

A Survey on Saliency Detection

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ABSTRACT: Visual saliency is an important quality that makes an object, person, or pixel that relative to its neighbours and thus captures humans attention. Detecting and segmenting salient objects in natural imageries, also known as salient object detection, has attracted a lot of research focused on computer vision and has resulted in many applications. However, while many such models exist.Saliency detection has gained a lot of attention in image processing. In past few years many saliency detection methods have been proposed. This paper presents various saliency detection methods.

KEYWORDS: Saliency detection, Visual attention, Human Visual System

I.INTRODUCTION

Visual attention is an important characteristic in the human visual system (HVS), through which a person can easily identify the interesting parts of a scene, i.e., visual saliency. Thus visual saliency has applied to a variety of application areas, e.g., object recognition, image/video compression, image cropping/ retargeting, human gaze and actions, image retrieval . A number of saliency models have been proposed in the past decades, which include the local and global features,to estimate the image saliency. The local feature-based approaches extract the visual features from pixels in an image, the global feature- based approaches, estimate the visual saliency from the whole image. The saliency detection performance has been improved with the emerging saliency models. Nevertheless, saliency models based on either local features or global features alone are still insufficient to effectively handle the images. To improve the overall saliency detection performance, taking effective local and global features and combination model. Accordingly, we shall choose and extract the corresponding features for saliency detection. Consequently two kinds of features: 1) local features and 2) global features. Specifically, the local features consist of local region-based color feature, and local region-based texture feature where the orientation information can be found as well, while the global features comprise: 1) global color feature that describes the color distribution in the whole image, and 2) global edge feature that is extracted in the frequency domain after smoothing, which can suppress the repeated patterns and preserve the edges. Hereinafter, the saliencies obtained using local region-based color feature, local region-based texture feature, global color feature, and global edge feature individually are named as local color saliency, local textural saliency, global color saliency, and global edge saliency, respectively. Further, the first two are simply called local saliency; the latter two are called global saliency.

In summary, the contribution of this paper is mainly twofold:

- 1) A smoothing scheme for the local color saliency detection and multiple edge saliency is proposed. Compared with the existing models, this method can provide better saliency, and can work well even in the low-resolution or noisy images.
- 2) The combination of the local and global saliency scheme which employs different visual cues can make fully use of their individual merits to achieve improved performance.

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II. LITERATURE SURVEY

A lot of work has been done and various methods have been proposed to detect image saliency. This section discusses some of those methods.

A. FREQUENCY-TUNED SALIENT REGION DETECTION

Achanta *et al.*[1] suggest that visual salient image region detection is useful for a large number of applications such as object segmentation, adaptive compression, and object recognition. In this method introduces a method for salient region detection whose output is full resolution saliency maps. These maps also define boundaries of salient objects. Boundary preservation is done by retaining substantially more frequency content from the original image than other techniques. These methods make use of colour and luminance for preserving the boundaries by obtaining more frequency content from the original image than the previous methods. This method is mainly divided into 5 stages:

1. In whole Image focus on largest salient objects.
2. Highlight whole salient regions uniformly.
3. Salient objects are preserved with their well defined boundaries.
4. Eliminate the high frequencies occurring from texture, noise as well as from blocking artifacts.
5. Final output full resolution saliency map with well defined boundaries.

This method highlights the whole salient objects, by establishing the well-defined borders of salient objects, and eliminating high frequencies arising from noise in it.

B. GRAPH-BASED VISUAL SALIENCY (GBVS)

Harel *et al.*[2] proposed that generally visual saliency models are divided into three different stages that are as follows:

1. Extraction: In this step feature vectors are extracted from different location over the image plane.
2. Activation: Use the feature vectors from previous stage to create activation map.
3. Normalization: Perform the normalization over activation map by combining one or more activation maps into single map.

In this graph based visual saliency model unified approach is used for step 2 and step 3 that is nothing but Markov chains are interpreted using dissimilarity and saliency to define edge weights on graphs and treat the equilibrium distribution over map locations as activation and saliency values.

C. SALIENCY DETECTION: A SPECTRAL RESIDUAL APPROACH

Hou *et al.*[3] suggested the ability of human visual system to detect salient regions is very fast and reliable. It presents a simple method for the visual saliency detection. This model is independent of features, categories, or other forms of prior knowledge of the objects. Extract the spectral residual of an image in spectral domain by analyzing the log-spectrum of an input image. This is a fast method to construct the respective saliency map in spatial domain. Generality is main advantage of the spectral residual approach. Other methods require the prior knowledge for saliency detection which is not required in this system.

International Journal of Innovative Research in Science, Engineering and Technology

An ISO 3297: 2007 Certified Organization

Volume 5, Special Issue 14, December 2016

3rd National Conference on Recent Trends in Computer Science and Engineering and Sustainability in Civil Engineering (TECHSYNOD'16)19th, 20th and 21st December 2016**Organized by**

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D. GLOBAL CONTRAST BASED SALIENT REGION DETECTION

Cheng *et al.*[4] uses a regional contrast based saliency extraction algorithm. This algorithm evaluates global contrast differences and spatial coherence. The algorithm is simple, efficient as well as yields saliency maps with full resolution. The region based contrast method first divides the input image into regions then computes the saliency of each region by calculating weighted sum of that region's contrast to other image regions. It is global contrast based method which considers motion contrast between images and can be calculated by considering planar motions between images. Colour histogram is used in this method to compute pixel level saliency maps which is combined with spatial attention model providing interesting regions as well as objects and finally this dynamic fusion framework is provided which can be apply on several video sequences and various images to detect the interesting objects and motions that are present in sequences with high user satisfactory rate.

E. SALIENCY DETECTION: A BOOLEAN MAP APPROACH

Zhang *et al.*[5] suggested that an image is characterized by a set of binary images, those are generated by randomly thresholding the image's color channels. Computes saliency maps by analyzing the topological structure of Boolean maps which is based on a Gestalt principle of figure-ground segregation. Implementation of this method is simple also it runs very efficiently.

F. SALIENT REGION DETECTION AND SEGMENTATION

Achanta *et al.*[6] says that detection of salient image regions is useful for applications like image segmentation, adaptive compression, and region-based image retrieval. In this method that determines salient regions in images with the help of low-level features of luminance and color. The key points of this method are fast, implementation is easy and generation of high quality saliency maps whose size and resolution is as same as the input image.

G. A FRAMEWORK FOR VISUAL SALIENCY DETECTION WITH APPLICATIONS TO IMAGE THUMBNAILING

Luca *et al.*[7] it uses a novel framework for visual saliency detection which based on a simple principle that images sharing their global visual appearances shares their similar salience . First retrieves the images more similar to the target image then built a simple classifier and then generate saliency maps by using created classifier. Finally, extract thumbnails by refining maps. "Isocentric Color Saliency in Images", in this method here suggest a computational method to detect visual saliency in images. This method suggests that salient object must have characteristics that are different than the remaining of the scene, being edges, color or shape . This approach is fast as well as runs without any learning.

H. CONTEXT-AWARE SALIENCY DETECTION

Goferman *et al.*[8] proposed that aim of this method is to at detect region in the image that represent the scene. The regions are salient if they draw the attention, sometimes background of object also contains important context which is useful for clear understanding of object so the proposed method detects the salient object with its surrounding. Which aims at detecting the image regions that represent the scene. This saliency is based on four principles :local low-level considerations, global considerations, visual organizational rules, and highlevel factors.This saliency detection method is different from other whose goal is to either identify fixation points or detect the dominant object. This method is beneficial in applications where image context of the dominant objects is as essential as the objects. The proposed method is useful in image retargeting and summarization.

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I. SALIENCY DETECTION BASED ON FREQUENCY AND SPATIAL DOMAIN ANALYSIS

Levine *et al.*[9] proposed a method that combines global information from frequency domain analysis and local information from spatial domain analysis. Frequency domain analysis-model non-salient region using global information. Spatial domain analysis-enhance region that are more informative by using center surrounded mechanism. Output from the two analysis used for creation of final saliency map.

J. A MODEL OF SALIENCY-BASED VISUAL ATTENTION FOR RAPID SCENE ANALYSIS

Itti *et al.*[10] proposed a local contrast based model in which multiscale image features such as colour, intensity and orientation information from images are combined into a single topographical saliency map. It makes use of Gaussian based approach to develop model called as dynamic routing model which is used to define saliency by calculating center surround differences in which information from only small region of visual field can progress through the cortical visual hierarchy. So this framework is important for fast selection of small number of interesting image locations which also extends the framework by including guided search which is used to weight the importance of various features so only those processes which have higher value of weight can proceed to the next level and reduce the time for object recognition.

K. SALIENT REGION DETECTION BY MODELING DISTRIBUTIONS OF COLOR AND ORIENTATION

in this part it is discovered that how an each element of the image is different from other element or other part of image.

M. A HYBRID OF LOCAL AND GLOBAL SALIENCIES FOR DETECTING IMAGE SALIENT REGION AND APPEARANCE

Qinmu *et al.*[13] presents a visual saliency detection approach, which is a hybrid of local feature-based saliency and global feature-based saliency (simply called local saliency and global saliency, respectively, for short). First, use an automatic selection of smoothing parameter scheme to make the foreground and background of an input image more homogeneous. Then, partition the smoothed image into a set of regions and compute the local saliency by measuring the color and texture dissimilarity in the smoothed regions and the original regions, respectively. Furthermore, we utilize the global color distribution model embedded with color coherence, together with the multiple edge saliency, to yield the global saliency. Finally, combine the local and global saliencies, and utilize the composition information to obtain the final saliency.

Gopalakrishnan *et al.*[11] presents a saliency region detection method by considering colour and orientation which are two important cues of image. It provides integrated approach in which output of colour saliency framework and orientation saliency framework are combined together. It considers that low level features at the background have more spread over the entire image than the salient regions. The colour saliency model can be obtained by calculating distribution of component colours over entire image space as well as considering their remoteness. And Orientation saliency framework considers the local and global orientations in the image that uses the method of Fourier transform to highlight local patches and finally either colour or orientation framework is selected to provide final saliency map based on the correctness of the framework to find out the salient region.

L. SALIENCY FILTERS: CONTRAST BASED FILTERING FOR SALIENT REGION DETECTION

Perazzi *et al.*[12] introduces a compactness based method for detecting salient region in image. As previous contrast based methods generate saliency maps which are generally blurry, and often overemphasize small, purely local features. So given algorithm consists of four basic steps. Firstly this method decomposes given images into homogenous elements that eliminate the parts which are not important and have less chance to be part of salient region and cluster the pixels which have similar properties into one group. After this abstraction element uniqueness and distribution is considered to compute final saliency map. Element uniqueness considers that image region that stands out different from other portion of image and catches attention can be labelled as to be more salient so Combine different saliencies

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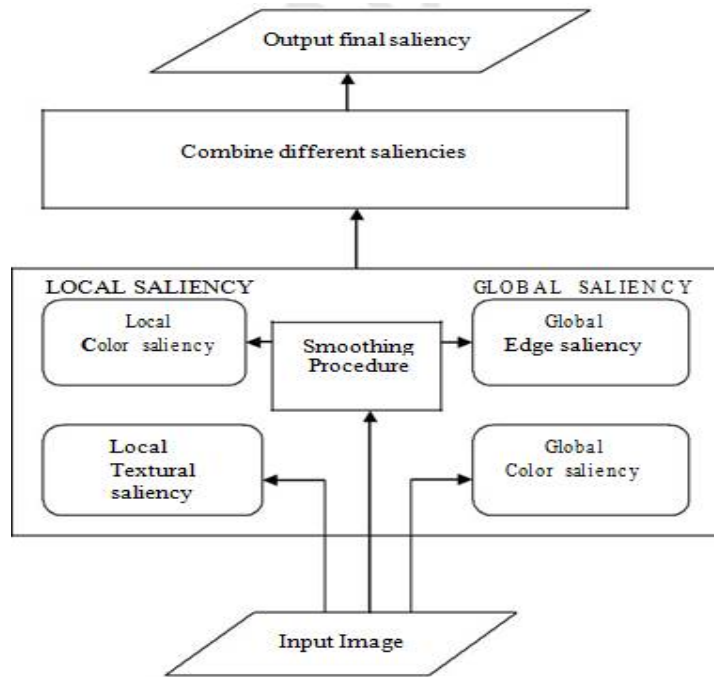


Fig1 .Hybrid of local and global saliencies

III. CONCLUSION

This paper, presents various saliency detection methods. The numerous works on salient object detection call for a methodological approach for evaluating results. Reviewed a large body of work in saliency modeling Salient object detection aims at highlighting the regions which can attract the human visual attention in the single image. Computationally detecting salient image regions remains a facund goal, as it allows preferential allocation of computational resources in subsequent image analysis and synthesis. Obtained saliency maps are widely used in many image processing applications such as adaptive content delivery, adaptive region of interest based image compression, object recognition. Detecting and segmenting salient objects is very useful for scene understanding. Objects in an image will automatically catch more attention than background stuff, such as grass, trees and sky. Therefore, if in the first place, it detects all generic objects then we can perform detailed reasoning and scene understanding at the next stage. Compared to traditional special-purpose object detectors, salient object detection models are general, typically fast, often without necessity of training or annotation.

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