Text Region Extraction in a Document Image Based on Discrete Wavelet transforms

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Abstract:

This paper presents a new approach for extracting text region from the document images employing the discrete wavelet transform. The detection of text region is achieved by the discrete wavelet transforms. Experimental results show that the proposed method gives better text extraction from the document images.

Index terms: Document segmentation, DWT

1. Introduction

The extraction of textual information from document images provides many useful applications in document analysis and understanding, such as optical character recognition, document retrieval, and compression. To-date, many effective techniques have been developed for extracting characters from monochromatic document images. The document image segmentation is an important component in the document image understanding.

A novel method for segmenting text and graphics part of document images based on textural cues is presented in [1]. The segmentation method uses the notion of discrete sc wavelet analysis and statistical pattern recognition. M band wavelets are used which decompose an image into M x M band pass channels The model is useful for image analysis by "bag-of-visual words" image representation. The performance of the method depends on the visual vocabulary generated by feature extraction from the document image. Kernel-based methods have demonstrated excellent performances in a variety of pattern recognition problems. The kernel-based methods and Gabor wavelet to the Segmentation of document image is presented in [5]. The feature images are derived from Gabor Filtered images.

The edges detection is accomplished by using 2-D Haar DWT and some of the non-text

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Edges are removed using thresholding. Afterward, we use different morphological dilation operators to connect the isolated candidate text edges in each detail component sub-band of the binary image. Although the color component may differ in a text region, the information about Colors do not help extracting texts from images If the input image is a gray-level image, the image is processed directly starting at discrete wavelet transform. If the input image is colored, its RGB components are combined to give an intensity image Y as follows:

Y=0.299 0.587 0.114 *Y R G* (1)

1.1 Edge detection in spatial domain

Edge detection is the most useful approach for detecting discontinuities in the grey level or color of an image. It defines edges as locations in an image where there is a sudden variation in the grey level or color of pixels. Intuitively, an edge can be thought of as a set of connected pixels that lie on the boundary between two regions. The contours of potentially interesting scene elements (solid objects, surface marking, text strings, etc.) all generate intensity or color edges. However, in contrast to a region boundary which is a global property of the region, an edge is a local concept. Edge enhancement and detection operations are obvious steps to undergo when attempting to locate and recognize the scene elements. However, it must be pointed out that the problem of locating and recognizing scene objects is not trivial, because they usually are occluded in the background and noise, which can also generate strong edges. The edge detection techniques that are discussed in this section are performed directly on the pixels of the image. Hence, the term spatial domain is used to distinguish this type of techniques from the others

1.2 Second-Order Edge Detection Operators

Gradient operation is an effective edge detector when the pixel gray levels (colors) change over space very rapidly. But when the gray levels change slowly from dark to bright, the gradient operation will produce a very wide edge. In this case, it is helpful to

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consider using the Laplace operation. The Laplacian of an image f is a second order derivative defined as:

$$\nabla^2 f = \frac{\partial^2 f}{\partial x^2} + \frac{\partial^2 f}{\partial y^2}$$

2. Methodology

2.1. DISCRETE WAVELET TRANSFORM

The discrete wavelet transform is a very useful tool for signal analysis and image processing, especially in multi-resolution representation. It can decompose signal into different components in the frequency domain. One-dimensional discrete wavelet transform (1-D DWT) decomposes an input sequence into two components (the average component and the detail component) by calculations with a low-pass filter and a high-pass filter.

2.2 Haar Wavelet Transform

In mathematics, the Haar wavelet is a certain sequence of functions. It is now recognized as the first known wavelet. This sequence was proposed in 1909 by Alfréd Haar. Haar used these functions to give an example of a countable orthonormal system for the space of square-integral functions on the real line. The study of wavelets, and even the term "wavelet", did not come until much later.

The Haar wavelet's mother wavelet function $\Psi(x)$ can be described as

$$\Psi(x) = \begin{cases} 1 & 0 \le x < \frac{1}{2}, \\ -1 & \frac{1}{2} \le x < 1, \\ 0 & otherwise \end{cases} \qquad (3.34)$$

And its scaling function $\Phi(x)$ can be described as

2.3 2D Haar Wavelet Transform:

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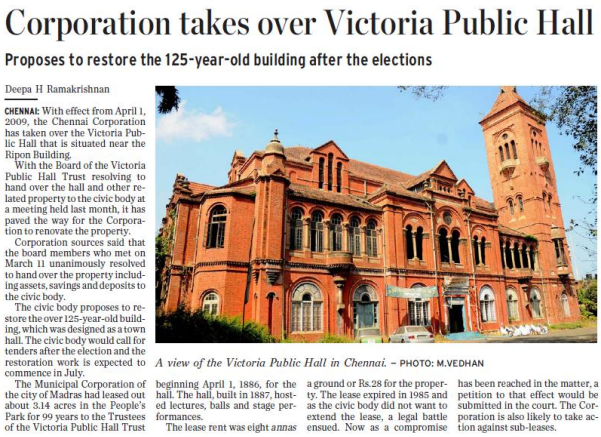
It has been shown in previous section how one dimensional image can be treated as sequences of coefficients. Alternatively, consider images as piecewise constant functions on the half-open interval [0, 1]. To do so, the concept of a vector space is used. A one-pixel image is just a function that is constant over the entire interval [0, 1]. Let V^0 be the vector space of all these functions. A two pixel image has two constant pieces over the intervals [0, 1/2) and [1/2, 1). Call the space,

3. Experimental Results

The performance of the proposed system is evaluated in this section. In this section, the performance of the Haar wavelet transform based document image segmentation is explained. First, the input document image is transformed into gray scale image and then Haar wavelet transform is applied. Figure 3.1 shows the input document image. Figure 3.2 shows the transformed gray scale image Figure 3.3 shows the segmented result based on Wavelet Transform

Figure 3.1: Input Document image



Corporation takes over Victoria Public Hall

Proposes to restore the 125-year-old building after the elections

Deepa H Ramakrishnan

CHENNAI: With effect from April 1, 2009, the Chennai Corporation has taken over the Victoria Public Hall that is situated near the Ripon Building.

With the Board of the Victoria Public Hall Trust resolving to hand over the hall and other related property to the civic body at a meeting held last month, it has paved the way for the Corporation to renovate the property.

Corporation sources said that the board members who met on March 11 unanimously resolved to hand over the property including assets, savings and deposits to the civic body.

The civic body proposes to restore the over 125-year-old building, which was designed as a town hall. The civic body would call for tenders after the election and the restoration work is expected to commence in July.

A view of the Victoria Public Hall in Chennai. – PHOTO: M.VEDHAN

The Municipal Corporation of the city of Madras had leased out about 3.14 acres in the People's Park for 99 years to the Trustees of the Victoria Public Hall Trust beginning April 1, 1886, for the hall. The hall, built in 1887, hosted lectures, balls and stage performances.

The lease rent was eight annas a ground or Rs.28 for the property. The lease expired in 1985 and as the civic body did not want to extend the lease, a legal battle ensued. Now as a compromise has been reached in the matter, a petition to that effect would be submitted in the court. The Corporation is also likely to take action against sub-leases.

Figure 3.2: Gray scale image

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Figure 3.3: Segmented result based on Wavelet Transform

4 .Conclusion

In the wavelet transform based document image segmentation, Haar discrete wavelet transform is used. Recently, a number of multi resolution analysis introduced by many researchers such as Contour let transform, curve let transform, Ridge let Transform and so on .The edges of text and non text regions must be clear. The experimental results indicate the proposed algorithm can effectively process a variety of document images with fonts, structures and components. When the method is used to select engines for document image recognition, it is preferable that the computation time is much faster.

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