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A Review of Adaptive Thresholding Techniques for Vehicle Number Plate Recognition

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Abstract: Automatic vehicle number plate recognition is a challenging task and becoming important area of research due to its difficult applications such as Traffic data collection, toll collection, crime prevention and security control of restricted areas. Therefore in the last few decades many efforts were taken by researchers to develop different techniques for thresholding and segmentation of the vehicle number plate. This review presents many basic and advanced adaptive thresholding techniques for automatic vehicle number plate recognition.

Keywords: Adaptive thresholding, Integral image, mean, median, Gaussian filter.

I. INTRODUCTION

In image processing, thresholding is one of the important step. Thresholding is used to segment an image by setting all pixels whose intensity values are above a threshold to a foreground value and all the remaining pixel to a background value.

Adaptive Thresholding is the form of thresholding which consider the problems such as illumination, noise, resolution and according to that threshold window moves successively over every pixel in image. This review presents the different methods of Adaptive Thresholding.

II. TECHNIQUES OF ADAPTIVE THRESHOLDING

In adaptive thresholding for each pixel in the image we calculate separate threshold value and if threshold value is greater than current pixel value it is set to background otherwise it will be foreground.

Here we are presenting four methods of adaptive thresholding.
1. Adaptive Thresholding using Mean
2. Adaptive Thresholding using Median
3. Adaptive Thresholding using Gaussian filter
4. Adaptive Thresholding using Integral image

A. Adaptive Thresholding using Mean

It is the basic method of thresholding in which the current pixel value of image is replaced with mean or average of all the neighbouring pixels and that value is compared with current pixel value.If the value of current pixel is less than mean value then it is set to black otherwise it is set to white.

Example1: Consider the current pixel values of the image matrix are,

$$\begin{bmatrix} 4 & 1 & 5 & 3 & 6 \\ 9 & 7 & 2 & 1 & 9 \\ 1 & 2 & 8 & 4 & 7 \\ 0 & 7 & 8 & 9 & 1 \end{bmatrix}$$

Here we will use 3*3 mask for mean filtering. we will apply mean adaptive thresholding on it. 3*3 mask window values are,

$$\begin{bmatrix} 5 & 3 & 6 \\ 2 & 1 & 9 \\ 8 & 4 & 7 \end{bmatrix}$$

The computed mean matrix value is,

$$\begin{bmatrix} * & * & * \\ * & 5 & * \\ * & * & * \end{bmatrix}$$

Current centre pixel value 1 is replaced by mean value 5. This value is compared with current pixel value using,

$$\text{Output threshold O (i,j)} = \begin{cases} 0, Im < FIm * [(1-t)]/100 \\ 255, \ otherwise \end{cases}$$

Figure 1 shows input image and fig.2 shows output of adaptive mean threshlding. It is useful to remove noise and it ignores soft gradient change.

Fig.1 Input image

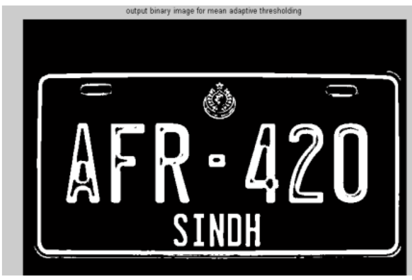

Fig. 2. Output binary image for Mean adaptive thresholding

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B. Adaptive Thresholding using Median filter

It is also basic method of thresholding similar to mean adaptive thresholding in which the current pixel value of image is replaced with median of all the neighbouring pixels and that value is compared with current pixel value.If the value of current pixel is less than mean value then it is set to black otherwise it is set to white.

Example 2:
Consider the image matrix as in example1.Here also we are using 3*3 matrix.To get the median, mask window values are arranged in ascending order as below,

1, 2, 3, 4, 5, 6, 7, 8, 9

The computed median matrix value is,

$$\begin{bmatrix} * & * & * \\ * & 5 & * \\ * & * & * \end{bmatrix}$$

Current centre pixel value 1 is replaced by mean value 5. This value is compared with current pixel value using,

$$\text{Output threshold O (i,j)} = \begin{cases} 0, Im < FIm * [(1-t)]/100 \\ 255, \ otherwise \end{cases}$$

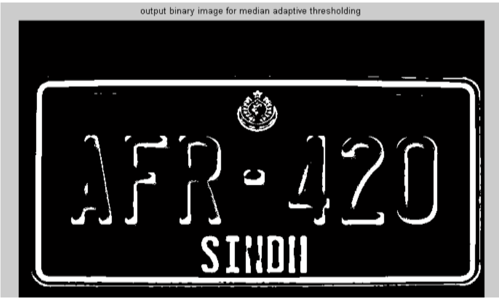


Fig.3 output image of adaptive thresholding using median filter.

Fig.3 shows output image of adaptive thresholding using median filter. It is used to remove impulse noise in the image but edges of the image may get blurred.

C. Adaptive Thresholding using Gaussian filter

Gaussian filter is the local filter which smoothens the image irrespective of its edges.Fig.4 shows output image for Gaussian filter adaptive thresholding. These filters remove high frequency components from the image. Adaptive thresholding using Gaussian filter depend on value of standard deviation. As the value of standard deviation increases more noise is suppressed but image also get blurred respectively. This is a common first step in edge detection Mostly this method is used for low value of standard deviation.

In one dimension, the Gaussian function is:

$$\frac{1}{\sqrt{2\pi\sigma^2}} e \frac{x^2}{2\sigma^2}$$

Considering standard deviation value 6, computation of the Gaussian filter value with current pixel value is done.

$$\text{Output threshold O (i,j)} = \begin{cases} 0, Im < FIm * [(1-t)]/100 \\ 255, \ otherwise \end{cases}$$

Fig. 4. Output binary image for Gaussian adaptive thresholding

D. Adaptive Thresholding using Integral image

An integral image is a tool that can be used when we have functions from pixel to real numbers. To compute the integral image we add left and top pixel values of the current matrix and that addition is replaced by current pixel value. Image matrix below shows the computation of integral image.

$$\begin{bmatrix} 1 & 2 & 3 & 4 \\ 0 & 1 & 1 & 4 \\ 3 & 1 & 0 & 4 \\ 2 & 1 & 3 & 1 \end{bmatrix}$$

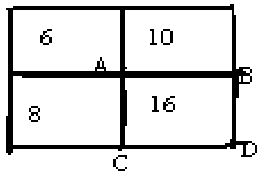
Simple input image matrix

The computed integral image matrix is,

$$\begin{bmatrix} 1 & 3 & 6 & 10 \\ 1 & 4 & 8 & 16 \\ 4 & 8 & 9 & 23 \\ 6 & 11 & 18 & 30 \end{bmatrix}$$

Adaptive thresholding technique used in this paper is the simple extension of Bradely and Roth's and Wellners method.Value of threshold T is constant that is t = 0.15.It is the optimal value for best thresholding performance.

The next process is to obtain intensity summation for each window using two subtractions and one addition. For this purpose we need only 4 values of integral image matrix.we will use top right 4 valued rectangle for calculation.



Sum of all values upto A,B,C,D are 6.10,8,16.

SUMwindow = A + D - B – C
= 6 + 16- 10 – 8
= 8

Threshold for each pixel can be calculated as,

t (i,j) = (1-T)* SUMwindow

Criteria to output the threshold value of integral image pixel:

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Wellner uses one eighth of image width for value of selection S thus output threshold can be given as,

Output threshold value

$$O(i,j) = \begin{cases} 0; current\ pixel\ value * s^2 < t(i,j) \\ 255 \quad\quad\quad\quad\quad\quad otherwise \end{cases}$$

Fig.5. Shows binary integral image. This technique is suitable for processing live video streams at a real-time frame-rate.

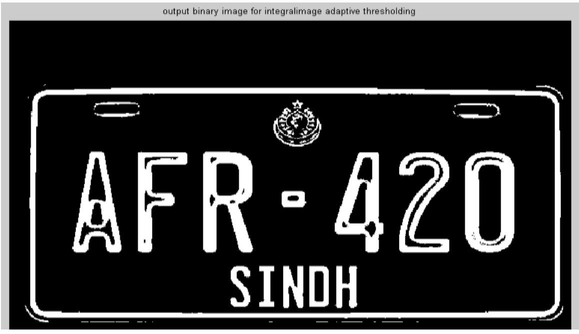

Fig. 5. Output binary image for Integral image

III. CONCLUSION

Image thresholding is important basic task required in many applications. In this paper we reviewed techniques for adaptive thresholding and comparative study of these techniques. Adaptive thresholding plays important role in the problem of light illumination and resolution.

REFERENCES

[1] R. Gonzalez and R.Woods digital image processing,
[2] Abbas M. Al-Ghaili, SyamsiahMashohor, Abdul Rahman Ramli and Alyani Ismail "Vertical-Edge-Based Car-License-Plate Detection Method" IEEETrans.Veh. Technol., vol. 62, no. 1, January 2013
[3] D. Bradley and G. Roth, "Adaptive thresholding using the integral image," *J. Graph. Tools*, vol. 12, no. 2, pp. 13–21, Jun. 2007.]
[4] P. D. Wellner, "Adaptive thresholding for the Digital Desk," Rank Xerox Ltd., Birmingham, U.K., Tech. Rep. EPC-1993-110, 1993.