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Recognition of Salient Structure by Contour Guided Visual Search

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Abstract: ***The task of Salient Structure (SS) detection to bind together the saliency-related undertakings, for example, fixation prediction, salient object detection, and discovery of different structures of enthusiasm for jumbled situations. To fathom such SS identification assignments, a unified structure enlivened by the two-pathway-based inquiry technique of natural vision is proposed. Initial, a Contour-Based Spatial Prior (CBSP) is extricated in view of the format of edges in the given scene along a quick non-particular pathway, which gives an unpleasant, assignment unessential, and strong estimation of the areas where the potential SSs are available. It is invariant to the size and features of objects. The test comes about on six huge datasets (three fixation forecast datasets and three notable protest datasets) exhibit that our framework accomplishes focused execution for SS location (i.e. both the errands of fixation expectation and striking item identification) contrasted and the cutting edge techniques. What's more, framework likewise performs well for notable protest development from saliency maps and can be effortlessly reached out for remarkable edge identification.***

Keywords: Salient structure, Contour, Contour-Based Spatial Prior (CBSP), Bayesian inference.

1. Introduction

Salient region detection techniques expect to totally highlight whole protests of intrigue and adequately smother foundation districts. It filters through repetitive visual information and effectively selects highly relevant subjects. Identification of salient regions can be adequately used to naturally zoom into "interesting" regions or for automatic cropping of "important" regions in image [1]. To accurately extract the dominant objects from natural scenes, formulated the salient object detection as a binary labeling problem [2].

VISUAL look is vital for fast scene examination in everyday life since data handling in the visual framework is restricted to one or a couple targets or locales at one time [1]. From the viewpoint of designing, displaying visual saliency typically encourages ensuing higher visual handling, such as image re-targeting, image compression, and object recognition [4].Several saliency-related concepts that need to be first clarified,

1) Fixations are usually related to human fixating points recorded by eye-tracker. Human fixations are usually used as the ground truth to benchmark fixation prediction methods.
2) Regions of Interest (ROIs) represent some regions containing interesting information, in which clear objects cannot be easily segregated from others. Although benchmarked on human fixations, fixation prediction methods usually obtain smoothed ROIs of scene, and 'Regions of Interest' and 'Saliency Map' are interchangeable when describing the output of fixation prediction methods [5].
3) Salient Objects are specific dominant objects (e.g., animals, people, cars, etc.) in natural scenes, and, in general, salient object detection requires labeling pixel-accurate object silhouettes [6].

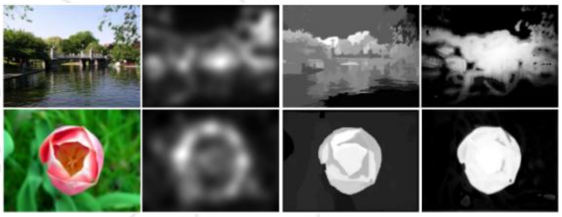

Figure1: Compared with the tasks of fixation prediction (b) and salient object detection (c), our salient structure detection (d) aims to extract interesting structures from both complex and simple scenes (a).

Salient Edges are only the edges of salient objects. In contrast, we propose a new model for Salient Structure (SS) detection, a more general term defined as the task of detecting the accurate regions containing structures of interest (e.g., ROIs, salient objects, salient edges, etc.) in a scene [7].

Fig. 1 shows two examples of SS detection. Fixation prediction techniques more often than not concentrate on high-differentiate limits, however disregard protest surfaces and shapes (Fig. 1b). Conversely, salient object detection models might be inefficient for ROI recognition in complex scenes without predominant items (Fig. 1c). The implemented technique is designed to extract SSs for both simple and complex scenes (Fig. 1d) [1].

2. Related Work

2.1 Fixation Prediction

As mentioned above, the existing fixation prediction models aim to compute 'Saliency Maps' to indicate the ROIs where human fixations locate. Some typical methods along this line include Graph-based (GB), Information Maximization (AIM), Image Signature (SIG), Adaptive Whitening Saliency (AWS) Local and Global Patch Rarities.

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2.2 Salient Object Detection

To accurately extract the dominant objects from natural scenes, formulated the salient object detection as a binary labeling problem. Further claimed that salient object detection requires labeling pixel-accurate object silhouettes. Most of the existing methods attempt to detect the most salient object based on local or global region contrast.

2.3 Bridging the Two Tasks

A random regression forest to extract salient regions based on an image segmentation method. Method can obtain more reasonable salient structures with accurate object silhouettes and object surfaces.

3. System Overview

The camera is use for capturing image. Different image processing step is performing in Matlab software. USB to serial converter is used to connect signals from PC to microcontroller. The salient object is detected then MATLAB generate control signals for LCD and these signals are send via USB to serial converter. Following Fig 2 shows block diagram of system it consist of Camera, Micro-controller, Motor, LCD.

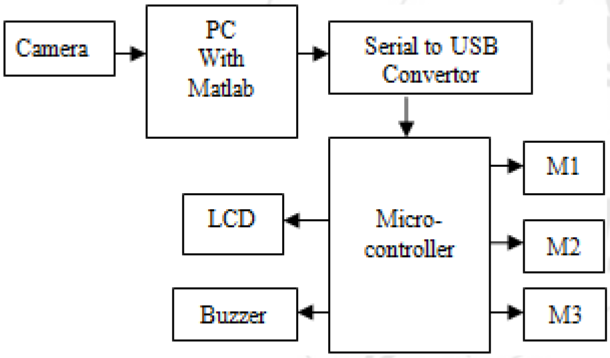

Figure 2: Implemented System

Following Fig.3 Shows complete block diagram of image processing system.

3.1 Image Acquisition

Image acquisition is the action of retrieving images from source, usually hardware based source such as camera. Image Pre-processing: Image pre-processing is required to remove unwanted distortions and enhance the image features[1]. After procurement of picture some pre-preparing is done on gained picture. Pre-handling incorporates taking after procedures,

1) Histogram equalization.
2) Median filtering.

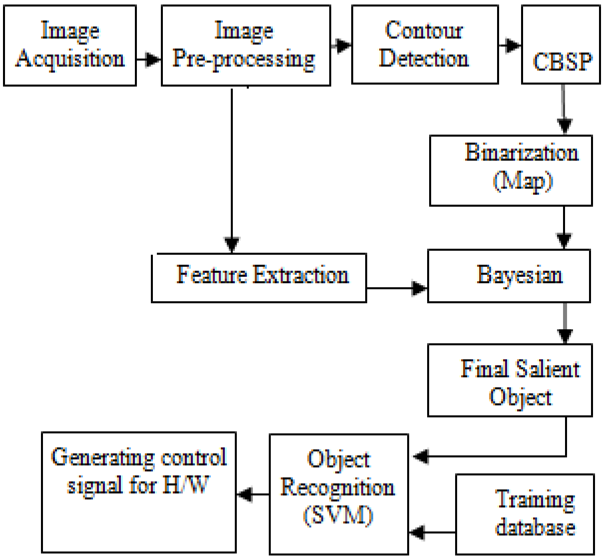

Figure 3: Image Processing Blocks

3.2 Histogram Equalization

Before histogram equalization image is converted in to gray scale format. Histogram balance is procedure of upgrading the differentiation of pictures by changing the qualities in a power picture, or the qualities in the shading guide of a filed picture, so that the histogram of the yield picture roughly coordinates a predefined histogram. Histogram equalization can be easily done in Matlab by using histeq function. Syntax for histeq function is as follows, J = histeq(I); Where J is the histogram equalized image [1].

3.3 Noise Filtering

Clamor from picture must be expelled for good precision. In our venture we are expelling Paper and Salt Noise. This noise can be removed by using Median Filter.

3.4 Median Filtering

Here, we are using median filter for removing the noise. Middle separating is a nonlinear operation frequently utilized as a part of picture handling to lessen "salt and pepper" commotion. A center channel is more fruitful than convolution when the goal is to in the meantime diminish noise and spare edges. Middle sifting is a nonlinear operation frequently utilized as a part of picture handling to lessen "salt and pepper" clamor. The Median Filter replaces the focal estimation of a M-by-N neighborhood with its middle esteem.

3.5 Contour Detection

Early ways to deal with shape recognition go for evaluating the nearness of a limit at a given picture area through nearby estimations. In general, contours or boundaries help to segment an image into various perceptional regions that may be used by the visual system to rapidly construct a rough sketch of the image structure in space [1].

3.6 Contour-Based Spatial Prior (CBSP)

In the non-selective pathway, we compute the rough spatial weights of saliency based on the distribution of the dominant edges. However, it is difficult to use these methods to provide regional information (e.g. object surfaces), and some isolated and high-contrast edges (e.g. the boundary between two large surfaces) may be incorrectly evaluated as high saliency [1]. First extract the edge responses and the corresponding orientations using the edge detector proposed, which is a biologically-inspired method and can efficiently detect both color- and brightness-defined dominant boundaries from cluttered scenes. Figure shows an example of reconstructing CBSP.

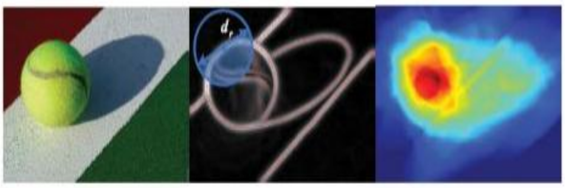

Figure 4: Example of reconstructing the potential saliency regions based on the dominant edges.

As Shown in Fig.4. It describes about the Example of reconstructing the potential saliency regions based on the dominant edges. Left: the input image. Middle: the dominant edges shown in red lines [1].

3.7 Bayesian Interference

In proposed system, we employ tool use of Bayesian inference to adaptively integrate the global CBSP and the local features, simulating the interaction of top-down and bottom-up information processing flows in the selective visual attention. With Bayesian inference, the possibility of a pixel at x belonging to a salient structure s (posterior probability), p(s|x), can be computed as

$$p(s/x) = \frac{p(s)p(x/s)}{p(s)p\left(\frac{x}{s}\right) + p(b)p(b/x)} \quad (1)$$

Where p(s) and p(b) = 1 − p(s) are the prior probabilities of a pixel at x belonging to a salient structure and the background, respectively. p(x/s) and p(x/b) are likelihood functions based on the observed salient structure and the background, respectively [1]. The implementation details are as follows.

- Predict the Size of Potential Structure
- Evaluate the Importance of Each Feature
- Calculate the Observation Likelihood

3.8 Feature Extraction

Include Extraction In machine learning, design acknowledgment and in picture preparing, highlight extraction begins from an underlying arrangement of measured information and manufactures inferred values (highlights) proposed to be enlightening and non-excess, encouraging the consequent learning and speculation steps, and now and again prompting better human understandings [2]. The selected features are expected to contain the relevant information from the input data, so that the desired task can be performed by using this reduced representation instead of the complete initial data[9]. Include extraction is utilized for change of information into an arrangement of highlight or highlight vector [3]. Thus templates of the matching operation contain only iris image basis that distinguish.

3.9 Object Recognition (SVM)

Extricated elements are passed to Support Vector machine all together characterize occasion between two classes, Support Vector Machines depend on the idea of decision planes which define decision boundaries. A decision plane or decision boundary is one that isolates between arrangements of objects having different class. A schematic case is appeared in the representation beneath. In this case, the items have a place either with class GREEN or RED.

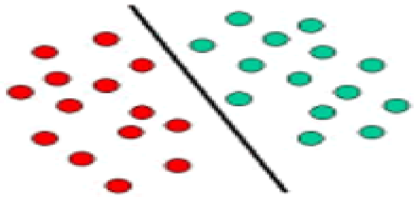

Figure 5: Linear classifier

The separating line sets a limit on the right half of which all objects are GREEN and to one side of which all objects are RED. Any new question (white hover) tumbling to the privilege is named as GREEN and on the off chance that it tumbling to one side of the isolating line it is classified as RED.

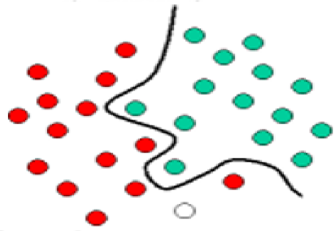

Figure 6: Hyper plane classifier

This circumstance is portrayed in the outline underneath. Compared with the past schematic, plainly a full detachment of the GREEN and RED objects would require a bend (which is more complex than a line). Support Vector Machines are especially suited to deal with such undertakings where straight classifier couldn't work.

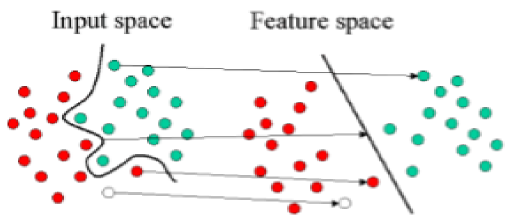

Figure 7: SVM classifier

Fig.7 demonstrates the fundamental thought behind Support Vector Machines. Here we see the first protests (left half of the schematic) are rearranged utilizing an arrangement of scientific capacities, which known as kernels. The way toward rearranging the objects is known as mapping (change). Note that in this new setting, the mapped objects (right 50% of the schematic) is directly distinguishable and, subsequently, rather than developing the perplexing bend (left schematic), we should simply to locate an ideal line that can isolate the GREEN and the RED objects.

4. Simulation Result

Frist acquire database image. The preprocessing perform on data base image to improve quality. Edges are find in contour detection. Finally we detect salient object and find out geometrical features of object.

The PSNR and MSE of Image 1 is,
- PSNR 37.6505
- MSE 11.21

Figure 8: Output of detected salient object Image 1

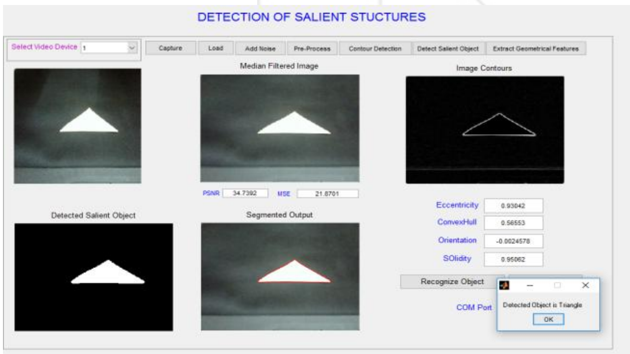

Figure 9: Output of detected salient object Image 2

The PSNR and MSE of Image 2 is,
- PSNR 34.7392
- MSE 21.8704

Table 1: Geometrical feature of object

	Eccentricity	*Convexhull*	*Orientation*	*Solidity*
Image1	0.87861	0.88264	-0.01641	0.98363
Image2	0.93042	0.56553	-0.0024578	0.95062

5. Conclusion

In this system, we proposed a contour-guided visual search (CGVS) system for salient structure. This method search for salient structures (SSs) with Bayesian inference guided by contour information, such as the location and size of SS, importance of features, etc. Although many recent models attempt to employ various image segmentation algorithms as a pre-processing step to obtain high quality salient object. The model highlights the dominant objects with accurate shapes from relatively simple scenes with as few as two or three steps of iteration. The application of system is object recognition and classification.

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