

# Text Detection and Character Extraction in Color Images using FFT Domain Filtering and SVM Classification

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**Abstract**—In this paper, a new approach for text detection and localization is proposed. For this purpose, we first localize text location and then determine characters' pixels. The proposed text detection approach is a two-stage algorithm that in first stage, we apply low pass filter on image in FFT domain to remove noisy element and then we apply Laplacian operator to the resultant image to highlight high contrast areas in the image. Then the product of corner dilated points and Laplacian enhanced image is calculated and text blocks are extracted using image vertical and horizontal projection. In the second stage of the algorithm, the extracted text blocks are verified using an SVM classifier. Text textures such as text angles and variance, momentum, entropy in co-occurrence matrix of text block are used for SVM training. We assumed that the characters of each text block have the same color. Therefore, we first estimate background color using image pixels in borders of detected text areas. Then the text color is estimated using the color clusters of pixels in text block and background color. We use color segmentation to extract character pixels. Experimental results show the promise of the proposed algorithm.

**Keywords**—text detection; text localization; textural features.

## I. INTRODUCTION

Text detection and OCR have many applications in digital image processing. For OCR applications in video images, in addition to text detection, it is important to localize text pixels more accurately. Usually because of intensity variation in image, determining text locations in image is challenging and it is necessary to use proper image features for accurate text localization.

Different algorithms have been proposed for text detection and localization. Different algorithms for text detection and localization may roughly be divided into three groups including, 1 – Methods based on color classification [1, 2], 2- gradient based algorithms [3, 4], and 3- algorithms based on texture and structure synthesis [5-18]. Color based approaches assume a predefined color for the text. Therefore, they lose their generality when the text color is not determined. These methods analyze connected component after color segmentation for the text localization as it proposed in [2].

Gradient based algorithms assume that text in image has a good contrast with background and its edge is obviously clear.

Connected Component (CC) based algorithms consider each character as connected component. Connected component based approaches generally extract characters based on their color or edge information. Therefore many text detection methods which are based on gradient or color segmentation are classified as CC methods as well.

Algorithms based on texture and structure synthesis utilize different textural and structural features to distinguish texts from background. Neural network [11, 15] and SVM based approaches [14, 18] are categorized in this group. In the case of proper feature, these methods generally show more efficiency in complex backgrounds.

For OCR applications as well as text inpainting, it is necessary to extract characters and determine the location of text pixels more accurately. Various approaches such as Niblack [19], Wolf [20], Sauvola and Pietikainen [21], Otsu [22], Wu [23], were also proposed for character extraction. Sauvola and Pietikainen method may be considered as improved version of Niblack thresholding algorithm.

In this paper, we propose a new algorithm for text detection, localization and inpainting. Our algorithm for text detection uses gradient and corner based features for text localization. To verify text blocks, we employ feature based on textural and structural features. We also benefit from color information for character extraction. To determine text color in a text block, we use Kmeans classification and adaptive Niblack thresholding algorithms.

The paper is organized as follows. Following this section, section II presents the proposed text localization algorithm. Proposed algorithm for extracting text characters is described in detail in section III. Section IV represents experimental results and at last conclusions are given in section V.

## II. TEXT LOCALIZATION ALGORITHM

The aim of text detection in image or video frames is to determine text blocks for extracting characters. The main feature of text that we use here is its contrast and connectedness. Generally there is less continuity in natural

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**Ahmad Khadem-Zadeh**  
**Organizing Committee Chair**

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