# Detection of 'No Parking' Signboards using Template Matching

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*Abstract*— The aim of this project is to recognize the signboards in a parking space in order to detect if a vehicle is violating the rules. By doing so we can manage a parking space smoothly. Static digital images are taken by a camera module. This camera is placed on a dynamic system (say a mobile robot). The software first preprocesses (grayscaling, blurring) followed by Canny edge detection, where in we do sobel edge detection, non-maximum suppression and double threshold hysteresis. To finally match and see if there is a signboard that is governing the parking area stretch we apply template match. By detecting the signboards we can make sure that the vehicles parked are not violating the signboards.

***Keywords:*** Preprocessing, Canny Edge Detection, Sobel Edge Detection, Non-Maximum Suppression, Double Thresholding, Template Match

## I. INTRODUCTION

Managing a parking area is a huge hassle. People avoid the signboards. Absence of a police personal creates disruption in the management of the parking space. In order to make sure that the vehicles have been parked correctly we have a monitoring system which contains a camera that captures the mage that needs to be studied to detect and recognize the violation. We convert the original image that is captured by the camera into a grayscale image. We then blur the image. Now we perform canny edge operation in order to keep the edges and find the main region of study. We then perform template matching. This help in in detecting the no parking signboard in the captured image.

## II. PROPOSED METHODOLOGY

### A. *Pre-processing*

Preprocessing is done in order to improve the quality of the image data that suppresses unwanted distortions or enhances some image features that will come in use during further processing of the image. This step involves converting the original image(i.e. the image captured by the camera) into grayscale image, followed by Gaussian Blurring.


Fig. 1.1: Original Image

#### 1) *Gray Scale Conversion*

Here we convert the original image into grayscale image. The image captured is an RGB image. Grayscale images are much easier to work within a variety of task like In many morphological operation and image segmentation problem, it is easier to work with single layered image (Grayscale image) than a three-layered image (RGB colour image ), as it is easier to distinguish the features of the image.


Fig. 1.2: Grayscale Image

#### 2) *Gaussian Blur*

Gaussian filter is used to blur the image. Here we convolve the image with a Gaussian filter. Gaussian Filter is a low pass filter that removes or reduces high frequency components. This is done in order to reduce image noise and details.


Fig. 1.3: Blurred Image

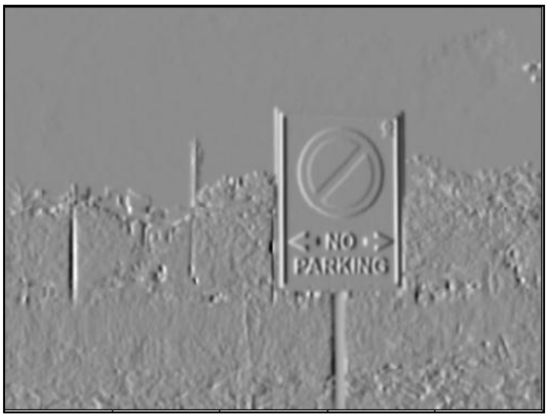
### B. *Canny Edge Detection*

#### 1) *Sobel Edge Detector*

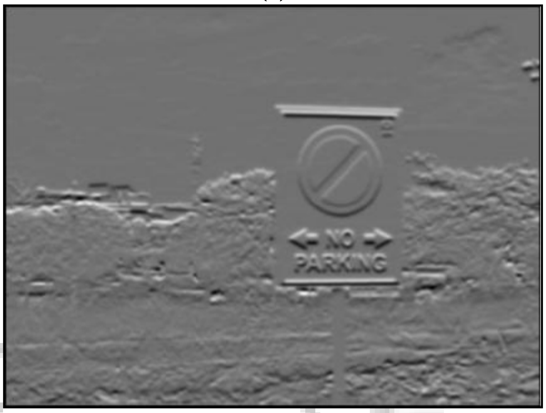
The gradients can be determined by using a Sobel filter where AA is the image. An edge occurs when the color of an image changes, hence the intensity of the pixel changes as well.

$$G_x = \begin{bmatrix} -1 & 0 & +1 \\ -1 & 0 & +1 \\ -1 & 0 & +1 \end{bmatrix} A\,, \quad G_y = \begin{bmatrix} -1 & -2 & -1 \\ 0 & 0 & 0 \\ +1 & +2 & +1 \end{bmatrix} A$$




(a)




(b)

Fig. 11.4: (a)Sobel Filter in x direction and (b)Sobel Filter in y direction

Here we are making the edges prominent in the vertical and horizontal direction. We calculate the difference in the pixel intensities of a particular edge. Increase of the sudden change in intensities makes the mask more visible.

Then we calculate the magnitude and angle of directional gradient

$$|G| = \sqrt{G_x^2 + G_y^2}$$


Fig. 1.5: Magnitude

$$\angle G = \arctan\left( {G_x}/{G_y} \right)$$

Fig. 1.6: Directional Gradient

*2) Non-maximum Suppression*

Non-maximum suppression is a thinning technique.

The image magnitude produces results in thick edges. Ideally, h final image should have thin edges. Thus, we must perform non maximum suppression to thin out the edges.

Non maximum suppression works by finding the pixel with the maximum value in an edge. When the pixel intensity is greater than those of the neighboring pixels, then we keep the pixel, or else we set the pixel to zero(make it a black pixel).

No maximum suppression can be achieved by interpolating the pixels for greater accuracy:

$$r = \alpha b + (1 - \alpha)\alpha$$

Fig. 1.7: Non Maximum Suppression

*3) Double Threshold Hysteresis*

Here we remove the noise that non maximum suppression failed to remove. Here we choose a higher threshold value and a lower threshold value. By setting ratios of the two we can establish the actual edges, even if the edge is a weak edge. This is done by seeing if the weak edge is a continuation of the verified actual edge.

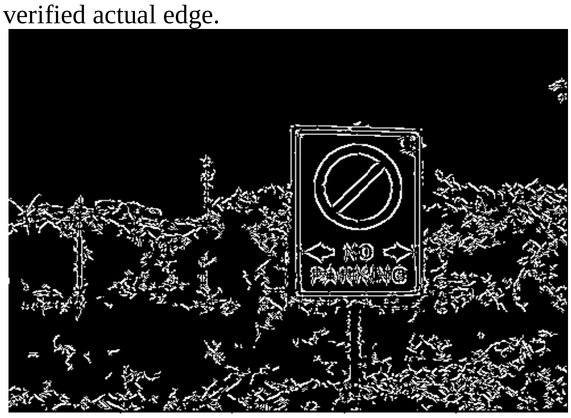


Fig. 1.8: Double Thresholded Image

### *C. Template Matching*

A dataset of templates are created for detecting 'No Parking' signboards. These templates are few in number so we convert them by using canny edge and store them for further use. These templates are matched to the image(captured by camera) we have converted using canny edge.

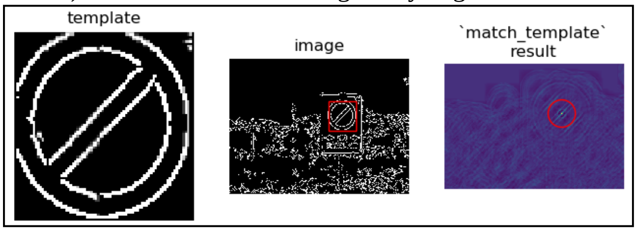



Fig. 1.9: Matched Image

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