



## Colorism in Snapchat Face Filter Results

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**ABSTRACT:** Due to the increasing amount of face filter usage on social media, it come to recognize the danger of ignorance of a diversified beauty standard. We conduct a research in order to acknowledge the colorism and racism in face filter results, as social media, the main platform using face filters, performs a major role on adolescents' perception of beauty and confidence.

**KEYWORDS:** Colorism, Racism, Face filter, Facial recognition, Snapchat, Bias on development of AR products

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### I. INTRODUCTION

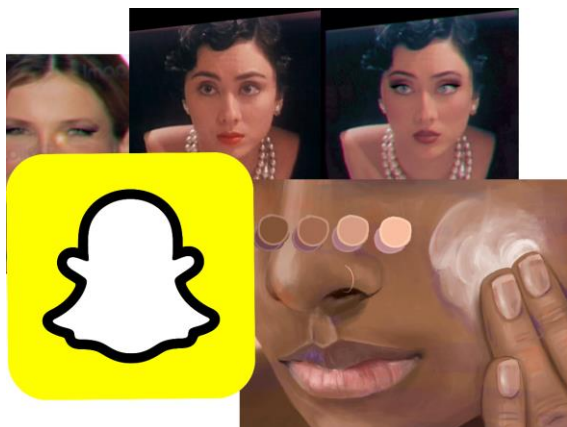
The seeking for beauty has long existed in human society. Since the first shape to represent human has been drawn, it has been present that the temptation of making the object fitting in more of a person's aesthetic and their ideal beauty is continuous. From portrait era, the artist have the responsibility of creating the glamorized look for the royals and nobles. To this day, the camera adapts the usage of portrait in a massive amount of areas as a cheaper, faster and simple tool for humans to capture the moment. However, the problem appeared as the camera can only capture the moment instead of the imaginative glorified image that is ideal in people's mind. There are ways to solve the problem.

Although It is possible to use photo-shop to change the effect of the camera, the requirement for computer and artistic skills ceased the original advantage of phone and the thrill of capturing the moment at anytime and any rate. If cannot change the image using high level photo-shop, how about cutting to the chase and make what people film change, as in putting on makeup. But then this method will still defeat the purpose of camera by what means its capturing the moment. What if the environments contrast the makeup look? More importantly, what if the makeup does not last long when you are facing some of the rough environment?

Here comes the most effective way to create the ideal image. Face filter, the process of detecting an image of a face and superimposing virtual elements onto that face via AR, is a popular way to create an ideal self-image on social media.

Bias in these other systems such as commercial face recognition APIs, or medical system fails has been studied in [1],[2] works. However, biases in face filters are not well studied. Therefore in this work we study bias in face filters in Snapchat, one of the most popular face filter application around the globe.

During the process of the experiment, we choose a selection of filters and put in face images of various racial groups from the RFW dataset. We later perform a qualitative analysis of bias in Snapchat face filters. We then divide the result of the analysis into different categories created. Using the difference in filtered traits in order to better distinguish possible bias, the categories are defined as Special Effects,



**Figure 1:** Snapchat face filters: In this paper, we analyze colorism in Snapchat face filters.

**Figure 2:** Colorism themed picture: In this paper, we discuss potential colorism incidents in face filter results.

Facial Makeup Application and Re-Pigmentation. We find that the current filters on market do have existing bias.

In Figure 1& 2, we show teaser.

## II. RELATED WORK

Several studies have already covered the existence of facial recognition in different professional areas, for example, medical, commercial, general machine learning area, and so on.

In the Medical area, the report assess whether the performance of a deep learning algorithm designed to detect low left ventricular ejection fraction using the 12-lead ECG varies by race/ethnicity and to determine whether its performance is determined by the derivation population or by racial variation in the ECG. Although the study informed that the difference in race will not affect the usage of the ECG on a large scale, the researchers recommend to test every possible diverse ethnic, racial, age, and sex groups for all new artificial intelligence tools to ensure responsible use of artificial intelligence in medicine.[2]

Commercial- General machine learning and artificial intelligence study-investigated different real-world applications that have shown biases in various ways, and we listed different sources of biases that can affect AI applications. We then created a taxonomy for fairness definitions that machine learning researchers have defined to avoid the existing bias in AI systems. In addition to that, we examined different domains and subdomains in AI showing what researchers have observed with regard to unfair outcomes in the state-of-the-art methods and ways they have tried to address them. [1]

NIST-the tested algorithms tended to misidentify photos of Asian and Black individuals more than they misidentified Caucasians.[3]

Thus, we conclude a new research project to draw focus in the racial bias in face filter.

## III. METHOD

### A. Producing face filter results with RFW dataset

For the dataset, we chose from both the RFW dataset and the fair-face face dataset, selecting Caucasian, African, Asian and Indian race group.

The research group decided to employ one of the biggest provider of face filter service as study case - snapchat. The application snapchat are not available on computer. However, there is an application created by the same company which has the same face filters. We used python to code making the image in the dataset able to show on the snapchat app. In order to record the process and later analysis, we used OBS system to film the screen. We change the video input from the laptop's camera into the snapchat image outcome. We installed miniconda and set up in order to fit in the Mac system. We used GitHub for online code sharing the project to sync up the difference of coding.

Creating a new conda named face-filter using the code "conda create -n face-filter python=3.7", then install the required dependencies in order to operate the program. Needing numpy, opencv-python, pillow, pyvirtualcam to set up the conda env which allows us to go to the next step. Running python send image.py -this is a code to send dataset image thorough snap camera.

In order to select random images in the dataset to stimulate the real world filter usage scenario, the code first set random seed for reproducible random sampling. Then, the code computes per race subset size. It

choose random sample of images for each race. The next step of the code is to copy selected images into new directory. Then, we coded to verify whether the number of images that are correct. When the code is finished building, it is important to test run on a visualization of the OBS camera, for example, this experiment we used zoom and setting up the camera source to OBS virtual camera.

After running the code and check the plain result, it is the time to put on the filters. Open the snapchat and set the media source to OBS virtual camera, select a filter and then the snap camera will apply the filter to the OBS virtual camera feed.

To save the output of snap filtered images, we used OBS. After adding snap camera as a media source, the image result will appear. However, the resolution will not match since snap camera is 1280x720 comparing to OBS which has a resolution of 1920x1080. We can fix the resolution by dragging the corner of the image. Now that the image output is in proper size, it is possible for us to save the output as a video using the app's recording function.

After test running the code and the applications, it is the time to extract the datasets and use the RFW datasets.

Then, typed the code "python generate rfw dataset.py" which generate subset dataset picking out 40 images randomly from 40 thousand image total in RFW dataset, 10 per race.

After having the dataset for the next process, it is the time to send the subset 40 images to the snap camera and save the outputs. First, open snap camera and select a filter. Then run the script we coded "python send dataset images.py —snap-filter-name [actual filter name goes here]" which first verify the usage of OBS virtual camera, then get the image paths, warming the computer up, sending the images to the virtual camera and cooling the computer off." Then, begin the recording and the outcome on the screen will be 40 randomly selected images with snapchat filtering effect. After the images are done, move the output video file to output/rfw-subset-40/[filter name]-video to begin process the data. Now, it is the time to process the OBS video recording of the snap camera output. First, running the command process snap output.py in order to process the outcome. We coded to verify video file exists. Then, the computer gets and verifies the image paths. The script will process the video and discard initial frames. Next, the code find matching output frames that we needed and save them as images. Then the code will generate a directory and an .html files as the visualization. The visualization contains 40 images which correspond to the 40 dataset images with the snap filter applied. In which the .html files contains a side by side view of the filter effect and the original pictures. Then we repeat the process for several times to get more data to process and get source.

Last, in order to gain more data for the analysis, we repeat the same process over for 10 times to focus analysis on 400 different images on every filter picked. We picked 12 different filters in total, per 4 in the same category as stated in analysis.

#### IV. ANALYSIS

##### A. face filter direct analysis with RFW dataset

The face filter existed on the market can be classified into three category.

1) Special Effects: These types of filter add a layer of non-existed structure onto human's face. The same as its definition, the filter focus on the non-existed shapes and structure which is the effect people are hoping to achieve using this filter. However, this kind of filter still provides its own ways of shifting the perception of beauty. Taking the example of the "Mavka" filter, in Figure 3 we show an African male using the "mavka" filter.



Figure3: Subject is an African Male, using the "Mavka" filter

The filter increased the eye size and made the general face shaped flat. The creation of making the face flat is in order to reduce the nose height, turning a perceptual large nose into a smaller, less structured nose. This showed the beauty stander made the filter to have the effect of creating a smaller, more delicate nose on a photo. Due to more and more people using this type of filter, a false perception of everyone have small nose appears which creates anxiety and stress. The latter two influenced the whole generation's state of mind.

2) Facial Makeup Application: this type of filter has the same effect as adding on make-up. It puts a layer of features on the user's face and create a look similar to the user's purpose if ideal. These types of filter tend to create most amounts of shifts towards the human face. It is because it serves as an easier but more powerful version of makeup allowing the user to exceed the boundaries of real life and change their face entirely. Taking the filter "90's Brows" as an example, in Figure 4 we show an Asian Woman with the comparison of before and after filtered face.



Figure 4: Subject is an Asian Woman, using the "90's Brows" filter

The after filter appearance shift human facial structures, instead of just adding effects to brows and 90's effect as the filter description said. The filter changed the user's eye color into blue and also added on a more definitive eyelash. The want of a different eye color have always existed in humans history. A report from the CDC points out that there are approximately 45 million people in the united states wear contact lenses[4]. Another market report from fortune suggested that the global false eyelashes market size was 1.14 billion USD in 2020 [5]. The two statistics suggest that there are a lot of people payed from this particular trend of beauty, which continue to shift when more and more unique face filter or makeup tools begin to place in the market. In this genre of face filter, the use of the filter sometimes serves as an advisement for real life makeup company as a "sample use result" given to the user to know what may the real product looks like. However, the effect itself does not play in all kind of face structure. The result maybe played into one form of beauty like previous image where people with a bigger nose tend to profit. Again, the simplicity in use and easy to access in face filter showed its user the ideal image of themselves that may not be shown in daily life. These have the potential to cause stress and anxiety to an extending of face dysmorphia. The filter "90's brows" not only add a pair of eyelash and change the eye color. It made changes to the human's eye shape, changing all the down shaped eye in the experiment into up foxy shaped eyes. The filter also make shift to the user's nose, distort the bridge of nose to let it become thinner. There is highlight added on the nose, letting the nose seems more structured. The filter also made changes to the lip. The filter increased the fullness, made the lip line more defined and changed the lip color and shade. The chin of the user was also changed into a more oval shape. The face also added some colored foundation which changed the face tone of the Asian and black faces to become lighter.

3) Re-Pigmentation: The third type of filter is "Re-Pigmentation". This type of filter usually lighter pigmented the subject's face. Directly turning the lightness of the face up to 20 percent based on a data of 200 images and 4 different filters, this filter truly most directly showed the existence of the colorism in face filter case. Using the "Procreate" App, picking out a pixel and get the value of its brightness. In Figure 5 we show an African Male, using the "soft light" filter. The subject's skin tone has gone up by 10 percent.



Figure 5: Subject is an African Male, using the "soft light" filter

## V. CONCLUSION

The certain aesthetic that people promote is the main reason behind the existence of colorism biased face filters. The unhealthy chase to make a person more close to the main stream beauty standard is definitely very toxic. However, the existence of poor structured filter made the beauty standard more popularized and consumed by a lot of people. This creates a false image where everyone seems to have an ideal face, which influences the mental health problem that existed in the population. Until more and more diverse face filter are created, the targeted users will keep on stuck in the perceptual beauty standard which may influence them into making more difficult and dangerous decisions.

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