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Photo Editing with Face Selection and Replacement

ABSTRACT

This disclosure describes techniques to enable users to edit photos to include selected faces or facial expressions. A user can select a photo from a burst or other collection of photos. Detected faces in the selected photo are highlighted in a user interface that enables a user to select a face in the photo to modify. In response, a set of candidate faces that are suitable to replace the selected face are presented in the user interface. With user permission, the candidate faces can be obtained and/or modified from other accessible photos, such as from a burst of photos. The user can select any candidate face that seamlessly replaces the selected face in the displayed photo. The described interface allows users to quickly and easily replace undesired facial expressions in photos with preferred facial expressions.

KEYWORDS

- Photo editing
- Face replacement
- Face swap
- Face selection
- Fix smiles
- Facial expression
- Style GAN
- Generative Adversarial Network (GAN)
- Group photo
- Photo burst

BACKGROUND

Users often capture photos of groups of people. However, it can be difficult to obtain a group photo in which every person has a preferred or pleasing facial expression. For example, one or more faces in the photo may have eyes closed, frowns or neutral expressions, tilting or rotation, etc. The photo may be edited manually to copy a face from a different, similar photo and paste it in the group photo. Such editing can be time consuming and often provides a modification in which edges between the replaced face and the other portions of the photo are noticeable.

Some applications are available that can automatically replace a face in a photo with a different face from a different photo. However, such applications do not provide the user with many options as to the particular faces in the photo to replace and/or face images that can be used as a replacement. Furthermore, such applications do not provide a capability of multiple users to determine how they want their own faces to appear in a group photo.

DESCRIPTION

This disclosure describes techniques for presenting photos from which a user can select, presenting candidate faces which can be used to replace faces in a selected photo, and automatically replacing a selected face in the photo with a selected candidate face. These techniques enable a user to easily replace faces in a photo with various other face images that are preferred by the user.

The described techniques can be implemented on any suitable device, e.g., a camera device, portable user device (e.g., a smartphone), desktop computer, etc. The user is provided with options to enable or disable described techniques. The user can permit specific data or types

of data (e.g., specific photos) to be processed and can deny processing of other data or types of data.

Selection of a base photo

A number of photos may be presented to one or more users to select for editing. In some examples, a user may have captured the photos using a device such as a camera or other portable device. In some examples, the user may capture a burst of photos in a short span of time, e.g., a burst mode of a camera may automatically capture several photos in quick succession.

A user can select a particular photo as a base photo. The base photo can be selected from a displayed grid or other list of photos. In some cases, the base photo may be selected from a burst of photos captured at the same location and about the same time. In some cases, the user can select a base photo based on its background and composition, e.g., the framing of the subjects in the photo, tilt of the scene, and other visual characteristics of the background and scene, rather than facial expressions that can be edited as described below.

In some cases, multiple users can be involved in selecting the base photo. For example, multiple persons depicted in a group photo can vote for their choices of base photo among a burst or other group of photos, and the photo that receives the most votes is selected as the base photo.

Editing faces in a base photo

Via a user interface on a device, a user can edit a selected base photo such that the faces of one or more persons in the base photo are replaced with faces appearing in other photos (or faces otherwise generated). A base photo is displayed in the user interface, and the user may input a command to cause the device to detect faces in the base photo that are eligible for replacement.

With user permission, automatic face detection techniques may be used to detect the faces in the photo. Based on user preferences or settings, faces less than a threshold size in the photo can be ignored, e.g., as background faces. Faces that are eligible for replacement are highlighted in the display of the base photo, e.g., by displaying a bounding box around each detected face, shading the face a particular color, or displaying a different visual highlight.

After the faces are highlighted in the base photo, the user can select one of the highlighted faces to edit. For example, the user can tap one of the highlighted faces via a touchscreen, or use a different input device to select one of the highlighted faces. With appropriate user permissions, an image library for photos that include a face of the person who has the selected face may be searched to identify candidate replacement faces. In some cases, if the base photo is included in a burst of photos captured close in time to each other, other photos in the burst can be prioritized when searching for candidate faces, since such photos typically have very similar lighting and other visual conditions to the base photo. With user permission, other images in an image library, outside of such a burst, can also be searched for candidate faces.

Image and face recognition techniques can be used to detect faces of the person who has the selected face in the searched photos. Detecting faces that belong to a particular person can be performed without determining the identity of that person. In some cases, a search can be performed for faces that are appropriate to be candidate faces that may replace the selected face in the base photo, e.g., visually similar to the selected face, such as having similar facial pose and angle, similar lighting, similar hair style or facial hair, wear similar accessories (glasses, hat, etc.). Some image processing techniques allow faces that are not as similar to the selected face to

be modified for use as a candidate replacement face, e.g., using a stored model of the face of the person to project different face angles, face expressions, etc. and generate a candidate face.

A set of candidate replacement faces are identified and presented in the editing interface. One of the candidate faces of the set can be the selected face in the base photo. This candidate face is highlighted to indicate that it is the face that is currently being displayed in the base photo.

The user can select one of the displayed candidate faces to cause that candidate face to replace the selected face. The selected candidate face can be highlighted in the user interface to indicate that it is the face displayed in the base photo. Any suitable image processing techniques can be utilized to size the candidate face appropriately, insert the candidate face over the face in the base photo, and seamlessly blend the candidate face into the base photo. For example, such techniques may utilize a generative adversarial network (GAN) or other artificial intelligence techniques. In some techniques, a model of the face can be used to modify a facial image so that it fits more appropriately into the visual context of the base photo.

The user interface allows a user to select any of a number of candidate faces and immediately view how that face appears in the base photo. The user can try out multiple candidate faces and decide which candidate face the user prefers in the context of the base photo.

In some cases, the user interface can allow a user to apply a selected candidate face to replace other faces in other photos in addition to the base photo. For example, the user can input a command to replace faces of the selected person with the selected candidate face in all the photos in a burst of photos of which the base photo is a member. The user interface can allow a user to select multiple photos and replace existing faces of the same person with the selected candidate face in any or all of the selected photos.

The user interface can allow multiple users, who appear in the base photo, to access and edit a shared version of the base photo. Each user can be presented with a set of candidate faces that can replace their own face in the shared base photo. Each user can select one of these candidate faces that is preferred by that user to replace the user's face in the base photo. The shared base photo is modified with each user's choice of candidate face. The shared base photo can be stored as a finalized shared group photo. This allows a group photo to be easily edited to portray faces preferred by the respective persons that appear in the photo.

Examples

Examples of the described techniques are presented below.

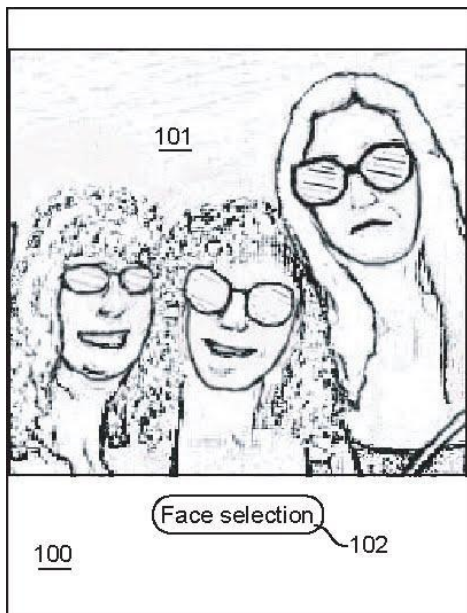


Fig. 1: Example of user interface and base photo

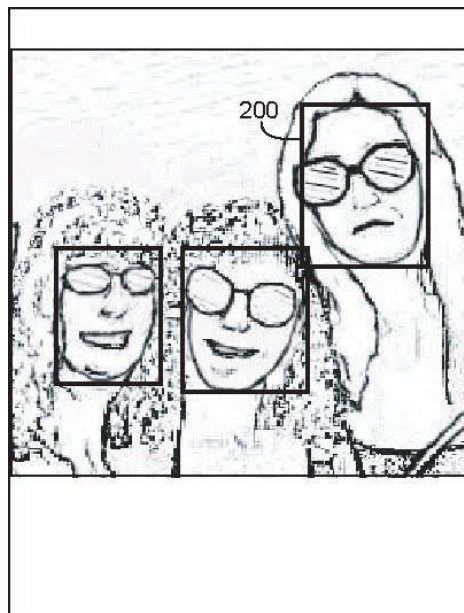


Fig. 2: Example of face highlighting in base photo

Fig. 1 shows an example of a user interface (100) displayed by a device, which presents a base photo (101) that has been selected by one or more users as described above. For example,

the base photo may have been selected from a burst of photos captured at about the same time. In this example, the user interface also displays a face selection button (102), which the user can select to command the interface to detect and highlight faces in the base photo.

Fig. 2 shows the user interface of Fig. 1 after the user has selected the face selection button. Faces are detected by the device and the detected faces are highlighted by bounding boxes in this example. The user can select one of these faces to edit. In this example, the user has selected the rightmost face (200) to edit, e.g., by tapping that face via a touchscreen.

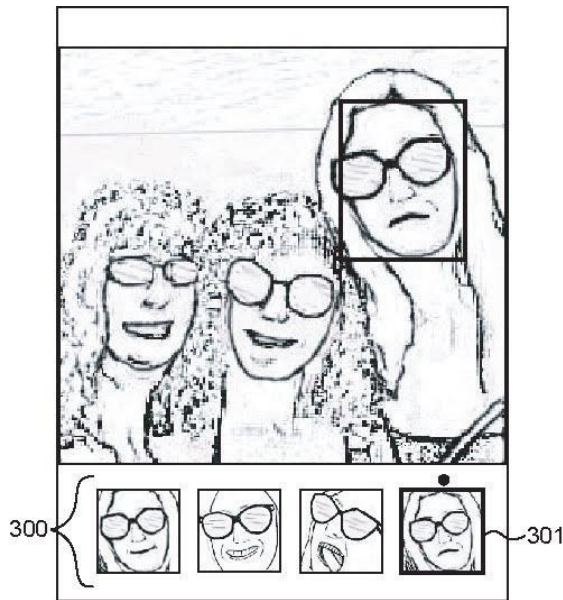


Fig. 3: Example of candidate replacement faces

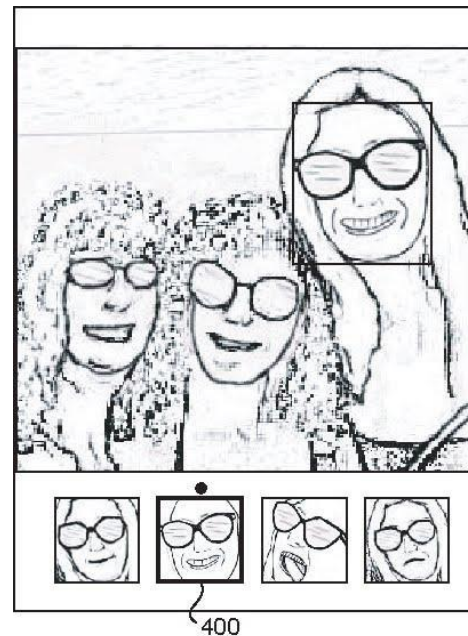


Fig. 4: Example of face replacement in base photo

Fig. 3 shows the user interface after the user has selected the rightmost face shown in the interface of Fig. 2. The device displays a set of candidate replacement faces (300) next to the base photo. The candidate faces are obtained from other photos in the burst of photos from which the base photo was obtained. In this example, the selected candidate face (301) corresponds to

the face that is shown with a bounding box in the base photo. The selected candidate face is shown highlighted to indicate its correspondence with the highlighted face in the base photo.

Fig. 4 shows the user interface after the user has selected a different candidate face (400). The selected candidate face is shown highlighted below the base photo, and the highlighted face in the base photo is replaced with the selected candidate face. As shown, the candidate face replaces the previous face seamlessly such that it blends in with the existing pixel content of the base photo.

Users are provided with options to grant permissions to and/or to disable described features entirely. The various features of the system are implemented only with user permission to access user information that serves as input to the system (e.g., user photos, image library, camera settings, user context information, camera input, user's preferences, etc.). Users 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, and if the user is sent content or communications from a server. Certain techniques are not implemented if users deny permission. 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 or depicted person's identity may be treated so that no personally identifiable information can be determined for the user or person. 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 to enable users to edit photos to include selected faces or facial expressions. A user can select a photo from a burst or other collection of photos. Detected faces in the selected photo are highlighted in a user interface that enables a user to select a face in the photo to modify. In response, a set of candidate faces that are suitable to replace the selected face are presented in the user interface. With user permission, the candidate faces can be obtained and/or modified from other accessible photos, such as from a burst of photos. The user can select any candidate face that seamlessly replaces the selected face in the displayed photo. The described interface allows users to quickly and easily replace undesired facial expressions in photos with preferred facial expressions.

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