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DETECTION AND CORRECTION OF SKEW IN TEXT DOCUMENT IMAGES USING ADVANCED PROFILE PROJECTION TECHNIQUE

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ABSTRACT

Document image processing has become an increasingly important technology in the automation of office documentation tasks. Automatic document scanners such as text readers and OCR (Optical Character Recognition) systems are an essential component of systems capable of those tasks. One of the problems in this field is that the document to be read is not always placed correctly on a flatbed scanner. This means that the document may be skewed on the scanner bed, resulting in a skewed image. This skew has a detrimental effect on document analysis, document understanding, and character segmentation and recognition. Consequently, detecting the skew of a document image and correcting it are important issues in realizing a practical document reader. Very frequently the digitalization process of documents produce images rotated of small angles in relation to the original image axis. In this paper, we present an algorithm that can detect and correct the skew in text document image using advanced projection profile technique. System is evaluated on various types of inputs consist of multiple script text. System first detect the skewed angle then system detect the type of skew whether it is upward or downward skew then accordingly system perform the rotation transformation on the given matrix. Overall accuracy of the proposed system is evaluated is very good than that of existing systems.

KEYWORDS: Skew detection, upward skew, downward skew, skew correction.

INTRODUCTION

There are several problems encountered in processing a document. Preprocessing is the primary stage before starting actual character recognition. Initially we obtain a digitized raster image of the document using appropriate scanning method. When the document image is scanned, it may be skew because of some reasons. The skewed image will cause serious problems in document analysis. Some processing needs the documents without skew, such as character extraction and recognition, structural analysis, and so on. Although some applications can use directly the skew documents, they are too complex and inefficient. It is, therefore, often necessary to determine the skew angle and reconstruct the document. Skew detection and correction indeed helps the subsequent stages in document image analysis. Devising schemes which can detect skew angles accurately irrespective of the scripts and range of skew angles is a challenging task in the field of document image analysis. Preprocessing focuses on enhancing the scanned image to make feature extraction easy and correct and to reimburse for the eventual poor quality of the scanned document. The all the other stages of OCR systems mainly depend upon the accuracy of preprocessing stage. During the scanning process, the whole document or a portion of it is fed through a scanner. The digital image of a document may be skewed / rotated arbitrarily because of direction in which it was placed on the platen when it was scanned or because of a document feeder malfunction. A significant skew in document can be detected by human vision easily and the skew correction can be made by re-scanning the document, whereas for mild skew it may not be possible to notice its skew as human vision system fails to identify it. Even a smallest skew angle existing in a given document image results in the failure of segmentation of complete characters from words or a text lines, as the distance between the character reduces. Further, most of the OCRs and document retrieval/display systems are very sensitive to skew in document images Skew angle detection is considered as a significant part of any Optical Character Recognition and document analysis system because correct skew angle has a direct effect on the segmentation and feature extraction stages and OCR system performance. Most of the skew detection methods have the following common features: (1) a prior text/graphics separation is necessary, which may take a significant amount of time, though it can be useful for the next steps; (2) large text areas have to be present on a page for an accurate estimation; (3) many techniques have been designed for high-resolution images ranging from 100 to 300 dpi. In projection profile technique a series of projection profiles are obtained at a number of angles close to the expected orientation, and the variation is calculated

for each of the profiles. The profile that gives maximum variation corresponds to the projection with the best alignment to the text line; this projection angle is called the skew angle . The Hough transform is another popular technique for skew detection; this transform is often applied to a number of representative points of characters such as the lowermost pixels or centers of gravity. Each representative point (x,y) is mapped from the Cartesian space to the points (ρ,θ) in the Hough space by forming a set of lines coming through (x,y) with a slope ρ and distance θ from the origin. The skew corresponds to the angle associated with a peak in the Hough space. The high computational complexity of the Hough Skew angle is the angle that the text lines in the digital image make with the horizontal direction. Therefore, skew estimation and correction are important steps before line and words segmentation. Various methods have been built for document skew angle estimation reported in the literature. Chen Yi-Kai has also proposed another method based on Fourier transform. In this method, the direction for which the density of the Fourier space is the largest gives the skew angle. The method requires the computation of the Fourier transform, which can be time consuming for a large image. Hong Yah presented a method based on the cross-correlation between two lines in the image with a fixed distance. The correlation functions for all pairs of lines in the image are accumulated. The shift for which the accumulated cross-correlation function takes the maximum is then used for determining the skew angle. The image is rotated in the opposite direction for skew angle. Transform often imposes restrictions on the possible angle range.
Skew in scanned document can be of two types which is as below:
1. Clock -wise skew (Positive skew)
2. Anti-clock wise skew (Negative skew)

Fig1(a) Clockwise skew

Fig1 (b) Anti Clockwise skew

LITERATURE SURVEY

[1]R. J. Ramteke,et.al.,The performance of an OCR system will not be satisfactory for most of the scanned images without accurate skew correction. This paper presents the skew angle estimation and correction for Urdu document images script using moments method. The basic idea is to draw a random polygon over the text in document. This

leads to thinning free preprocessing. The skew angle is calculated using Central moments and centroid of the document image. Experimental results are found to be satisfactory and compared with other skew detection techniques.

[2]Rajeev N. Verma, et.al.,The image obtained after scanning an opened book page usually suffers from various scanning artifacts. One such major artifact is the Skew defect. This defect reduces the quality of the scanned images and cause many problems to the process of document image analysis. It is difficult to understand such documents by the Optical Character Recognizer(OCR). Some effective methods are present to rectify this error. Techniques discussed in this paper result in making the documents skew free. These techniques prove to be very appealing to non-expert users in real applications. This paper reviews and explicates such skew correction techniques in brief.

[3]Mamatha Hosalli Ramappa,Optical character recognition (OCR) refers to a process of generating a character input by optical means, like scanning, for recognition in subsequent stages by which a printed or handwritten text can be converted to a form which a computer can understand and manipulate. A generic character recognition system has different stages like noise removal, skew detection and correction, segmentation, feature extraction and classification. Results of the later stages can affect the performance of the subsequent stages in the OCR process. To make the results of the subsequent stages more accurate, the skew detection and correction and segmentation play an important role. In this paper, author have proposed schemes for skew detection and correction, segmentation of handwritten Kannada document using bounding box technique, Hough transform and contour detection respectively. An average segmentation rate of 91% and 70% for lines and words is obtained respectively.

[4]Yang Cao,et.al., During document scanning, skew is inevitably introduced into the incoming document image. Since the algorithms for layout analysis and character recognition are generally very sensitive to the page skew, skew detection and correction in document images are the critical steps before layout analysis. In this paper, a novel skew detection method based on straight-line fitting is proposed. And a concept of Eigen-point is introduced. After the relations between the neighboring Eigen-points in every text line within a suitable sub-region were analyzed, the Eigen-points most possibly laid on the baselines are selected as samples for the straight-line fitting. The average of these baseline directions is computed, which corresponds to the degree of skew of the whole document image. Then a fast skew correction method based on the scanning line model is also presented. Experiments prove that the proposed approaches are fast and accurate.

PROPOSED METHODOLOGY

The projection profile can be used as a suitable feature for skew detection. We need to create a feature to describe which one is more peaked for comparing peaks of projection profiles. So employing a criterion function provides a numerical description of the peaks. The projection profile analysis process is as follows:

Skew estimation

The horizontal projection profile is based on the histogram of black pixels along horizontal scan-lines. For a script with horizontal text lines, the horizontal projection profile will have peaks at text line positions and troughs at positions in between successive text lines [9]. This concludes to the fact that any noise and warp will ruin those peaks and troughs of the horizontal projection histogram and the efficiency of this technique. On the contrary a vertical projection method is robust to noise and warp of the image. The sum of squares of the projection profile elements as the value of the criterion function. This method also works well for the languages where most of their letters include at least one vertical line, such as languages with Latin alphabets. The pseudo codes of both the algorithms are as follows:

VERTICAL PROJECTION PROFILE ANALYSIS ALGORITHM:

1. Read the image data into a matrix and convert it to grayscale.
2. This grayscale image is changed to black background and white writing on comparison each pixel with 0.34
3. Searches for the first column with a white pixel, i.e., with a written pixel.
4. The entire image column-wise is stored in a variable (Skew input).
5. Each element of the input image matrix is added column-wise to get the number of white pixels per column and is stored in a variable Sum_col.
6. Sum of the squares of each Sum_col gives the value of energy function for the skew angle.

7. Input Image is rotated by angle "rot_angle" and steps 5 and 6 are repeated for this angle to obtain the value of energy function.
8. Input Image is rotated by angle "(-)rot_angle" and steps 5 and 6 are repeated for this angle to obtain the value of energy function.
9. rot_angle = rot_angle – 1.
10. Repeat steps 7, 8 & 9 till rot_angle != 0.
11. Find the angle for which the value of Energy function is maximum.
12. This angle gives the skew angle.
13. To display as output the values of energy function for each angle is displayed along with the bar graph for the column values for the skew angle and the corrected image segment.

Horizontal Projection profile Analysis Algorithm

1. Read the image data into a matrix and convert it to grayscale.
2. This grayscale image is changed to black background and white writing on comparison each pixels with 0.34
3. Searches for the first column with a white pixel, i.e., with a written pixel.
4. One-Fourth of the image row-wise is stored in a variable (Skew_input).
5. Each element of the input image matrix is added row-wise to get the number of white pixels per column and is stored in a variable Sum_row.
6. Sum of the squares of each Sum_row gives the value of energy function for the skew angle.
7. Input Image is rotated by angle "rot_angle" and steps 5 and 6 are repeated for this angle to obtain the value of energy function.
8. Input Image is rotated by angle "(-)rot_angle" and steps 5 and 6 are repeated for this angle to obtain the value of energy function.
9. rot_angle = rot_angle – 1
10. Repeat steps 7, 8 & 9 till rot_angle != 0
11. Find the angle for which the value of Energy function is maximum.
12. This angle gives the skew angle.
13. To display as output the values of energy function for each angle is displayed along with the bar graph for the row values for the skew angle and the corrected image segment.

Overall Algorithm Steps for Skew Detection and Correction

[1] Input the Text Document Image written in simple or multiple languages.
[2] Binirize the text Image obtained in the step 1.
[3] Find the four corners of Image file using Horizontal and vertical profile protection technique.
[4] Construct the triangle using upper corner of the Image.
[5] Calculate the skewed angle with the help of triangle extracted in step 4.
[6] Rotate the Image on the angle detected in step 3.
[7] Save the contents of the Image.
[8] Display Result to the user
[9] End.

RESULTS AND DISCUSSION

The proposed system is experimented with more than 20 images for testing. The algorithm has provided satisfactory results. Proposed system is implemented and tested using MATLAB. The use of projection profile for determination of skew angle is really simple and efficient. The accuracy of the proposed system is defined as the difference in skew angle calculate to the original skew angle present in the document. The accuracy of algorithm is around 95%.

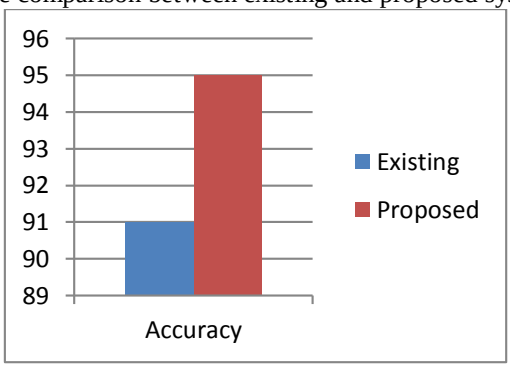
Statistics of the proposed system :

Parameters	Value
No. of Images Tested	20
Skew detected and corrected	19
Overall System accuracy	95
Avg. Time	2.132

The following table is showing the comparison of the existing system with the proposed system on the basis of accuracy:

Accuracy(%)	**Value**
Existing System	91%
Proposed System	**95%**

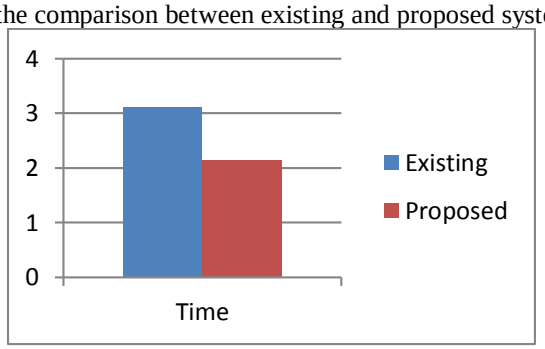
The following graph is showing the comparison between existing and proposed system :



The following table is showing the comparison of the existing system with the proposed system on the basis of Time to detect and correct skew:

Time	**Value**
Existing System	3.12
Proposed System	**3.13**

The following graph is showing the comparison between existing and proposed system :



CONCLUSION AND FUTURE SCOPE

Conclusion

In the proposed system we have implemented a technique based on advanced profile projection to detect and correct the skew angle from the image. Proposed system is tested on various types of inputs containing text in various scripts. System is evaluated on three parameters which are skew angle detected, time to correct the skew angle, and type of skewed angle. Proposed system shows good results on various images tested than that of existing system.

In future system can be extended to do work with any type of image containing text data and images collectively. System can be further improved to take lesser time to correct the skewed angle detected in the text document images.

REFERENCES

[1] R. J. Ramteke, Imran Khan Pathan, S. C. Mehrotra,Skew Angle Estimation of Urdu Document Images: A Moments Based Approach

[2] Rajeev N. Verma, Dr. Latesh G. Malik, REVIEW ON SKEW DETECTION AND CORRECTION TECHNIQUES
[3] Mamatha Hosalli Ramappa and Srikantamurthy Krishnamurthy,Skew Detection, Correction and Segmentation of Handwritten Kannada Document
[4] Yang Cao, Heng Li,Skew Detection and Correction in Document Images Based on Straight-Line Fitting
[5] Rajeev N. Verma, Dr. Latesh G. Malik,REVIEW ON SKEW DETECTION AND CORRECTION TECHNIQUES
[6] Jung Gap Kuk,Nam Ik Cho,Feature Based Binarization of Document Images Degraded by Uneven Light Condition
[7] S P Sachin, Banumathi K L, Vanitha R, DATABASE DEVELOPMENT OF HISTORICAL DOCUMENTS: SKEW DETECTION AND CORRECTION
[8] Mandip Kaur, Simpel Jindal,An Integrated Skew Detection And Correction Using Fast Fourier Transform And DCT
[9] Ruby Singh, Ramandeep Kaur,Improved Skew Detection and Correction Approach Using Discrete Fourier Algorithm
[10] Deepak Kumar, Dalwinder Singh,A Review of Scanned Document Skew Detection and Correction Techniques
[11] Ray Smith ,A Simple and Efficient Skew Detection Algorithm via Text Row Algorithm
[12] Zhixin Shi and Venu Govindaraju,Skew Detection for Complex Document Images Using Fuzzy Runlength
[13] A. Papandreou, B. Gatos, G. Louloudis and N. Stamatopoulos, ICDAR2013 Document Image Skew Estimation Contest (DISEC'13)
[14] RUBY SINGH, RAMANDEEP KAUR, SKEW DETECTION IN IMAGE PROCESSING
[15] Sepideh Barekat Rezaei, Abdolhossein Sarrafzadeh, and Jamshid Shanbehzadeh,Skew Detection of Scanned Document Images
[16] Rajiv Kapoor, Deepak Bagai , T.S. Kamal,A new algorithm for skew detection and correction