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Selection of images for automatic display based on image capture history

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Selection of images for automatic display based on image capture history

ABSTRACT

Users have extensive collections of digital photographs and videos available for display on their devices. This disclosure describes techniques to perform selection and suggestion of digital images in a user's collection for display on a device. With user permission, image subjects that are more relevant to the user's current or recent interests are selected and/or suggested, based on the frequency, recency, and visual quality of subjects appearing in the collection. Images depicting selected subjects are displayed on a display screen of a device.

KEYWORDS

- ambient display
- photo library
- photo curation
- photo album
- smart display
- standby mode
- suggested photos

BACKGROUND

Users capture extensive numbers of images such as digital photographs with their mobile devices. Users also obtain images and videos via other mechanisms, e.g., via sharing by other users, via scanning printed photographs, etc. Based on user preferences, some images on a user's mobile device are backed up to a server, e.g., using a cloud storage service. Some applications and services include features that automatically find and display images from a user's collection. For example, the user may have selected particular subjects that the user

desires to see in such automatically-displayed images, and the system randomly selects images that depict user-approved subjects and displays the images.

However, using such techniques, the displayed images may bear low relevance to the user's current interests or lifestyle. For example, the displayed images may depict people that were friends of the user some time ago, who the user has not seen in quite some time or who live in a different place than the user is currently living. The user may be more interested in seeing images that depict friends more frequently seen or other people and other subjects of more current relevance to the user.

DESCRIPTION

This disclosure describes techniques that select and display images (and videos) from a user's collection that are related to the user's current interests. With user permission, described techniques determine which image subjects are of current interest to the user by detecting which subjects are included in images captured recently by the user (or captured by other users, e.g., and shared with the user). Based on such detection, subjects can be automatically added to or removed from the set of subjects that appear in images which are selected and displayed.

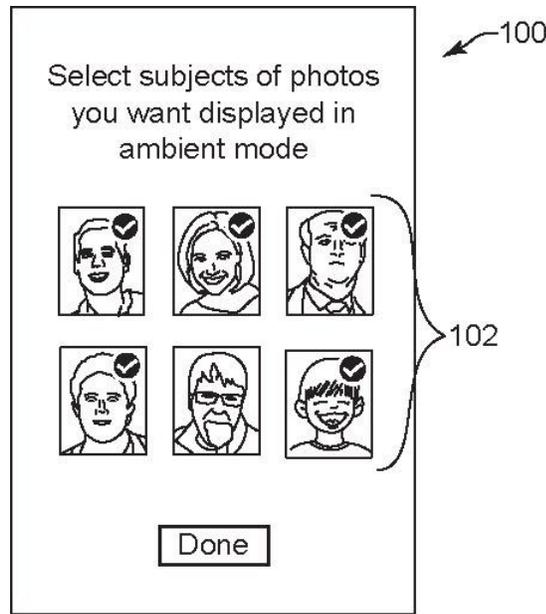


Fig. 1

Fig. 1 illustrates a view of an example user interface (100) that allows a user to select particular subjects (102) for future display on one or more devices, e.g., in an ambient mode of display. The subjects displayed for selection are obtained from the user's collection of images, if user consent has been obtained to examine the user's collection and data. For example, each of the subjects may have been found by locating faces appearing in the image collection that belong to the same person, as determined by machine learning and other face detection techniques.

For example, one or more machine learning models can run on a device to locate images that have the same subjects. With user permission, a face detector can be used for isolating regions in images that include faces and detecting faces that belong to the same person. With user permission, the machine learning models for detecting classifications of subjects can be trained using the images in a user's collection of images. In an example of detecting faces, the identities of persons of the faces is not determined, since the system need only identify that

depicted faces belong to a particular person, e.g., assigned an internal person classification or identification. The machine learning models can be implemented on a local device, e.g., a camera or other mobile device, and/or can be fully or partially implemented on a server or other remote device in communication with the local device, if permitted by the user. In some cases, heuristics and rules can be used instead of or in addition to machine learning models.

The subjects displayed in the user interface can be displayed in an order of the most commonly-appearing subjects in the user's images. In some implementations, if the user has input or confirmed names or titles for the subjects, those names can also be displayed in the user interface. Besides persons, other types of subjects from the user's image collection can also be displayed for selection, if user consent has been obtained, such as pets, locations or outdoor scenes and features (e.g., water, lakes, mountains, etc.), objects, activities (e.g., sports game, concert, etc.), and so on.

The subjects that the user selects for display can be provided in a list of display subjects which is used to determine which images to display. The list of display subjects can be associated with the user, with the user's accounts on devices, etc.

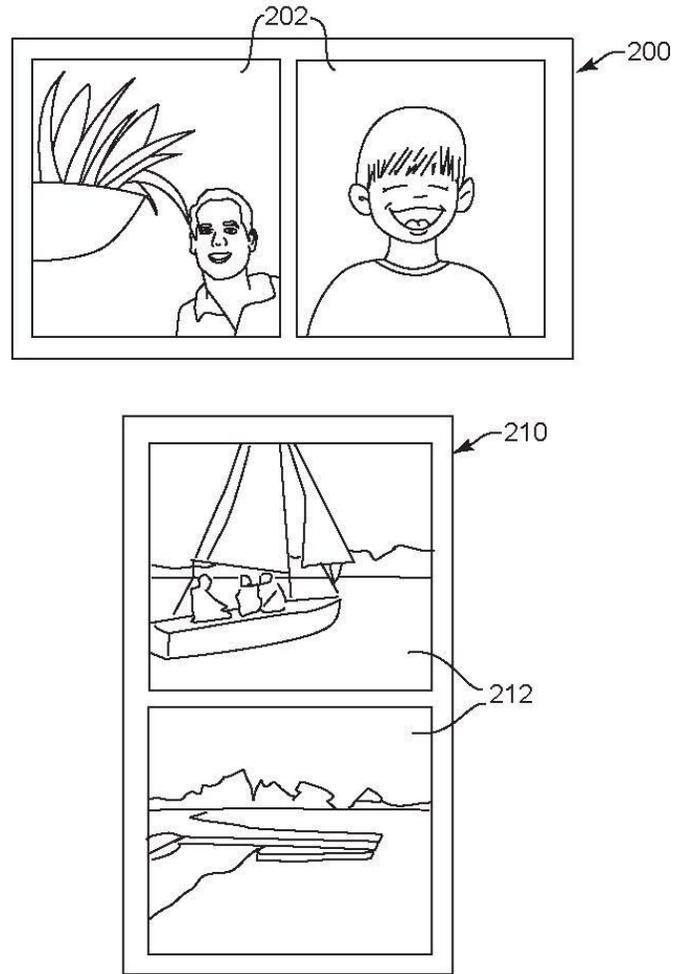


Fig. 2

Fig. 2 illustrates example display screens (200 and 210) that display images (202 and 212, respectively) selected from the user's collection. In this example, the display screens are showing an "ambient mode" of a device, where the device is not being actively used by the user to display information and is in a standby mode. The device is thus able to display images and provide other media output (e.g., play music). In this example, each display screen displays two images simultaneously, and the images changed to different images, e.g., at periodic intervals, with fade-in, scrolling, or other type of transition. The device with the display screen can be a television, for example, having a large screen, or can be a device with a smaller screen,

e.g., a home speaker device, a connected display, a digital photo frame, etc. In some examples, a smaller device, such as a mobile device, can send image data to a larger device, such as a television, which displays the images, or the mobile device instructs the larger device to receive image data from a server.

In one example, images can be selected for display from the user's collection that show subjects selected by the user, e.g., as shown in Fig. 1. For example, the displayed images can be randomly selected from the set of images showing user-selected subjects, or can be selected in a particular order from that set of images, e.g., based on frequency of occurrence in the user's image collection, recency of images based on capture time/date, or other criteria.

In addition, images can be further filtered for display based on characteristics that indicate image quality. For example, with user permission, machine learning models can be trained to select images based on overall quality as indicated in training data, where such quality can include, e.g., low blurriness, correct exposure, low color noise, presence of smiles on faces, eyes that are open and not closed, etc.

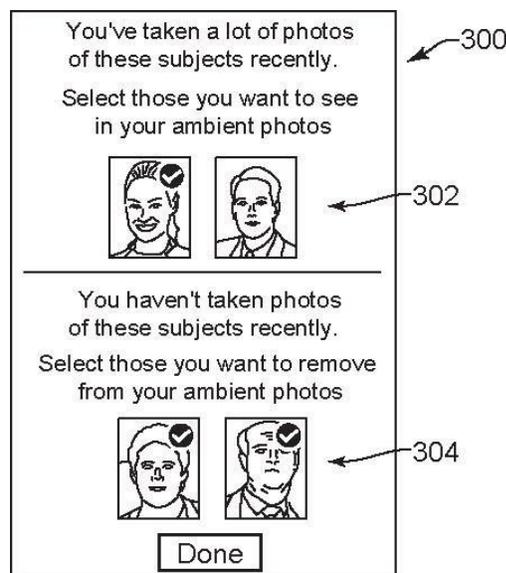


Fig. 3

Fig. 3 illustrates a view of an example suggestion interface (300) that provides options to a user to add or remove subjects from the list of display subjects and thereby adjust the set of images that are displayable by a device as described above.

If user consent has been obtained, the suggestion interface displays a first set of options (302) which are suggested subjects to be added to the list of display subjects of displayed images. In this example, the first set of options is a number of persons that have been depicted in several images recently captured (e.g., by the user, or by other users and shared with the user).

To determine these suggested additional subjects, a device examines a portion of the user's collection of captured images, if user consent has been obtained. Recent images, e.g., images that have been captured within a recent period of time (up to the current time), are examined by the device, e.g., images captured in the previous week, two weeks, month, three months, etc. (this period of time can be specified by the user). The device determines the frequency of each subject appearing in the recent images. For example, the device may determine that a first person appears in 15 images captured within the last month and a second person appears in 8 images captured in that month.

If a particular subject appears in a number of the recent images that is equal or greater than an addition threshold, then that subject is displayed in the suggestion interface as an addition suggestion. For example, if the addition threshold is set to 10, a subject appearing in 10 or more images in the period of time is displayed as an addition suggestion in the suggestion interface. The user can select any or all of the addition suggestions to add the selected subjects to the list of display subjects.

If user consent has been obtained, the suggestion interface can also or alternately display a second set of options (304) which are suggested subjects to be removed from the list of display subjects of displayed images. In this example, the second set of options are a number of persons that have not appeared in any of the user's images that are recently captured.

To determine these suggested removal subjects, a device examines a portion of the user's collection of images, if user consent has been obtained. The device determines a frequency of each subject appearing in recent images, e.g., images that have been captured in a recent period of time (up to the current time). For example, the period of time can be the same used for adding subjects as described above or can be a different period of time, e.g., a period of time specified by the user. The device determines which subjects on the list of display subjects that occur in the recent images at or below a removal threshold frequency.

If a listed subject appears in a number of recent images that is equal to or less than a removal threshold, then that subject is displayed in the suggestion interface as a removal suggestion. For example, the removal threshold can be set to zero, such that a subject appearing in zero recent images is displayed as a removal suggestion in the suggestion interface. Alternatively, the removal threshold can be set to a non-zero (e.g., low) number, such as 1 or 2.

The user can select any or all of the provided removal suggestions to remove the selected subjects from the list of display subjects, causing images showing the selected subjects to be ineligible for display by a device.

The suggestion interface can be displayed at various times. For example, the interface can be displayed periodically, e.g., after each period of time when recent images are examined by the device, or according to a user-specified period of time. In other examples, the

suggestion interface can be displayed as soon as the threshold frequency of recent images is reached that depict one or more subjects that are not currently on the list of display subjects.

Additional examples

In some examples, the user can, upon user request, be presented with a list of additional subjects that are present in recent images, but which may not have met the addition threshold. This allows the user to view and potentially add additional subjects to the list that may be of interest. Similarly, the user can request to be presented with additional subjects that did not meet the removal threshold, so that the user can view and potentially remove additional subjects from the list. Such additional subjects can be presented in an order based on their frequency of appearance in the recent images.

In some other examples, e.g., if the user has selected appropriate preferences, the suggestion interface is not displayed at all, and the determined suggested subjects are added and removed from the list of display subjects automatically by a device.

Some devices, e.g., smart displays, home speakers, etc., can play audio, e.g., music, speech, etc., that is output to accompany the display of images described above. In some cases, stored metadata that describes audio data that was played at the time of image capture can be associated with the image. Such audio data can be output with the display of the associated images. In additional examples, audio selections accompanying images can be presented in the suggestion interface as subjects which can be added or removed from the list of display subjects. For example, titles of audio selections (e.g., songs) can be presented, and the user can select to add or remove such audio selections from the list. Audio selections that have been frequently or infrequently associated with recent images can be suggested to be added or removed from the list similarly as the image subjects described above.

In further examples, the user can provide input to various applications and interfaces of a device indicating approval or disapproval for particular images. Such approval or disapproval can be used to influence the suggested subjects in the suggestion interface. For example, a subject that has been approved by the user a number of times over a threshold amount can be included in the suggestions to add subjects to the list of display subjects.

Described features for determining subjects for the suggestion interface can be implemented on a local device without contacting a server, and/or can be fully or partially implemented on a server or other remote device in communication with one or more local devices.

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 activities, social network, or social actions, profession, a user's preferences, or a user's current location), and if a user device 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 for determining images for display from a user's collection of images. Images in a user's collection can be examined, with user permission, to determine which image subjects are of more current interest to the user based on recency of images and frequency of subjects appearing in these images. This allows images depicting such subjects to be automatically selected and displayed on display devices for the user.

Additionally, other media such as specific audio tracks that were played at the time of capturing the images may be automatically played back as the images are displayed in order to recreate the complete ambience and history of the moments the images were captured.