Philip Lee
Philee

CS 231M Project Proposal – Automatic Picture Facial Hair Augmentation

1. Introduction

I propose an android application that takes a picture and automatically detects a face, its pose, and interest points on the face. Using this information, I plan to superimpose an image of facial hair onto the picture of a face. I will first concentrate on processing images of mustaches onto still images of a user's face. If time permits, I will add support for real time video and augmentations of other kinds of images.

1.1 Problem Description

The major technical challenge of the application will be to locate a user's face, find interest points on the face, and estimate its pose. To restrict the problem, I will have the application take a single picture with the assumption that there is only a single face in the picture. In addition, I will assume that the lighting conditions are such that the face is easily discernable. As time allows, I will add more features and add robustness to my total system.

An extension of the project may be to augment an image of the facial hair on top of a real time video. Additionally, different varieties of augmented images (glasses, wigs, mustaches, beards, etc.) may be supported if time permits.

1.2 Motivation

This application will primarily be for recreational purposes. The primary goal of the app is to have a novel use of mobile computer vision techniques. However, there are some real uses for this application. For some people, the author of the project included, growing facial hair is a long process and commitment. Several weeks or months of unkempt appearance may result from the decision to grow a mustache. A quick visual image of a hypothetical mustache (or other facial hair) could help someone decide if the commitment to grow facial hair would be worth it.

On a more serious note, there has recently been an interest in using virtual reality to help online clothing retailers show their clients how they would look in different clothes [1]. This application could be an extension of that, showing customers how they would appear wearing different kinds of glasses, jewelry, tattoos, and etc.

2 Technical Details

I plan to use the OpenCV library on the Android platform to develop my application [2]. My project will leverage several topics from the class to accomplish its goal.

2.1 Proposed Plan

I will begin with the application framework provided in a previous programming project. This will allow me to focus primarily on the computer vision aspects of my endeavor. Using OpenCV, I will process images of a user's face by first applying the Viola-Jones face detector [3]. If a face is located, I will use Active Appearance Models to locate interest points on the face [4]. This will be accomplished with an open source OpenCV implementation [5]. Next, the application will calculate the homography required to warp a template image of a mustache (or other image augment) to the pose of the face using RANSAC or other suitable technique [6]. Then, I will apply the homography to the template image and blend superimpose the two images with a weight map derived by thresholding the template image and using the same homography to warp the thresholds.

2.2 Target Mobile Platform

I plan to implement this project on the Android platform using the C++ OpenCV library similar to the programming assignments in this class. I will use the class provided NVIDIA Tegra Note Tablets to develop my application.

3 Milestones

The plan for the application and milestones are detailed in Table 1 below.

Table 1: Major Milestones

Date (2014)	Milestone
5/20	Project proposal finalized and submitted.
5/23	Initial pipeline and face detection working
5/27	Active Appearance Model library integrated.
5/31	Interest point homographies estimated and image augmentation completed.
6/2	Project presentations begin.
6/5	Additional features / Speed optimizations (if necessary) completed.
6/9	Final testing and project report complete. Project Due date.

4 References

[1] Mashable. (2014, April 2). *When Will AR Replace the Fitting Room?* [online]. Available: http://mashable.com/2014/04/02/augmented-reality-dressing-room/

[2] Culjak, I.; Abram, D.; Pribanic, T.; Dzapo, H.; Cifrek, M., "A brief introduction to OpenCV," *MIPRO, 2012 Proceedings of the 35th International Convention* , vol., no., pp.1725,1730, 21-25 May 2012.
URL: http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=6240859&isnumber=6240598

[3] Viola, P.; Jones, M., "Robust real-time face detection," *Computer Vision, 2001. ICCV 2001. Proceedings. Eighth IEEE International Conference on* , vol.2, no., pp.747,747, 2001. URL: http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=937709&isnumber=20294

[4] P. Tresadern, M. Ionita, T. Cootes, "Real-Time Facial Feature Tracking on a Mobile Device". *International Journal of Computer Vision*, vol. 96, no. 3, pp. 280-289. Feb. 2012.

[5] BITS Pilani Goa Campus, India, "Active Appearance Model Face Tracer using OpenCV in C++". [online]. Available: https://code.google.com/p/aam-opencv/

[6] Richard Hartley and Andrew Zisserman (2003). *Multiple View Geometry in Computer Vision* (2nd ed.). Cambridge University Press.