Data-driven Saliency Region Detection Based on Undirected Graph Ranking

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Abstract: Highlighting saliency region is still a challenging problem in computer vision. In this paper, we present a data-driven salient region detection method based on undirected graph ranking. It consists of two steps: we first compute priori saliency map on super-pixel image by combining region contrast and center prior information, and then extract saliency map by optimized ranking function based on a new affinity matrix. It is simple and efficient. Furthermore, salient objects can be successfully highlighted with precise details and high consistency. We evaluate the proposed method with three image datasets. The experimental results show that the proposed approach has a good performance in terms with the PR curve, the ROC curve.

Key-Words: - Image saliency, salient region, affinity matrix, undirected graph ranking

1 Introduction

Visual saliency is an intractable problem in neuroscience, psychology, neural systems, and computer vision [1]. Gestalt principle states that human vision generally pays more attention to one or more central region rather than background region in the scene. The main task of image saliency detection is to estimate the position of the salient object(s) and make its salient value higher than other background regions in a scene. The extracted saliency map can be applied to: image segmentation [2, 3], image retrieval [4], dominant color detection [5] et al.

Saliency detection can be attributed to two types: one [6, 7] is task-driven, top-down; the other [8-16, 18] is data-driven, bottom-up. The top-down methods pay attention to a specific object and produce salient features by supervised learning on a larger dataset which contains the specific object. While bottom-up methods just rely on underlying data. In this work, we focus on bottom-up saliency region detection.

In this paper, we regard saliency detection as an undirected graph ranking problem, and learn a grading function that directly maps the regional feature to a saliency score. The proposed salient algorithm contains two parts: the first part is priori saliency detection, the second part is optimizing saliency map on undirected graph, and the flow chart is shown in Fig.1. Specifically, the proposed method uses super pixel method SLIC[17] (Simple Linear Iterative Clustering, SLIC) to segment image into different regions, in which each super-pixel represents a node, and then utilizes the image contrast and the center prior relationship to calculate priori saliency nodes. Lastly, regional saliency is calculated by using the optimal sorting based on a constructed affinity matrix, in which priori significant clusters are marked as the given node sequences by the binary segmentation.

The main objective of this work is to propose a data-driven salient region detection method based on undirected graph ranking. By combining region contrast and center prior information, a new method is proposed to compute priori saliency map, and we construct an affinity matrix to weight edges between any pair of nodes on undirected graph. Finally we acquire saliency map by optimizing ranking function.

The remainder of this paper is organized as follows. In Section 2, we review the main work related to saliency detection in recent year. In Section 3, we introduce how to model the salient object. Specifically, in Section 3.1, the priori noteworthy object extraction by combining region contrast and center prior is presented. And then we optimize the salient object by ranking on undirected graph in Section 3.2. The experimental results are shown in Section 4. Finally, conclusions are drawn in Section 5.

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