Automatic extraction of semantic object in image using local brightness variances

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Extended Abstract

Extracting semantic objects in image and video is considered as an essential preprocessing for image and video recognition problems. However, with current computing technologies, the fully automatic semantic object segmentation is not possible. Therefore, user assistance is needed somewhere during the segmentation process of a semantic object. That is, whenever we want to extract semantic objects from the video, we need a time-consuming and inconvenient user intervention for roughly outlining the object boundary. To facilitate the semi-automatic process, there have been some efforts to minimize and simplify the human interactions [1][2].

In this paper, we propose a method to reduce the number of human interventions for the same image. That is, we just need the very first semi-automatic image segmentation and, after the first segmentation, the object extraction for the image can be done automatically without human intervention. The basic idea is to manipulate the object and the background brightness obtained from the first semi-automatic segmentation such that they can be separated by the local variance information. Now, given the contrast-manipulated image, we can apply the automatic object segmentation proposed for the low depth-of-field (LDOF) images [3][4] to extract the object automatically.

The overall block-diagram for the proposed semantic object segmentation method is depicted in Figure 1 and 2. As shown in Figure 1, given the original image, we first execute a semi-automatic image segmentation method with user assistance [1][2]. This can be done by drawing a rough boundary of the object [1] or by selecting key contour points of the object boundary [2]. Then, the pixel-wise accurate object boundary can be obtained automatically by using a boundary refining method such as the watershed algorithm. After the semi-automatic object segmentation, the extracted object is manipulated by a contrast enhancing method such as the unsharp-masking method and the background is blurred by a contrast suppression method such as the Guassian-blurring. Of course, these contrast manipulations should be done such that the image alterations should be unnoticeable by human vision. Then, the contrast-manipulated object and background are combined together to have an automatic-object-extractible image. This is stored to be used later for the automatic object extractions.

Given the automatic-object-extractible image, we can now extract the object from the background without human intervention. To do that, we first need to calculate the local variances for all pixels. The local-variance-image-field (LVIF) [3] normalized by the maximum local variance can highlight the image areas with high local variances. For example, the LVIF image in Figure 2 clearly identifies the contrast-enhanced object (face) in the image. To automatically extract the object, we can use the segmentation methods proposed for the LDOF images [3][4]. Even a simple circle drawing method at the center of gravity of the local variances can give a rough region of the object (see Figure 3-c).

In this paper, we introduce a novel approach for the automatic object segmentation. By manipulating the contrast of the object and the background of the image, we can automatically extract the semantic object without human assistance thereafter. The proposed method can be used for object-based image editing and the content-based image retrieval problems. The future works include the extension of the proposed object segmentation to the video data and the systematic contrast-manipulation of the object and the background using the human vision system.

References

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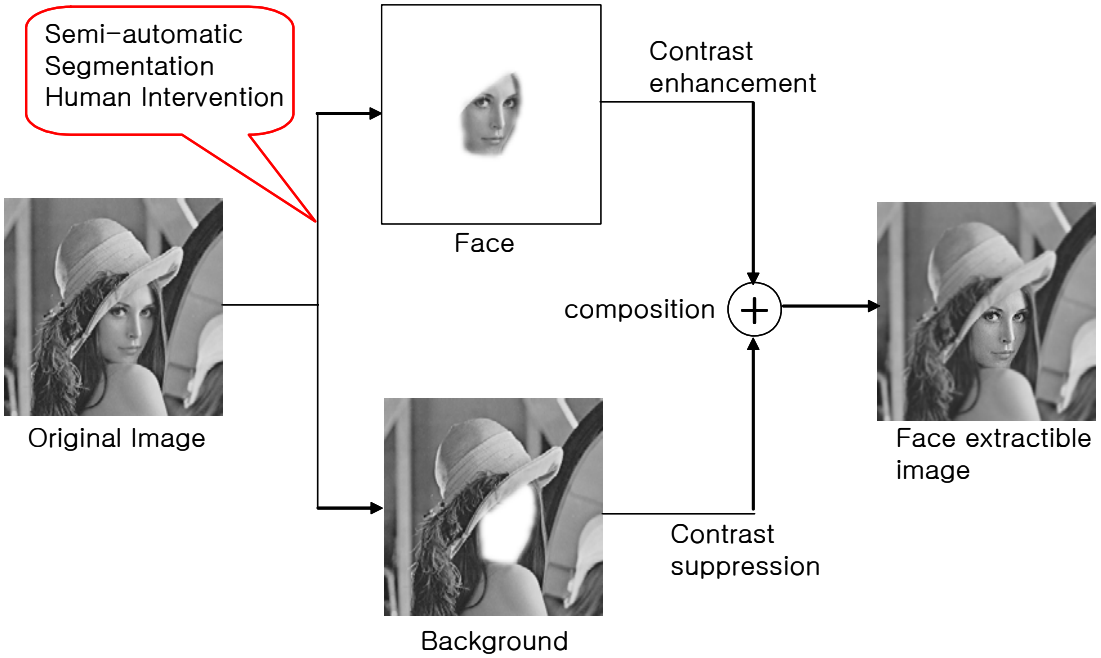
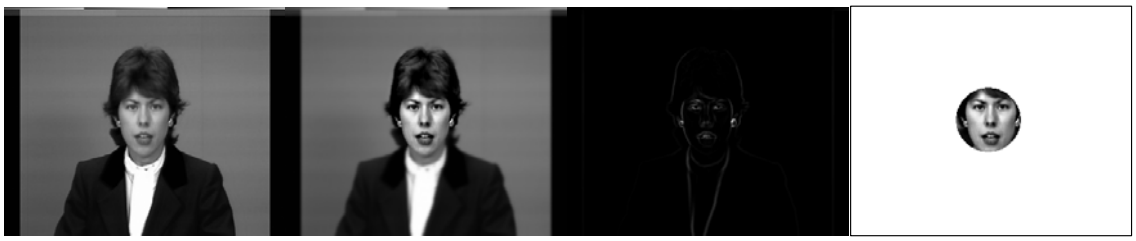


Figure 1. Semi-automatic object (face) extraction and contrast manipulation.

Figure 2. Automatic object (face) extraction for the contrast enhanced image.



(a) (b) (c) (d)

Figure 3. Example of face extraction: (a) Original image, (b) Contrast-manipulated image, (c) Local variance image field, (d) Automatic face extraction (circular method).