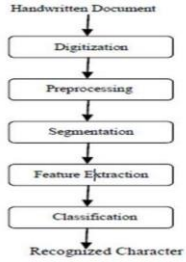

Figure 1 Phases of General Character Recognition System

may be used to guide feature extraction.

as well as the paragraph level. The characteristics recovered in the preceding step are used in the classification phase to determine the class memberships in a pattern recognition system, which is the decision making phase of an OCR engine. The primary objective of OCR's classification phase is to provide the constraint for minimizing misclassification pertinent to feature extractions.

1. METHODOLOGY

Skew identification and correction is a crucial pre-processing step in practically all document analysis and recognition systems, and it is one of the most critical processes in offline character recognition systems. In this research, we provide a method for automatically detecting and correcting the skew in scanned Assamese-language document pictures utilizing the horizontal and vertical alignment features.

Profiling via vertical projection [5]. An OCR malfunction occurs when a document has a backdrop picture. Every channel's visual contrast is improved via a non-linear adjustment. It has been shown experimentally that eliminating background pictures greatly improves identification accuracy [7]. The Fourier Transform is useful for preprocessing because it breaks down a picture into its component sine and cosine waves as the frequency increases. [1] The Fourier transform is a mathematical operation that transforms data from the spatial domain to the frequency domain, making it amenable to further processing. The difficulty of deciphering written material from visual sources is complex. They used modern machine learning methods to automatically learn the characteristics from unlabeled data. They used photographs of text in real environments to test out their suggested text detection and identification system, which is based on a scalable feature learning method [8]. Machine-printed Chinese and English

characters have been the subject of study for some years. Both the search and quick-match methods were detailed in this study. Building such a comprehensive vocabulary requires a high-performance Chinese/English OCR engine. They have amassed a total of 1862 text lines from a wide variety of print media [9].

It was suggested by H. Wang and J. Kangas [10] to automatically extract and detect characters in photographs of natural color scenes by finding character-like areas.

The potential block candidates are evaluated with the help of connected component extraction. To successfully extract the character's foreground pixels in each block, priority adaptive segmentation (PAS) is used. In paper [11], we showed how to use the freely available OCR technique to create a text extraction system. The TVs' functionality is checked with the help of the system. Using the phase congruency and local energy model, J. Diaz-Escobar [12] offered a novel approach to the identification of content-less characters in damaged pictures. The proposed phase characteristics do not change significantly in response to changes in lighting or geometry. Metrics for recognizability were evaluated between the SIFT approach and the degraded photos. There is an alternative method discussed in the article [13]. Scene text extraction from images and videos is difficult because of factors such as the images' or videos' busy backgrounds, varying font sizes and styles, unclear layouts, low quality or blurring, the subjects' positions and perspectives, and so on. Text is extracted using linked component and region based algorithms. To separate the text from the rest, a classifier based on an artificial neural network (ANN) is utilized. As there are individual differences in people's handwriting, creating a trustworthy OCR system is difficult. In this study, we provide a computational method that makes use of the Kohonen Neural Network. Kohonen, a kind of artificial neural network algorithm The results also showed that a two-layered neural network, as opposed to a multi-layered one, may drastically decrease system complexity without compromising performance.

Neural networks with layers [14]. In this work [15] we provide a comprehensive OCR approach for reading old texts, whether printed or handwritten, without needing to know the typeface. To identify text lines, words, and characters, a pre-processing and segmentation strategy is used. A technique for recognizing handwriting was presented by Yaeger [16]. The neural network methods are used to make the suggested system functional. This method uses a multi-layer perceptron to improve upon character recognition. The approach described by J. Hu et al. [17] combines high-level characteristics with low-level features on simple points to accommodate a wide variety of input patterns. Additional to this, the invariance attribute of these features is used in the standardization of feature curvature. A method based on HMM for online handwriting recognition was presented by Funanda [18]. The suggested system is more efficient in its memory use and better at recognizing handwritten letters typed into a computer. Both the Horizontal Projection Profile and Vertical Projection Profile techniques are employed for segmentation in the aforementioned research study [1]. At each intermediate step of OCR, a new set of techniques is used. The Projection Profile technique is used for text segmentation. They devised a computer technique to fix the crookedness of the paper.

J. r' Matas [19] introduced a full-scenario text localization and recognition system that operates in real time.

method. To begin the categorization process, we use new characteristics derived with O(1)

complexity to evaluate the chance of each ER being a character. When it comes to the second phase, only ERs with the highest local likelihood are chosen. Training time is cut down while accuracy is kept high using the neural network based strategy proposed by Huei- Yung Lin and Chin-Yu Hsu [20]. Experiment preparation involves a multi-step procedure. Before the training step can begin, the data must be preprocessed in order to be divided into manageable chunks. Toll roads, parking garages, and freeways might all benefit greatly from the license plate recognition (LPR) algorithm introduced in this study [21], which could serve as the backbone of an intelligent infrastructure based on things like electronic payment systems. We describe an innovative adaptive picture segmentation approach based on connected component analysis [21].

3. COMPARISON

An appropriate characteristic for skew identification is the projection profile, as reported in paper [5]. The influence of noise is amplified in Vertical Projection Profile Analysis, while it is mitigated in Horizontal Projection Profile Analysis. In comparison to a horizontal projection profile, Vertical's temporal complexity is much higher. The author of article [7] offered a technique to prevent the background picture from piling up. Organizational Capability Requirements (OCR) streamlines many administrative processes, including data gathering and analysis, in both government and non-profit institutions

procedures, recording. We test three different optical character recognition (OCR) programs: HANWANG OCR, ABBYY, and Tesseract. Built-in features to preprocess images before text extraction make HANWANG OCR and ABBYY OCR superior than Tesseract OCR. This character classifier was learned using features in article [8]. There were a total of 5198 characters (26 uppercase and 26 lowercase) put through the paces. The biggest system (1500 features) achieves an accuracy of 81.7% on the 62-way classification issue. In optical character recognition (OCR), segmentation is a crucial first step. The authors of this study [22] provide a comprehensive overview of the various segmentation methods currently in use. There are often three types of methodologies: analytical, empirically good, and empirically discrepant. There are two main types of assessment approaches that may be used to assess segmentation algorithms: analytical methods and empirical methods. The analytical approaches evaluate segmentation algorithms by delving deep into their inner workings to determine their strengths and weaknesses. By putting the segmentation algorithms to the test on sample photos and evaluating the outcomes, empirical approaches provide an indirect evaluation of the algorithms' performance. There are two broad categories of empirical approaches, which are the "empirical goodness" approach and the "empirical discrepancy" approach. The first technique use "goodness" metrics to evaluate the characteristics of segmented pictures. Whereas the second kind has citations that desired or anticipated segmentation outcomes are identified initially.
Online handwritten character recognition algorithms are crucial for devices like personal data assistants

Table 1. Comparison of the different OCR Techniques

Author(s)	Data set	Method	Recognition rate
Yaeger et al. [16] (1998)	(A-Z) characters, (0-9) digits, 23 symbols with writer independent system	Multi-Layer Perceptron	21.3%
Hu et al.[17] (2000)	(a) 500, 1000 and 2000 unipen database. (b) 5000, 10000 and 20000 unipen database.	Hidden Markov Model	91.8%, 90.5% and 87.2% for (a) dataset and 83.2%, 79.8% and 76.3% for (b) dataset.
Funanda et al. [18] (2004)	Kanji, Katakana, Hirangana, Western alphabets and symbols with writer Independent system.	Hidden Markov Model	91.34%
A. F. Mollah et al. [4] (2011)	Set of 100 business cards images.	Segmentation using Vertical Projection Profile	92.74%
M. Shen [7] (2015)	1160 images with various resolutions, font sizes and noise levels.	Image Enhancement using non-linear Transformation	-
J. B. Pedersen et al. [3] (2016)	100 images with a total of 840 characters	Character based segmentation and Nearest Neighbour Classifier	98.69%
V. Kieu et al. [2] (2016)	IPAD contains 297 document images and PME contains 1998 document images	Fuzzy-C-Means clustering method	90.57%
C. N. E. Anagnostopoulos et al. [21] (2006)	1334 natural-scene gray-level vehicle images	probabilistic neural network (PNN)	96.5% (Segmentation) 89.1%(Entire Plate Recognition)
A. Coates *et al.* [8]	ICDAR data set 5198 test characters	Machine Learning Algorithm	85.5%

(PDAs), which use a pen to enter data. Online handwriting recognition has been greatly improved thanks to a novel technique described by A. Funada et al. [18], which makes use of hidden Markov models (Hidden Markov Model). How quickly one may forget anything depends on two variables: the size of the matrix and the total number of states. They used a multilayer perceptron trained with error back propagation to accomplish character classification and segmentation, which is very conventional.

2.APPLICATION

Below we present a few of the many uses for optical character recognition [23]. An improved technique for picture segmentation based on histogram equalization is utilized for optical character recognition (OCR).

4.1 Captcha

A CAPTCHA is a piece of software that can create and evaluate tests that modern computers can't handle but humans can. In CAPTCHA, a picture is created that has a succession of characters or numbers that are difficult to read due to visual distortion, size and font fluctuation, distracting backdrops, random segments, highlights, and noise. In order to make the picture usable by OCR (Optical Character Recognition) systems, this approach may be used to filter out the background noise and divide the image into distinct regions.

Institutional repositories and electronic libraries (4.2) To put it simply, institutional repositories are online archives of academic or scientific institutions' collective works. A digital repository is a place where intellectual material is stored and shared by a group of people, often a research organization. It aids in making an institution's work more accessible, raising its profile and increasing its global effect.

Image-Based Billing 4.3.1 To maintain track of invoices and avoid a payment backlog, invoice imaging is utilized in a variety of commercial contexts. OCR has a prominent role in both government institutions and private businesses. facilitates, among other things, data collecting and analysis

The Recognition of Numbers Automatically 4.4 Vehicle registration plates may be identified automatically [6] using optical character recognition on photographs, which is used as a kind of mass surveillance. The pictures taken by the cameras, including the license plate numbers, may now be saved using automatic number plate recognition technology.

4.5 Business Sector Legal The legal sector is another sector that has benefited from OCR technology. Documents are scanned using OCR and uploaded to a database instantly.

4.6 Banking OCR also finds applications in the banking industry, where it is utilized to automate the processing of checks. The amount on the cheque is scanned by a computer and the appropriate funds are withdrawn.

4.7 Healthcare The use of OCR technology for document management has also been on the rise in the healthcare industry. There is always a mountain of paperwork for each patient that healthcare providers must deal with, from insurance claims to general health questionnaires. Entering pertinent data into an electronic database that can be accessed as needed is helpful for keeping up with all of this information.

4. CONCLUSION

In-depth research on "this paper's comprehensive overview of several OCR approaches" has been conducted. Images of handwriting, landscapes, business cards, and televisions are chosen for testing. The methodical operation of an OCR system is described. This work describes the use of a nearest-neighbor classifier for classification, the Fourier transform methodology for pre-processing, and a projection-profile based

method for segmentation. For researchers interested in choosing methods that will provide the best possible results in a given application within the context of the many parameters discussed above, this article may be a useful resource.

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