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INTERACTIVE COMPUTER-ASSISTED IMAGE SEGMENTATION AND ENHANCEMENT

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Interactive Computer-Assisted Image Segmentation and Enhancement

Abstract: An interactive assisted segmentation technique provides a semi-automated way for users to individually adjust image parameters of segments of a composite image.

This disclosure relates to the field of image processing.

A technique is disclosed that provides a semi-automated way for users to individually adjust composite images with an interactive assisted segmentation algorithm.

While scanning or printing composite images, there is no solution allowing for the user to easily and interactively determine regions for customized adjustments. This is a common problem when scanning multiple documents or a composite content in a single scan capture. The problem also occurs when printing documents comprising multiple photos, or regions, that are drastically distinct. Technically, the problem relies on the challenges around calculating not only the optimal, but also subjective, configurations for contrast, brightness, saturation, etc., or applying specific transformations to the image. Such configurations may drastically change according to the regions of the document, and based on users' goals and subjective factors. Some examples are:

- A photo comprising a mountain and a blue sky: while one user may prefer to highlight details of the blue sky, others may prefer the mountain, or both.
- The scan of a driver license plus a proof-of-residence in a single scan: while the driver license may be better in color mode, and with increased brightness, the proof-of-residence is better in black and white, and with more contrast.
- Printing a photo collage: while one photo needs more contrast and less brightness, another may be the exact opposite.

According to the present disclosure, and as understood with reference to the Figure, a composite image is identified. The identification of a composite image is done by either user indication, or automatic detection, that the image is a photo collage. Methods for edge detection are applied to segment the image in different regions. If not a photo collage, a user can ask the printer or scanner software to segment a single photo, automatically detecting relevant segments using Superpixel segmentation and a pre-defined number of segments. If the algorithm does not segment the image as expected by the user, the user can change the number of segments or draw easy traces to indicate segments to merge or split, using mouse or touch interfaces. Each of the segments are then treated individually, applying automatic or manual adjustment of quality, properties, and effects, before being printed or saved / copied / emailed (in the case of a scanned image). The technique operates as follows:

1) A software module running on the printer or scanner having a display, or in a computer connected to the printer or scanner, receives the image and displays it to the user as a preview image.

2) A Segment control is presented to the user. If the user selects Segment, two further options are offered: Automatic or Manual (in which the user indicates the desired segments).

3) If Automatic mode is selected, a first image segmentation tries to identify a photo-collage (grid lines clearly dividing different photos). An option to force the interpretation as a collage can also be presented, although the algorithm can also achieve the result to segment a photo collage without selecting such option. If a collage isn't identified, Superpixel segmentation is applied up to the level that identifies a pre-set fixed number of segments (e.g.: from 2 to 4). The number of segments into which the image was divided is presented, and the user given the option to increase or decrease the number of segments into which the image will be automatically split. In parallel, user can also draw rough traces on the screen to indicate areas that will be auto-merged by Superpixel (reducing the number of segments), or indicate rough lines that the algorithm will use as reference to precisely split the image.

4) If Manual mode is selected, the image is displayed. The user then draws rough traces in the screen to indicate areas that will be auto-merged by Superpixel (reducing the number of segments), or indicate rough lines that the algorithm will use as reference to precisely split the image using Superpixel (or alternatively methods to detect straight edge lines).

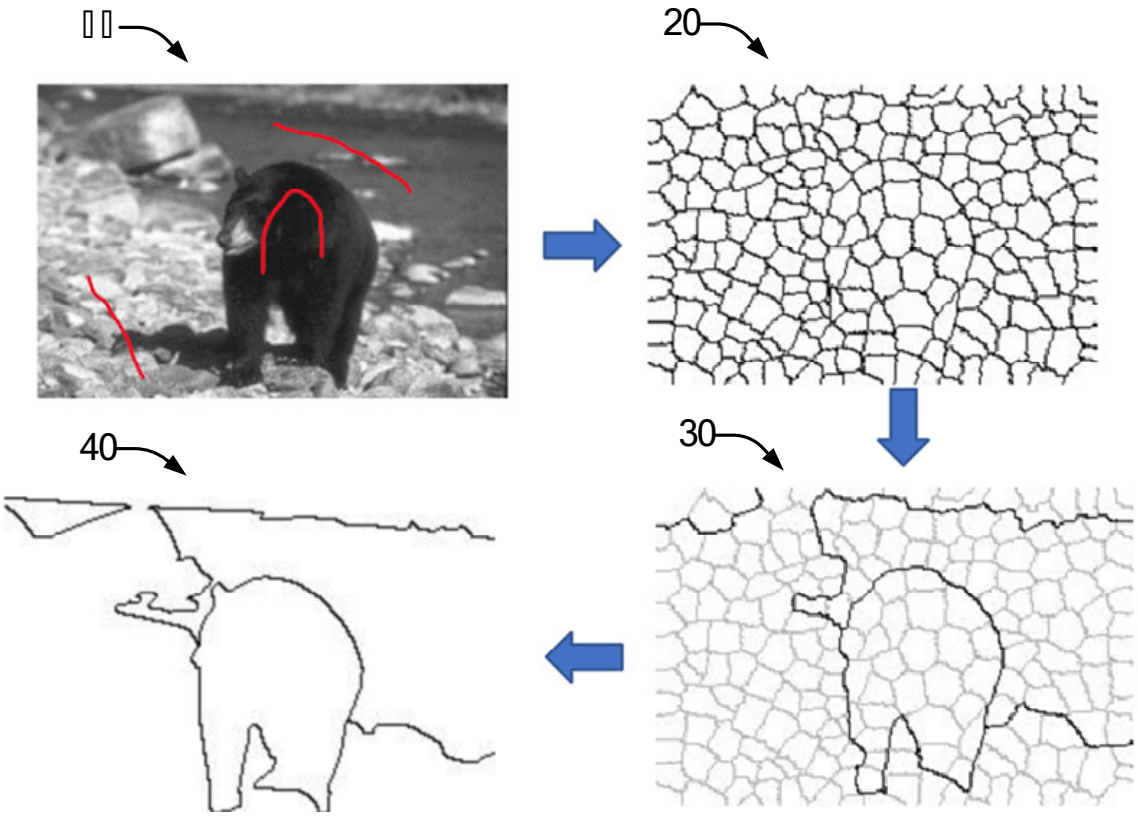
5) For each segment, image parameters such as brightness, contrast, color level, etc. can be adjusted automatically, where the system automatically compute good parameters for each region individually, or the user can adjust these parameters manually. The user can also merge and split one or more of the segments; remove one of the segments; and increase or decrease the size of the segments. At the conclusion, the image is ready to be printed or saved/transmitted/copied as one.

In some configurations, the module which automatically segments the image can also list objects recognized by computer vision using machine learning or traditional techniques, and the user can then select each element to be adjusted.

The Figure illustrates an example of applying the disclosed technique to an image of a bear. At 10, a user in manual mode draws the red traces on the image, roughly indicating regions that are to be segmented with Superpixel. The technique proceeds through 20 and 30 to yield the final segmentation shown at 40.

The disclosed technique advantageously corrects and/or enhances images being printed or scanned based on specific areas determined by easy and interactive user feedback

Disclosed by Carlos Haas and Diogo Strube de Lima, HP Inc.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