Saliency Object Detection based on Detail Preservation of Morphological Operations

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Extended Abstract

Saliency-based object detection identifies the target of an image based on the distinctiveness of a region from its adjacent regions within the image. This model of object detection is based on the Human Visual System (HVS) and has applications in many fields that benefit from digital image processing, from medical imaging to machine automation. While visual saliency is a powerful determinant in object detection, the resulting image is noisy due to artifacts of the detection process. To remedy this problem, morphological operations are applied as post-processing to improve the detection performance.

Morphological techniques probe an image with a structuring element. By varying the size and the shape of structuring elements, geometrical information of different parts of an image and their interrelation can be extracted for the applications of demodulating boundary, identifying components or removing noise. While large size elements benefit eliminating noise, they may be disadvantageous for preserving details in an image. Taking this into consideration, in this paper, we propose an image scaling method that will preserve detailed information when applying morphological operations to remove noise. First, a Preservation Ratio Scalar (PRS) is calculated from an image. The PRS is used for upscaling the image before morphological operations, which aims at preserving structural fine details otherwise eliminated during the morphological process. Finally, the morphological operator processed image is downscaled using the PRS.

The effectiveness of the proposed method was evaluated by target detection in a set of benchmark color images for which the ground truth is available. A gray scale saliency map was initially obtained from a color image based on intensity and color information. Morphological operations with and without image scaling were applied to remove noises in the saliency map. Lastly, thresholding was applied to the morphological operator processed image to obtain a binary image and the largest object was identified as the target object. The Sorensen-Dice method was used to numerically evaluate detection results in comparison with the ground truth. According to the experimental results, we found that the majority of the time the proposed method resulted in a higher detection rate mainly due to the improved preservation of fine structural information than the conventional morphological operations.