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Detection of Salient Region by Local Spatial Support & High Dimensional Color Transform

Pooja A. Khodaskar[1], Prof.A. P. Dhande[2]

[1]M.E. Scholar, Department of Electronics & Communication Engineering, P. R. Pote (Patil) GP of Edu. Inst. College of Engineering & Management, Amravati, Maharashtra, India

[2]Professor, Department of Electronics & Communication Engineering, P. R. Pote (Patil) GP of Edu. Inst. College of Engineering & Management, Amravati, Maharashtra, India

Abstract—***Automatic salient region detection crosswise over pictures, with no earlier data or information of the contentsof the relating pictures, upgrades numerous PC vision and PC illustrations applications. Our approach proposesautomatic salient region detection in a picture which incorporates both the global and local features. The primary inspiration driving this approach is to develop a saliency map using linear combination of colors in a high dimensional color space. By and large, the human recognition is exceptionally confounded and non-straight and in light of that, the salient region comprises of particular color contrasted with the background. The estimation of an ideal development of a saliency map done by gathering the low-dimensional colors to the high-dimensional feature vectors. Moreover, a relative location and color contrast between super pixels are used as a features and resolve the saliency estimation from a trimap by means of learning-based technique to enhance the performance.The extra local features and learning-based calculation supplement the global estimation from the high-dimensional color transformed based calculation.***

Keywords- Salient Region Detection, Super Pixel, Trimap, Color Channel, High-dimensional color space, Random Forest

I. INTRODUCTION

The people are specialists at rapidly and precisely recognizing the most outwardly discernible foreground object in the scene, known as salient object, and adaptively concentrate on such apparent critical areas. Salient region detection is essential in picture comprehension and examination. It will probably recognize salient region in a picture in terms of a saliency map, the distinguished areas would draw people's consideration. Numerous past investigations have demonstrated that salient region detection is helpful, and it has been connected to numerous applications including segmentation, object recognition, area based picture recovery, photograph adjustment, picture quality appraisal, versatile compression, and video compression. The advancement of salient region detection has regularly been propelled by the ideas of human visual perception. As color is an imperative visual signal to human, numerous salient region detection procedures are based upon unmistakable color discovery from a picture. The diagram of our strategy is exhibited in fig 1.

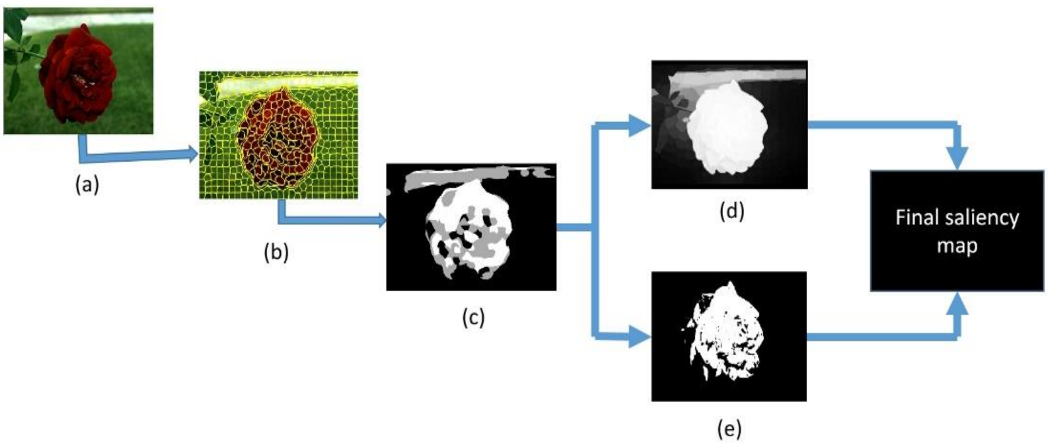

Fig.1. Overview of our method: (a) Input image, (b) Over-segmentation to super pixels, (c) Initial saliency trimap, (d) Global salient region detection via HDCT, (e) Local saliency map via local learning based method

This approach utilizes the random forest classifier to gauge the area of salient region. This classifier characterizes every super pixel as foreground, background and unknown region. These region forms the initial trimap. HDCT technique isolates the background and foreground regionfor saliency map. HDCT and local learning method are proposed from the trimap. Global based HDCT technique is to discover colorfeatures This strategy joins numerous agent color spaces. Map the low dimensional color space into high dimensional color features by utilizing HDCT. Random forest strategy connected in local learning based technique. This strategy plays out the relative location and color contrast between super pixels. A random forest classifier to characterizes the saliency of a super pixel by looking at the location and color contrast differentiation of a super pixel to the K closest foreground super pixels and the K closest background super pixels. The saliency maps got from the HDCT based strategy and the local learning based method is our last saliency map.

II. LITERATURE REVIEW

Jiwhan Kim, Dongyoon Han, Yu-Wing Tai, and Junmo Kim, "*Salient Region Detection via High-Dimensional Color Transform and Local Spatial Support",* IEEE transactions on image processing, vol. 25, No. 1, January 2016.
In this paper, a novel approach to automatically detect salient regions in an image. It consists of global and local features, which complement each other to compute a saliency map. The first key idea is to create a saliency map of an image by using a linear combination of colors in a high dimensional color space. This is based on an observation that salient regions often have distinctive colors compared with backgrounds in human perception, however human perception is complicated and highly nonlinear. By mapping the low dimensional red, green, and blue color to a feature vector in a high dimensional color space, show that it can composite an accurate saliency map by finding the optimal linear combination of color coefficients in the high dimensional color space. To further improve the performance, second key idea is to utilize relative location and color contrast between super pixels as features and to resolve the saliency estimation from a tri map via a learning based algorithm. The additional local features and learning based algorithm complement the global estimation from the high dimensional color transform-based algorithm.

N. Kalaivani, S. Sanjuna, "*Salient region detection via super pixels, histogram of gradients",* International journal of electrical, electronics and data communication, ISSN: 2320-2084 Volume-5, March 2017.
In this paper, it considers feature based on global and local features, which complement each other to compute a saliency map. The proposed approach automatically detects salient regions in an image dataset. The proposed algorithm based on applies super pixel segmentation appearance model. To improve the performance of saliency map estimation, based on super pixels as features algorithm to resolve the saliency estimation from a tri map via a learning based algorithm. It introduces a novel technique to automatically detect salient regions of an image via high dimensional color transform. To represent a saliency map of an image as a linear combination of high dimensional color space where salient regions and backgrounds can be distinctively separated. This is based on an observation that salient regions often have distinctive colors compared to the background in human perception. By mapping a low dimensional RGB color to a feature vector in a high dimensional color space, it shows that it can linearly separate HDCT and local learning methods are proposed from the tri map. The salient regions from the background by finding an optimal linear combination of color coefficients in the high dimensional color space. High dimensional color space incorporates multiple color representations including RGB, CIELab, HSV and with gamma corrections to enrich its representative power.

LalkotFarhaNaaz A. Rahim, V.S.Kolkure "A High Dimensional Color Transform and Learning BasedApproach for Dominant Area Detection" International Journal of Engineering Science and Computing, April 2017.
The proposed method of dominant region detection estimates the foreground regions from an initial dominancy trimap using two different methods first is global dominancy estimation via global High Dimensional Color Transform (HDCT) method and second is local dominancy estimation via local learning based (LLB) method. High Dimensional Color Transform(HDCT) detection uses HDCT algorithm and local learning based (LLB) detection uses regression algorithm.LLB method has low computational complexity and is an excellent complement for HDCT method. The trimap-based robust estimation overcomes the limitations of inaccurate initial dominancy classification. There is use of some most effective features that can be calculated rapidly, such as color, contrast and location features. So, the dominant region can be found accurately using even a smaller number of features. Computations are performed in super pixel level. As a result, this proposed approach achieves good performance and is computationally efficient.

III. IMPLEMENTATION OF PROPOSED METHODOLOGY

A. Initial Saliency Trimap Generation

Salient Trimap method determines the location of salient region in an image. This method performs an image in superpixel level. Salient Trimap contain background region, foreground region and unknown region. This method calculates the feature vector of image, such as color feature, histogram feature and location feature.

1) Super Pixel Saliency Features

First over segment the input image to form super pixels. SLIC super pixel is used for over segment the image. Set the number of super pixels to N=500.

Consolidate different data, that are utilized as a part of saliency identification. For saliency discovery first form feature vector. Connect the area of x and y superpixel into feature vector. At that point connect the color features utilizing different color space portrayals. Here, we are extricating the normal RGB values, normal CIElabvalues, huevalues, saturationvalues. Next link the histogram features. In these, we are extracting the RGB histogram, CIElab histogram, HSV histogram, and local binary pattern histogram(LBPH). Then we find the standard mean deviation(SMD) for color contrast features. Utilize the super pixel zone, histogram of gradients (HOG) and gray level co-occurrence matrix(GLCM) for texture and shape features. The HOG gives show feature utilizing pixel slope data.

2) Initial Salient Trimap via Random Forest Classification

Compute the feature vector for each superpixel, at that point to check whether each area is salient using classification algorithm. This work is utilized the Random Forest classification strategy. This model works by developing different choice trees at preparing time. Random forest model consolidates the bootstrap conglomerating thought and irregular element determination. These two thoughts are to reduce the generalization error. Few features are randomly selected from the decision tree.Classification technique is to classify each superpixel as background and foreground.

Three-class order strategy is to produce a trimap from output of random forest, rather than a binary classification, which identify the reliableforeground and background region. Check whether each superpixel has a place with foreground candidate, background candidate, or unknown regionusing response valueextracted from the classifier. In this work used threshold values $T_{fore} = 1$ and$T_{back} = -1$. If a super pixel's response value exceeds T_{fore}, then it set to the foreground; however, if the value is lower thanT_{back}, then it set to the background, otherwise it is considered as unknown.

B. Saliency Estimation fromTrimap

In this, we show ourglobal salient regiondetection by means of HDCT and learning-based local salient region detection. The global saliency estimation assumes that pixels in the salient region have independent and indistinguishable color distribution. A linear combination of high dimensional color channels, separate salient region and background. We propose a local saliency estimation by means of learning-basedmethod. Localfeaturessuchas colorcontrast can decrease the gap between anindependent and indistinguishable color distribution display suggested by HDCT and genuine circulations of sensible pictures.

1) Global Saliency Estimation via HDCT

Objective of this strategy is to locate the linear combination of color features in HDCT space. The color of salient region and background are separated. To start with link the RGB color space to manufacture the HDCT space. Connected the CIELabcolor space and the hue and saturation channel in the HSV color space. In this way, 8 diverse color channels are utilized as a part of our HDCT space. To acquire saliency map, the foreground and background candidate color samples in trimap to assess an ideal linear combination of color coefficient to isolate the salient region color and background region color. After that we included the color samples of the foreground region and background region. The saliency map can be developed aslinear combination of the color coefficient of HDCT. Saliency map more reliable for the both foreground and background superpixels are at initially classified in the trimap.Both foreground and background superpixels in HDCT space are essential for this work.

2) Local Learning based Method

The HDCT-based salient region detection gives a focused outcome a low false positive rate, however this technique has a restriction. It is effortlessly influenced by the texture of the salient region, and along these lines, it has a moderately high false negative rate. To defeat this confinement, we display a learning-based local salient region detection that depends on the spatial and color distance from neighboring superpixels.

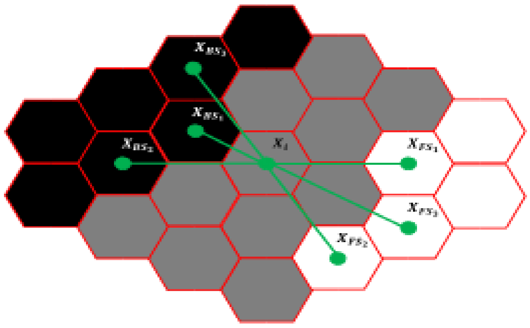

Fig.2. An illustration of local saliency features. Black, white, and gray regions denote background super pixels, foreground super pixels, and unknown super pixels, respectively. We use K nearest foreground super pixels and K nearest background super pixels to calculate a feature vector.

For each superpixel, first we find the K-nearest foreground superpixels and K-nearest background superpixels. For each superpixel Xi, we find the K-nearest foreground super pixels X_{FS} = {X_{FS1}, X_{FS2},..., X_{FSk}} and K-nearest background super pixels X_{BS} = {X_{BS1}, X_{BS2},...,X_{BSk}}, and we use the Euclidean distance between a superpixel Xi and super pixels X_{FS} or X_{BS} as features.

We likewise utilize the color distance features between super pixels. Despite the fact that a super pixel situated close to the foreground super pixels has a tendency to be a foreground, if the color is different, there is a high plausibility that it is a background superpixel situated close to the boundary of the object. We utilize eight color channels, for example, RGB, CIELab, hue, and saturation to quantify the color separation.

For saliency estimation, we utilized the super pixel-wise random forest algorithm, which is viable for vast high-dimensional information. We extract the feature vector utilizing the underlying trimap, and after that, we assessed the saliency degree for every single super pixel and classified as foreground\background candidate. For this local saliency map, super pixels in the initial trimap are reevaluated because they could still be misclassified. The underlying trimap is created by the random forest classifier and that the second is therandom forest regressor generates a local saliency map.

C. Final Saliency Map

The saliency map obtained from HDCT based global method and local learning based method is our final saliency map.

IV. EXPERIMENTAL RESULT

The result of our proposed methodology for MSRA-B dataset. Our program is done in OpenCV. MSRA-B dataset has 5000 images with the pixel-wise ground truth. This dataset mostly contains salient objects in which the colors are different from the background. Some output results of salient region detection on the MSRA-B dataset are presented in fig.3. The first image is the original image, shows in fig.3.(a). Then second image is the HDCT transformed saliency map, shows in fig.3. (b). Third stacked image is after applying local saliency estimation, shows in fig.3 (c). Fourth stacked image is after applying thresholding, shows in fig.3 (d). And final is masked image over original image which returns required salient region, shows in fig.3. (e). From the experiments results, we find that our algorithm is effective and computationally efficient.

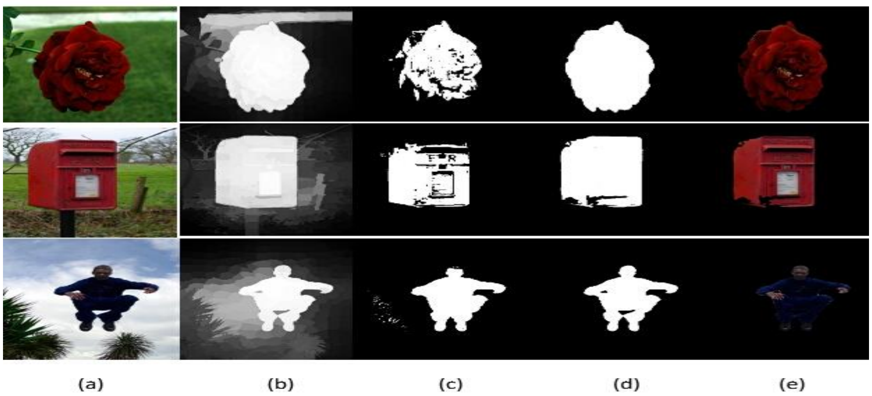

Fig 3. Output result of our work. (a) Original image, (b) HDCT result, (c) Local saliency estimation result, (d) Thresholded map, (e) Salient region.

V. CONCLUSION

We have exhibited the novel way to deal with naturally recognize salient region in a picture from trimap utilizing two distinct strategies: HDCT based global technique and local learning based strategy. Trimap based strong estimation defeats the impediment of incorrect initial saliency classification. As our calculation is performed in super pixel level, it diminishes the calculations. Subsequently, our strategy accomplishes great execution and is computationally effective.

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