

Skew Detection from Natural Scene Images: A Review

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Abstract—Natural scene images are generally captured with portable devices such as mobile phone cameras. Scene images contains text information as part of captured scene. Scene image text poses difficulty in processing as compared to document text due to complexity of scene and open environment conditions. Scene images usually suffer from skew deformation due to inherent nature of portable capturing device and 3D scene. The scene text images must be checked for skew and necessary skew correction has to be applied in order to improve the results of character segmentation and recognition. In this paper, various existing techniques for skew detection of scene images have been discussed. The study cover skew detection techniques for scene images for various scripts with major emphasis on Indian scripts.

Keywords—Natural scene images; Skew Detection; scene text extraction; Indian Script

I. INTRODUCTION

Scene text extraction has gained attention of research community worldwide in recent years. Images of natural scenes captured by portable devices such as shop names, display boards, posters, vehicle number plates, mile-stones and road signs etc. are regarded as natural scene images. Natural scene images often contains textual information which can be exploited for use in many applications such as text extraction, location identification, content retrieval, indexing, computer vision and translation systems. Some example Scene text images are shown in Figure 1.

Extracting text from scene images is very challenging as compared to document images due to inherent complexities involved and open environment. Scene images generally suffer from [1] uneven intensity & shadow, complex background, noise, unknown text location, coloured & fancy fonts, skewness & perspective deformation etc. Various pre-processing operations like enhancement and skew removal has to be applied prior to scene text recognition for attaining comparable accuracy.

In a perfectly de-skewed text, the baseline should be parallel to horizontal axis. Any deviation or tilt of text baseline from this position is termed as skew and angle made by baseline with horizontal orientation is known as skew angle [2]. For superior results, skew need to be detected, estimated and corrected accurately prior to segmentation and recognition of text.

Several methods exist in literature for skew estimation of documents images of various scripts. These methods are generally based on skew detection of full page or a block of text. These methods may not work well for scene text images due to presence of few words. This paper presents a survey of

methods for skew detection of scene images for various scripts with a special treatment to Indian scripts.

The paper is organized as follows. Section II presents the extensive survey of skew detection in scene images for various scripts. Section III provides the conclusion and future scope of the study.



Figure 1. Natural scene images containing text of various scripts.

II. RELATED LITERATURE

Murthy et. al. [3] presented a Devangari scene words character segmentation scheme using header-line property of script. The words have been skew corrected by first identifying farthest located points from all salient (corner) points as header-line endpoints. The slope of detected header-line has been used to estimate the skew of word image and skew correction has been applied by rotating the image using rotation transformation. The character segmentation has been carried

out by drawing vertical projection profiles of top and bottom zones of word and with k-means clustering.

Singh & Maini [4] proposed a technique for skew detection of Gurmukhi scene words using Murthy's Devanagari scene words skew detection method [3]. The technique first locates straight horizontal line present on top of each Gurmukhi character (a connector for all characters in a word), known as header-line. Header-line is identified by joining of two far-off located salient points in upper part of Gurmukhi words. The tilt of this line with horizontal direction gives the skew angle of Gurmukhi scene word. The method has been tested on dataset containing 100 good quality as well as noisy Gurmukhi word images and found to be working well on all word images with intact header-line endpoints with accuracy of 62.8%.

Yamaguchi et. al. [5] proposed a method for recognition of telephone number digits after normalization of skew and slant. Hough transform has been used for skew angle calculation and de-skewing has been performed with affine transformation. The individual digits have been circumscribed with rectangles to compute slant angle and slant has been normalized by another affine transformation.

Gracia [6] et. al. presented a fast method for perspective recovery of Roman scene text after text detection. The text has been bounded with an imaginary quadrilateral by identifying top, bottom, extreme left and right imaginary lines. This quadrilateral has been mapped to rectangle by using homography to normalize horizontal foreshortening. The shearing has been estimated by regression of each character shear. The method has been tested on a set of natural scene images and found to be fast and robust than existing techniques.

Fang et. al. [7] presented an approach to remove distortions in scene text images using Morphology to estimate baseline of text and RANSAC algorithm to further improve the baseline points. Text distortion has been normalized by homography matrix after optimizing deformation parameters. Results have been carried out on 50 scene images with various distortions and the method is able to significantly improve the results of character recognition.

Banik et. al. [8] presented a character segmentation technique for Bangla scene word images, in which thinning has been applied prior to Hough transform in upper half of word image to locate the header-line. Out of all straight lines identified by Hough, longest line with length greater than empirically decided threshold has been designated as header-line. The skew has been removed by rotating the word image with angle computed from slope of this header-line.

Shiraishi et. al. [9] presented a skew assessment method for scene images based on various local parts of the character. The skew angle of parts of character has been computed using SURF features and these angles have been combined to generate a global skew angle. The results of this method have

been comparatively better as compared to traditional conventional skew detection methods.

Arulmozhi et. al. [10] presented a centroid based faster skew detection approach using Hough transform for Indian License plates. The image has been normalized by rotating the image by obtained skew angle. The method has been tested on various types of plates and found to be performing well than traditional methods of skew detection.

Ghoshal et. al. [11] presented a recognition system for Bangla scene images after removing perspective. Edge image obtained by applying Sobel on grayscale image has been subjected to Hough transform and two non-parallel lines has been identified to form imaginary rectangle around text. The perspective correction has been applied using Homography transformation.

III. CONCLUSION AND FUTURE SCOPE

The paper carried out extensive review on various approaches of skew detection. Many techniques requires enhancement as a pre-processing operation due to presence of noise, others work for a specific script. Handling scene images is more challenging than document images and require more sophisticated techniques. Most of skew detection techniques for Indian scripts are based on estimating skew of header-line. Hough transform proved to be an ideal operator for identification of straight lines in document image processing, but it performed poorly on scene images due to thickness of text.

Although natural scene extraction has been widely studied for various scripts, but limited literature is available for Indian scripts such as Gurmukhi. Removal of skew and slant of Gurmukhi script has to be addressed in the future and demand implementation of robust methods. An improved technique for skew detection will be proposed in future for Gurmukhi scene isolated words.

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