Make Up Flash: Web Application for the Improvement of Physical Appearance in Images Based on Recognition Methods

Stefania Arguelles Reyes, Octavio José Salcedo Parra, Alberto Acosta López

Abstract—This paper presents a web application for the improvement of images through recognition. The web application is based on the analysis of picture-based recognition methods that allow an improvement on the physical appearance of people posting in social networks. The basis relies on the study of tools that can correct or improve some features of the face, with the help of a wide collection of user images taken as reference to build a facial profile. Automatic facial profiling can be achieved with a deeper study of the Object Detection Library. It was possible to improve the initial images with the help of MATLAB and its filtering functions. The user can have a direct interaction with the program and manually adjust his preferences.

Keywords—Application, MATLAB, make up, model, recognition.

I. INTRODUCTION

THE first part of this project will focus on the development of the web application whose purpose is to aesthetically improve a user's photo album by making small modifications of his face without altering the content of the image at a large scale. Using the ObjectDetect and MATLAB libraries, this improvement is achieved via data mining supported by the information given by the user. The pattern is thus generated, and the final result will be an app similar to Photoshop or GIMP but with a more automated operation.

II. BACKGROUND

A. GIMP

Fig. 1 GIMP: program for editing digital images in the form of a bitmap [1]

GIMP is free software used as an alternative to Photoshop

Stefania Arguelles Reyes is with the Universidad Nacional de Colombia, Bogotá D.C., Colombia, Faculty of Engineering (e-mail: sarguellesr@unal.edu.co).
Octavio José Salcedo Parra is with the Universidad Nacional de Colombia, Bogotá D.C., Colombia, Faculty of Engineering and with the Universidad Distrital Francisco José de Caldas, Bogotá D.C., Colombia, Faculty of Engineering (e-mail: ojsalcedop@unal.edu.co).
Alberto Acosta López is with the Universidad Distrital Francisco José de Caldas, Bogotá D.C., Colombia Faculty of Engineering, Colombia (e-mail: aacosta@udistrital.edu.co).

that can retouch or edit photographs with the help of the bit mapping system. It uses a layer-based editing system that can retouch specific parts of the image without affecting the other layers. One of its main features is that it can automatically generate new photographs based on a database.

B. DXO Optics Pro

Fig. 2 DxO: advanced photo editing software [2]

DXO Optics Pro is free software dedicated to the professional editing of photographs. It uses PRIME which is in charge of analyzing the structure of RAW files. So, that the fundamental parts of the image are highlighted. This leads to a significant reduction in the noise level. Some of its features include increasing the level of detail, optimizing exposure and adjusting the contrast.

C. A Fast GNU Method to Draw Accurate Scientific Illustrations for Taxonomy

In [3], the techniques used to create digital images are discussed. These are new creations based on previous images. The methods described include bit mapping and image processing programs (GNU (GIMP).

D. Exposing Photograph Manipulation with Inconsistent Reflections

Reference [4] focuses on finding the reflections causing imperfections in photographs. This analysis uses basic geometry rules of reflection and linear perspective projection. Minimal suppositions on the scene's geometry are made and it only requires that the user identifies the corresponding points in an object and its reflection.

E. 'Shrekifying' Faces could Protect Privacy Online

Reference [5] centers in an algorithm that seeks to improve the security in social networks by changing the face of one photograph by artificial faces. This is achieved with the help of data mining.

F. The Download Directory

Reference [6] is dedicated to evaluating computer applications. Among them, the lot-based image processing is characterized by simultaneously making changes in different photographs according to the user's preferences.

G. Getting That Look (Cover Story)

Reference [7] is dedicated to the performance of tests on photographs created by professionals where each one describes the method that is most suitable: RAW conversion software, Adobe Photoshop, Daryn LaBier retoucher to help visualize the final image using the capture of Phase One, etc.

III. METHODOLOGY

Facial profile: With the help of association algorithms, some correlations are created between the most highlighted attributes in images from databases. This leads to a facial profile through the analysis of different photographs since one is not enough. It is possible to create a 3D model based solely on the user images, but we will focus only on 2D profiles.

An association model will be generated which highlights the main features of the photograph that needs to be treated. Some rules will be implemented in the algorithm in order to predict the user's preferences based on a set of elements that includes identifiers that establish a pattern. When the model is implemented, it will generate predictions related to the user's preferences which will be the result of grouping data iterations of different photographs. The preferences will focus mainly on the shape of facial features.

In case the database is scarce, the system will also be supported on the forensic method for facial reconstruction based on the shape of the skull. This mechanism is achieved by initially making 2D sketches on the bone complexion and moving on the muscular reconstruction as shown in Fig. 3. The forensic algorithm used is called surface reconstruction or anthropometric modeling which consists of gathering points that describe the surface of an object (or in this case a face) based on the geometry which gives the positions, shapes and dimensions. After grouping these points, a sort of faceted eggshell is created, and this type of mapping generates a parameterization. Nevertheless, the focus will center on a 2D profile since the algorithm is too complex for the desired application when working with 3D reconstruction.

Image analysis: After having an established facial profile, the algorithm proceeds to editing the photograph with the help of segmentation which divides the digital image into different parts so that specific parts can be retouched. This is also complemented by bit mapping. This process is similar to the algorithm used by scientists from the MIT (Massachusetts Institute of Technology) that generate a recognition result based on images and previously established patterns [8]. No

matter in what angle the object or face is seen, it can be easily recognized so that editing can be performed.
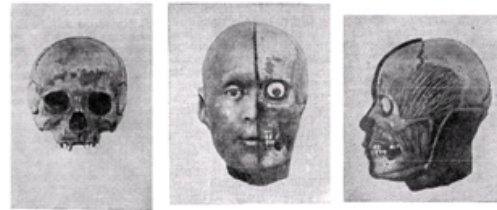

Fig. 3 Image from the facial reconstruction of Valentina Kosova [8]

A. Tools

- JavaScriptSQL (JS ObjectDetect library): This tool enables the interaction of the users with an online database by modifying the supplied data. ObjectDetect is based on the OpenCV library and can recognize images (movements when using the computer's camera) instead of using a database.
- MATLAB: This mathematical software is based on the use of matrices that includes an Image Processing Toolbox. Images can be retouched one section at a time without the need of affecting the rest of the images

Design: To implement the application, two modules were used:

- Databases: This module will be implemented in a browser since the application is portable and needs to establish a facial profile based on a wide database which is too heavy for a mobile device. Therefore, we will use the cloud tool via a browser and the module will be oriented to generate a facial profile.
- Mobile application: This module will be the interface of the application and will be implemented in mobile devices and its purpose is retouching the images as the user wants.

IV. PRELIMINARY DESCRIPTION OF THE MODULES

A. Database

The database is programmed with the JS ObjectDetect library and allows the user to generate his facial profile in two different ways. The first one consists of direct recognition of his face with the help of the computer camera and includes a facial and movement recognition tool which leads to a first profile. The second method is based on using a JavaScriptSQL

tool regarding online databases. With this library, a facial profile is built by gathering various images given by the user and implemented into the online database.
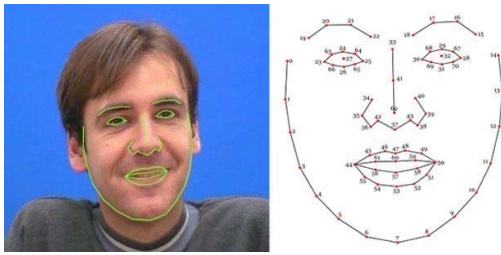

Fig. 4. Clmtrackr: A javascript library for fitting facial models to faces in videos or images [9]

B. Mobile Application

Mobile application module will be developed with the Image Processing Toolbox that includes different algorithms that can modify an image with matrix segmentation on every image, direct enhancements (color, tilting and resolution), geometric transformations and other characteristics that offer the desired retouches. Since the facial profile was generated in the previous module, it will only focus on retouching the image chosen by the user given the specifications that he offered during the creation of his profile. As a part of MATLAB, the application will only be available for Android devices.

V. IMPLEMENTATION OF THE ALGORITHMS

A. Image Digital Processing

The images will go through different processes, so they can be set apart and treated according to the user's needs.

B. Grayscale

The RGB model is used which consists on assigning an intensity of the primary colors (red, green and blue) to every pixel according to the intensity of every color. Since they are blended, a pondered average is executed to convert them into a grayscale with the ObjectDetect tool.

C. Image Filtering

With the GaussianBlur tool from OpenCV, the color's intensity variations are softened by assigning to every pixel an average value of the neighboring pixels.

D. Feature Extraction

After highlighting the main characteristics of the previous processes, the most repeated features are used to establish a framework in case the tilting of a photograph does not allow the recognition of the face's main features. In this case, a rotation operation is executed.

E. Geometric Rotation

With the help of data mining, a rotation profile is created, and a scale is also given. The geometric transformations are made in MATLAB by separating the face into matrix-based sections and geometrically displacing the pre-established values.

VI. DEVELOPMENT

The first phase of the web app was developed in a website programmed in JavaScript with the help of a library called ObjectDetect. It allows the storage and modification of the supplied data with the help of a classifier that specifies the shape, scale and the position in the studied region.
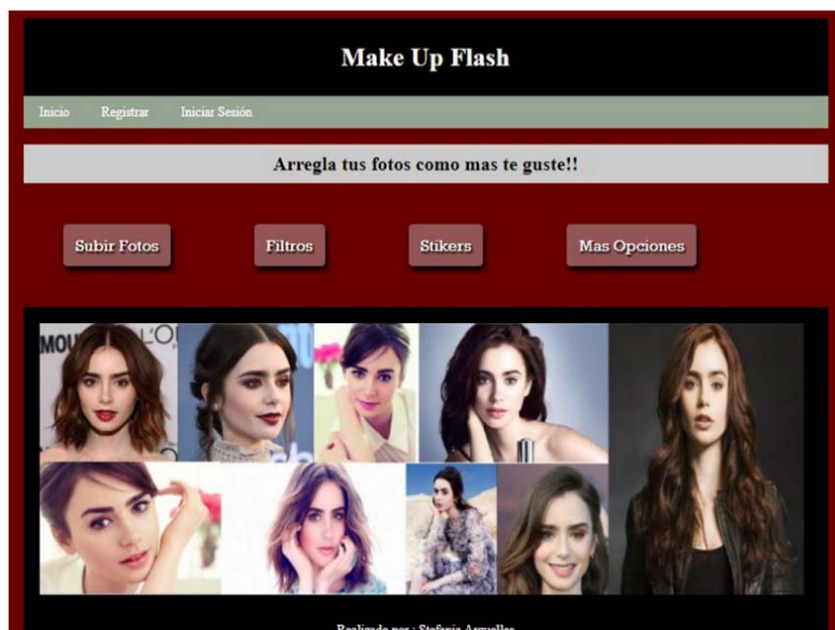

Fig. 5 First prototype of the web application

To perform facial recognition, the cascade classifier option is used to identify the areas of the face by fragmenting into a set of smaller classifiers that cover specific areas of the face. The database of the application will be created with the JavaScriptSQL library since this database can manipulate files online. The images used in this recompilation are free to use.

With the libraries from MATLAB, a change in the images' color is generated so the retouches on color images move on to a grayish tone. This is achieved by taking the image as a file and retouching the pixels one section at a time thanks to the Image Processing tool. For the retouching process, the meshgrid and linspace functions are used to relocate the image pixels and generate the desired retouch.

Fig. 6 Image before and after the change of RGB format in MATLAB

VII. ANALYSIS OF RESULTS

Although the possibility of generating a mobile application was stated, only the web module could be generated with basic functions that can modify the color as seen in Figs. 5 and 6. The use of the database with the JavaScriptSQL allows the user to generate a larger database thanks to the use of a cloud as memory as was initially planned. This did not allow the lot-based image processing as stated in "the download directory" [4]. Due to several circumstances, it was not possible to automate the operation of the app as was mentioned in the beginning. This led to a direct interaction with the images from the database and not with the help of data mining.

VIII. DISCUSSION

The lack of mining in the app does not allow the implementation of editing methods such as the GNU or significant facial changes such as the security one in "Shrekifying" faces could protect privacy online [5]. Because of the lack of knowledge in developing the algorithms in MATLAB, this mathematical tool can perform a linear perspective projection as was mentioned in "Exposing photo manipulation with inconsistent Reflections" [4] but this reduces the quality of the image in about 80% compared to the process mentioned in the article.

IX. CONCLUSIONS

The library used turned out to be a very complete tool for image processing since it includes facial recognition and data modification functions similar to those used in OpenCV. Although the ObjectDetect library contains the basic facial recognition operations of eyes, nose and mouth, some

classifiers reduce its performance by 21% (beyond reality face) and 66% (jsfeat).

The web application can be totally developed with a deeper focus towards mobile devices.

When using MATLAB's Image Processing, some filters reduce the image quality by 50% (RGB with infilter) so not all the library's functions are used. Other functions such as infill improve the overall aspect of the image.

REFERENCES

[1] GNU Image Manipulation Program, The GIMP Team, (Online). Available: https://www.gimp.org/ (Last access: 22 03 2017).
[2] DXO, (Online). Available: http://www.dxo.com (Last access: 31 05 2019).
[3] Ghini, L.: A fast GNU method to draw accurate scientific illustrations for taxonomy, University of Pisa, Department of Biology, Pisa, Italy.
[4] James, F.F., O'Brien, Arid, H.: Exposing Photo Manipulation with Inconsistent Reflections.
[5] 'SHREKIFYING' Faces Could Protect Privacy Online. Engineering & Technology (17509637); Aug/Sep2015, Vol. 1 0 Issue 7 /8, p 20-21, 2 p, 2 Color Photographs
[6] The Download Directory. Micro Mart; 2015 Special Issue, Issue 1 358, p 94-98, 5 p
[7] Getting That Look. (cover story). Popular Photography; Oct2015, Vol. 7 7 Issue 1 0, p 61-66, 5 p
[8] Gerasimov, M. M.: Bases Recovery Face On Skull. State Publishing House "Soviet Science", Moscow (1949).
[9] «40 JavaScript Libraries You Shouldn't Mis,» WebToolsDepot, 30 Janaury 2014. (On line). Available: https://webtoolsdepot.com/40-javascript-libraries-you-shouldnt-miss/. (Last access: 28 03 2017).