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# Automatic removal of unwanted objects from images

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## **Automatic removal of unwanted objects from images**

### **ABSTRACT**

It is sometimes necessary to remove a person or other object from an image. Per current techniques, the removal of a person from an image, e.g., via manual cropping, produces a crude result, e.g., an image with discontinuities, an image with visible cropping boundaries, etc. Some image management and photo sharing applications/ services include features that enable users to remove specific persons from being categorized or surfaced in images; however, such solutions simply de-lists photos with the specified persons.

This disclosure describes techniques that enable a user to remove specified individuals or other objects from images. The portion of the image from which the objects are removed are replaced with content generated by applying machine-learning models to other portions, e.g., background, of the image. With user permission, the techniques also automatically insert a descriptor in the image that indicates that image has been thus modified.

### **KEYWORDS**

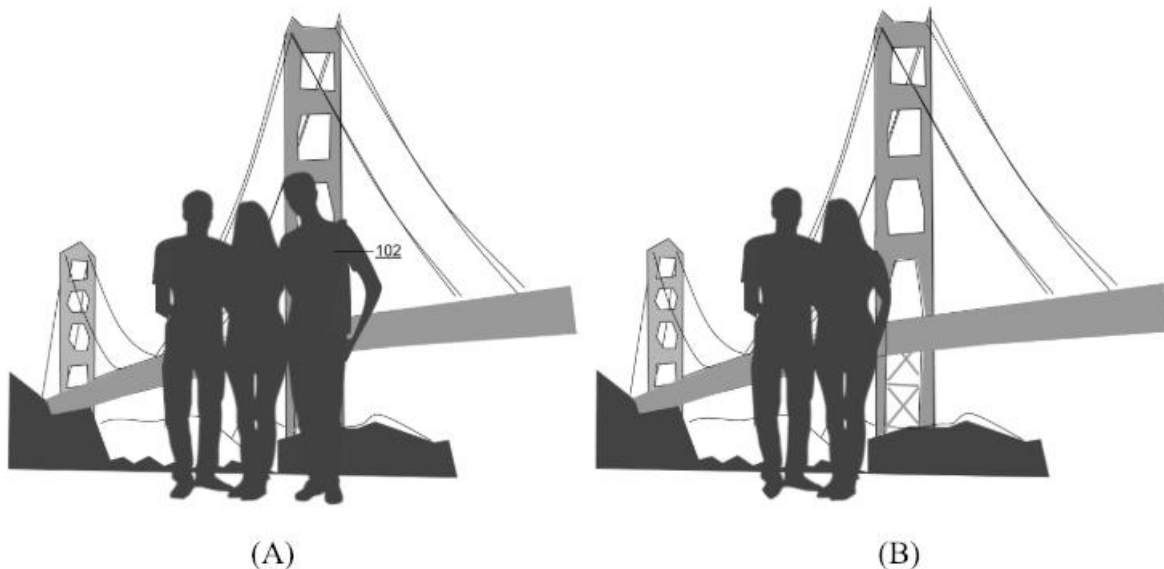
- object removal
- image modification
- image completion
- image filling
- machine learning
- background detection
- scene recognition
- face recognition

## BACKGROUND

It is sometimes necessary to remove a person or other object from an image. Per current techniques, the removal of a person from an image, e.g., via manual cropping, produces a crude result, e.g., an image with discontinuities, an image with visible cropping boundaries, etc. Some image management and photo sharing applications/ services include features that enable users to remove specific persons from being categorized or surfaced in images; however, such solutions simply de-lists photos with the specified persons.

## DESCRIPTION

When the user permits, images in the user's image collection are analyzed to identify individuals that are present, e.g., using face recognition, pose detection, matching clothing or other objects, etc. Such analysis may result in labels being associated with the images where the labels are indicative of individuals or objects that appear in each image. When a user specifies that a particular individual be removed from their image collection, images that depict the individual are automatically identified, e.g., using the labels.



**Fig. 1: (A) Original image; (B) Automatically modified image**

Fig. 1(A) illustrates an example image that depicts an individual (102) that the user has specified for removal. The image is analyzed to automatically outline the body frame of the individual using, e.g., image segmentation techniques. Pixels corresponding to the body frame of the individual are replaced with pixels that match the image background. Such replacement can be performed, e.g., using image completion techniques that employ machine learning. This is illustrated in Fig. 1(B), where the pixels originally occupied by the body frame of the individual are smoothly filled in with the background of the image. With user permission, the techniques also automatically insert a descriptor in the image that indicates that image has been thus modified. All images in the user's image collection that depict the individual to be removed are processed in this manner.

Removal of persons or objects from images allow users to continue enjoying their photos or images without having to view images that depict certain individuals. Automatic removal techniques as described herein eliminate the need for the user to perform time-consuming manual work of outlining an individual, cropping relevant parts of the image, and filling in the cropped regions.

Further to the descriptions above, a user may be provided with controls allowing the user to make an election as to both if and when systems, programs or features described herein may enable collection of user information (e.g., information about a user's social network, social actions or activities, profession, a user's preferences, or a user's current location), and if the user is sent content or communications from a server. In addition, certain data may be treated in one or more ways before it is stored or used, so that personally identifiable information is removed. For example, a user's identity may be treated so that no personally identifiable information can be determined for the user, or a user's geographic location may be generalized where location

information is obtained (such as to a city, ZIP code, or state level), so that a particular location of a user cannot be determined. Thus, the user may have control over what information is collected about the user, how that information is used, and what information is provided to the user.

## CONCLUSION

This disclosure describes techniques that enable a user to remove specified individuals or other objects from images. The portion of the image from which the objects are removed are replaced with content generated by applying machine-learning models to other portions, e.g., background, of the image. With user permission, the techniques also automatically insert a descriptor in the image that indicates that image has been thus modified.