

## Rotation Estimation Of Gujarati Script Document Using Hough Transform

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### ABSTRACT

This paper includes a proposed technique for the Estimation of Skew present in the image of Gujarati Script Document using the Hough Transform technique. It includes simple pre-processing tasks like the Dilation, Erosion, and Thinning. Once these processes are applied the Final image is gone through Hough Transform and a quietly close angle is achieved. It provides promising results when applied on a wide range of images and also at different Skew Angles. This method provides less complexity in the Optical Character Recognition for the Gujarati Script. We obtain 44 % accuracy in this method.

**Keywords** - Gujarati Script, Hough Transform, Optical Character Recognition

### I. INTRODUCTION

Gujarati is the official language of Gujarat state, on the west coast of India, with an area of 196,024 square kilometers. Within the Republic of India, Gujarat borders with Rajasthan, Madhyapradesh, and Maharashtra; it also borders with Pakistan to the northwest. The languages spoken in the areas contiguous to the Gujarat within India are Marwari, Hindi, and Marathi. The 1991 census of India reports 40,673,814 speakers, accounting for approximately five percent (4.85%) of the population. This includes Gujaratis living outside Gujarat state, in Maharashtra (Mumbai has a substantial Gujarati population), Rajasthan, Madhyapradesh and Karnatak. Gujarati speakers also reside in many other countries, principally Pakistan, Singapore, Fiji, South Africa, the United Kingdom, the United states, and Canada.[1]

In the Application formation of Optical Character Recognition for any language the scanned image goes through a number of processes so that a final output in the form of Text File can be obtained. These processes include Pre-Processing, Segmentation, Classification, Feature Extraction and Post-Processing. These all processes have equal importance and play a vital role in obtaining the Text File of the image. As Pre-Processing provides an Enhanced image on which further processes are to be applied it is necessary that this process provides accurate results. It is sometimes possible that while scanning there is a misalignment in the image which would raise errors in detecting the text from the image. The angle to which this image is tilted or misaligned is called the Skew angle. For the accurate recognition of text from the image it is necessary that this Skew angle should be detected and must be

corrected. Many techniques are present for this Skew Detection and Correction. Of all these Hough Transform which is based on detecting the edges of the curves in an image provides a faithful result. This is a paper which demonstrates that as for other scripts for Gujarati Script also this Hough Transform provides quite accurate results.

### II. REVIEW WORKS

A lot of intensive works have been done by many authors regarding the Rotation Estimation using Hough Transform and various other techniques.

As in [2] the authors proposed a technique which is based on the Connected Components Approach, they applied the Hough Transform technique on English Script Document by applying two method—Centroid Approach wherein they took help of the centroids of each words for Skew Detection and the Dilate & Thin Approach wherein the selected characters are blocked and dilated to get word blocks and later thinning is applied.

In [3] the authors used a High Accuracy Rotation Estimation Algorithm using 1D Phase only Correction which reduced the problems of rotation estimation between two images. They also used a Line Extraction algorithm for improving the Estimation Accuracy.

As proposed in [4] an efficient, high precision algorithm is proposed for the correction of the skew angle of scanned document images used in OCR (Optical Character Recognition). The algorithm employs moments to find the primary axis of every object in the document rather than the Hough transform and handles arbitrary angles.

In [5] the author applied a different approach called the Discrete and Fast Fourier Transform Approach. This approach is basically used to speed up the Estimation process. Moreover, they used the angle of elevation theory for determining the angle in efficient manner.

Author in [6] use a novel method for complex document skew angle detection. The method uses a new concept of fuzzy runlength which imitates an extended running path through a pixel of a document.

As seen the above all processes were more or less applied for the English Script Document or may be another script but not on Gujarati Script Document.

As proposed in [7] the authors applied 'Line Fitting' i.e. Linear Regression method to recognize skew angle. In this each character is as a graph i.e. all the pixels that have value 1 are considered to be data points. Then we perform linear regression.

### III. HOUGH TRANSFORM

The Hough Transform is a global method for finding straight lines hidden in larger amounts of other data. It is an important technique in image processing. For detecting lines in images, the image is first binarised using some form of thresholding and then the positive instances catalogued in an examples dataset.

To understand Hough Transform it becomes important to get through what is the Hough Space. Each point  $(x, \Omega)$  in Hough space corresponds to a line at angle  $\Omega$  and distance  $d$  from the origin in the original data space. The value of a function in Hough space gives the point density along a line in the data space.

The Hough Transform progresses as follows:

For each point in the original space consider all the lines which go through that point at a particular discrete set of angles, chosen as priori point. For each angle  $\Omega$ , calculate the distance to the line through the point at that angle and discretize that distance using an a priori chosen discretization, giving value  $x$ .

Make a corresponding discretization of the Hough space - this will result in a set of boxes in Hough space. These boxes are called the Hough accumulators. For each line we consider above, we increment a count (initialized at zero) in the Hough accumulator at point  $(x, \Omega)$ . After considering all the lines through all the points, a Hough accumulator with a high value will probably correspond to a line of points. In fact for uniformly distributed points, each Hough box should have a Poisson distributed

count with mean given by the length of the line times discretization width times uniform point density. Some Hough boxes will correspond to longer lines than other, resulting in the pattern seen in the star/galaxy data transform below. A count which is in the tail of the relevant Poisson distribution is unlikely to be the result of the underlying uniform data, and hence more likely to be the result of some line of points. Giving some prior model for the number of points in a line will allow a proper Bayesian assessment of whether there is a line at the relevant angle and distance from the origin.

### IV. PROPOSED METHOD

In this proposed method, we performed simple steps which are illustrated below and got satisfactory results.

First of all, after taking a known angled skewed image (for testing), converted to the Gray scale image from the color.

Then this image is gone through Erosion wherein the boundary of the regions of the foreground pixels are eroded i.e. foreground pixels shrink in size and holes within those areas become larger.

After successful erosion the image is now ready to undergo through Dilation. Dilation is basically a process which gradually enlarges the boundaries of regions of foreground pixels i.e. the foreground pixels grow in size while the holes within the regions become smaller. Dilation should be applied a number of times appropriately to get the desired dilated image.

Next to these Morphological Operations Hough Transform is applied to the final image. We detected peaks values of that image and convert that peaks from Polar to Cartesian form. Using that values we estimated lines and found angle based on estimated lines. Finally, the angle to which the image is rotated is displayed. This angle is the angle to which the image has been tilted during the Scanning and this angle is known as the Skew Angle. The flow of the processes we applied is shown in Fig-1.

### V. RESULTS & DISCUSSIONS

After a careful study of the proposed method on a large number of different text images it was found that this technique worked fine for almost every image. Also a satisfactory accuracy was obtained from this technique of Skew Estimation using Hough Transform.

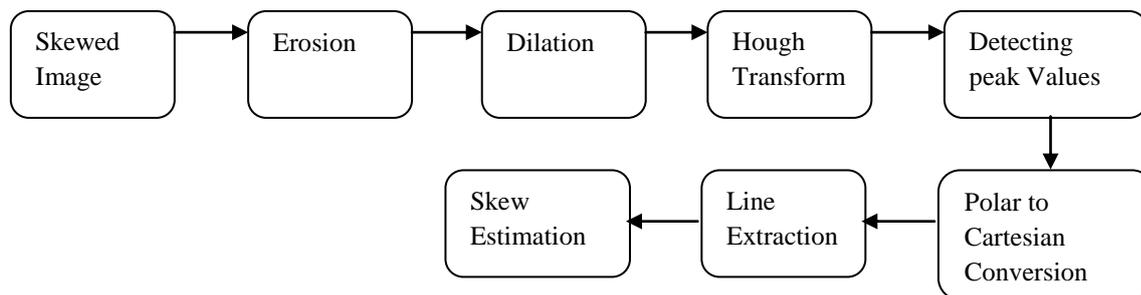


Fig.1 Block Diagram of Process Flow

નૂતન વર્ષની તને શુભાશિષ પાકવું છે. તે સારો પ્રશ્ન ઉઠાવ્યો છે. જો માનવી માટે યેશ અને આશીનની એકતાનો સાક્ષાત્કાર કરવાનું નિર્માયુ હોય તો દરેક મનુષ્ય તે કેવી રીતે કરશે ? આ માટે શુદ્ધકરણની પ્રક્રિયા છે. વ્યક્તિએ પોતાના સંસ્કારો, ભૂતકાળથી મુક્ત થવાનું છે.

Fig.2 Skewed Image



Fig.3 Image after applying Erosion



Fig.4 Image after applying Dilation

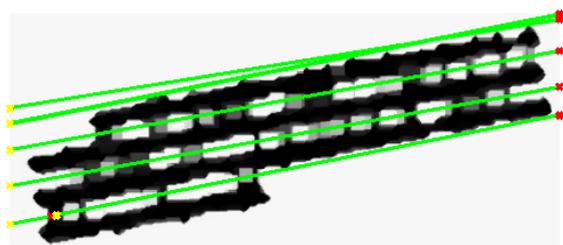


Fig.5 Image after Line Estimation

Table-1 Results of Hough Transform

Actual Rotation Angle (Degree)	Estimated Rotation Angle (Degree)
8(Anti Clockwise)	8
9	10
10	10.6
11	12
12	13
13	13.6
14	14
15	12.6
16	12

Table 1 shows actual angle and estimated angle using Hough transform. The proposed approach gives proper result up to certain angle but as angle is increased error between actual and estimated angle is increased. The proposed approach is working for both clockwise and anticlockwise skew.

## VI. CONCLUSION

In this paper, we present the Hough Transform Method for rotation estimation in Gujarati script document. We applied morphological operation on skewed image and applied Hough Transform on that image in this method. Applying Polar to Cartesian conversion we have done the line estimation and angle estimation. By applying this method we get satisfactory results of skew angle estimation. For the further improvement in the result of skew detection we can use other methods.

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