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A latest efficient edge detection Approach using Sobel with HDL Coder and Ant colony Technique

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Abstract—— A latest efficient edge detection is the approach for obtaining information from a specific application like aerial urban remote sensing images. A latest efficient edge detection operation is a hybrid one. In this paper, Sobel with HDL Coder and ant colony techniques are identified and implemented for better performance. The output of initial stage edge detection methods analyzed with basic sobel edge detection and performance improvement is identified on different application scenario. It generally detects the contour of an image and thus provides important details about an image. The result of first stage on different application is given input for the ant colony optimization. Sobel with HDL Coder combined with ant colony method result are analyzed. The evaluation is done using different quantitative performance measure on the three standard images.

Keywords — Sobel with HDL Coder, Ant Colony Optimization algorithm, Latest efficient edge detection.

I. INTRODUCTION

All standard Computer vision aims to duplicate the effect of human vision by electronically perceiving and understanding an image. Giving computers the ability to see is not an easy task. Over the recent years, analysis of images such as segmentation, Edge Detection, Boundary detection, classification, clustering and texture property extraction were attracts the attention of many Researchers in the image processing and pattern recognition area. These types of tasks in image analysis are complicated, to analyze an image, which is having more than one uniform region to be portioned into several homogenous sub images.

Edge detection methods have been intensively used recently in many applications of image processing. Content separation which is normally called segmentation of image [1],[2], object classification or identification [3] are some of the uses of image edge detection in image processing techniques apart from detection the significance differences in level of gray and noise elimination in digital images[4].

Image can be defined as the real pr similarity of somebody or something. However, the sharp variations in the intensity level observed on the image refer to the edges of the image. These intensity variations of image typify its border and this property makes it useful in image analysis like segmentation, objects recognition and registrations.

Research on a new meta-heuristic for optimization is often initially focused on proof-of-concept applications. In the early 1990s, ant colony optimization (ACO) was introduced by M. Dorigo and colleagues as a novel nature-inspired meta-heuristic for the solution of hard combinatorial optimization (CO) problems. Ant Colony Optimization Algorithm is introduced to tackle the Image edge detection problem. The proposed ACO-based edge detection approach is able to establish a pheromone matrix that represents the edge information presented at each pixel of the image, according to the movements of a number of ants which are dispatched to move on the image. Furthermore, the movements of these ants are driven by the local variation of the images intensity values. Experimental results are provided to demonstrate the superior performance of this approach.

II. SOBEL WITH HDL CODER AND ANT COLONY TECHNIQUE

A. Sobel with HDL Coder

The Sobel operator performs a 2-D spatial gradient measurement on an image and so emphasizes regions of high spatial frequency that correspond to edges. Typically it is used to find the approximate absolute gradient magnitude at each point in an input grayscale image. The operator consists of a pair of 3×3 convolution kernels as shown in Figure 1. One kernel is simply the other rotated by 90°.

-1	0	+1
-2	0	+2
-1	0	+1

Gx

+1	+2	+1
0	0	0
-1	-2	-1

Gy

Fig1: Masks used by Sobel Operator

These kernels are designed to respond maximally to edges running vertically and horizontally relative to the pixel grid, one kernel for each of the two perpendicular orientations. The kernels can be applied separately to the input image, to produce separate measurements of the gradient component in each orientation (call these Gx and Gy). These can then be combined together to find the absolute magnitude of the gradient at each point and the orientation of that gradient. The gradient magnitude is given by:

$$|G| = (Gx^2 + Gy^2)^{1/2}$$

Typically, an approximate magnitude is computed using:

$$|G| = |Gx| + |Gy|$$

This is much faster to compute The angle of orientation of the edge (relative to the pixel grid) giving rise to the spatial gradient is given by:

$$\Theta = \arctan(Gy / Gx)$$

To create HDL Coder do the following steps:

1. Creating a New MATLAB HDL Coder project
2. Adding design and testbench files to the project
3. Launching the HDL workflow advisor for MATLAB
4. Running sobel code generation steps

Original Image

Sobel with HDL Coder

B. Ant Colony Optimization Method

Different ACO optimization algorithms had been proposed earlier. First ACO, as mentioned earlier was known as Ant System . Several ACO algorithms have been developed after that such as Max-Min Ant System, and Ant Colony System. The proposed ACO is presented in earlier chapter. The ACO algorithms while being implemented on the image undergo some changes. The solution space for ants now is the 2D image and the artificial ants are now made to move over the image. Therefore, the artificial ants, simulating the real ants, leave pheromone on the nodes or image pixels. The edges of the image becomes the food for
the ants. Therefore, in this way the ants develop a pheromone matrix.

In ACO, pheromone trail values serve as distributed, numerical information, which the ants use to construct solutions probabilistically. There is one solution per ant. The higher the pheromone value (initial edge), the higher the probability of an ant choosing that particular trail will be. The pheromone values on lower quality trails which are not reinforced often enough will progressively evaporate. The pheromone based evaporation implements a useful form of forgetting: it avoids the algorithm from converging too rapidly toward a suboptimal region (final edge map), therefore, as mentioned above, it is repeatedly applied until a termination condition is satisfied.

Algorithm:

```
Begin
    Define clique
    Set the parameters
    Record the location of ant
    Initialize the positions of ants
    Record the positions in ant's memory
            For each image pixel (i, j)
               For iteration = 1 .. n
                Repeat
                 Get the pixel at i, j
                 Find the neighborhood of current position
                Calculate the transit probability to the neighborhood of current position
                Identify ant position is in ant's memory or not
              If exist
```


Change transit probability
Else
Assign Zero to the probability
Mark as visited
Until every i, ,j in the image has been visited
All neighborhoods are in memory, and then the permissible search range is Re-calculated.
Update the pheromone function
Threshold these edges to eliminate insignificant edges
End

Original Image

Ant Colony Optimization

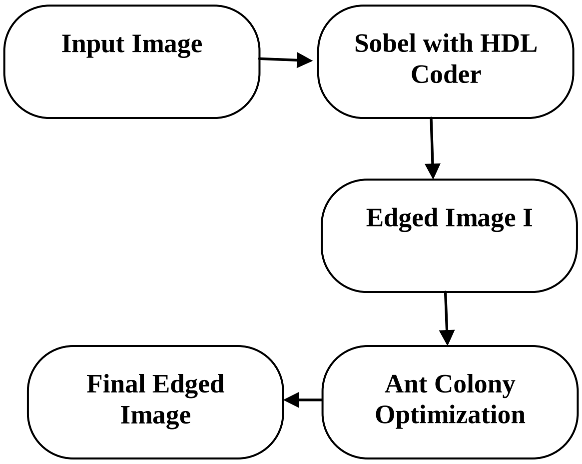
III. EXPERIMENT AND RESULTS

The experiments for demonstrating the performance of the proposed approach are conducted in this section. The parameters used in this approach are

α= 10; β = 0.1; rho = 0.1; π= 0.05;

The proposed system was developed using MATLAB R2012b and it was tested with different images, its performance being compared the existing edge detection algorithms and it was observed that the outputs of this algorithm provide much more distinct marked edges and thus have better visual appearance than the standard existing.

Block Diagram of proposed algorithm



The experimental results of various pictures in Berkley dataset are shown below:

(a) (b) (c) (d)

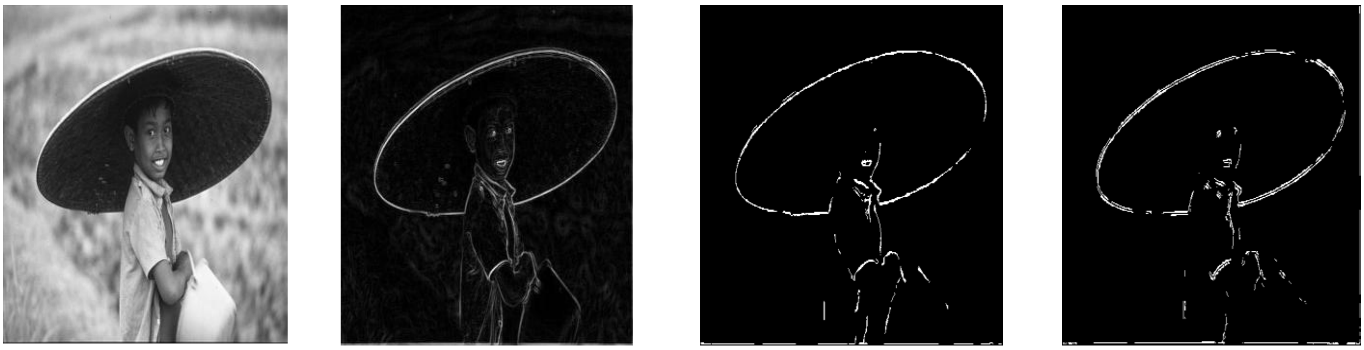


Figure 1: (189011.jpg)

(a) (b) (c) (d)

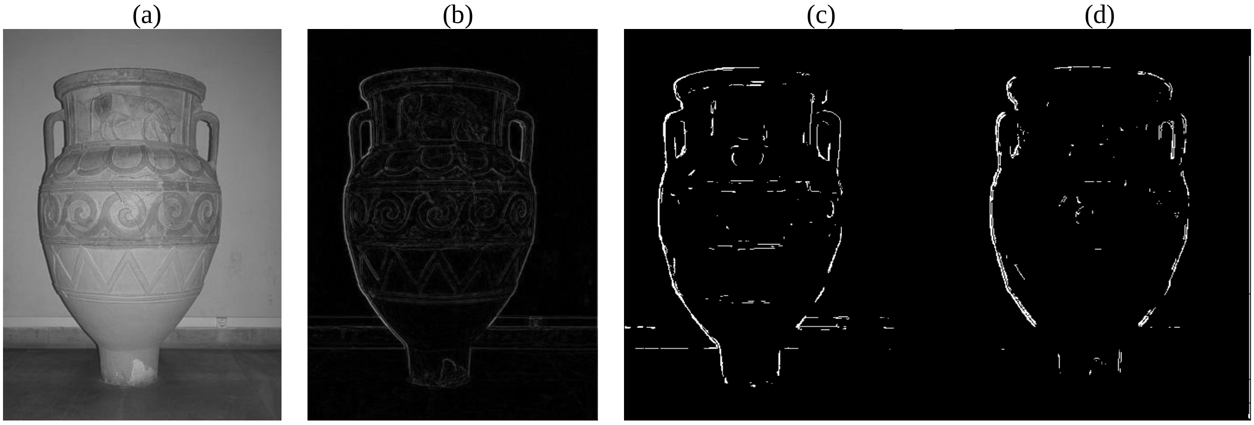


Figure 2: (227092.jpg)

(a) (b) (c) (d)

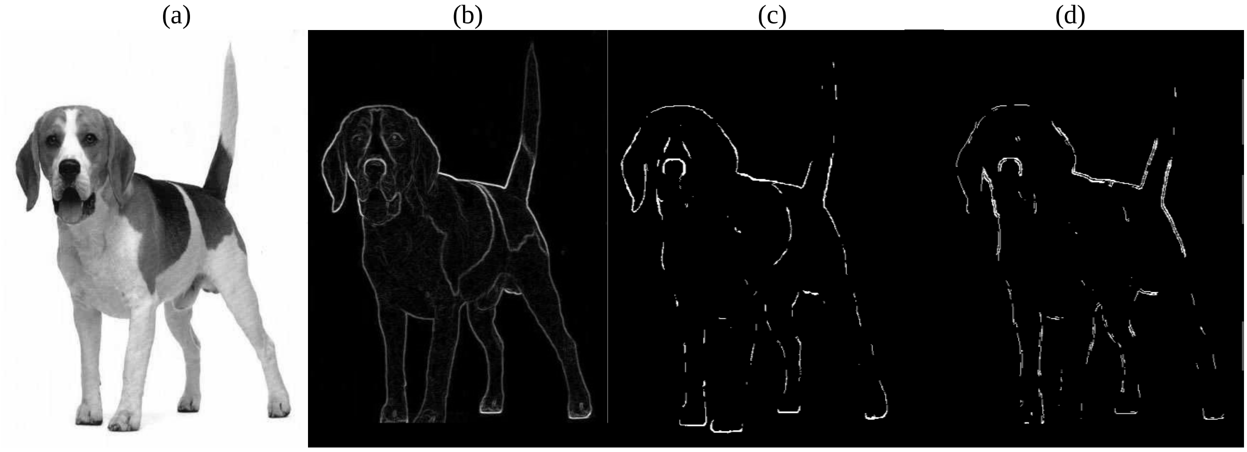


Figure 3: (perro.jpg)

EDGE DETECTION: (A) INPUT IMAGE, (B) SOBEL WITH HDL CODER IMAGE, (C) ANT COLONY OPTIMIZATION IMAGE, (D) BOTH SOBEL AND ANT COLONY APPLIED IMAGE

IV. CONCLUSION

In this paper, a latest efficient method is proposed to detect edges of an image. In the performance evaluation three standard images are tested with sobel filter, ant colony optimization and efficient method edge detectors. The latest efficient method proposed outperforms the traditional sobel edge detector with HDL Coder and ant colony edge detector. The result of the evaluation of the performance of edge detectors, based on evaluation by different parameters, shows the measures in the paper match with the qualitative analysis by visual inspection is considered as ideal edge in ground truth. Further work or enhancement can be done by different operators other than sobel edge detector.

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