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Applying Virtual Makeup Using Makeup Detection and Recommendations

Shengyi Lin

Nisha Masharani

Marius Renn

Leslie Shaw

Applying Virtual Makeup Using Makeup Detection and Recommendations

Abstract:

This publication describes systems and techniques for makeup detection on an electronic device that uses an image of a user's desired look as an input to detect makeup. The detected makeup is mapped to a virtual makeup library and saved as virtual makeup in a corresponding user profile. The user can retrieve and apply the virtual makeup to their face in another image to achieve a desired look. The mapped virtual makeup can be displayed as a filter over an image to digitally create an appearance of the user wearing makeup. The user is able to adjust the strength, color, and/or style of the virtual makeup. Further, the user may be presented with one or more recommendations for virtual makeup based on attributes of an image (e.g., a background of an image, the user's clothing, hairstyle, etc.). The recommendations for virtual makeup may be based on results of a machine-learned model that received training from a professional source (e.g., stylist, makeup artist, etc.). The recommendations for virtual makeup may display on a captured image or they may display in real time on a display of the electronic device. The user is able to adjust the strength, color, and/or style of the recommendations for virtual makeup to achieve a desired look.

Keywords:

makeup, cosmetics, user profile, image, picture, photograph, database, makeup library, recommendation, machine-learning, machine-learned model, convolutional neural network, model, face attribute, camera

Background:

Many people prefer to wear makeup when they use the camera features (e.g., photo, video, video calls) of their electronic device. However, there are situations when a user is not wearing makeup, but the user wants to keep their daily look in front of the camera. Additionally or alternatively, the user may want recommendations to customize their makeup based on clothing, background, lighting, etc. The user may want professional recommendations of what makeup look would suit them.

Therefore, it is desirable to provide a user with options to apply virtual makeup to images (e.g., photographs, videos) to create their preferred appearance.

Description:

This publication describes systems and techniques for makeup detection on an electronic device that uses an image of a user's desired look as an input to detect makeup. The detected makeup is mapped to a virtual makeup library and saved as virtual makeup in a corresponding user profile. The user can retrieve and apply the virtual makeup to their face in another image to achieve a desired look. Further, the user may be presented with one or more recommendations for virtual makeup based on user attributes of an image (e.g., a background of an image, the user's clothing, hairstyle, etc.). The recommendations for virtual makeup may be based on results of a machine-learned model that received training from a professional source (e.g., stylist, makeup artist, etc.).

Figure 1 illustrates an example system in which an electronic device that supports a makeup detection application and a makeup recommendation application.

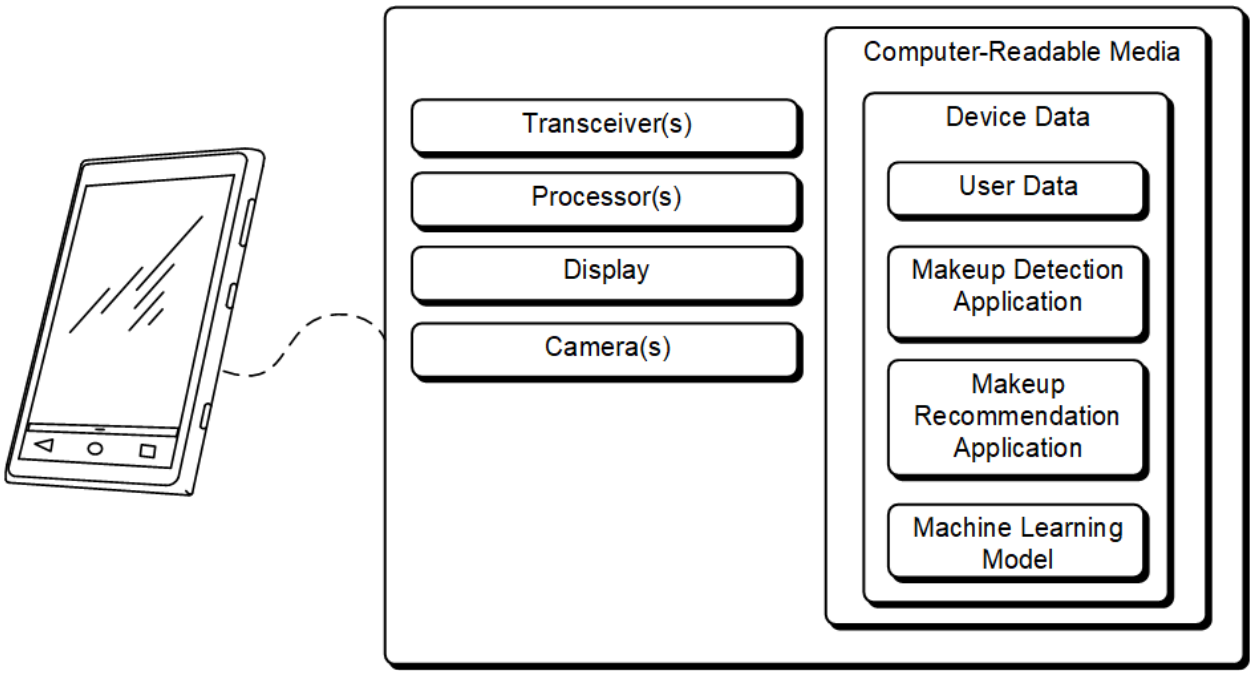

Figure 1

As illustrated in Figure 1, the electronic device is a smartphone. However, other electronic devices (e.g., a tablet, smartwatch, a wearable device, or the like) can also support the makeup detection application and makeup recommendation application described in this publication. The electronic device includes a processor(s), transceiver(s) for transmitting data to and receiving data from a wireless network, a display, and one or more camera(s). The electronic device also includes a computer-readable media (CRM) with device data. The device data includes user data, applications (e.g., a makeup detection application, makeup recommendation application), and at least one machine-learned model (ML model) that are executable by the processor(s) to enable virtual makeup application. While the makeup detection application, makeup recommendation application, and ML model could be stored within the CRM, other implementations can include any combination of firmware, hardware, and/or software.

The device data includes executable instructions of a makeup detection application that can be executed by the processor(s). The makeup detection application represents functionality that

detects makeup applied on a user's face, maps the detected makeup with a virtual makeup library, saves the virtual makeup to a corresponding user profile, retrieves virtual makeup, and applies the virtual makeup to another user image for display by the electronic device.

Figure 2, below, illustrates a diagram of a makeup detection application logic that may be performed by an electronic device.

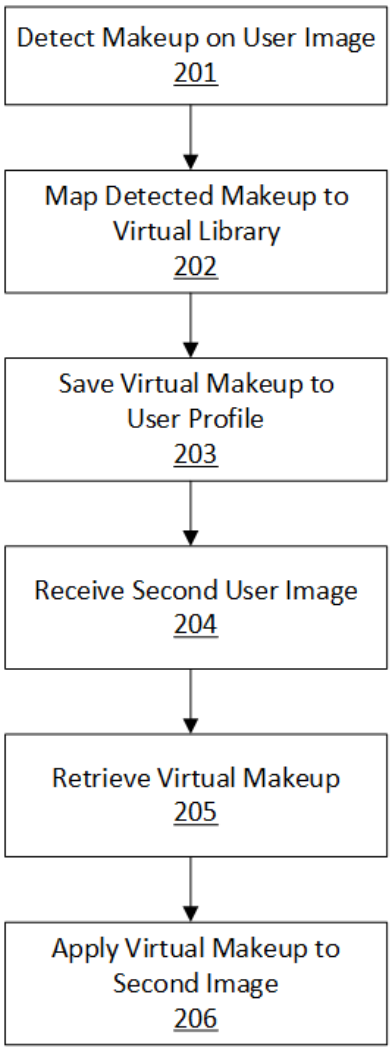

Figure 2

The makeup detection application may use an image provided by a user to detect makeup (e.g., cosmetics) on a face that is a desired look for a user as indicated at 201 in Figure 2. The image may be from a photo, video, or video call. The detected makeup may include multiple

makeup effects (e.g., eye shadow, lipstick, blush). At 202, the detected makeup is mapped to a virtual library. The virtual library may be local to the device and/or remote (e.g., cloud-based) and sort each makeup effect (e.g., eye shadow, lipstick, blush) independently. As an example, the makeup effect of eyeshadow may be mapped with a first color, strength (e.g., intensity), and style to the virtual library. This allows each makeup effect to be independently retrieved and/or adjusted. At 203, the virtual makeup may be associated with a user profile. At 204, the user provides a second image (e.g., photo, video, live view of user). At 205, the makeup detection application retrieves virtual makeup from the virtual library. The user may provide an indication to retrieve the mapped virtual makeup from their profile. Alternatively, the makeup detection application may detect that the user is not wearing desired makeup in the second image and automatically apply the virtual makeup. At 206, the makeup detection application applies the virtual makeup to the second image as a filter over the second image. The user may adjust the colors, strength, and style of the virtual makeup effects of the virtual makeup. The virtual makeup may be applied in real time to allow a user to achieve a preferred look.

The device data may include a ML model. The ML model may be a standard neural network-based model with corresponding layers required for processing input features like fixed-side vectors, text embeddings, or variable length sequences. The ML model may be a convolutional neural network (CNN), heuristics, or a combination thereof. Images that contain a face can be collected and labeled with virtual makeup recommendations by professionals. Attributes of each image, for example, facial attributes (e.g., age, skin color, freckles), other attributes (e.g., hair style, outfit style, etc.) of this person and the environment information (e.g., location, major background color), can be extracted from the images by using CNN models. The labeled virtual makeup recommendations and the attributes extracted from the images may be used

to train a machine-learned model (e.g., neural network). After sufficient training, the machine-learned model can be deployed to the device.

The ML model is trained to recognize attributes (e.g., facial, environmental) in an image and use makeup that has been previously labeled by professionals to generate predictions for attractive virtual makeup.

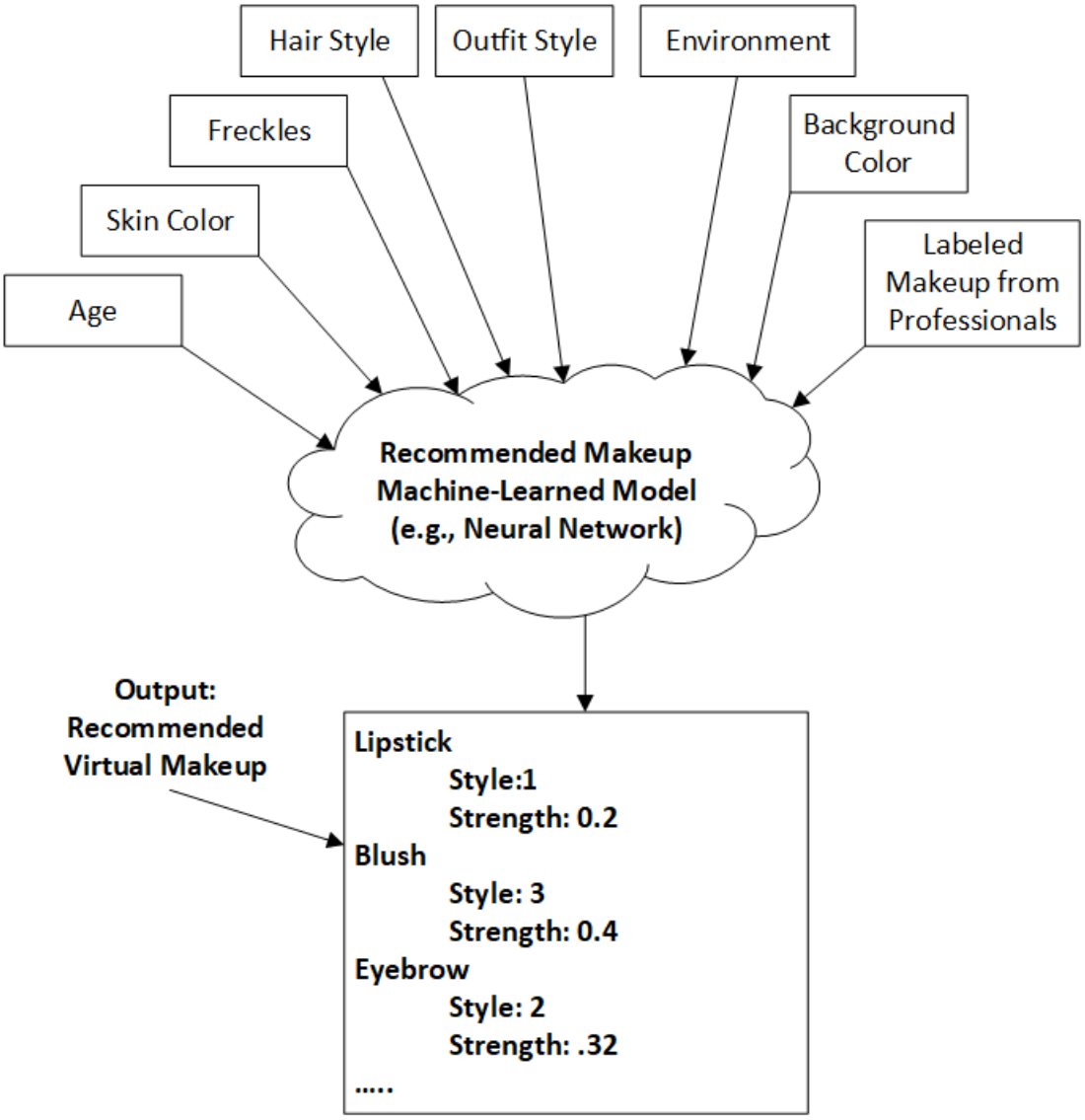

Figure 3

As illustrated in Figure 3, the electronic device feeds several inputs to the ML model. An image containing a face is analyzed for facial attributes (e.g., age, skin color, freckles, hair style,

outfit style, environment, background color, and so forth). Labeled makeup from one or more professionals is also an input. The ML model analyzes these factors and determines the makeup combination that is most likely recommended by a professional makeup artist. The output of the ML model is recommended virtual makeup that includes one or more virtual makeup effects (e.g., lipstick, blush, eyebrow, eyeshadow, etc.). The output may include options (e.g., style, strength (e.g., intensity), and color) for each virtual makeup effect that is communicated to the makeup recommendation application.

The makeup recommendation application represents functionality that retrieves the recommended virtual makeup and applies the recommended virtual makeup effects to a user image. The recommended virtual makeup may be displayed to a user over the original image. The recommended virtual makeup may be applied in real time so the user can see the recommended makeup prior to taking a photo/video. The user may be prompted to accept recommended virtual makeup. The user of the electronic device may choose to accept the recommended virtual makeup or to adjust it (e.g., the color, strength, and/or style). The recommended virtual makeup may be saved as part of a user profile.

Throughout this disclosure, examples are described where an electronic device may analyze information (e.g., age, skin color, freckles, hair style, outfit style, environment) associated with a user, for example, the recommended virtual makeup mentioned with respect to Figure 3. Further to the above descriptions, a user may be provided with controls allowing the user to make an election as to both if and when systems, applications, and/or features described herein may enable collection of user information (e.g., facial attributes, environmental information, information about a user's social network, social actions, social activities, a user's preferences, a user's current location), and if the user is sent content and/or communications from a server. In

addition, certain data may be treated in one or more ways before it is stored and/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. In another example, a user's geographic location may be generalized where location information is obtained (for example, 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.

Using the methods and systems described herein, electronic devices are able to use virtual makeup to provide a user with their desired makeup look.

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