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# Edge Detection for Night Vision Images Using Canny

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**Abstract**
*On night time, it is very difficult to identify the vehicles that make crime on the highway due to unwanted light sources. Investigating the vehicles that make crime on the highway is decisive. Vehicle Edge Detection images are taken from CCTV mounted on the highway. The system uses a canny edge detection technique and tracks the road boundaries, building, street lamp and other vehicles on the road. In this paper we present canny method to detect edges for vehicle, road boundary, street light, and buildings.*

**Keywords**
*Edge Detection, Canny*

## I. Introduction

Vehicle Edge detection from CCTV Captured Image had been researched and developed for night time for better efficiency and reduces restriction. In most of the Highways a single camera is mounted for identifying vehicles that simplicity makes more complex and difficult to get various postures and appearances of vehicle, uncontrollable and unpredictable surroundings, and problems of outdoor environments. In additions, complex backgrounds such as long haul street lights, vehicle front lights and rear light, break lamps, buildings lights, traffic signals, also make the vehicle edge detection more challenging problem.
The system of the proposed method is to detect edges for vehicle by the edge detection techniques.
The vehicles which violet traffic rules, vehicle which make an accident, vehicle which are high jacked at the night time, make the investigation more critical because of the outer light courses damages the edges in the image.
The color and intensity of pixels of the image depends on the properties and configuration of the camera. The target vehicle is highly dependent on its distance from the camera. The distance is an important factor for edge detection.
The physical events changes the intensity of the image, Geometric events such as object boundary and surface boundary. Non-Geometric events light reflection, mirror reflection, shadow of lights

## II. Edge Detection

The boundary of the object is represented by edges. Edges are also used to identify areas and shapes of the object.

- Human vision interprets a scene as a series of edges, and will interpret a line drawing of the same scene in the same interpretation.
- If a process can be applied to its output with no change then its non-linear parts are functioning correctly.
- If a process is then it is clear that only one application of the process is necessary to achieve the maximum ``enhancement'' possible. This *could* be seen as signifying efficient design.

### A. Canny Edge Detection

Canny edge detector was developed by John F. Canny in 1986. The canny edge detection provides an exact detection of edges within the actual and provided edge. Canny edge detector is used to detect the edges in congested scenes, because it has good detection, good localization and minimal response.
Canny edge detector uses multi-stage algorithm to detect a wide range of edges in an image. Those stages are noise reduction, finding the intensity gradient of the image non maximum suppression and tracing edges.
The algorithm has five steps

### 1. Smoothing:

The image taken from the camera has some noise. The noise make edges mistaken, noise should be reduced or noise to be prevented. The image is first smoothed by gaussian filter.

### 2. Finding gradients

The Canny algorithm basically finds edges where the grayscale intensity of the image changes the most. The areas are found by determining gradients of the image.

$f_x(x, y) = f(x, y) * g_x(x, y)$
$= (f(x, y) * g_x(x)) * g(y)$
$f_y(x, y) = f(x, y) * g_y(x, y)$
$= (f(x, y) * g_y(y)) * g(x)$

$(f_x, f_y)$ Gradient Vector

$$\text{Magnitude} = \sqrt{f_x^2 + f_y^2}$$

$$\text{Direction} = \theta = \tan^{-1}\frac{f_y}{f_x}$$

### 3. Non-maximum suppression

This process converts the blurred edges in the image of the gradient magnitudes to sharp edges this is done by preserving all local maxima in the gradient image and deleting everything other than local maxima. The algorithm for each pixel in the gradient image

1. Round the gradient direction to nearest 45◦, corresponding to the use of an 8-connected neighbourhood.
2. Compare the edge strength of the current pixel with the edge strength of the pixel in the positive and negative gradient direction, if the gradient direction is north (θ=90◦), compare with the pixels to the north and south.
3. If the edge strength of the current pixel is largest preserve the value of the edge strength. If not suppress remove the value.

All pixels have gradient directions pointing towards north. They are compared with the pixels above and below. The picture that turn out to be maximal in this comparison are marked as gray back color and all other pixels are suppressed

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| | | | | |
|---|---|---|---|---|
| 2↑ | 3↑ | 4↑ | 6↑ | 5↑ |
| 4↑ | 5↑ | 6↑ | 7↑ | 2↑ |
| 5↑ | 7↑ | 3↑ | 4↑ | 2 |
| 7↑ | 4↑ | 4↑ | 1 | 2 |

Fig. 1

### 4. Double thresholding

The edge-pixels remaining after the non-maximum suppression step marked with their strength pixel-by-pixel. Probably there will be true edges in the image, but some edges may be caused by noise or light affected by the outer light sources (such as building light, street light, and vehicle front, real light). The simplest way to differentiate these would be to use a threshold, so that only edges stronger that a certain value would be preserved.

The Canny edge detection algorithm uses double thresholding. Edge pixels stronger than the high threshold are marked as strong, edge pixels weaker than the low threshold are suppressed and edge pixels between the two thresholds are marked as weak.

### 5. Edge tracking by hysteresis

Strong edges are detected and they are included as the final edge image. Weak edges are included if they are connected to strong edges. The noise and other small variations are unlikely to added in a strong edge. Thus strong edges are true edges in the original image. The weak edges or noise/color variations added to the strong edges on the entire mage, and thus only a small amount will be located adjacent to strong edges.

## III. Performance of Edge Detection

Evaluating the performance of the canny edge detection for night vision includes shown in fig.3

1. Probability of false edge because of the lights.
2. Probability of missing edge due to outer light sources.
3. Missing Object in night vision
4. Night vision create errors in edge angles.

## IV. Conclusion

The proposed method conclude that the canny algorithm finds the strong edges. The weak edges due to the outer light sources are missed and also it finds the false edges that are not subject to the images, it happens due to the surrounding of outer light sources in the night vision.


Fig.2 : Original Image

Fig.3 : Canny Edge Detection

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