Image segmentation and extraction using improved visual attention model

Ankita Panigrahi, Sunita Sarangi, Shubhendu Kumar Sarangi

Abstract— Image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain visual characteristics. In this paper image segmentation and extraction is described which is done using improved visual attention model. Input taken is of color image then it is converted into gray image. Gray and edge features are extracted using canny edge detector and Gabor filter respectively. After that center-surround difference operator is used to get gray and edge feature map. To get the saliency map gray and edge feature map are linearly combined. On that part image segmentation and extraction method is applied to extract each and every parts of the image. Experimental results show that this method is well organized, systematic and economical in such a way that it achieves the salient part of image which is the most informative part as well as extraction of other parts of image. So as a whole it is one of the models which automatically find Region of Interest (ROI) as well as other parts of image which is virtuous and dynamic in nature. The proposed method is effective to reduce over segmentation in auto extraction of ROI for different images.

Index Terms— Improved visual attention model; Gray and edge feature extraction; Center-surround difference operator ;saliency region; Gabor filter; LOG; Canny edge detector.

Image segmentation and extraction is one of the most vibrant topic in modern era whose wide spread applications are useful in each and every fields. Image segmentation is the process of partitioning a digital image into multiple segments (sets of pixel, also known as super pixel) .The goal of image segmentation is domain independent partitioning an image into a set of disjoint regions that are visually different, homogeneous and meaningful with respect to some characteristics or computed properties such as gray level, texture or color to enable easy image analysis (object identification, classification and processing). Segmentation is to simplify or change the representation of an image into something that is more meaningful and easy to analyze. Image segmentation is typically used to locate objects and boundaries (lines, curves) in images. Result of image segmentation is a set of segments that collectively cover the entire image or a set of contours extracted from the image. Level of detail to which subdivision is carried depends on problem being solved.

Improved visual attention model is a proficient method that computes the most salient parts in an image and represents the image as a gray scale "saliency map", which results in the creation of attention regions. As the reality that human beings usually pay more attention to areas of interest, attention model is a feasible method to find ROI and measure the interest of a region.

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Zhang et al. [7] proposed the model in which we can easily find out the most noticeable or interesting part of image. Here result is not that much of accurate and cannot apply for all types of images. It may also lead to over segmentation of image.

On the same basis of selection of saliency part of an image Itti et al. [9] proposed one model which automatically finds out region of interest of an image. It gives good result but still it is time taking because here we need to extract three parts of an image which are intensity, color and orientation. It is not possible to use the model for each and every types of image.

Ittiet al. [3] have proposed another efficient method of selection of saliency area of an image but here we need to extract three parts of an image which are intensity, color and orientation which is sometime becomes more complicated and clumsy.

More recently improved visual attention model [1] is able to detect ROIs, the detected boundary is almost inaccurate, especially for large and complicated objects; therefore it is difficult to calculate region features that the proposed model demands. Another reason is that it only extract the most noticeable part of image which is none other than saliency part of the image but at the same time it suppress rest of the parts of image which is improved in this proposed model.

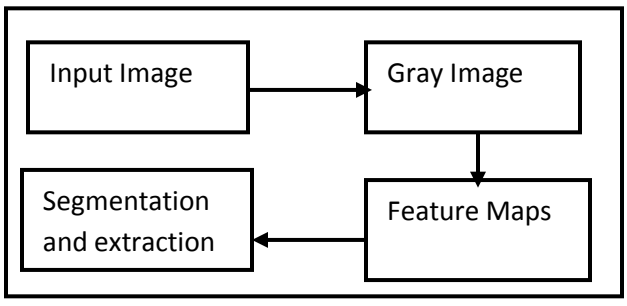

Figure 1: Flow chart of proposed model

In this paper, we have proposed a method where we use the combination of improved visual attention model and image segmentation to extract salient as well as other parts of image which is suppressed in improved visual attention model. Here saliency map finds out using improved visual attention [1] then image segmentation and extraction is applied so that each and every part is extracted Flow chart is shown in Figure 1. The paper is organized as follows. In section-2, we introduce the proposed approach for detection of saliency region and extraction of visual features is carried out. Result is reported in section-3, the paper is concluded in section-4.

2 THE PROPOSED APPROACH

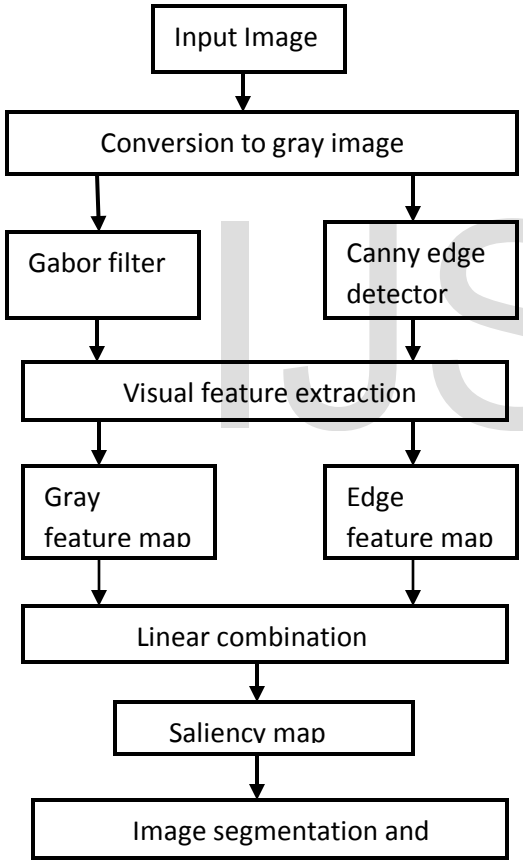

Figure 2: Proposed Model

The proposed model is shown in figure 2. Here input taken is of color image. It is converted into gray image. Feature extraction method is carried out where Gabor filter and canny edge detector are used for extraction of gray and edge feature respectively .Center-surround difference operator is used on the extracted gray and edge feature to get the gray feature map and edge feature map. After that both are linearly combined to get the saliency map.

.After that extraction process is carried out whose goal is not only to extract the saliency area as in improved visual attention model but also to extract rest of the parts of image which remains suppressed in improved visual attention model [1]. So each and every parts are extracted which is one of the requirements of this paper.

2.1 Extraction of visual features

Using Gabor filter and canny edge detector gray feature and edge feature are extracted respectively. Center-surround difference operator [1] is used on that extracted parts. So we get G(C, S) which is the gray feature map and E(C, S) is the edge feature map in formula (1) and (2).

$$G(C,S=G(C)-G(S) \quad (1)$$

$$E(C,S)=E(C)-E(S) \quad (2)$$

2.2 Saliency map

This is based on improved visual attention model [1]. It only extracts most noticeable part of an image and other parts are suppressed. In the proposed model this suppressed part is improved by extracting each and every parts of image using the help of segmentation. Gray feature map and edge feature map are given by the formula (3) and (4)

$$G_c = \sum_{C=3}^{4} \sum_{S=C+3}^{C+4;S<8} G(C,S) \quad (3)$$

$$E_c = \sum_{C=3}^{4} \sum_{S=C+3}^{C+4;S<8} E(C,S) \quad (4)$$

Saliency map S could be obtained by the formula (5) given below:

$$S = N\left(\frac{N(G_c)+N(E_c)}{2}\right) \quad (5)$$

2.3 Feature extraction and segmentation

Thresholding and objects extraction method is used. and every parts are extracted. The model was tested over several images. Then a comparative study is carried out to find out the effectual part of proposed model.

3. EXPERIMENTAL RESULTS

The model was tested over several images. Then a comparative study is carried out to find out the effectual part of proposed model.

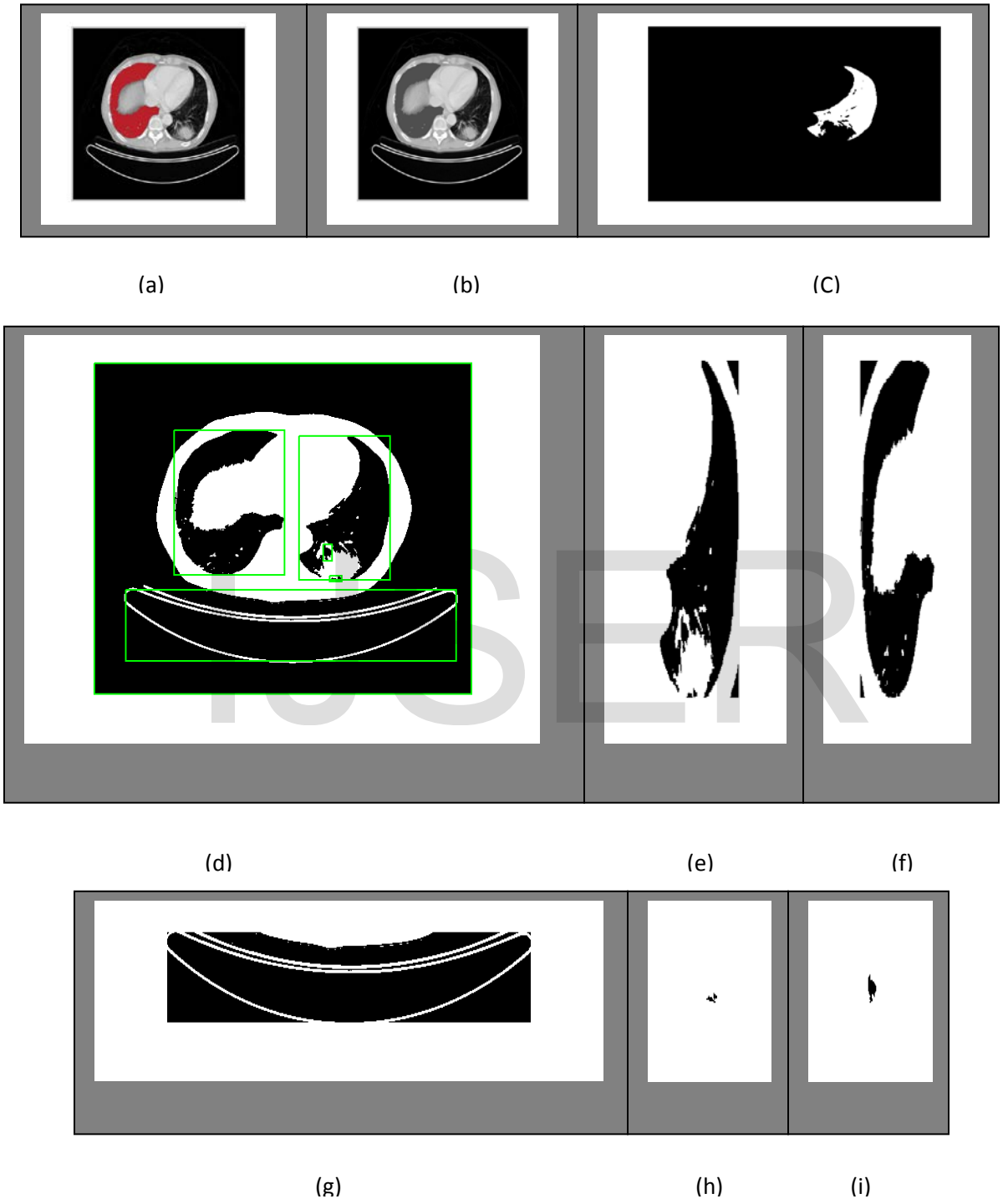

Figure 3: (a) Medtest image (b) conversion into grayscale image (c) saliency map using improved visual attention model of input image Medtest (d) - (I) image segmentation and extraction using proposed model

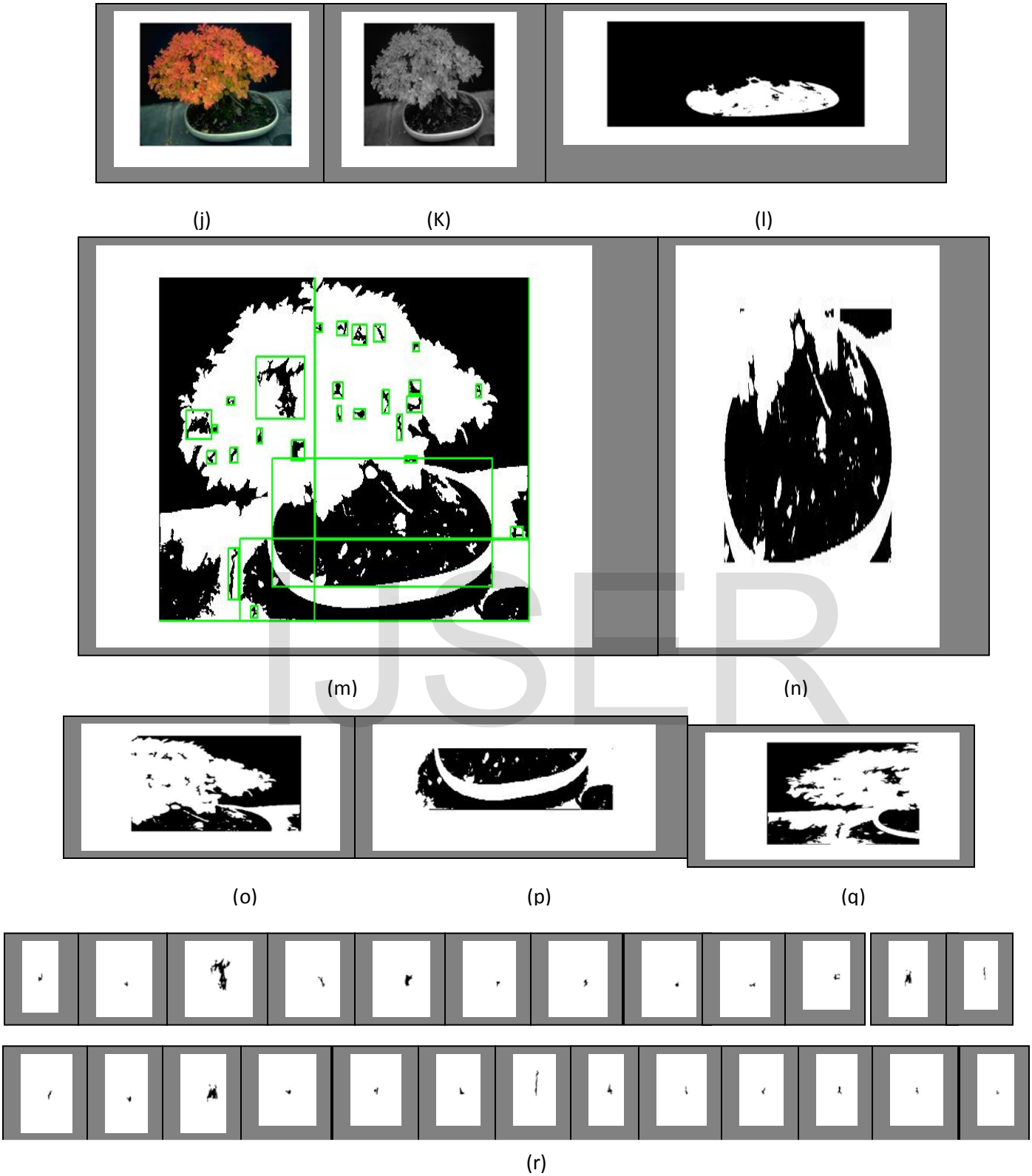

Figure 4: (j) Flower image (k) conversion into grayscale image (l) saliency map using improved visual attention model of input image Flower (m)-(r) image segmentation and extraction using proposed model

4. CONCLUSIONS AND OUTLOOKS

We have proposed the image segmentation and extraction in combination with improved visual attention model which finds out the salient as well as other regions of the image which is one of the advantages of this model that it does not suppress any part of the image which is well distinguished in experimental result. It has wide future scope where it improves the segmentation speed, quality and automatic identification of salient and other parts of image. So this model supplies a very good solution to identify the salient part and of course the rest part of the image which is left by improved visual attention model based segmentation.

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