



Visual Saliency for Surveillance Images- A Brief Study

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Abstract: The need for constant surveillance in various organizations has become a necessity for security reasons. This facilitates a need for an online solution which can detect the object of interest given an image sequence. To cater to this need, various saliency detection algorithms have been developed. The objective of this paper is to compare three saliency detection methods which help us in achieving this.

Keywords: Saliency map; Feature extraction; Visual attention; Contrast.

I. INTRODUCTION

Visual saliency is a perceptual quality which makes some objects in a scene pop out from the surroundings. Humans have this ability to spot the object of interest almost instantaneously from an image. Saliency is also a subjective property that arises from visual distinctiveness and is attributed to factors like color, intensity, edges, texture, etc. in an image. Reliably detecting such a salient region from a given image remains a challenging goal.

For example, in the two images given below, the man's face and the sign-board stand out as salient objects.



II. COMPARITIVE STUDY

In this paper, three saliency detection algorithms are discussed. Images with single and multiple salient objects are tested and are compared.

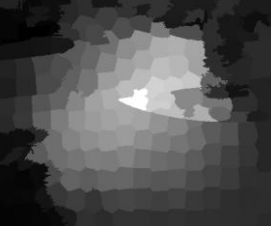
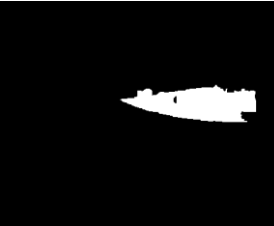
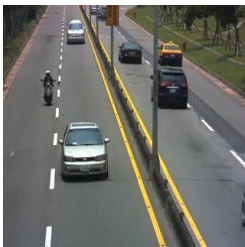
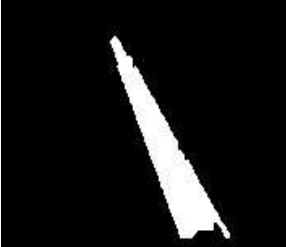
A. A model of Saliency based Visual attention

This popular approach for saliency detection was proposed by Laurent Itti. It is inspired from the behavior of human visual system and the fact that visual attention is driven by low level stimulus. The first step is to create a multi-resolution pyramid of the image. The next step is feature extraction where multiple low level features namely intensity, color, orientation, texture, etc. are extracted from the image at multiple scales. Each feature is computed by a set of center-surround operations. The first set of feature maps is based on intensity, which in humans, is detected by neurons sensitive to bright center with dark surrounds or dark center with bright surrounds. The second set of feature maps is based on color channels, which in cortex, is represented using color-opponent theory. The third set of feature maps is based on orientation, where the orientation information is got from the image by using oriented Gabor filters. Finally these three sets of feature maps are normalized and combined to obtain the final saliency map.

B. Global Contrast based Salient Region Detection

This approach was proposed by Ming Ming Cheng. He proposed a histogram-based contrast method for detecting saliency. The HC maps assign pixel-wise saliency values based on the color separation from all the other pixels in the image. He uses a histogram based approach for efficient processing. A smoothing procedure is applied to take care of the quantization artifacts. As an improvement over these HC maps, spatial relationship is incorporated to obtain region-based contrast maps. In these region-based maps the input images are first segmented and then saliency values are assigned to them. The saliency value of each region is calculated using a global contrast score, measured by a region's contrast and spatial distances to other regions present in the image.

II. EXPERIMENTAL RESULTS

INPUT IMAGES	GRAPH BASED SALIENCY CUT	HISTOGRAM BASED SALIENCY CUT	SALIENCY CUT BY ITTI'S METHOD
			
			
			
			

Two natural images (rows 1 and 3) and two surveillance images (rows 2 and 4) are being tested with all three algorithms and the results are tabulated above.

A. A Graph based Manifold Ranking method

Here, saliency detection is modeled with a two stage ranking algorithm. A close loop graph is constructed where each node is a super pixel. In the first stage, the boundaries are exploited by using each side of an image as a labeled background query. The saliency of each node is computed based on its relevance (i.e. ranking) to those queries as background labels. The four labeled maps are integrated to a final saliency map. In the second stage, binary segmentation is applied on the previously obtained saliency map and the labeled foreground nodes are taken as the salient queries. The saliency of each node is obtained based on its relevance to the foreground queries to get the final map.

III. RESULTS AND OBSERVATION

These three algorithms are tested with two types of images, natural images and images taken from real time surveillance footages. For an image with a single salient object and a natural background, the graph based and the contrast based method gives better results. The Itti's method gives a reasonable salient map though it is not as good as the other two. On the other hand, when we consider images taken from real-time surveillance footages that have more than one salient object, the Itti's method shows better results. The other two methods fail when there is more than one salient object. Object detection in videos with dynamic background still remains a significant and a difficult research problem.

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