Final Project Proposal

Team name: Shallow Faces

Skill Assessment

Team member A: Frontend, design, project management

Team member C: Backend, thinking about src implications,

Team member J: Frontend, data visualization, have touched C++ several times

Project Idea

Our idea is to create a tool for replacing faces in an image with a randomly-generated face. We will initially use our tool on our own images of various people, who have consented to being used in our project. If we have time and our tool is fast enough, a stretch goal is to be able to replace the face of someone through webcam.

We will construct a dataset of pre-generated anonymous faces, and we will use a pre-trained model to locate faces in the input images.

The bulk of our work will focus on finding a good match from the set of anonymous faces. We will attempt to select an appropriate replacement face by matching up skin tone, gender, and possibly age/expression, and angle. We will also need to extract the replacement face from its background, and potentially adjust lighting (shadows falling on the face?).

Socio-Historical Context

Many people want to obscure the faces of people in an image or video to protect their privacy. This can help protect protesters, and could also serve as a fun effect for social media apps. While it is of course possible to blur or completely black out faces from an image, we hope to improve upon the status quo by performing automatic redaction, and potentially even attempting to match expressions between the source and anonymized face.

Impacted Groups

1. Protesters would be able to use this technology to safely organize a protest without revealing their face (making it harder to identify them). Additionally, videos of protests (with all the faces replaced with different faces) would be much more emotionally charged than a sea of blurry or fully covered up faces, leading to increased international support.

2. This project would impact people who are in the witness protection program. People in the witness protection program are trying to avoid being seen by people who might want to harm them, they could use this tool to appear in photos and videos to remain anonymous and untraceable.

3. Criminals who are holding hostages could use this tool in a harmful manner. Criminals intending to make a video with demands in order to release a hostage might want a way to anonymize themselves so that they don't risk getting caught. Our tool could allow these criminals to anonymize themselves while still having a human face in the video, instead of a mask or blurred face.

Data

We will use the set of pre-generated anonymous faces from the StyleGAN2 paper (on Google Drive) for replacing faces of real people in our images, and may augment this with additional public data generated by similar algorithms.

For images of real people, we will capture our own images and ensure that the people included have consented to being used in our project, or use images of celebrities.

Software/Hardware

We plan to use OpenCV's face detection module with a pretrained model. We plan to build the custom code in Python. We'll use our laptops and the CS machines to do any processing work, and we'll use laptop webcams if we get live replacement working.

Team Member Roles

Team member A:

- skin tone/gender estimation
- build the UI/CLI for interacting with this tool

Team member C:

- alignment of anonymous face over real one, including scaling
- calculating progress metrics

Team member J:

- integrate the face detector
- background removal of generated faces

Progress Metric

"does it look good?"

- **Skin tone matching**: Euclidean measure of color difference between original face and replacement face.
- **Pose matching**: distance between old features and new features
- **Background removal percentage**: increase in absolute value of Sobel filter (measuring discontinuities introduced into the image, zero is best)
- **Qualitative**: Inflicting this upon our friends and asking their opinion

Technical Problems Forseen

One technical problem that we foresee is how computationally expensive this tool will be. It will be important to ensure that this tool runs fast enough in order to be usable, especially if we decide to implement live webcam anonymization.

Another problem we forsee is how well we will be able to replace faces that match the gender of the person we are trying to anonymize.

Another potential technical problem could be performing feature matching on a face without glasses with a face with glasses. We would need to determine a way to ignore detected features from the glasses when matching and re-sizing faces.

Resources Needed

We don't think we will need any special software/hardware aside from our laptops, the CS machines we can connect to, and guidance from our TA.