Thesis title: Modeling and Application of Visual Saliency
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Abstract:
Visual saliency is a property of contents in a scene that specifies the propensity to draw attention. In this work, a graph-based approach for determining visual saliency is described. The proposed model uses degree centrality over a graph representation of an image to form a saliency map. Experimental evaluation establishes the superiority of the method over existing saliency models. Various critical issues concerned to visual saliency models are also addressed. These include: (i) evaluation of saliency models, (ii) selection of appropriate features, and (iii) role of warm colors in saliency.

Evaluation of visual saliency models requires annotation of salient locations/objects in an image according to human perception. In several experiments, eye-trackers are used for this purpose. In this work, an alternative method of collecting groundtruth data is proposed. It is based on hand-eye coordination of a person and it does not require any instruments other than the usual computing resources. Compilation of collected data from individual volunteer is carried out using image segmentation. It is followed by rule based analysis of each segment to determine whether it is part of the groundtruth. An evaluation metric is also proposed that suits the necessity of the saliency models.

In this work, suitable features for visual saliency computation are identified by analysing the performance of individual/combination of a set of common candidate features through a forward selection scheme. Experimental results support the fact that selection of appropriate features improves the performance. Usage of only a few principal components of selected features also achieves good performance, reduces feature channels and saves computational resources.

Red, orange and yellow are denoted as warm colors. A study regarding role of these warm colors in visual saliency is also reported in this work. It is observed that likelihood of drawing attention by a warm color depends on both of its hue and saturation component. Warm colors with hue relatively closer to red and/or higher saturation are more likely to guide attention. These findings are integrated with the proposed saliency model to improve its performance.

Finally, as an application of visual saliency models, the problem of image retargeting for a small target area is demonstrated.

Keywords: Visual saliency, attention, bottom-up attention, groundtruth, feature selection, warm color, image retargeting.