Analyzing the Symbolism within Shot Marilyn Paintings

STA 160 Final Project

Spring 2023 Professor Hsieh

Group Members: Yali Bai, Gabriel Josh Udasco Balingit, Ka Wai Sit, Ru Han Wang

---

ABSTRACT

This analysis combined various statistical methods with an examination of characteristics conveyed through color, symbolism, and artistic techniques in a series of five Marilyn artworks by Andy Warhol. By employing the RGB projection graphs and the RGB value distributions, the study explored the color dynamics and their meaning in the artworks. Each artwork offered a distinct perspective on Shot Marilyn Series, delving into the complexities of fame, emotion, and societal expectations. For instance, "*Shot Orange Marilyn*" conveys emotional positivity and freshness through color consistency and neutrality. "*Shot Red Marilyn*" symbolizes intense rage with its prominent use of red, while "*Shot Turquoise Marilyn*" represents intelligence through bright colors and illuminating effects. "*Shot Blue Marilyn*" juxtaposes beauty and fragility with its predominant use of blue, and "*Shot Sage Blue Marilyn*" evokes a sense of dull lifelessness with its grayish blue tones. Through this analysis, viewers are prompted to reflect on the multidimensional nature of Marilyn Monroe's persona and contemplate the wider implications of celebrity culture and human emotions. The findings shed light on Warhol's artistic choices and thematic exploration within the Marilyn series, providing valuable insights into the visual aesthetics and symbolism employed in these iconic artworks.

Our analysis is mainly the following:
1. **Transform the images to the matrices with RGB values**
2. **Compress the images into different color components**
3. **Extraction by applying the mean hierarchical clustering**
4. **Direct comparison of 2D density plots and the density bin distribution**
5. **Background layer comparison by separating the outer and inner layers**
6. **Visualization of 3D interactive plots, 2D RGB plots, and 2D density plots**

I. INTRODUCTION

According to the article, "A Visual Critique of Warhol's Shot Sage Blue Marilyn, 1964" from The Interior Review, we aim to analyze a collection of five paintings by Andy Warhol featuring Marilyn Monroe for this project. The five original images are the following:

- Image 1: *Shot Orange Marilyn*
- Image 2: *Shot Red Marilyn*
- Image 3: *Shot Turquoise Marilyn*
- Image 4: *Shot Blue Marilyn*
- Image 5: *Shot Sage Blue Marilyn*

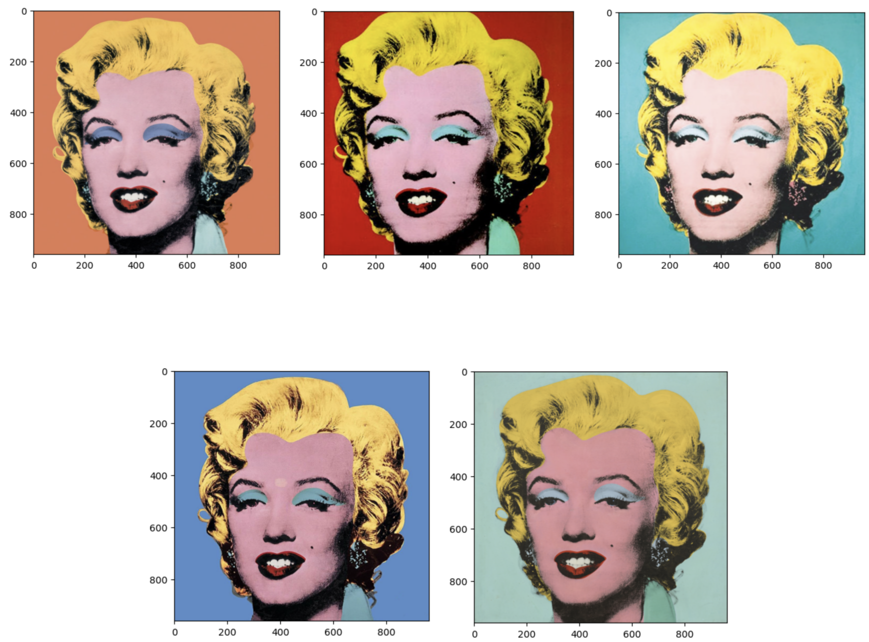


Figure 1: The Original Images

(The 1st row from left to right: images 1 thru 3; 2nd row from left to right: images 4 and 5)

As audiences, we are trying to interpret a series of distinct emotional states by comparing and contrasting the colors and shadows among the 5 printings. In reality, people often believe that the color blue is associated with sadness while the color red is associated with passion. Along the analysis, we will transform each individual image to the RGB (red, green, and blue) space with each axis from 0 to 255. The main idea of the analysis is to separate all the different colors contained in each image and compare all the distinct colors across these 5 images. There are four primary components for each image: the background, the hairs, the skin, and the makeup, which is included with the eyeshadow, the outlines, the lips, the teeth, and the collar. Afterward, we will come up with an emotional interpretation for each painting based on the evidence we obtained from each component.

II. DATA DESCRIPTION

First, we obtained these original paintings from the interior review website. To extract these images, we utilized the URL request method and converted images into matrices using np. array(). Conversion from images to matrices allowed us to conduct data analysis on the images. To enhance the quality of our data analysis, we utilized the highest resolution available for our image data. We attained a resolution of 960 pixels for both height and width, surpassing the resolution of 750 pixels achieved through other methods.

Out of the five images, image 4 stands out as the only one in JPG format, whereas the others were in PNG format. We initially converted the JPG image to PNG for consistency. However, the conversion process caused data loss, resulting in two distinct matrices for the same image at the same resolution. To avoid complications, we opted to keep the original file type.

Upon closer analysis, a dimension discrepancy was noted between the matrix of image 4 and the matrices of images 1, 2, 3, and 5. While matrices of images 1, 2, 3, and 5 consisted of four columns representing the Red value, Green value, Blue value, and Transparency, the matrix of image 4 did not have the transparency column. Further examination revealed repeating values in the transparency column of the matrices for images 1, 2, 3, and 5. We determined the transparency column redundant and decided to remove the transparency column. As a result, we had five matrices with the same dimensions.

We also explored the 3D RGB interactive plots for the original images. Based on the current 3D plot angle, we observe that image 5 is "thinner" than others, which indicates that the colors of the images are highly concentrated/less separate-out. Images 2 and 3 are high in blue, and image 2 is also high in red. However, since the original image contains 960×960 pixels, the interactive feature does not work for the 3D plots.

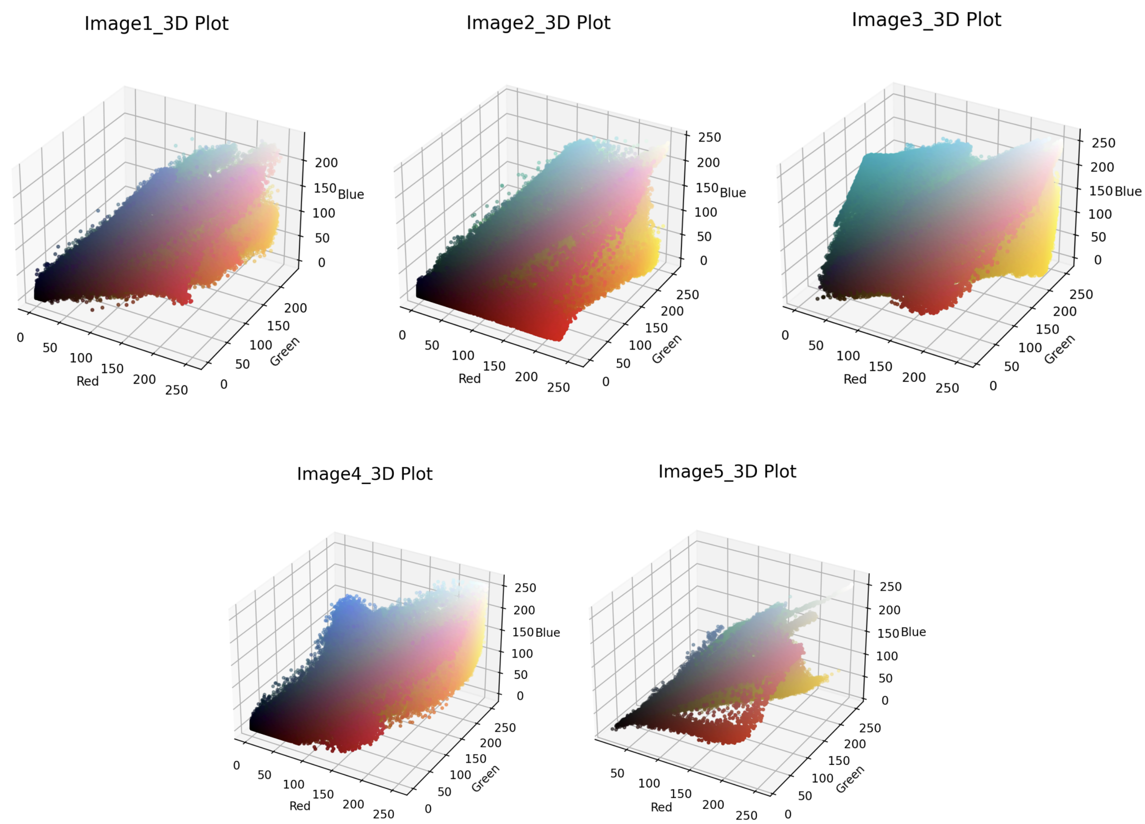


Figure 2: The 3D RGB Plots of Original Images

III. METHODOLOGY

We started our analysis by breaking each painting into separate components (i.e. background, hair, skin, makeup, etc.). Regarding extraction, we applied mean hierarchical clustering based on the RGB values of subsetted regions. This is because clustering with entire images yielded large dendrograms that were often time-consuming to generate and difficult to read. However, the computational cost was still prevalent for small subsets. To address these issues, we compressed the subsetted images by assigning each of their pixels with the appropriate “center RGB value”.

In this context, a “center RGB value” refers to the RGB value at the center of a given in $10 \times 10 \times 10$ cube in RGB space. We represent every pixel in said space with this center value. It is important to note that representation will not always be perfect; however, center values should provide sufficient depictions given the relatively small size of every cube. After this compression process, we extracted all unique center values and proceeded with clustering based on these numbers.

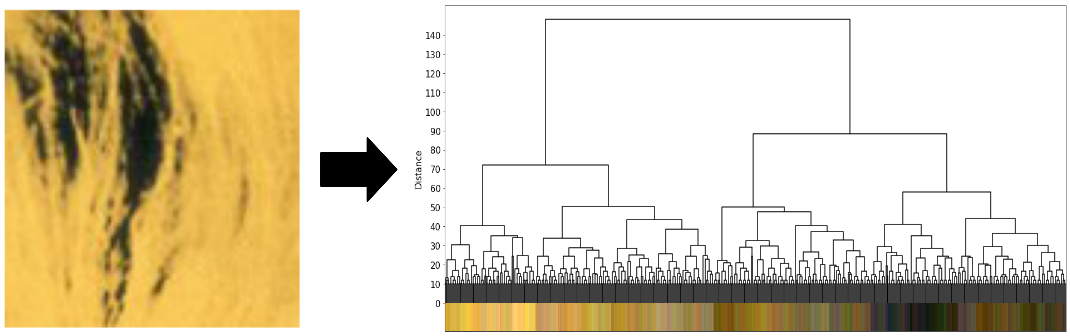


Figure 3: Hair Subset and Dendrogram from Image 1

By applying these different techniques, we were left with more readable dendrograms that took seconds to produce. With these diagrams, we defined a certain distance threshold such that every root branch immediately below it would form an individual cluster, with an example shown below.

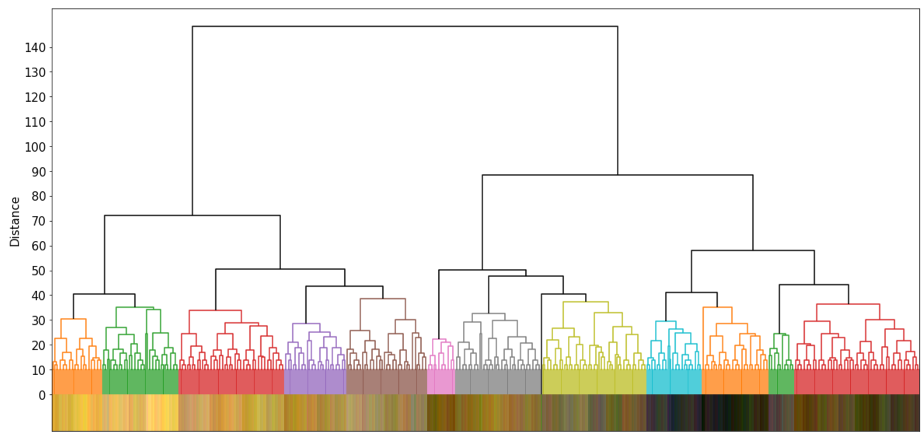


Figure 4: Dendrogram with Clusters formed at Threshold Distance 40 for Image 1

We then selected clusters that resembled colors present in a desired region. A self-defined function would then use this information to locate certain pixels within entire images, specifically those "near" the center RGB values we selected. In this context, "near" is defined as a pixel residing in the $10 \times 10 \times 10$ cubic space of a given center RGB value. Once these points are located, every other pixel is reassigned to a new color to serve as contrast. We then used all of this to generate new images that highlighted desired areas, along with data frames containing all of the exact RGB values within these regions.

IV. BACKGROUND EXPLORATORY ANALYSIS

One of the primary objectives of our project is to examine how background colors affect viewer opinions. The background color plays a significant role in the visual presentation of a painting, potentially shaping and influencing how viewers perceive and interpret the artwork. Through a comprehensive analysis of different background colors in the images, our goal is to determine the extent to which these colors impact and evoke specific responses and opinions from viewers. After conducting our analysis, it becomes evident that each image possesses its own distinct characteristics. Consequently, we want to highlight some key findings and insights regarding the backgrounds in these images.

Different background colors elicit various emotions and moods. Warm hues such as red, orange, or yellow exude energy, passion, and warmth, while cool shades like blue, green, or purple evoke calmness, tranquility, and introspection. Additionally, the background color can create contrast with the subject or focal point of the painting, accentuating and emphasizing its main elements. This contrast directs the viewer's attention and guides their gaze toward the intended focal point, enhancing the visual impact of the artwork. Moreover, the choice of background color range significantly impacts the painting's focal point and overall impact. A broader color range in the background may divert attention from the main subject or objective, whereas a narrower range or a consistent color directs focus toward the intended message. In Warhol's works, the deliberate incorporation of a wider color spectrum encourages viewers to explore the painting's symbolism and meaning.

The findings mentioned above represent significant discoveries from our analysis of the background color data for the five images. Later on, we will delve deeper into these findings by presenting visualizations with explanations to provide a comprehensive understanding of how we address these key findings.

To analyze the background color, we extract a small section, such as a corner or a thin rectangle, to infer the color range of the entire background from this sample. By employing a combination of clustering techniques on those samples, we can accurately deduce the comprehensive color range of the entire background.

For images 1, 4, and 5, we extracted 100×100 square pixels from one corner as our sample to outline the background using its color range. However, the initial corner sample method was unsuccessful for images 2 and image 3. Instead, we obtained good results by utilizing a combination of two thin rectangles from both sides. This implies images 2 and 3 might have a different background color distribution than images 1, 4, and 5.

Figure 5: Image 2 and Image 3 Sample Section

During the sampling process for image 4, we initially encountered an error when attempting to sample the top left corner using a 100×100 square of pixels. We then explored alternative sampling options such as the bottom left corner, top right corner, and a thin rectangle on the left side, but the same error persisted. We concluded that the left side of the background, along with the top corner, shared identical RGB values, preventing effective clustering. To resolve this, we opted to use the bottom right corner as our sample, successfully avoiding the duplication of RGB values found on the left side and top right corner.

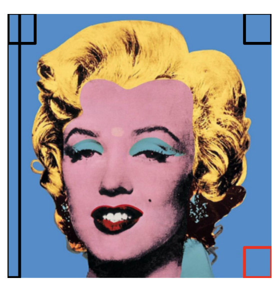


Figure 6: Image 4 Sample Section

In order to analyze the background, we initially intended to visualize the distribution of RGB values for each image using a 3D scatter plot created with Plotty. However, due to computational limitations, we had to explore alternative methods. As a compromise, we opted to generate three 2D scatter plots instead. These 2D scatter plots effectively convey the information inherent in the RGB values by employing the x-axis, y-axis, and color fill as dimensions in the projection.

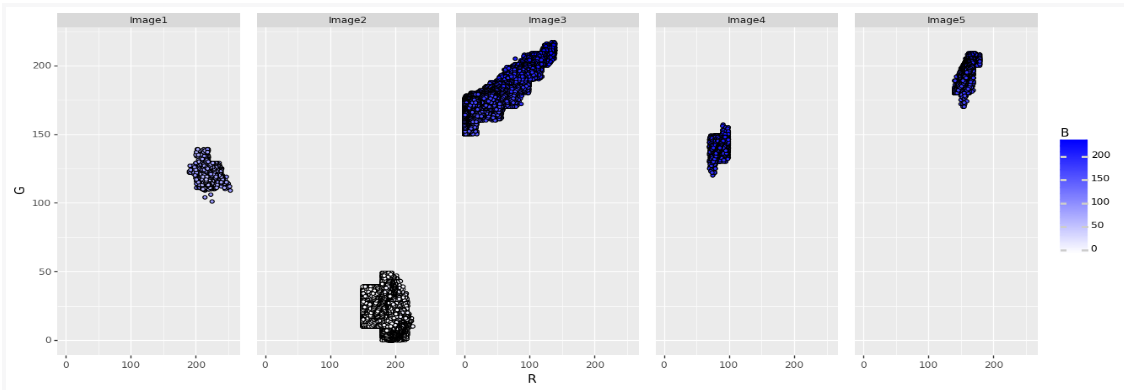


Figure 7: Red (x-axis), Green (y-axis), Blue (color fill) 2D Projection

In the scatterplot with Red as the x-axis, Green as the y-axis, and Blue as the color fill, there is a contrast between the concentrated distribution of RGB values in images 1, 4, and 5 compared to the more dispersed values in images 2 and 3. The blue range is also notable, with images 1 and 2 showing lower values and images 3, 4, and 5 displaying higher values.

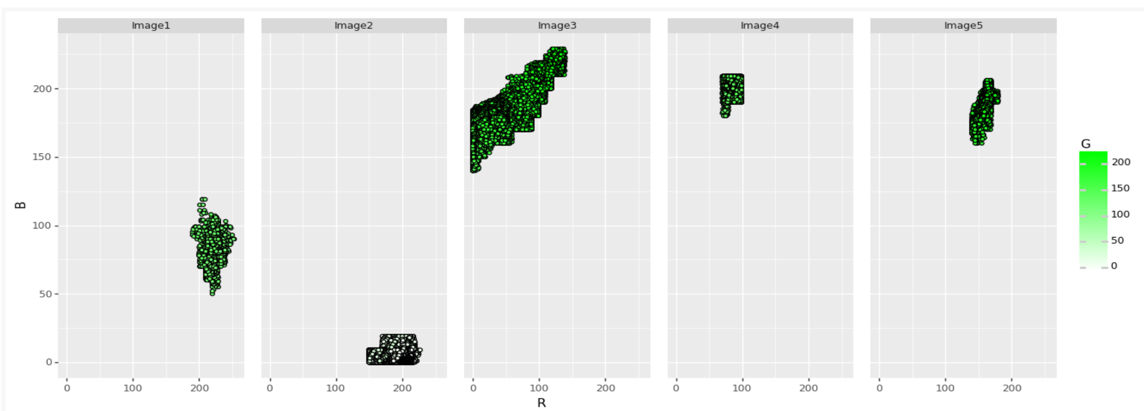


Figure 8: Red (x-axis), Blue (y-axis), Green (color fill) 2D Projection

In the scatterplot with Red as the x-axis, Blue as the y-axis, and Green as the color fill, several observations can be made. Firstly, images 4 and 5 exhibit a narrower range of RGB values compared to the other images. In contrast, image 2 stands out with its lower green values in this graph. Furthermore, image 3 displays a more diverse and spread-out RGB range compared to the rest of the images.

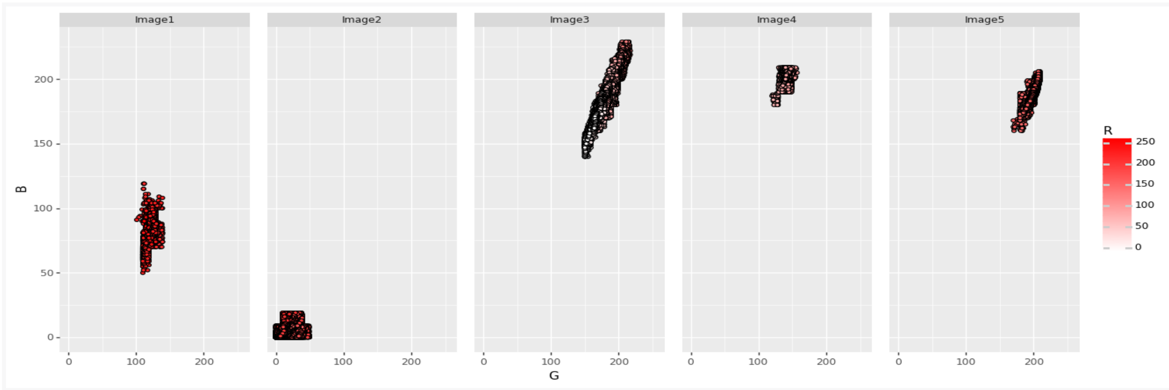


Figure 9: Green (x-axis), Blue (y-axis), Red (color fill) 2D Projection

In the scatterplot, with Green as the x-axis, Blue as the y-axis, and Red as the color fill, there are several distinct patterns. Notably, images 1 and 3 exhibit a broader range of RGB values compared to the other images. Image 3 particularly stands out with its wide range of Red values.

Upon reviewing the three scatter plots, we have noticed a notable distinction between images 1, 4, and 5, which exhibit a higher degree of consistency, and images 2 and 3, which possess unique characteristics. As a result, we have determined that further analysis should be conducted specifically for images 2 and 3, as the information gleaned from the scatter plots is relatively limited for these images.

To conduct a more in-depth analysis of the background, we extracted the background color data from each image and compiled it into a matrix. We then categorized the Red, Green, and Blue values of each image into 26 bins for each color. The bin range is evenly distributed, starting from 0 to 9 and ending with the final bin containing 6 values. This distribution corresponds to the RGB value range of 0 to 255. Using these bins, we generated plots to visualize the proportion of each bin for each color and image.

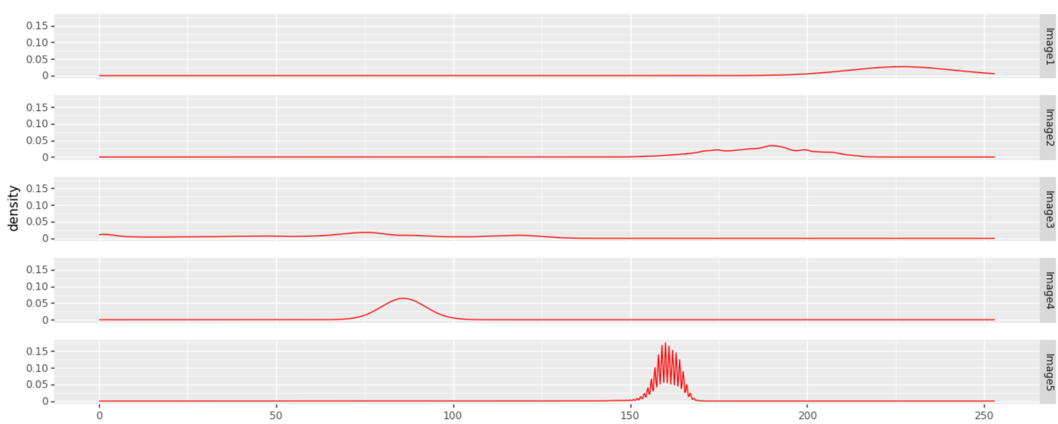


Figure 10: Geom_Density Plot for Red Values in Each Image

We have opted to use the geom_line graph instead of the geom_density graph for the analysis. This decision was based on the observation that the geom_density graph produced misleading results for those images. We suspect that the sensitivity of geom_density to the mean and spread might have contributed to unknown errors.

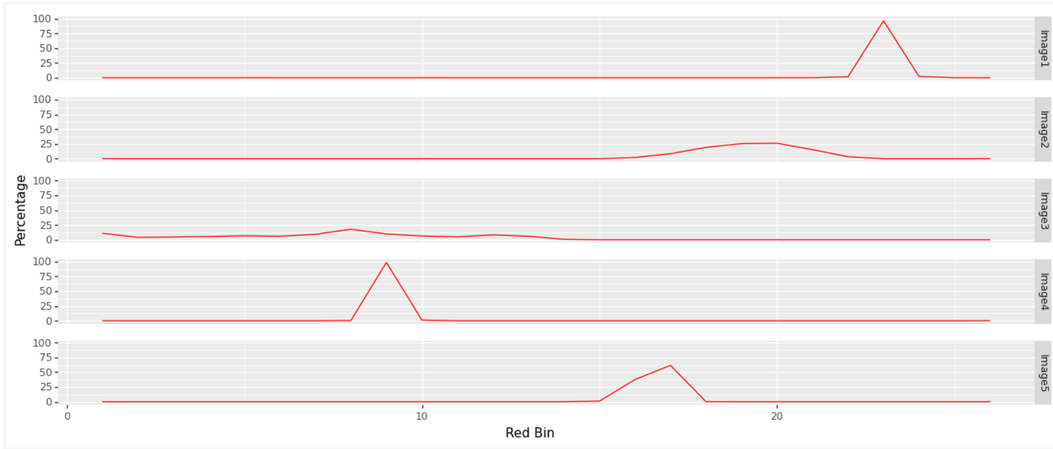


Figure 11: Proportions of Red Color Bins in Each Image

Distinct patterns emerge in the red distribution of the images. Images 1, 4, and 5 display a highly concentrated range, where over 90% of the red values are confined to a single bin. In contrast, image 2 exhibits a less concentrated distribution, with red values spanning across bins 17 [160, 169] to 21 [200, 209]. Image 3 demonstrates a wide-ranging distribution, with the majority of red values spanning from bin 1 [0, 9] to bin 13 [120, 129]. These findings support our hypothesis that image 2 and image 3 differ from the other images in terms of their red distribution.

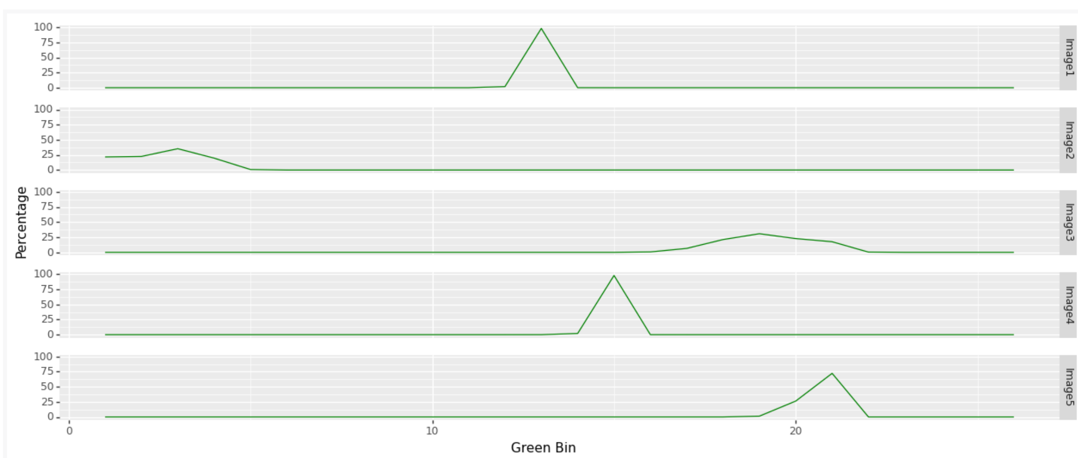


Figure 12: Proportions of Green Color Bins in Each Image

Similarly to the red bin distribution, we observe a similar pattern in the distribution of green bins. Images 1, 4, and 5 show a concentration of green values, with over 90% falling within a specific bin. In contrast, images 2 and 3 exhibit a wider range of green values. Specifically, for image 2, the majority of values span from bin 1 [0, 9] to bin 5 [40, 49], while for image 3, they are primarily distributed between bin 17 [160, 169] and bin 21 [200, 209]. These findings support our assumption that image 2 and image 3 differ from the other images.

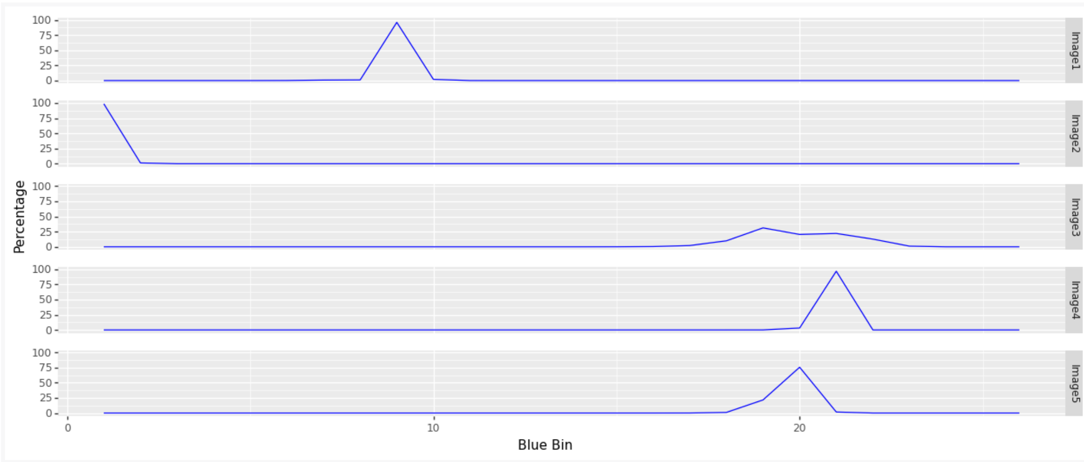


Figure 13: Proportions of Blue Color Bins in Each Image

The distribution of blue bins reveals distinct characteristics among the images. For images 1, 2, and 4, the blue values are highly concentrated within a single bin, with over 90% falling within that range. In contrast, image 3 exhibits a broader range, with the majority of blue values spanning from bin 18 [170, 179] to bin 22 [210, 219]. Notably, image 2 stands out with a highly concentrated blue bin distribution, where the majority of values are confined to the first bin [0, 9]. Image 5, on the other hand, shows a slightly more spread-out distribution, with over 90% of values falling within bin 19 [180,189] and bin 20 [190, 199].

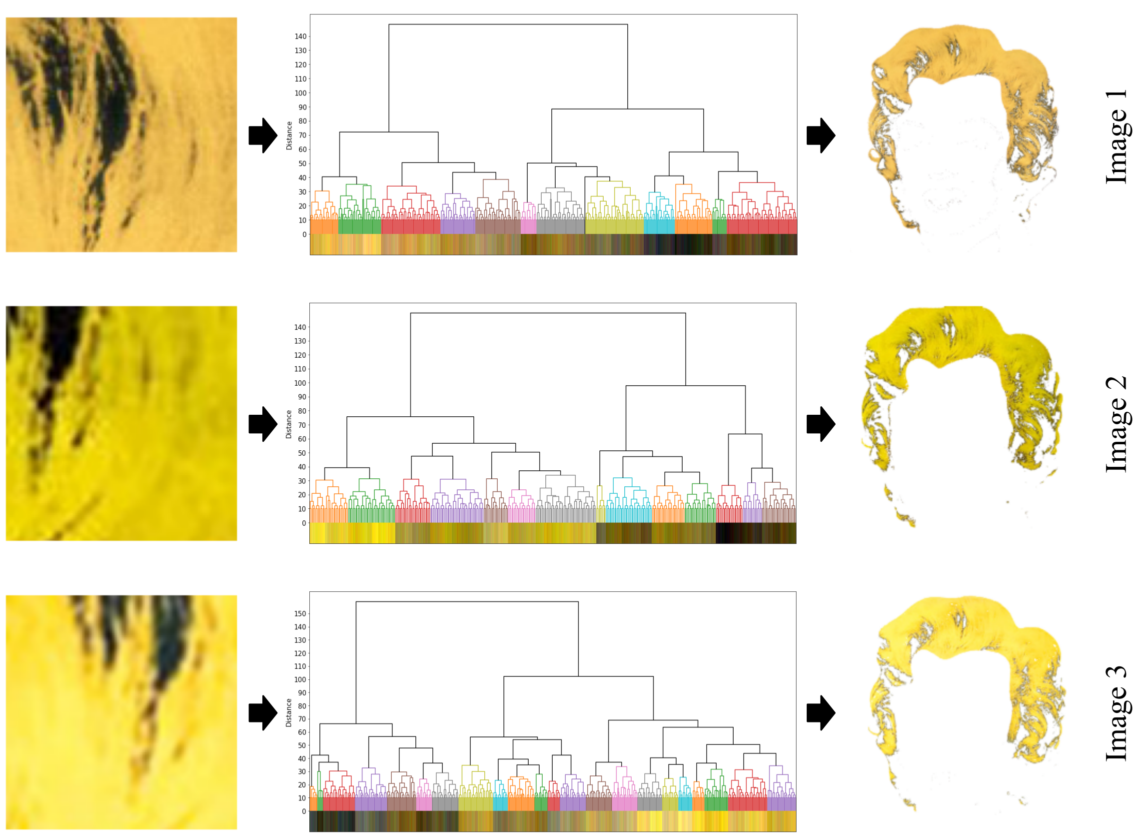
Figure 14: Image 3 Inner Background Section and Outer Background Section

Following a thorough analysis of the 2D projection and RGB bin distribution, our attention turned to exploring the background color of image 3 in greater detail. Rather than examining the overall RGB range of the background, our focus shifted to identifying any distinctive regions or intriguing patterns within the background using a clustering algorithm. Through our experimentation, we observed that the color range surrounding the head appeared lighter compared to the bottom left and bottom right corners, suggesting a deliberate artistic choice. This pattern carries a potential symbolic significance, and we intend to delve deeper into this matter in subsequent investigations.

Figure 15: Image 2 Background Color Range Distribution

Drawing inspiration from our exploration of image 3, we further delved into the background color analysis for image 2 to uncover intriguing patterns. Our experiments revealed a seemingly random utilization of color ranges, almost as if Warhol deliberately intended to convey a message to the audience through this uneven distribution. We firmly believe that this intentional irregularity in the background color holds symbolic significance, which we will thoroughly address in the summary section.

V. HAIR EXPLORATORY ANALYSIS



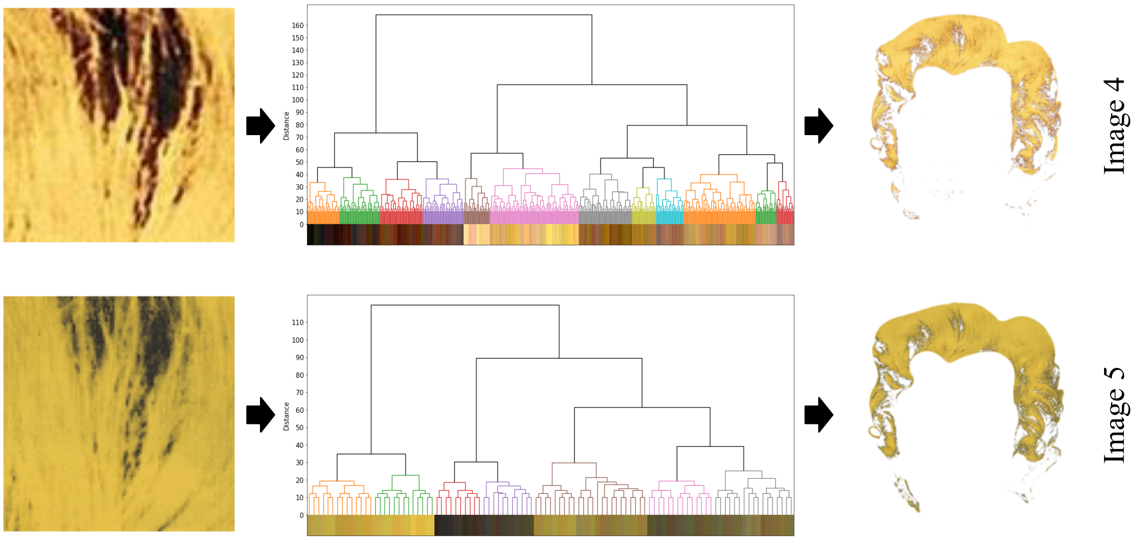


Figure 16: Hair Samples and Dendrograms Used to Extract Hair

When extracting information on the hair, small 100×100 subsets above the hairline proved to be sufficient samples across all 5 images. However, cluster selection required a fair amount of trial and error. This was primarily because of certain "unexpected" colors represented in several dendrograms.

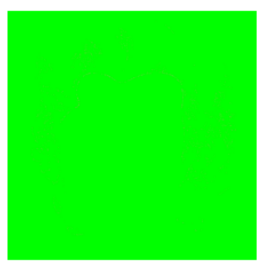


Figure 17: Pinkish Colors present in the Hair of Image 4

Examples of these include pinkish colors for image 4 and grayish colors for images 1, 2, and 3. None of these colors were what we expected to appear in the hair across these images; however, upon further inspection, small traces of pink were shown to be primarily present along the hairline in image 4. This is likely due to some of the pink paint in Monroe's forehead bleeding over edge lines.

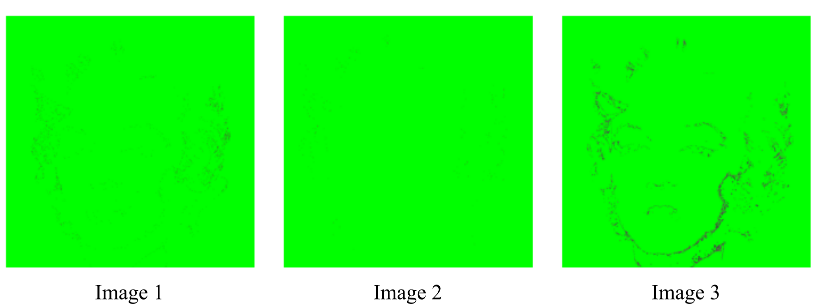


Figure 18: Grayish Colors Present in the Hair of Images 1, 2, and 3

In addition, we found that elements of gray were present on the side regions of the hair in images 1 and 3. However, our analysis for the gray content in image 2 was not as straightforward. When filtering for these colors, all that would return were seemingly blank paintings. Even after zooming in different regions and testing different contrast colors, we could not pinpoint where gray was present in the hair. Based on these results, we were only able to conclude that the gray content in image 2 was extremely low. One possible explanation for these grayish colors is that they represent traces of the dark ink used to print out Monroe's portrait. This is likely why we see the same grayish colors present along Monroe's eyes, brows, lips, and face in Image 3. In addition to this, it is important to note the range of colors present in our dendrograms. For images 1, 2, 3, and 4, we see hundreds of different yellows and browns; however, for image 5, we observe a significantly smaller variety.

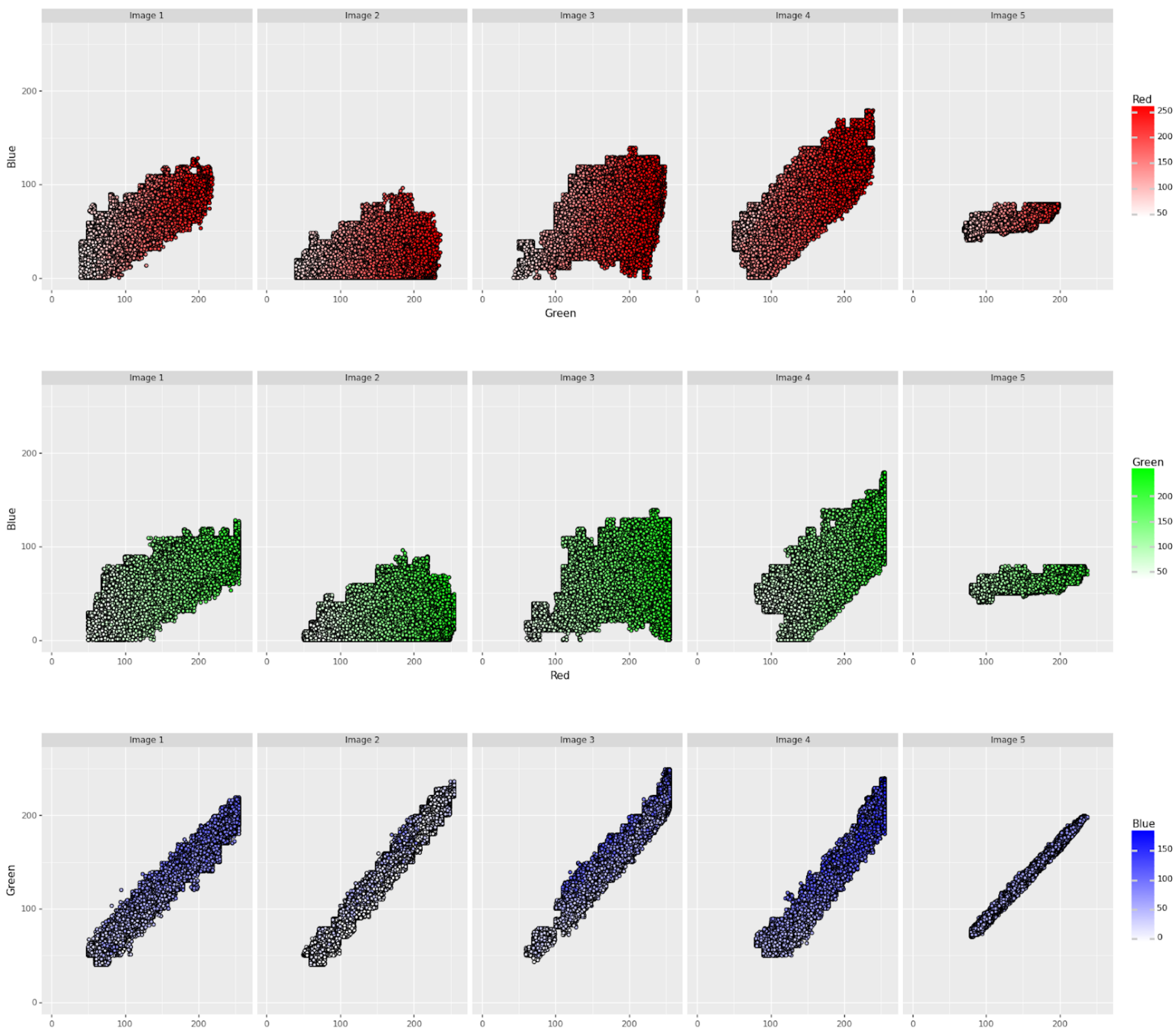


Figure 19: RGB Projection Graphs of the Hair

To further investigate this phenomenon, we plotted all of the hair colors present throughout these images in RGB space. Compared to other images, we see that the hair colors in image 5 are much more concentrated around a small area, which supports the findings from our dendrogram and ultimately indicates the use of a smaller range of colors. When this occurs, paintings will appear more uniform and consistent. These RGB projection graphs also suggest an abundance of blue present in the hair of image 4 and a lack of blue in image 2.

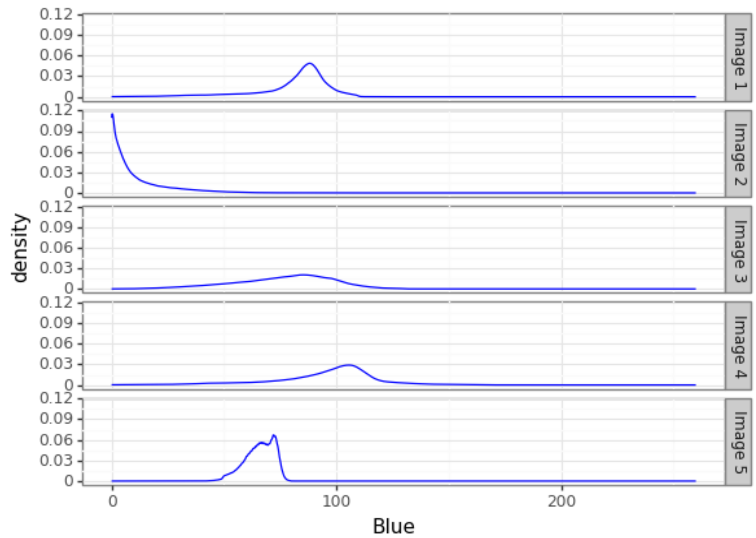


Figure 20: Blue Distribution of Hair

To explore this pattern more explicitly, we plotted the blue distribution of all 5 images. When examining these distributions, we see that most hair pixels in image 4 are centered around 100, which is the highest center value among all 5 images. We also observe a significant spike around 0 for the blue distribution of image 2. These findings not only support our previous discovery but also highlight significant differences in color purity. For instance, we can see from the RGB projection graphs that the red and green intensity is roughly equal for hair pixels in image 2. This observation, combined with the fact that these pixels contain low levels of blue, shows that Monroe's hair in image 2 represents varying shades of pure yellow. Meanwhile, we can see from the RGB projection graphs that the red intensity is roughly 50 levels higher than the green intensity for hair pixels in image 4. This observation, combined with the fact that these pixels contain higher levels of blue, shows that Monroe's hair in image 2 represents varying shades of impure orange.

VI. SKIN EXPLORATORY ANALYSIS

Figure 21: Image 4 with Bullet Shot Circled

Before extracting the RGB values present in every skin layer, one major adjustment needed to be made for image 4. Upon closer inspection, one can observe an unusually, bright region between Monroe's eyebrows. With its shape closely resembling a bullet hole, this area was likely the artist's attempt to restore image 4 after getting shot by

Dorothy Podber. Despite the effort, it is evident that the colors in this region do not blend in and are different from the colors used in the rest of Monroe's skin.

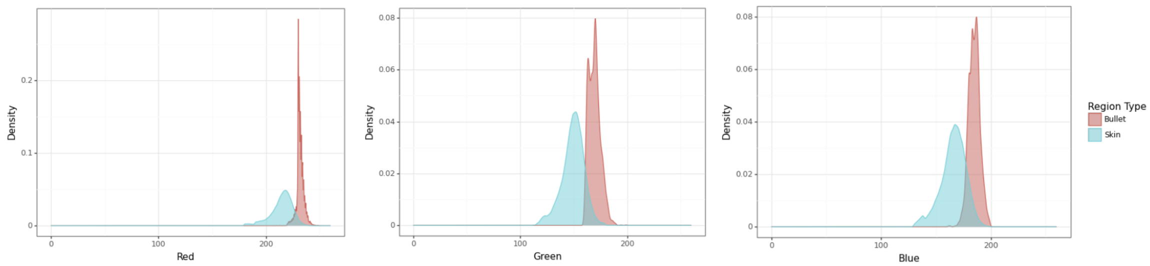


Figure 22: Red, Green, and Blue Distribution of Bullet Region and Skin for Image 4

This is further supported by the separate red, green, and blue distributions shown above. When examining these graphs, we specifically see that the bullet region between Monroe's eyebrows contains, on average, a higher level of red, green, and blue. This makes sense as increasing the amount of red, green, and blue throughout an image will make it appear more bright. Despite this region and the rest of Monroe's skin possessing different averages, their distributions share similar symmetric shapes. Using this information, we restored image 4 by shifting down the red, green, and blue distributions of the unusually, bright region so that their respective means equaled those associated with the rest of Monroe's skin. After doing so, we were left with the image shown below.

Before Restored

Figure 23: Before and Restored Comparison for Image 4

Next, let's move on to skin tone exploration. The below shows skin tones for the respective images. Please note that the shot on image 4 was left there because even after trying multiple samples of modified image 4, the shot between the eyebrows is still left undetected. Visually, the skin tone of images 2 and 5 stand out. The skin tone for image 2 is the brightest and the skin tone for image 5 has the most unique color composition. Skin tones from images 1, 2, and 4 are more or less similar with various shades of pink.

Figure 24: The Extraction of the Skin
(from left to right: images 1 thru 5)

From the below RGB projection graphs, we clearly see that image 1 has the most closely clustered points, meaning that colors across the entire face are consistent or concentrated around the same areas of the RGB space. Image 5 is similar in that regard but has a bigger variety. Images 2 and 4 display a larger range of spaces for all red, green, and blue colors. Image 3 appears to have the largest occupation of space for all comparisons of Red vs Green, Red vs Blue, and Green vs Blue, implying that image 3 has the largest range of colors, despite its overall brightness. One can observe from Image 3 that the upper left forehead and the upper right forehead exhibit different brightness of colors and the jaw area is apparently darker.

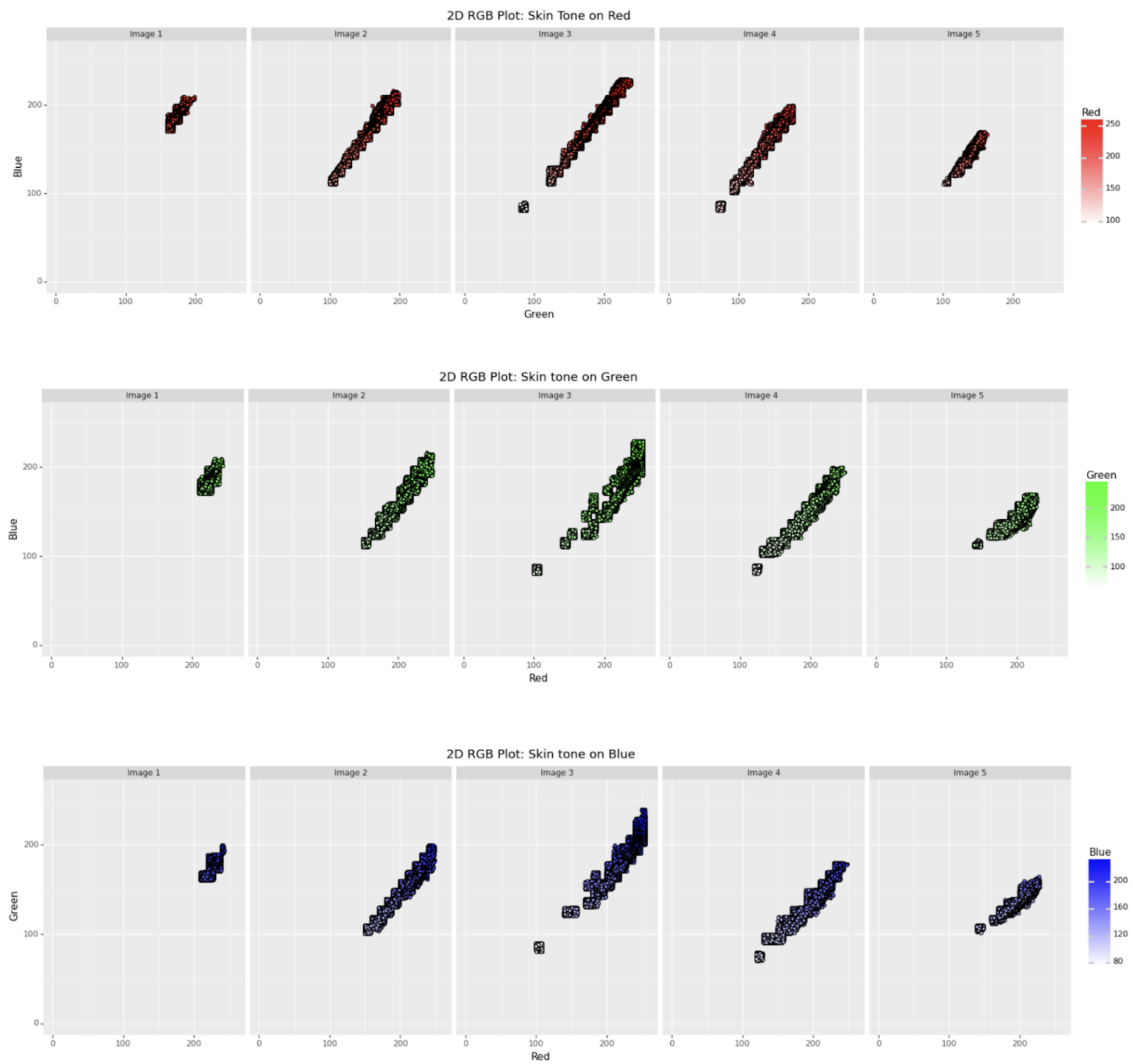


Figure 25: RGB Projection Graphs of the Skin Tone

Looking at the density plots below, we can see that the distributions of red, green, and blue for image 3 all peak at higher values than the remaining images, meaning that there are an overwhelming amount of white-like colors. This comes as no surprise. Image 5 is similar in the sense that it has a relatively more consistent skin tone color than the remaining images. Image 5 is interesting because it has a unique color tone compared to the rest. From the density distribution, there are a majority of colors that feature medium-level green and blue color bases and a majority of high red colors. This combined forms a unique pink color that spreads evenly across the face. Image 1 in particular has a much larger concentration of green and blue colors between [150, 200]. Red colors are mostly concentrated around [200, 250], meaning that most of image 1's skin tone occurs in the same RGB space. This further supports the previous finding that image 1's skin tone is the most consistent. The distribution of Blue and Green colors in skin tone for image 2 is similar to image 1 but has irregular shapes, implying more variation. The distribution of Red for image 2 is flatter, meaning that their color composition leans more towards cold colors. Image 4's RGB distributions appear to be the smoothest among all images. Peaks are not particularly high and the color spread is relatively wide.

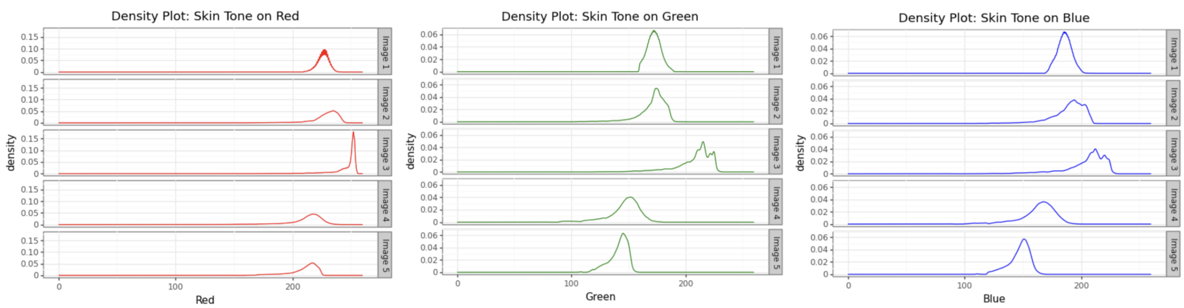


Figure 26: The Skin Tone Density Plots on Red, Green, and Blue

VII. MAKEUP EXPLORATORY ANALYSIS

- ### THE EYESHADOW

For the eyeshadow, we used the same extraction method to get the portion of the eyeshadow of each image. However, one problem we encountered was how the extraction could not reveal the eyeshadow accurately. After several experiments, the workaround was to extract a small enough portion from the original images that contained the pure eyeshadow color primarily. The matrix [460:480, 270:290, :] was selected to create the cluster dendrogram for each image and the eyeshadow subsets. We then applied the same strategy for the outlines, the lips, the teeth, and the collar. The eyeshadow of each image is listed below and the dendrograms can be found in the appendix. Note that the eyeshadow and the collar of image 4 are the same color but not for other images.

Figure 27: The Extraction of the Eyeshadow
(from left to right: images 1 thru 5)

Then, we analyze each eyeshadow image on 2D RGB plots. First, image 3 is high on Red, Green, and Blue and has the highest concentration among all 5 images. Image 2 is more spread out than others. Moreover, this is a linear association for images 1, 2, 3, and 5, but not for image 4.

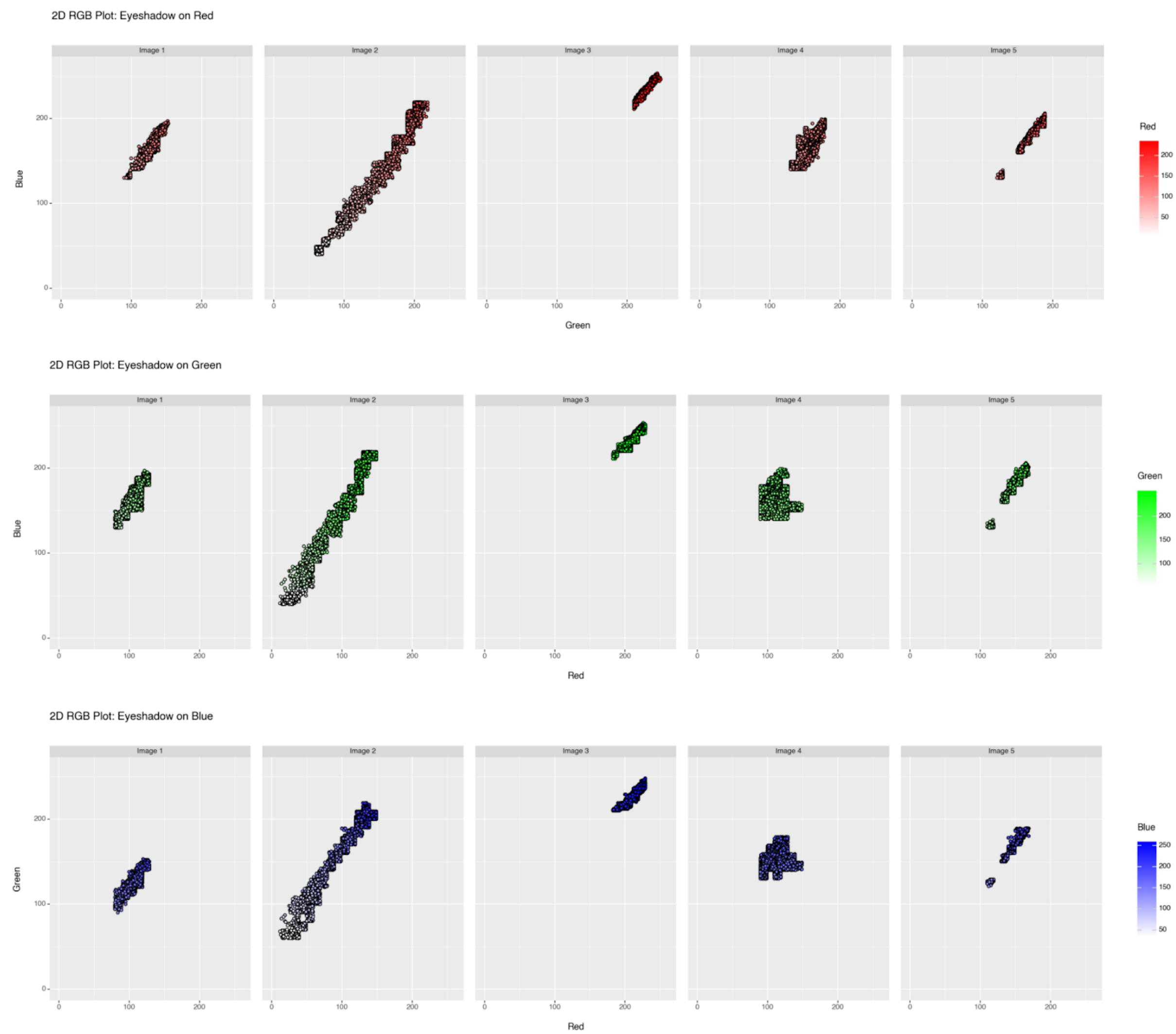


Figure 28: 2D RGB Projection Graphs of the Eyeshadow

Next, we analyze the density plots for the eyeshadow on Red, Green, and Blue along with their density distributions. Based on the density plots, we observe that each image has a similar density curve among Red, Green, and Blue. Also, image 3 is high in Red, Green, and Blue since the density curves are extremely left skewed. Also, from the density bin distribution, the majority of the points for image 3 are located at the high bins (over 20). Note: the bin value 21 is associated with the RGB value 200.

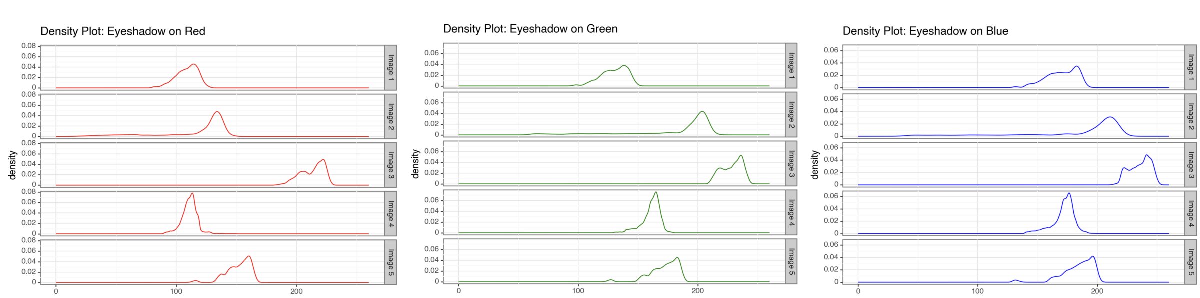


Figure 29: The Eyeshadow Density Plots on Red, Green, and Blue

The RGB value for the color blue is RGB[0, 0, 255]. As the Red and Green values are getting larger, the blue color is getting lighter. With all the findings above, we can conclude that image 3 has the lightest eyeshadow among all 5 images.

In addition, image 1 has lower destiny bins on Red and Blue, which is mostly between 10 to 15. Thus, the eyeshadow of image 1 is higher on Blue. Image 4 has a similar density bin value on Red, but a higher destiny bin value on Green, which is between 15 to 20. Therefore, the eyeshadow of image 4 contains more Green. Image 5 is with lighter blue eyeshadow since density bin values on Red and Green are at a higher range, which is between 15 to 20. Lastly, the eyeshadow of image 2 contains more Green than images 1, 4, and 5 since the density bin on Green is between 19 to 22.

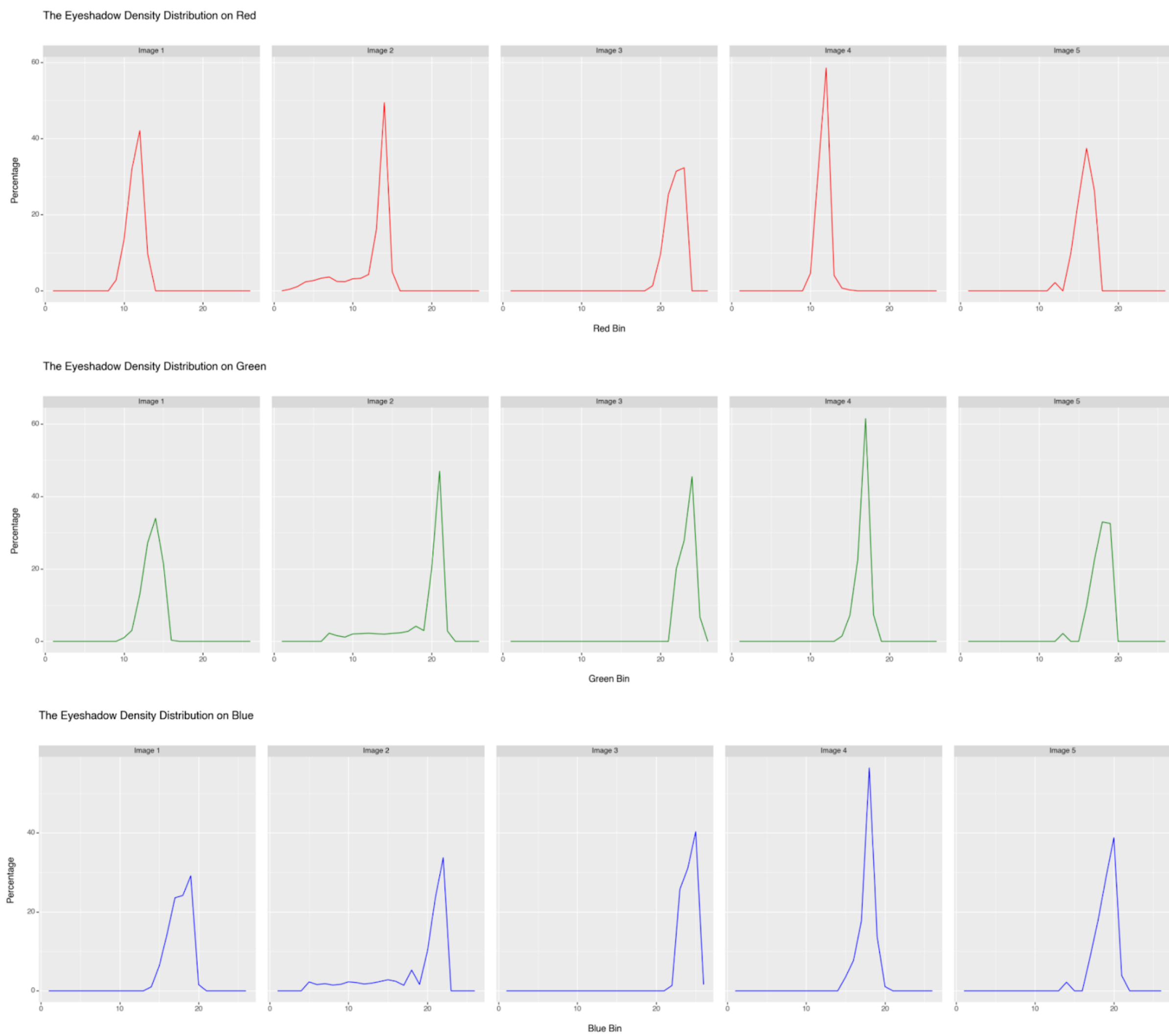


Figure 30: The Eyeshadow Density Bin Distribution on Red, Green, and Blue

- **THE OUTLINES**

The extraction of the outlines provides us with the color black portion and the shadow areas of the original images. Here we use the matrix [490:510, 210:240, :] to extract the eyelashes as a sample. Then we use it to reveal the entire outline for each image. The outline of each image is listed below and the dendrogram can be found in the appendix.

Figure 31: The Extraction of the Outlines
(from left to right: images 1 thru 5)

All 5 outline extractions can sketch the contours of her face, hairs, and the shadow areas. Then, we analyze each outlined image on the 2D RGB plots.

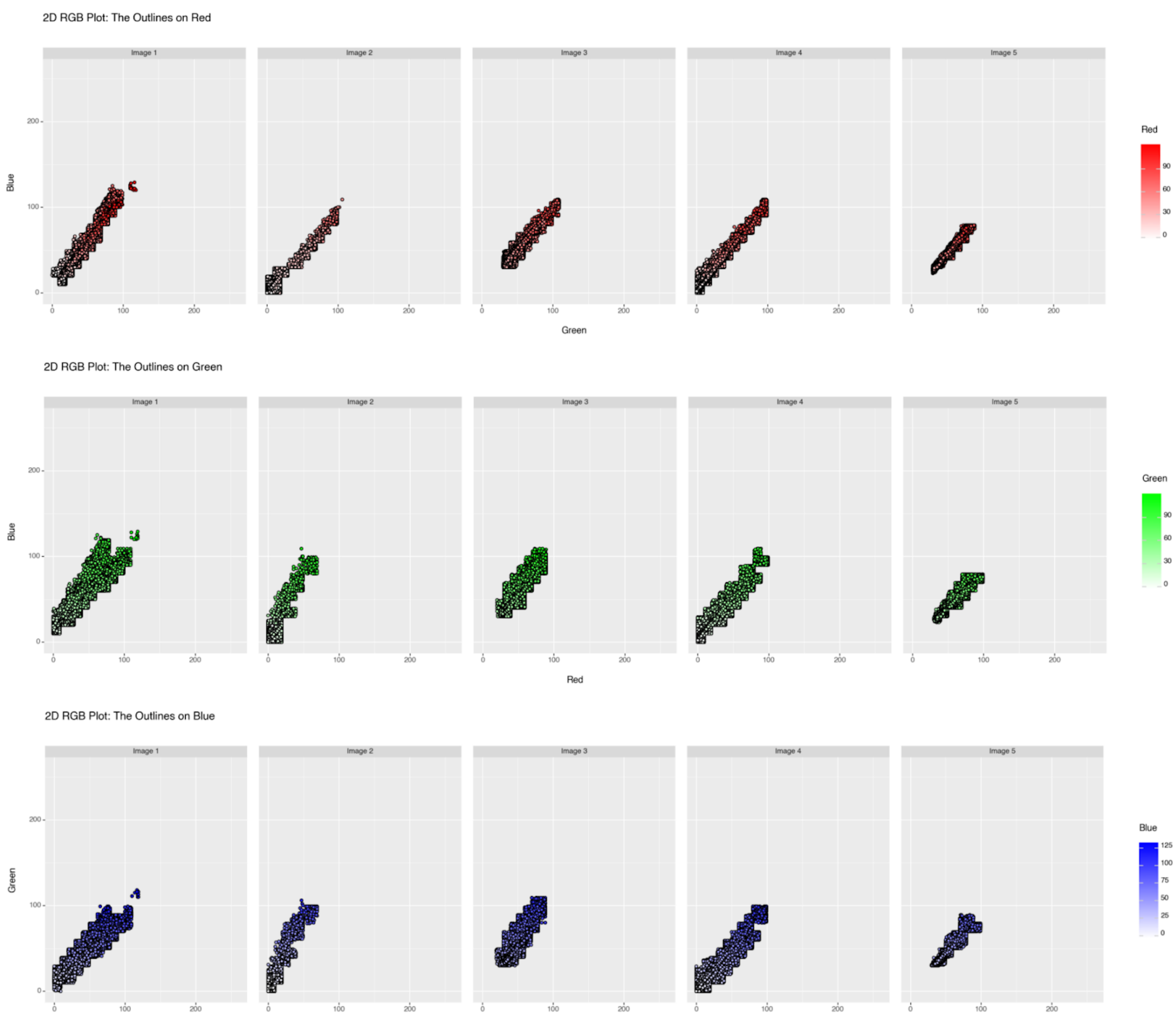


Figure 32: 2D RGB Projection Graphs of the Outlines

The 2D GRB plots on Red, Green, and Blue yield very similar observations. First, all 5 images are low on Red, Green, and Blue since they are all located at the lower left corner of the plot (under 100 on both axes). And, image 5 is the most concentrated among all 5 images. Meanwhile, all 5 plots seem to have linearity, but image 2 has less obvious linearity.

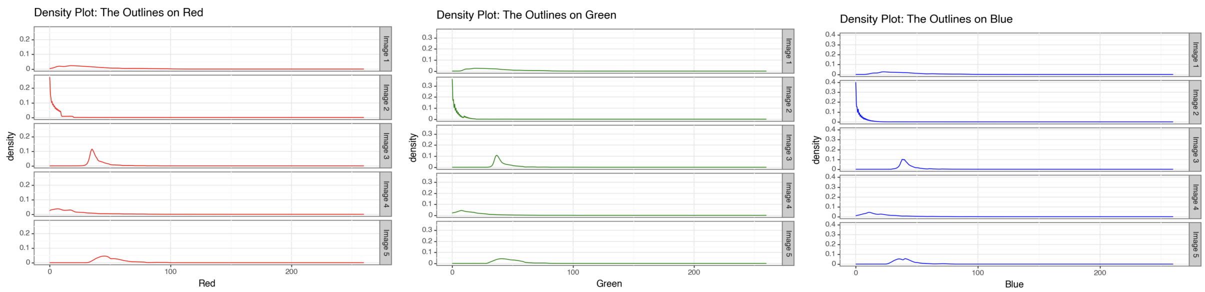
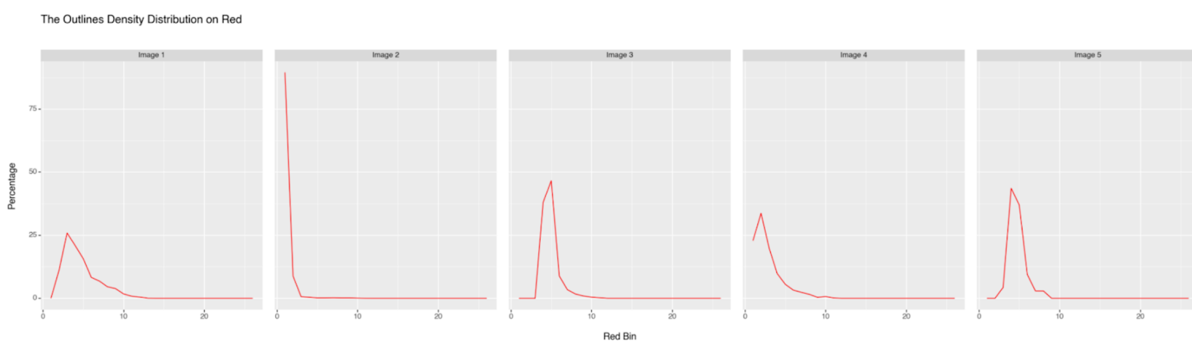
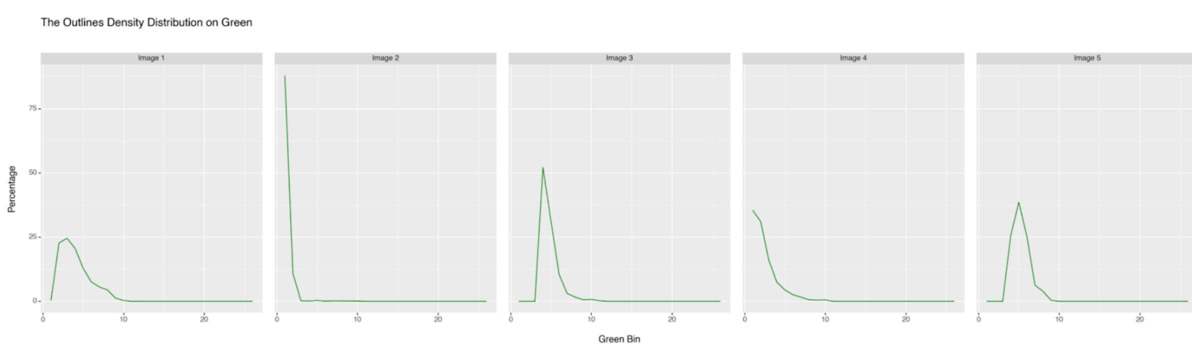


Figure 33: The Outlines Density Plots on Red, Green, and Blue

Next, we analyze the density plots for the outlines on Red, Green, and Blue along with their density distributions. Based on the density plots, we notice that images 1, 4, and 5 have much less Red, Green, and Blue. Image 2 is extremely right skewed while image 3 is slightly right skewed.

All these findings match with the black color (RGB[0, 0, 0]) which is the primary color for the outlines. Additionally, it matched with the density bin distribution plots. The majority of points have under bin value 10 which is associated with the RGB value under 100.





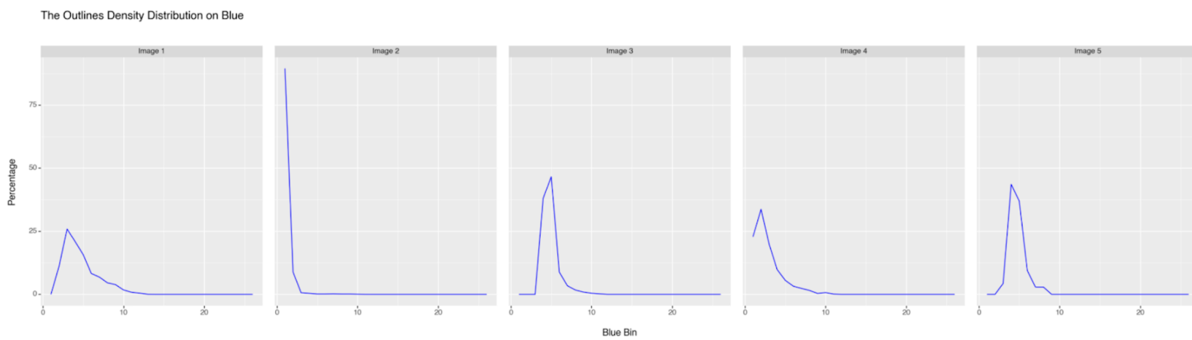


Figure 34: The Outlines Density Bin Distribution on Red, Green, and Blue

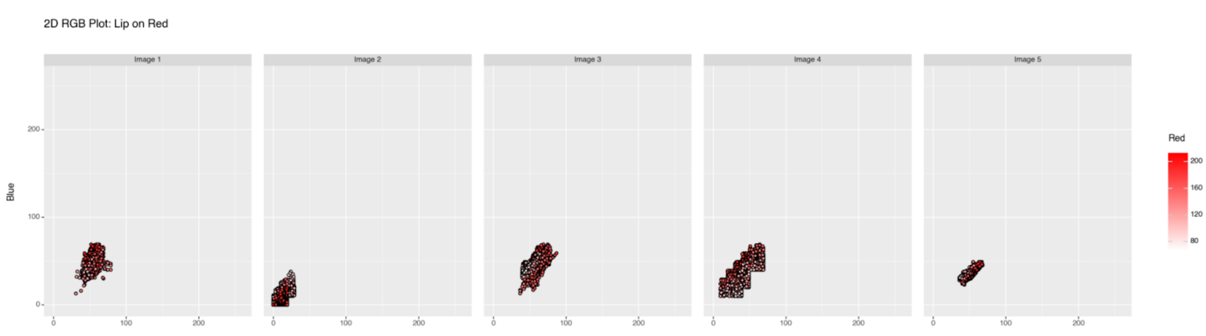
- **THE LIPS**

The extraction of the lips provides us with the color red portion of the original images. Here we use the matrix [760:780, 380:400, :] to extract the middle of the lower lip as a sample. Then use it to reveal the entire lips for each image. The lips of each image are listed below and the dendrogram can be found in the appendix.

Figure 35: The Extraction of the Lips
(from left to right: images 1 thru 5)

We see that image 2 includes some of the background portions since the background is in red. Then, we analyze each lip image on the 2D RGB plots. At first glance, we see that the 2D RGB plot on Red is quite different from the plots on Green and Blue. All 5 plots on Red are more highly concentrated than the corresponding ones on Green and Blue. This can reflect the lips on mainly red color.

Then, the majority of Red values are between 100 and 200 for all 5 images but have a low range on Green and Blue. Because we observe that they are all located at the lower left corner of the 2D RGB plot on Red, which is under 100 on both the Green axis and the Blue axis.



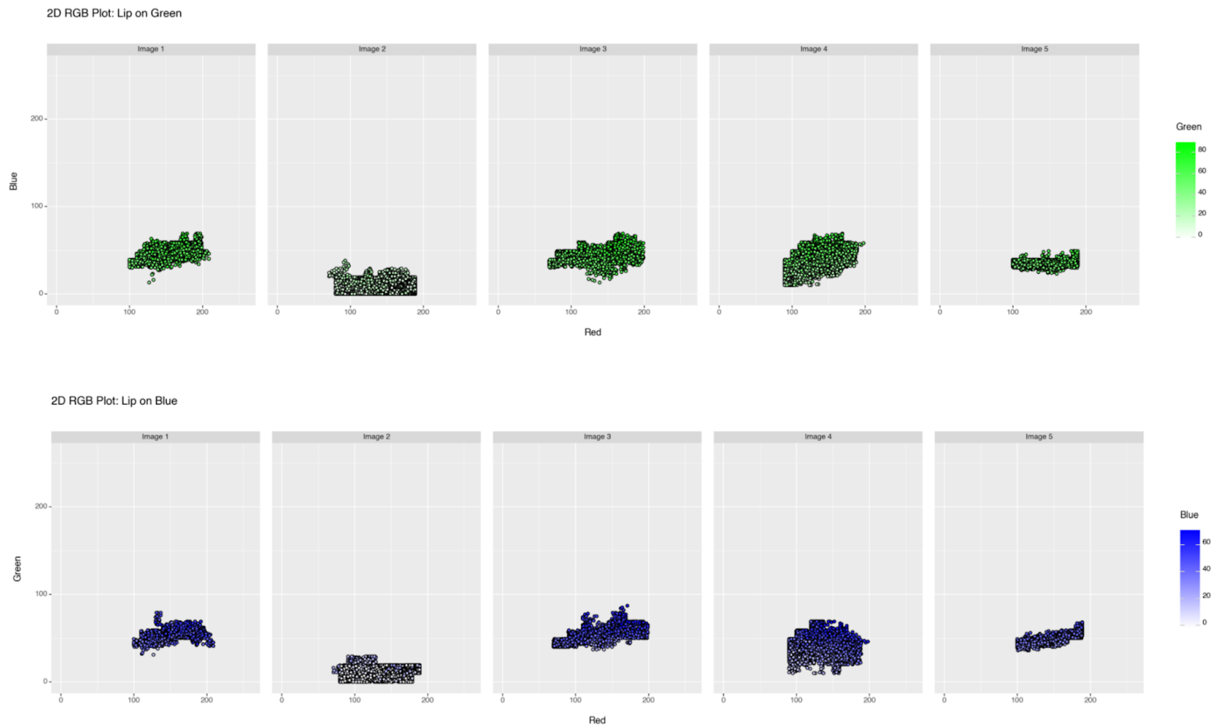


Figure 36: 2D RGB Projection Graphs of the Lips

Next, we analyze the density plots for the lips on Red, Green, and Blue along with their density distributions. Observe that the density plots on Green and Blue are almost identical for each image except for image 2 has a slight difference in the right skewness. And they are primarily right-skewed. However, the density plot in Red appears to have a less obvious left skewness for images 1, 4, and 5. Image 2 is clearly left skewed.

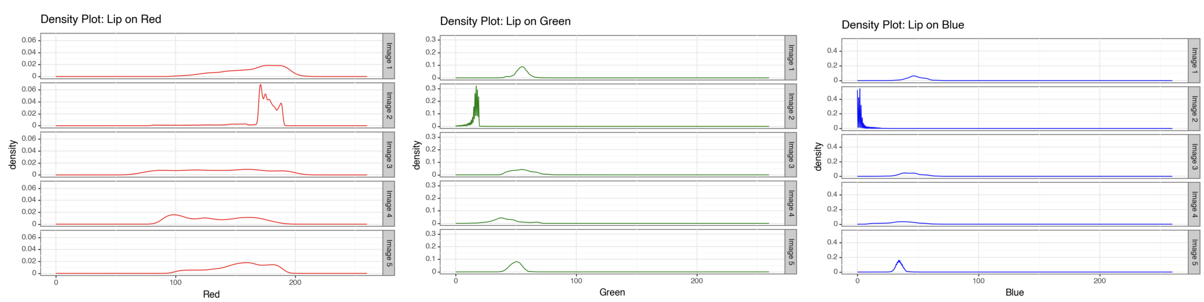


Figure 37: The Lips Density Plots on Red, Green, and Blue

Lastly, we have the same findings from the density distribution. The density distribution on Red and Blue for 5 all images mainly ranges between bin values 10 to 20, which is associated with the RGB value between 100 to 200. In Particular, image 2 has a concentrated bin value between 16 and 20, which is associated with an RGB value between 150 and 200. Nevertheless, all 5 images have a low RGB value under 100 on Green since their density bin values are mostly under 10.

All these findings can support that the lip color is red (RGB[255, 0, 0]) but not pure red. Because as the Green and Blue RGB values are getting larger, the Red is getting darker. Therefore, we can conclude that image 2 has the darkest red lip color among all 5 images.

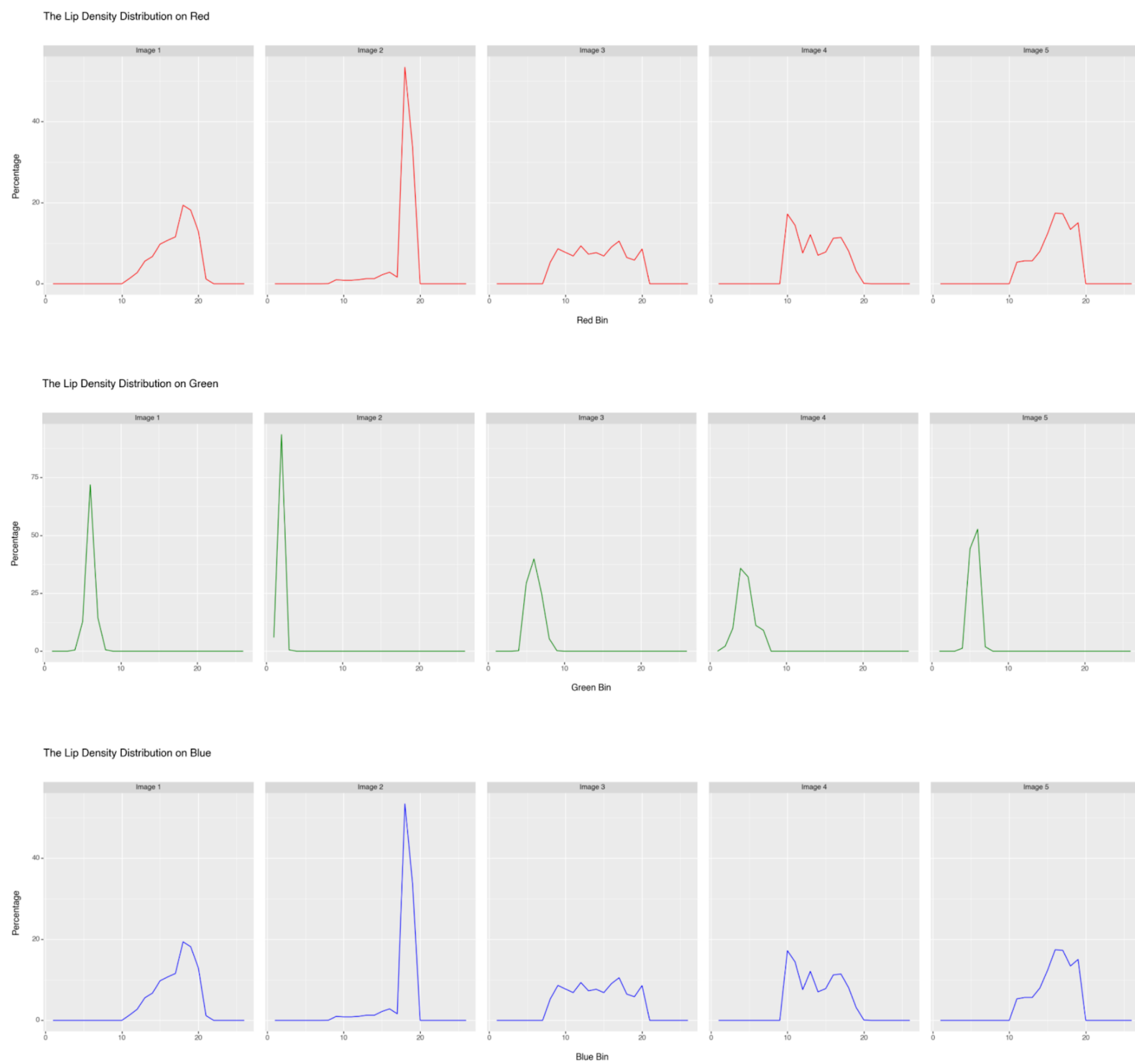


Figure 38: The Lips Density Bin Distribution on Red, Green, and Blue

- **THE TEETH**

The extraction of the teeth provides us with the color white portion of the original images. Here we use the matrix [730:750, 370:400, :] to extract the central lower teeth as a sample. Then use it to reveal the entire teeth for each image. The teeth of each image are listed below and the dendrogram can be found in the appendix.

Figure 39: The Extraction of the Teeth
(from left to right: images 1 thru 5)

Based on the 5 extractions of the teeth, we notice that they are different colors of white. Now, we need to take a closer look at the 2D RGB plots. Firstly, we spot that all the 2D RGB plots on Red, Green, and Blue have a very similar distribution. All images are apparent in the upper right corner, which indicates higher RGB values. Images 1, 3, and 4 are highly concentrated on high Red, high Green, and high Blue. Image 2 is more spread out than others. We can pick out a linearity between both axes among all 5 images but is less obvious for images 1 and 4 of their 2D RGB plots on Green and Blue. Images 2 and 5 seem to have a lower RGB value range than others.

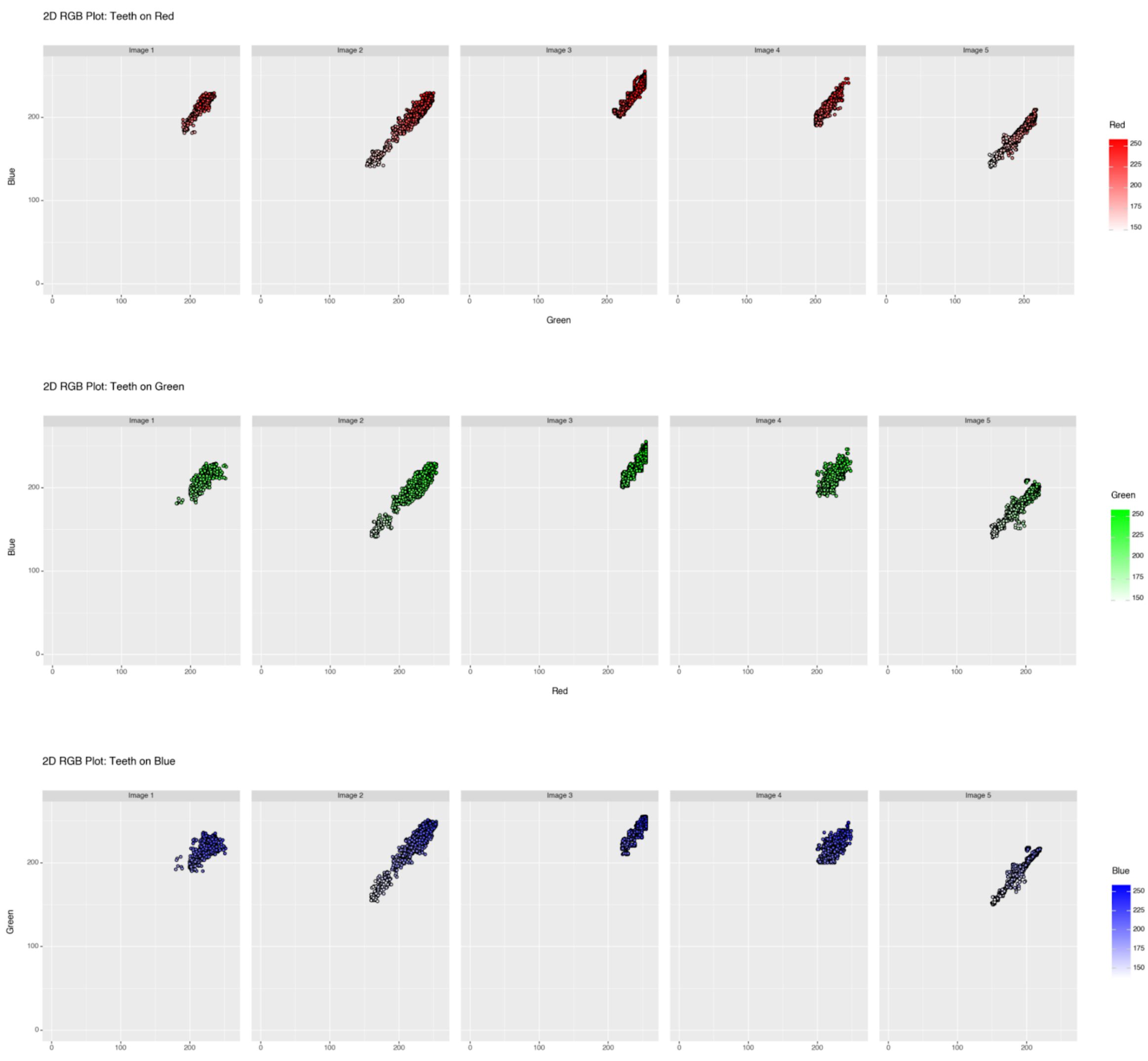


Figure 40: 2D RGB Projection Graphs of the Teeth

Next, we analyze the density plots for the teeth on Red, Green, and Blue along with their density distributions. The density plots of the 5 images are almost identical on Red, Green, and Blue. They are extremely left skewed especially for images 1, 2, 3, and 4.

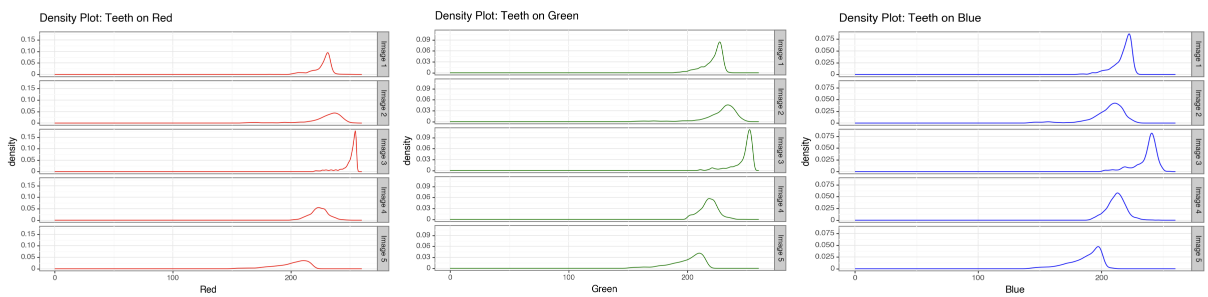
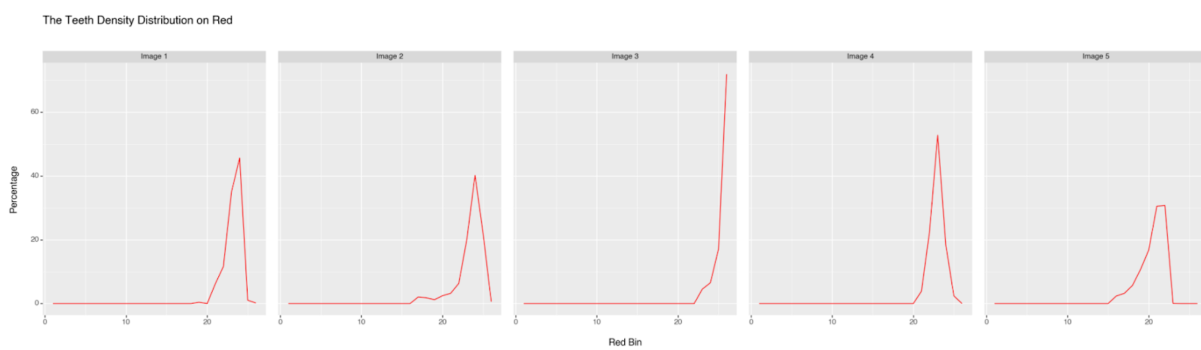
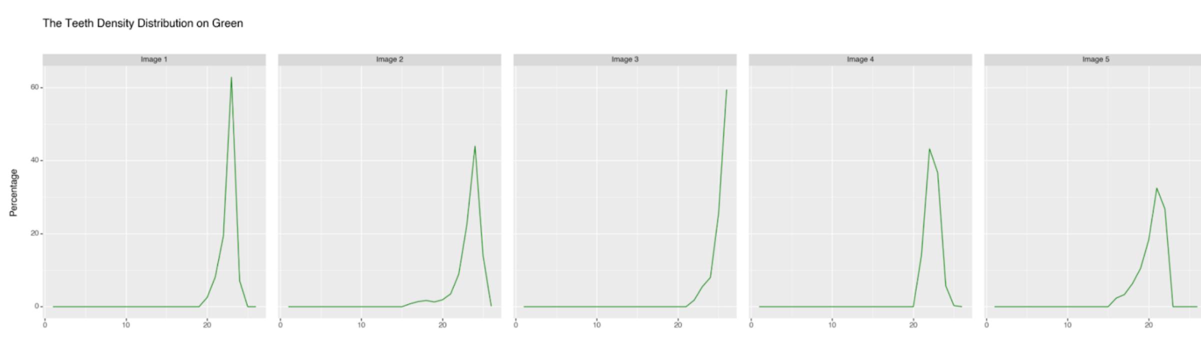


Figure 41: The Teeth Density Plots on Red, Green, and Blue

Then, we need to dig further into the density bin distribution plots. First of all, image 3 is concentrated with the highest density bin values (over 20) on Red, Green, and Blue. We know that the pure white color has a GRB value [255, 255, 255]. As the RGB value gets smaller for Red, Green, and Blue, the character white is getting less. Hence, the teeth of image 3 are the most white one among all 5 images.

Images 1 and 4 share very similar density bin distributions on Red and Blue but slightly differ on Green. Therefore, the teeth of images 1 and 4 should have a very close white color. Images 2 and 5 have a wider density bin value range (between 15 to 25). Since they are lower on Red, Green, and Blue, the teeth color of images 2 and 5 are darker.





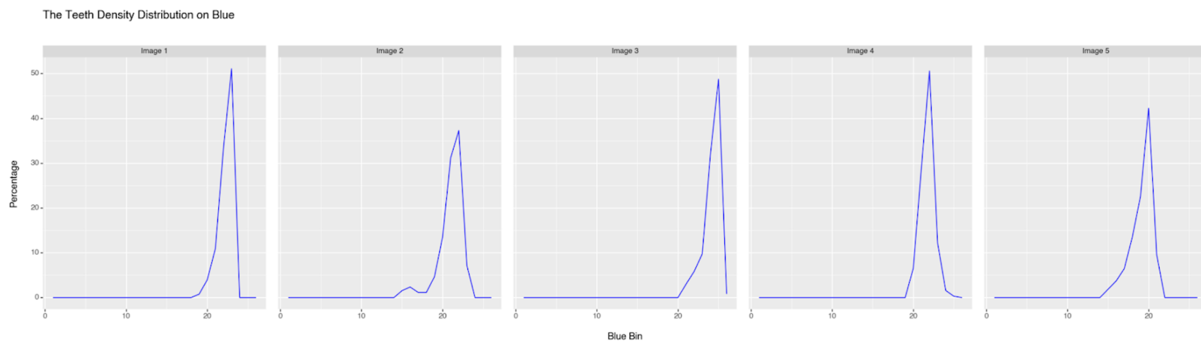


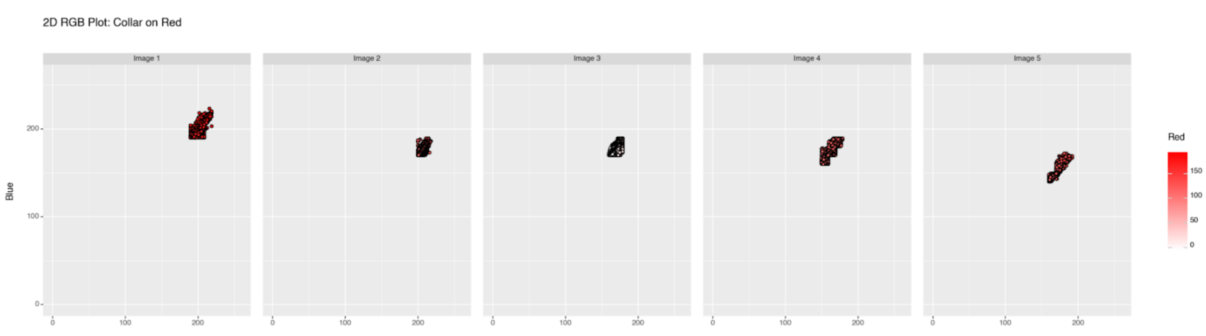
Figure 42: The Teeth Density Bin Distribution on Red, Green, and Blue

- **THE COLLAR**

The extraction of the collar is the matrix [900:950, 650:700, :]. After the extraction, the collar of each image is listed below and the dendrogram can be found in the appendix.

Figure 43: The Extraction of the Collar
(from left to right: images 1 thru 5)

Based on the 5 extractions of the collar, we notice that the collar of image 3 and the portion of the background color are identical. And, a duplicate finding is the collar of image 4 and the eyeshadow are the same. Next, we need to take a closer look at the 2D RGB plots.



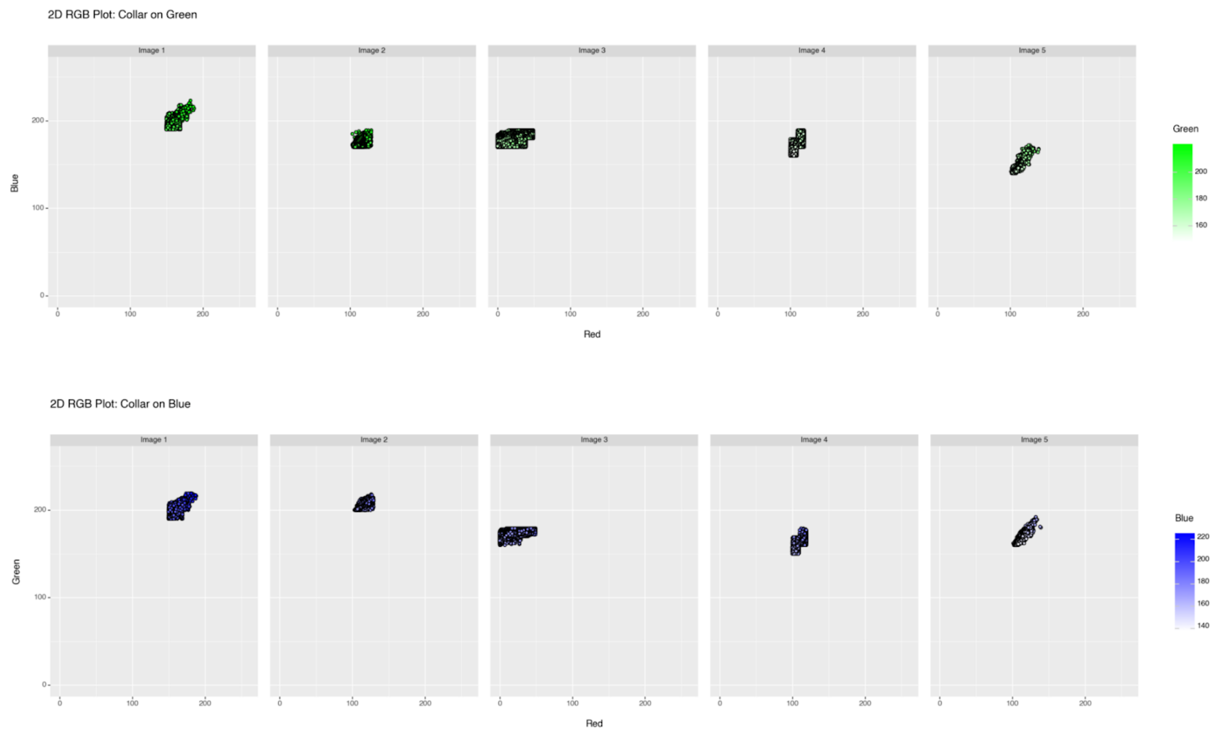


Figure 44: 2D RGB Projection Graphs of the Collar

First of all, we notice that all 2D RGB plots on Red, Green, and Blue are highly concentrated. There are a variety of differences across all 5 images. First, image 1 is high on Green and Blue and image 2 is high on Green, which is over 200. Image 3 is extremely low on Red, which is less than 50 but apparently high on Green and Blue, which is between 150 to 200. Images 3 and 4 have a very similar RGB value range on Red, Green, and Blue.

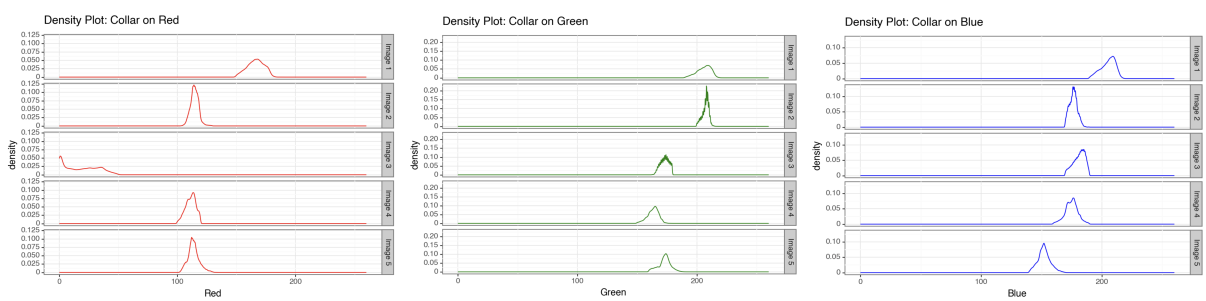


Figure 45: The Collar Density Plots on Red, Green, and Blue

Next, we analyze the density plots for the collar on Red, Green, and Blue along with their density distributions. The density plots are analogous to images 1, 3, and 4 on Red, Green, and Blue. The density curves of image 2 on Green and Blue are left skewed but normal on Red. Image 3 has an opposite skewness density curve on Red (extremely right-skewed) compared with the ones on Green and Blue (left-skewed).

Similarly to the eyeshadow analysis, the pure color blue is RGB[0, 0, 255]. The larger RGB values on Red and Green, the lighter the blue appears. Image 3 has the least density bin value, which is under 5. Thus, image 3 contains the highest blue than others.

Image 1 has higher density bin values on Red, Green, and Blue than the other 4 images. Hence, image 1 has the lightest blue collar. Images 2, 4, and 5 have the same density bin value range on Red, which is between 10 to 15 but differ on Green and Blue. Therefore, image 2 has more green for the collar portion than images 4 and 5 while image 4 has more blue for the collar portion than image 5.

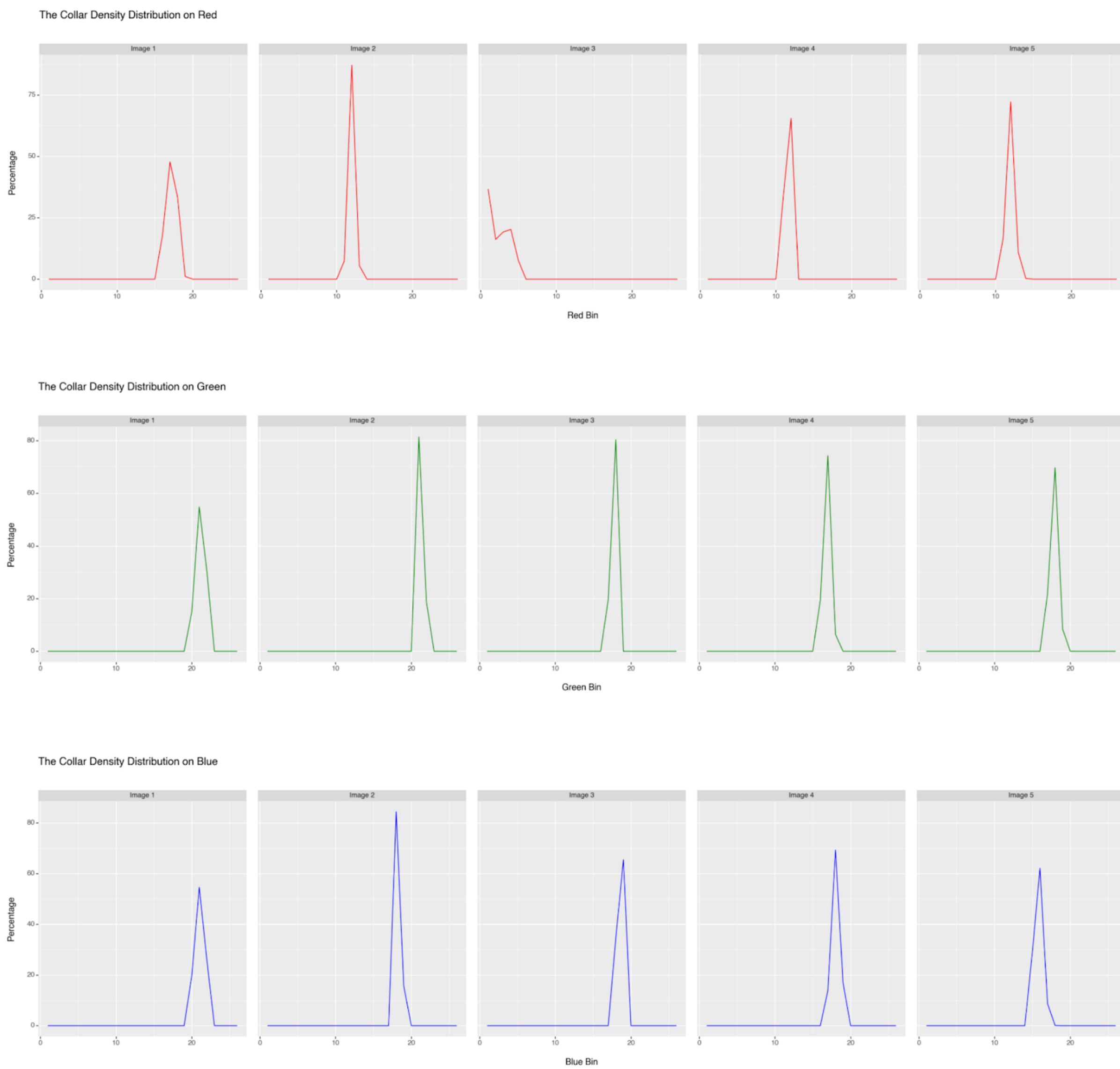


Figure 46: The Collar Density Bin Distribution on Red, Green, and Blue

VIII. SUMMARY

- ### IMAGE ONE

The first painting, "*Shot Orange Marilyn*", to symbolize the emotion of "fresh". Upon basic inspection, we see that the background utilizes a rich range of orange, which is a mix of red and yellow. Orange combines the passion of the former with the positivity of the latter. Bright and vibrant oranges are fun colors that burst with youthfulness, energy, and happiness. They inspire creativity and uplift people's moods.

Based on the analysis evidence from the skin tone of image 1, we know that the skin colors across the entire face are consistent. The point matches with the emotion “fresh”. Because when you first complete your makeup in the morning, it helps the face to create an even base — or foundation — for the rest of the makeup. The consistency creates fair-toned skin, which commonly represents neutral undertones. Moreover, the eyeshadow of image 1 is higher on Blue and the lips of image 1 is not the darkest in red. Along with the makeup, we can interpret the emotion of image 1 as fresh, positive, and ready to start.

In addition, the outlines of image 1 is the lightest one among all 5 images. The less blackness and shadow also represent brightness. And, the dendrogram of image 1 contains hundreds of different yellows and browns to reveal the grayish. The variety of her golden hair is vivid and permeated with positivity to the painting.

- **IMAGE TWO**

When taking into account all of our findings, it is likely that the artist intended for image 2, “*Shot Red Marilyn*”, to symbolize the emotion of “intense rage”. Upon basic inspection, we see that the lips and background utilize red, which is a color often associated with anger and frustration. Several pop culture examples that illustrate this include Pixar’s Anger, DC’s Atrocitus, and Nickelodeon’s Raphael. In TV and media, these characters often display acts of extreme rage all while possessing red-like attire and/or skin.

In addition to this, a deep analysis of RGB projection graphs and distributions reveals that the red used in image 2 is not any ordinary shade. Given the lack of green and blue present, it is evident that it is a “pure” red. This further supports our claim, as this purity likely symbolizes the intense sensations experienced under a fit of rage. During these moments, immense levels of adrenaline rush through the body, all while the heart begins vigorously expanding and retracting. However, these strong responses are not only present in the lips and background, as Monroe’s hair also utilizes “pure” colors. Given the equal levels of red and green along with extremely low levels of blue, it is evident that hair pixels in this image represent varying shades of concentrated yellow.

RGB projection graphs also show that the eyeshadow pixels in this image are the most dispersed relative to other images. From a technical standpoint, this means that colors in this region are less consistent. When connecting this to our other findings, it is likely that color inconsistency signifies the unclear, chaotic mindset that one develops under intense fury. This is supported by the fact that mad, hectic people often rush through daily activities, especially those that require patience and precision. During this rush, small details begin to be overlooked. People start forgetting43 to lock their car after unloading groceries, to turn off their stove after baking a cake, and to use the same blend of colors when applying makeup. These themes are also present throughout the background. Compared to every other painting, the background in image 2 was one the most varied in terms of color shades. When subsetting certain regions based on these different shades, we could not discern any notable pattern. And so, similar to Monroe’s makeup, we concluded that this uneven spread of colors likely represents how rage causes surrounding thoughts to become unclear and chaotic.

- **IMAGE THREE**

On the other hand, we believe that the artist intended image 3, “*Shot Turquoise Marilyn*”, to symbolize “intelligence”. By closely inspecting RGB distribution graphs, we see that Monroe’s head contains high levels of red, green, and blue, as shown below.

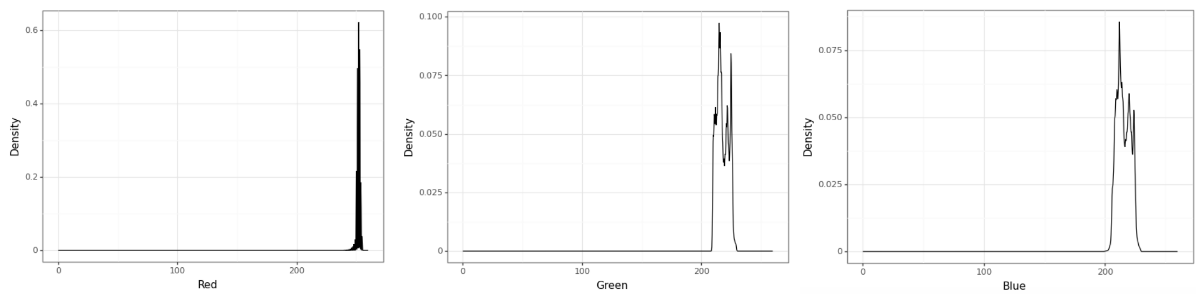


Figure 47: Red, Green, and Blue Distribution of Head for Image 3

In other words, these pixels closely resemble white-like shades. The use of light colors in such a region is likely the artist's way of creatively symbolizing a "bright mind" — a common saying that refers to one's brilliance and ingenuity. This is further reinforced by the fact that image 3's background can be separated into two radial regions. By carefully selecting certain color clusters from our dendrogram plots, we were able to extract the inner area surrounding Monroe's head along with the outer corners. RGB distribution graphs from the background section also show that the red, green, and blue values for the inner region are higher, on average, compared to the outer region. This indicates that brightness peaks while remaining close to Monroe's head and decreases while radially exiting outwards, which is a phenomenon we observe in light sources like candles and lamps. In other words, a "bright mind" is not only showcased in the colors used in Monroe's head but through the way it "illuminates" the background.

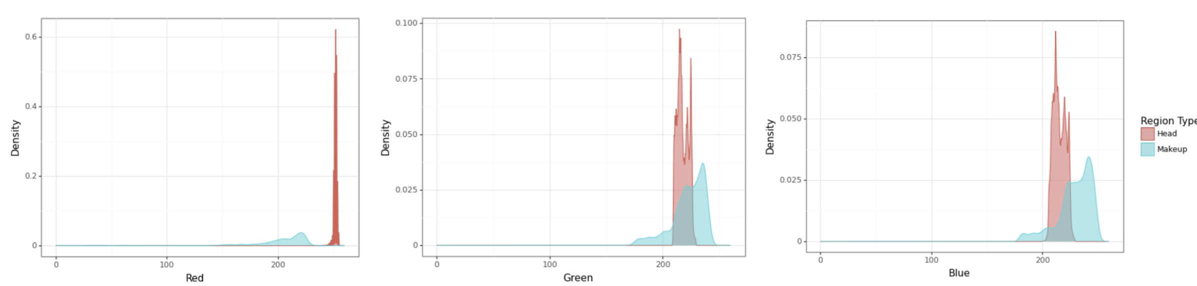


Figure 48: Red, Green, and Blue Distribution for Head and Eyeshadow Makeup in Image 3

This theme is also made apparent when comparing the RGB distributions of the eyeshadow to those of the head. As mentioned before, the head contains high levels of red, green, and blue; however, the graphs above show that a similar pattern can be observed for the eyeshadow as well. Now, both regions still vary in their shapes and centers, which results in technical differences in color, but given that their averages are all relatively high, it is also worth noting that these differences are not drastic. This finding along with the image itself shows that the eyeshadow and head, although technically distinct, blend together through the joint use of bright colors. Moreover, cluster analysis from previous sections reveals that the collar and background not only blend together but utilize the same exact colors. By employing these techniques, the artist draws less focus on the eyeshadow and collar. When connecting these observations to our previous findings, it is likely that the artist intended to hide these beauty-related aspects and to emphasize that physical appearance ultimately pales in comparison to brilliance and ingenuity.

- **IMAGE FOUR**

The "*Shot Blue Marilyn*" artwork features a blue background and a bullet shot. Consider the symbolism and significance of these elements. The blue background could represent various emotions or concepts, such as calmness, serenity, or introspection. The presence of a bullet shot introduces themes of violence, tragedy, or mortality. The combination of these elements might explore the contrast between beauty and fragility, fame and tragedy, or the transient nature of celebrity.

Through our analysis, we found out that the hair and skin of Marilyn in the artwork contain a high amount of blue in the RGB values, which reinforces the overall theme and aesthetic choices of the artwork. The prominence of blue in these areas could enhance the emotional impact and convey a sense of depth or vulnerability in Marilyn's portrayal. It may suggest a focus on the inner struggles or hidden aspects behind her public image, and it connects back to the cause of her death as a barbiturate overdose.

We also found out that the makeup color and collar color behind Marilyn's head are identical and there is consistency in the background color between the left side and top right corner; it aligns with Warhol's signature style of repetition and variation. In the case of "*Shot Blue Marilyn*", the repetition may be observed in the consistent portrayal of Marilyn's image across multiple artworks in the series. Each piece features the same image of Marilyn but with slight variations in colors, backgrounds, or the addition of elements like the bullet shot. This repetition invites viewers to ponder the role of repetition in the construction of celebrity identity.

- ### IMAGE FIVE

When examining the last image, "*Shot Sage Blue Marilyn*", it is likely that the artist intended to symbolize "dull lifelessness". Upon basic inspection, we see the use of grayish blue, a color that closely resembles that of fog. For many people, fog is what "takes the life" out of an exciting day. It is what "drains the energy" out of people's bodies. With the clouds blocking the skies, people are deprived of the sun's healthy rays. This theme is further supported by RGB projection graphs across various aspects of the 5th image. By examining these plots for the background, hair, and eyeshadow, we see pixels reside in one small, concentrated area in RGB space. In cases like these, colors appear more uniform. Often, a lack of color variation hides away intricate details such as depth, shadows, and lighting aspects that make an art piece look "alive". It is these artistic techniques that ultimately make Monroe's expression feel fatigued as though she has gone through an "exhausting" day and is using all of her "remaining energy" to force out a small smile.

IX. CONCLUSION

In analyzing the five Marilyn artworks, it becomes apparent that Andy Warhol employed a range of colors and elements to evoke different emotions and themes. Each image offers a unique perspective on the subject of Marilyn Monroe and the complexities of fame, emotion, and societal expectations.

- Image 1, "*Shot Orange Marilyn*": This artwork symbolizes freshness through the use of orange in the background. The rich orange background and various golden hairs imbued creativity and positivity. The consistency of the fair-toned skin reflects a neutral and stable foundation.
- Image 2, "*Shot Red Marilyn*": This artwork symbolizes intense rage through the use of red in the lips and background. The purity of the red color reflects the heightened moment of anger. The inconsistent distribution of colors in the makeup and background represents the chaotic mindset that companies intense fury.
- Image 3, "*Shot Turquoise Marilyn*": This artwork symbolizes intelligence through the use of bright colors in Monroe's head, resembling a bright mind. The way the colors illuminate the background reinforces the concept of brilliance and ingenuity. The blending of colors in the eyeshadow and head emphasizes that physical appearance pales in comparison to intellectual depth.
- Image 4, "*Shot Blue Marilyn*": This artwork explores the contrast between beauty and fragility. The high amount of blue in the hair and skin represents depth and vulnerability. The repetition of Marilyn's image

and the consistency in makeup and background colors highlight the constructed nature of celebrity identity and the role of repetition in media.

- Image 5: "*Shot Sage Blue Marilyn*", This artwork portrays a sense of dull lifelessness through the use of grayish blue colors resembling fog. The uniformity of colors and the lack of variation suggest a lack of vitality. Monroe's fatigued expression conveys exhaustion and depleted energy.

Through these analyses, Warhol invites us to reflect on the multifaceted nature of Marilyn Monroe's persona and the broader themes of fame, emotion, and societal expectations. The series of Marilyn's artworks serve as a platform for exploring these concepts through color, symbolism, and artistic techniques, inviting viewers to contemplate the complexities behind celebrity culture and human emotions.

X. APPENDIX

1. Dendrograms for The Eyeshadow

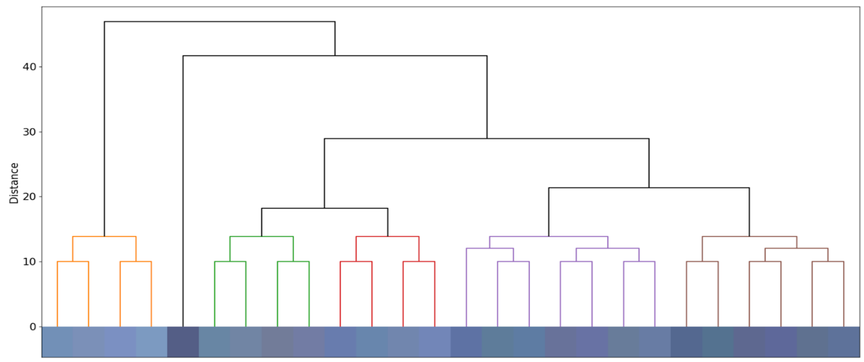


Figure 1: The Dendrogram at Threshold Distance 15 for the Eyeshadow of Image 1

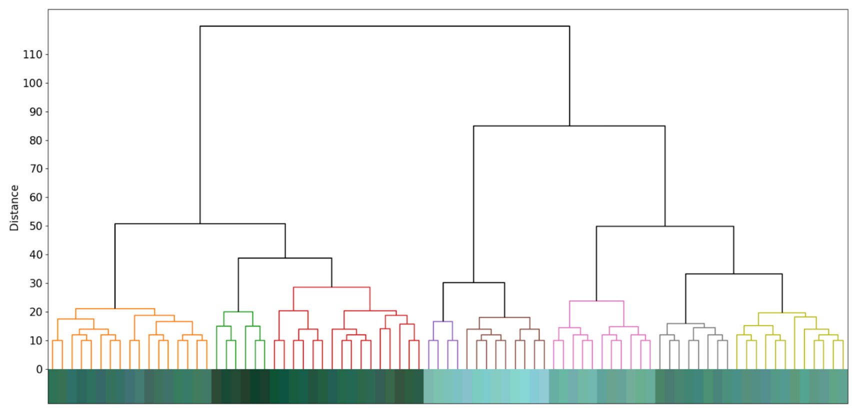


Figure 2: The Dendrogram at Threshold Distance 30 for the Eyeshadow of Image 2

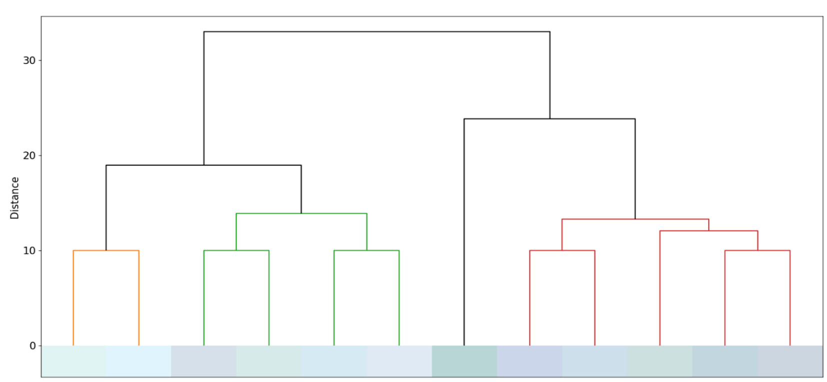


Figure 3: The Dendrogram at Threshold Distance 15 for the Eyeshadow of Image 3

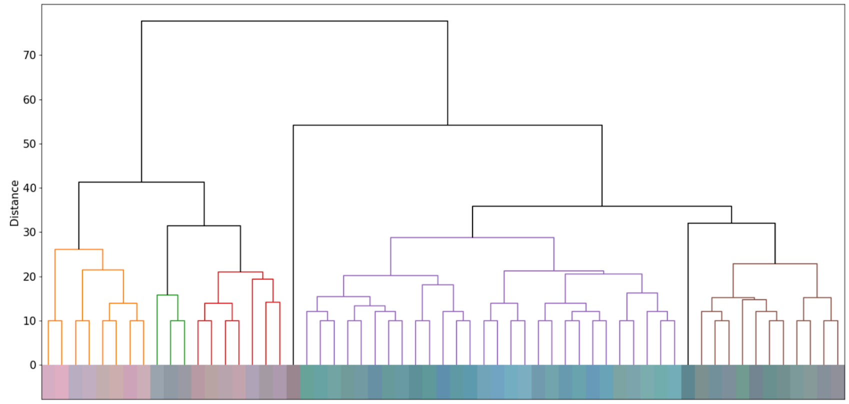


Figure 4: The Dendrogram at Threshold Distance 30 for the Eyeshadow of Image 4

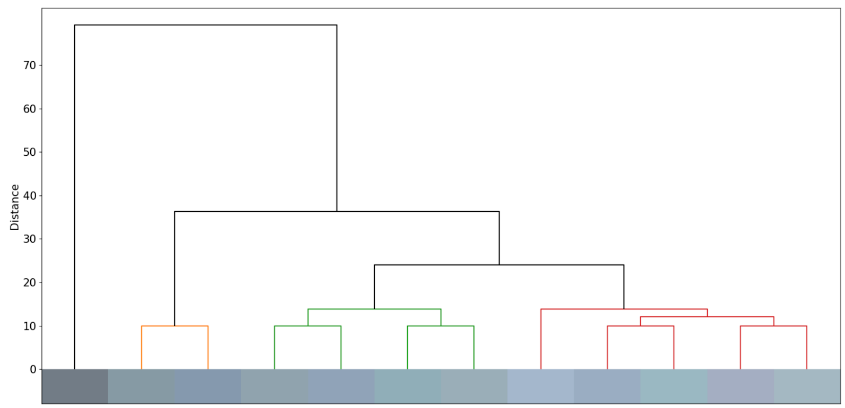


Figure 5: The Dendrogram at Threshold Distance 20 for the Eyeshadow of Image 5

2. Dendrograms for The Outlines

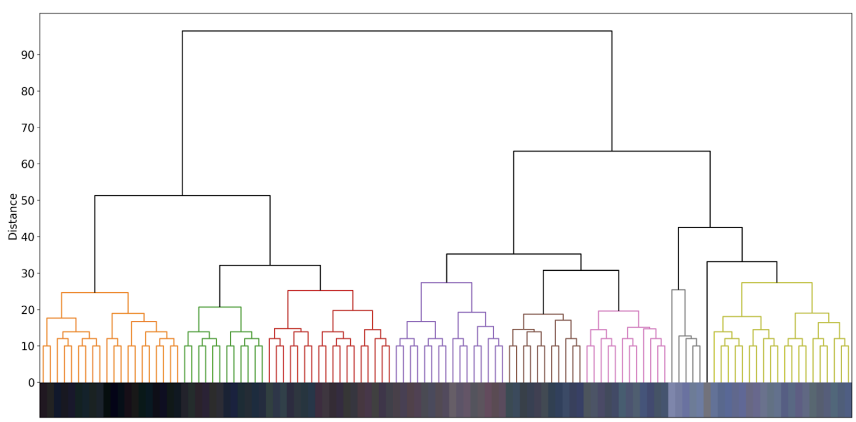


Figure 6: The Dendrogram at Threshold Distance 30 for the Outlines of Image 1

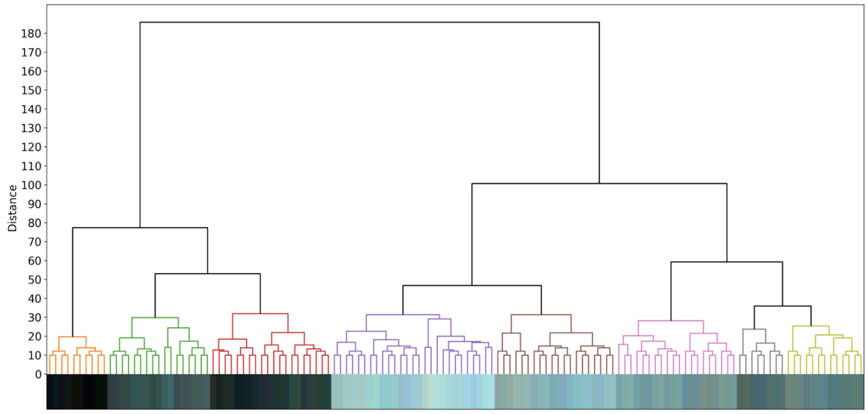


Figure 7: The Dendrogram at Threshold Distance 35 for the Outlines of Image 2

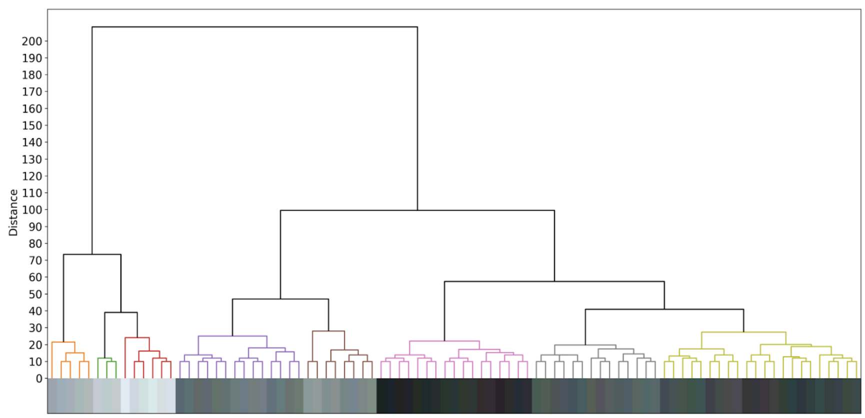


Figure 8: The Dendrogram at Threshold Distance 35 for the Outlines of Image 3

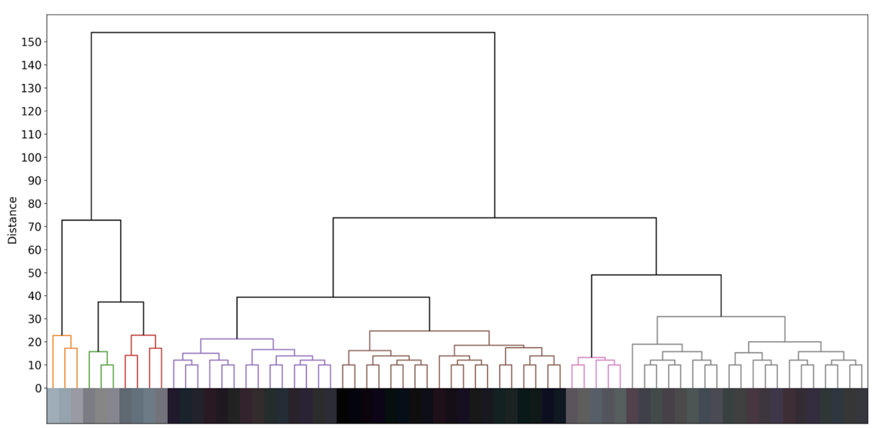


Figure 9: The Dendrogram at Threshold Distance 35 for the Outlines of Image 4

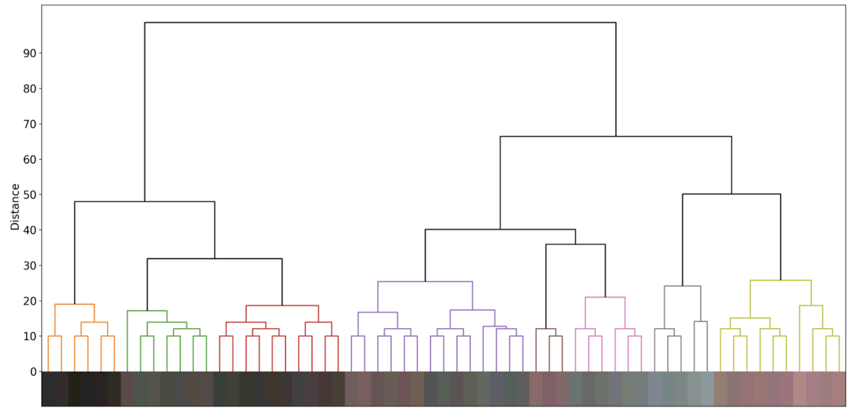


Figure 10: The Dendrogram at Threshold Distance 30 for the Outlines of Image 5

3. Dendrograms for The Lips

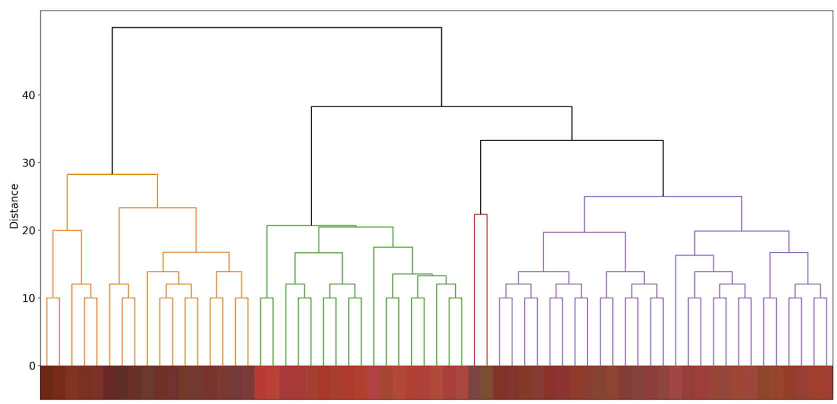


Figure 11: The Dendrogram at Threshold Distance 30 for the Lips of Image 1

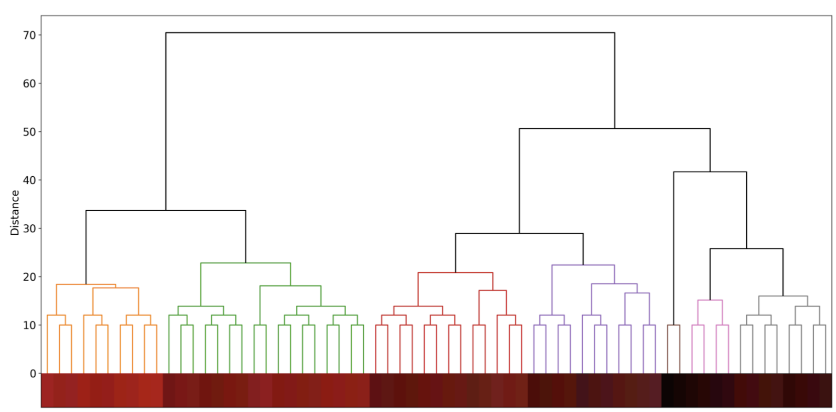


Figure 12: The Dendrogram at Threshold Distance 25 for the Lips of Image 2

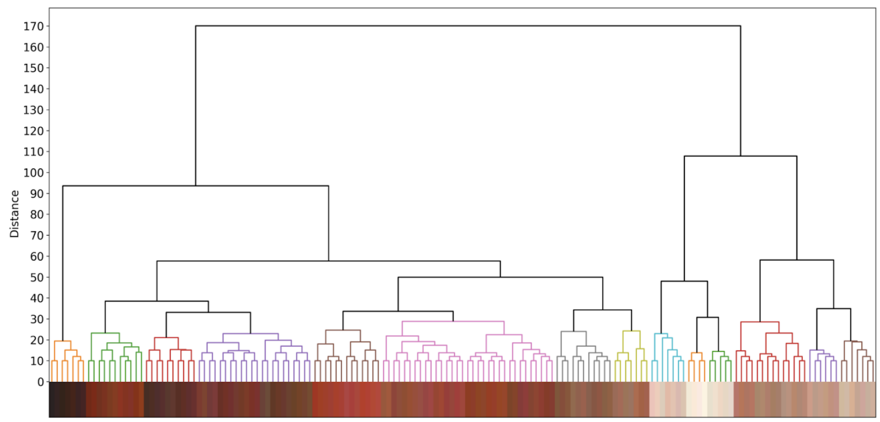


Figure 13: The Dendrogram at Threshold Distance 30 for the Lips of Image 3

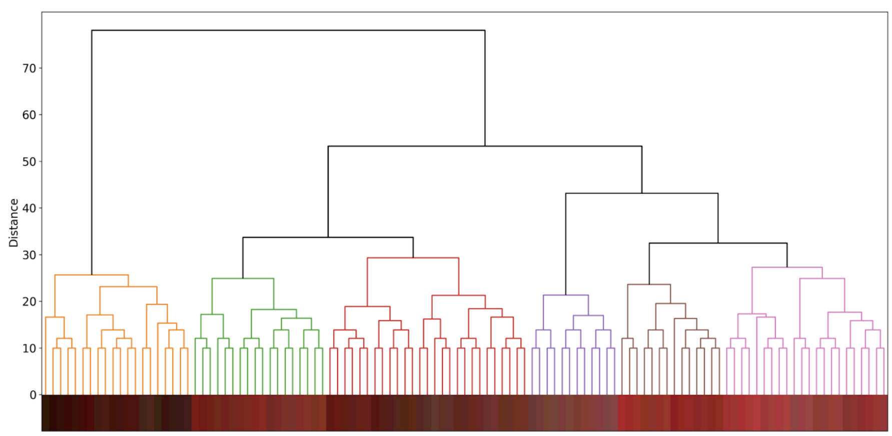


Figure 14: The Dendrogram at Threshold Distance 30 for the Lips of Image 4

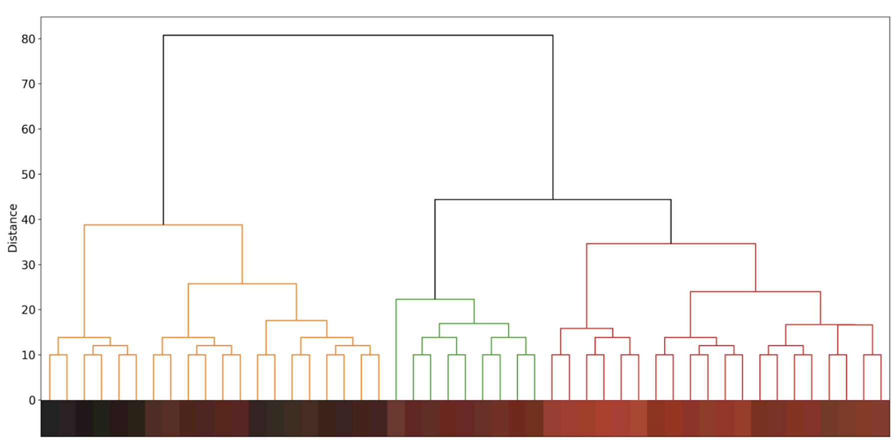


Figure 15: The Dendrogram at Threshold Distance 40 for the Lips of Image 5

4. Dendrograms for The Teeth

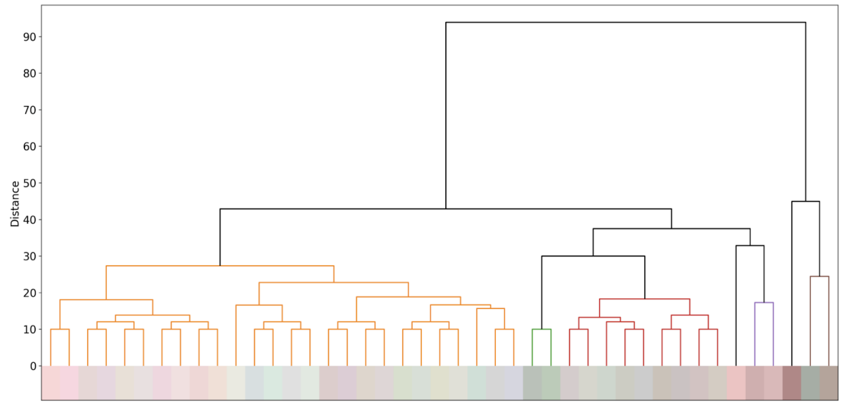


Figure 16: The Dendrogram for the Teeth of Image 1

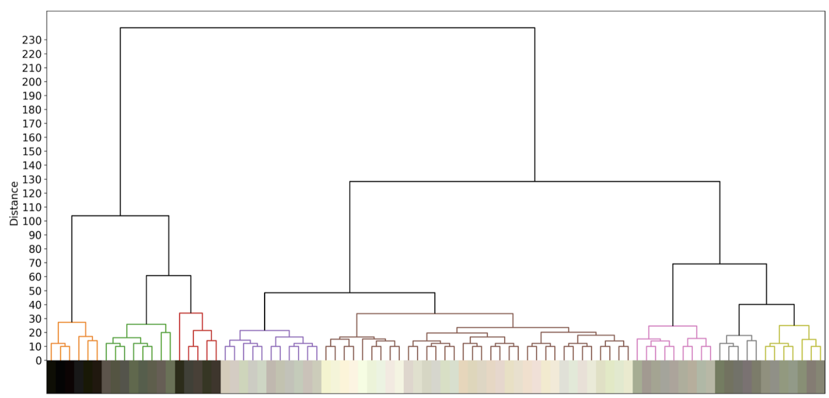


Figure 17: The Dendrogram at Threshold Distance 30 for the Teeth of Image 2

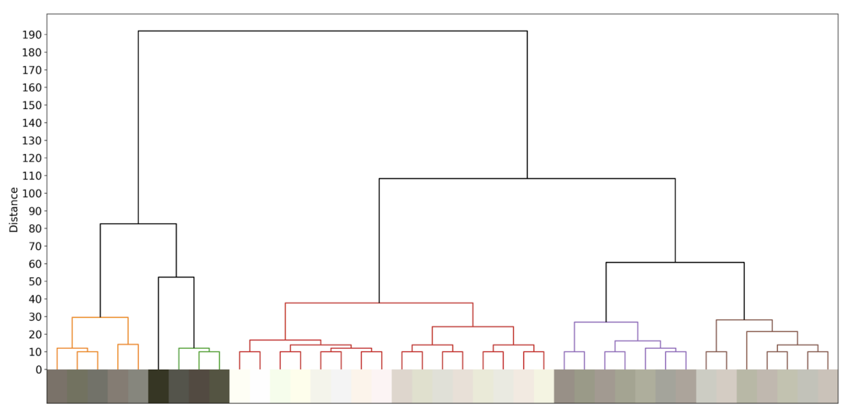


Figure 18: The Dendrogram at Threshold Distance 40 for the Teeth of Image 3

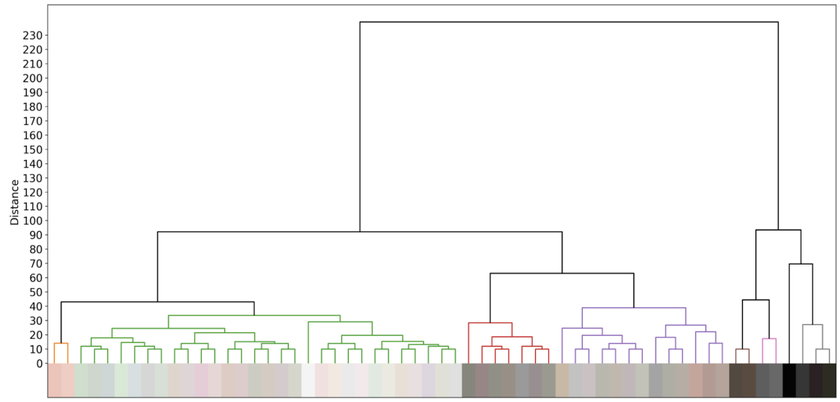


Figure 19: The Dendrogram at Threshold Distance 40 for the Teeth of Image 4

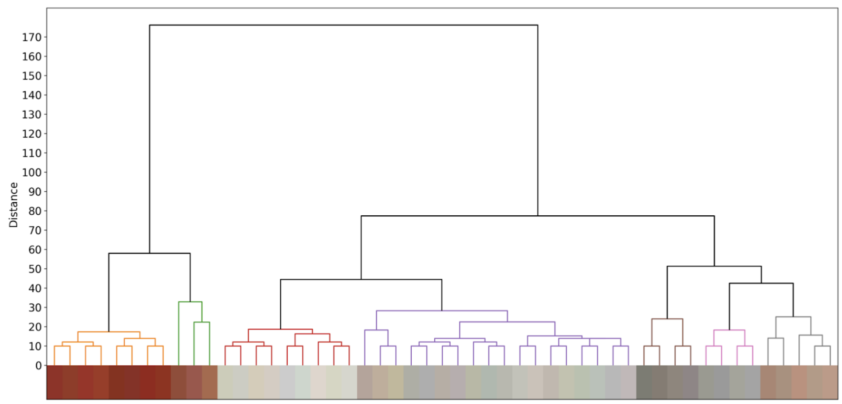


Figure 20: The Dendrogram at Threshold Distance 40 for the Teeth of Image 5

5. Dendrograms for The Collar

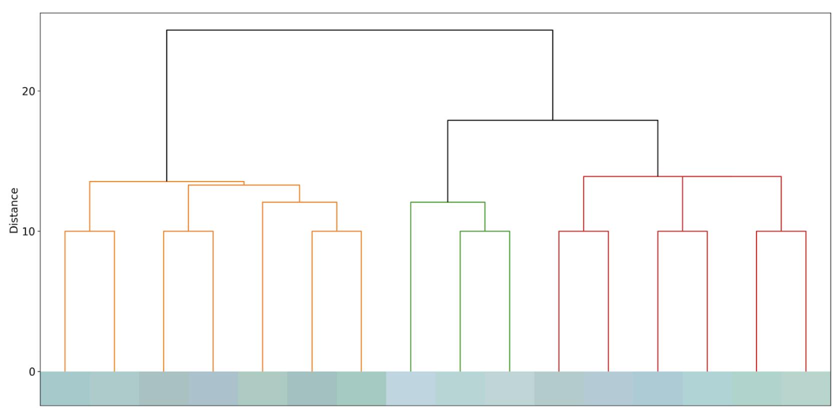


Figure 21: The Dendrogram at Threshold Distance 15 for the Collar of Image 1

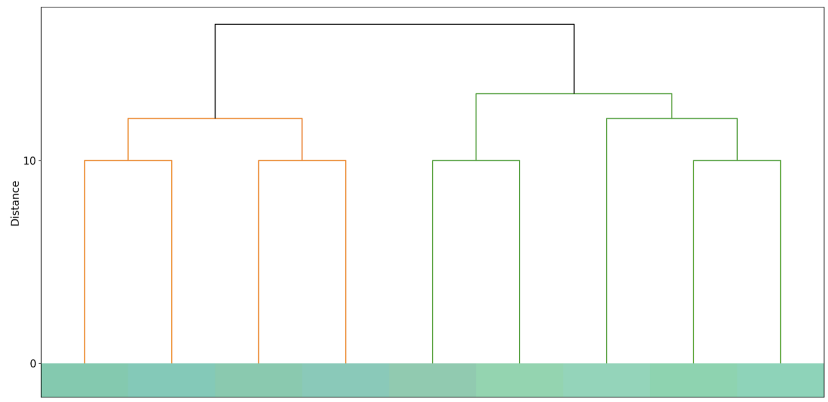


Figure 22: The Dendrogram at Threshold Distance 15 for the Collar of Image 2

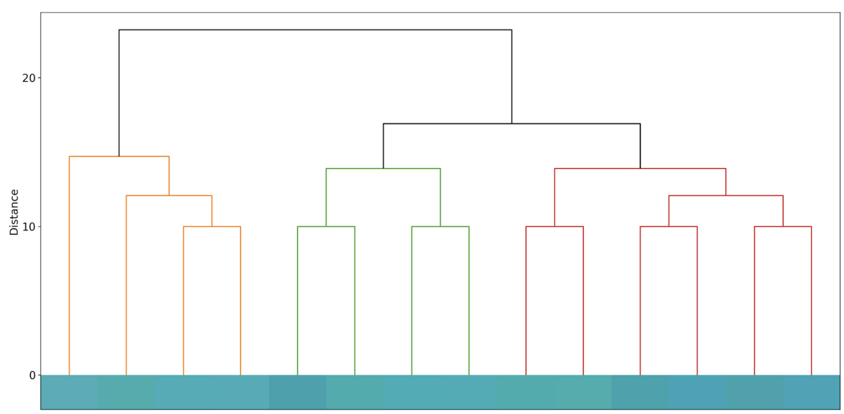


Figure 23: The Dendrogram at Threshold Distance 15 for the Collar of Image 3

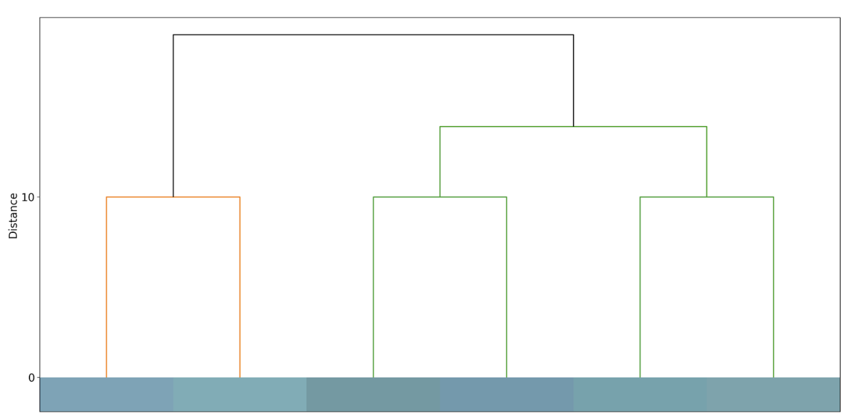


Figure 24: The Dendrogram at Threshold Distance 15 for the Collar of Image 4

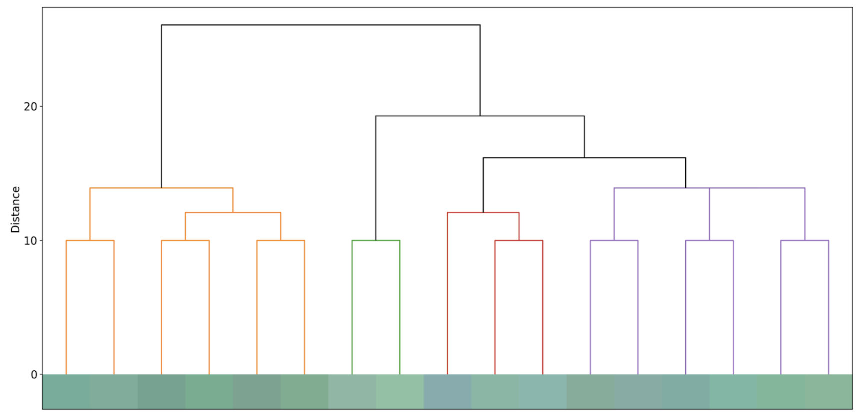


Figure 25: The Dendrogram at Threshold Distance 15 for the Collar of Image 5

6. Dendrograms for The Skin

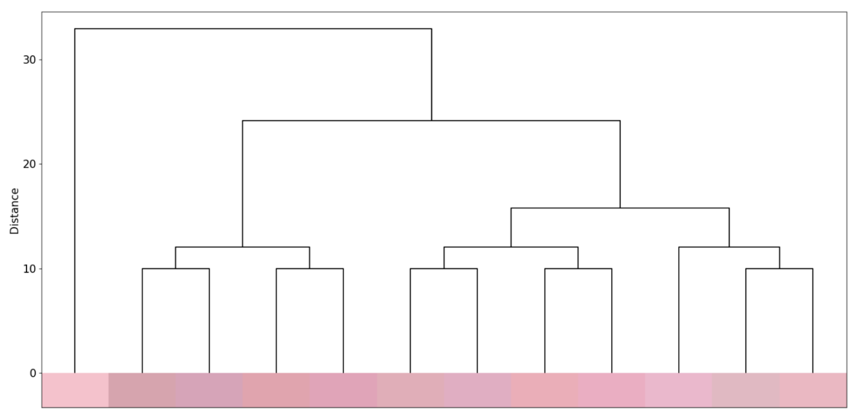


Figure 26: The Dendrogram at Threshold Distance 0 for the Skin of Image 1

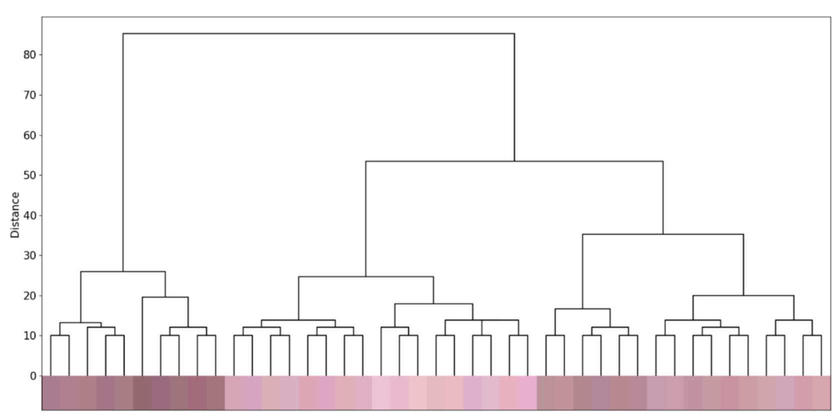


Figure 27: The Dendrogram at Threshold Distance 0 for the Skin of Image 2

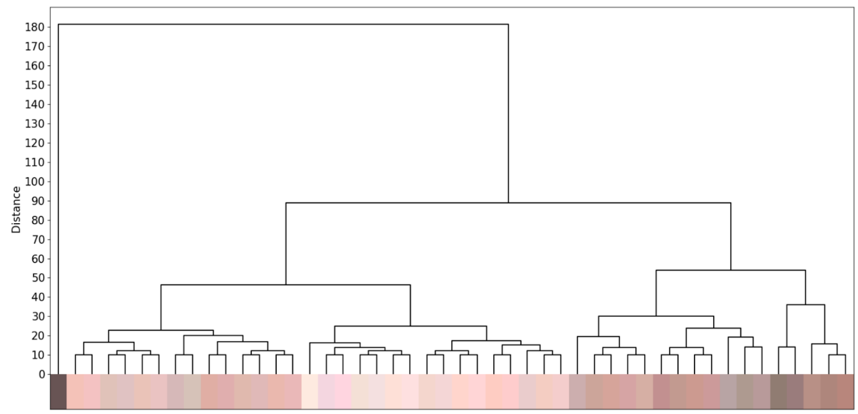


Figure 28: The Dendrogram at Threshold Distance 0 for the Skin of Image 3

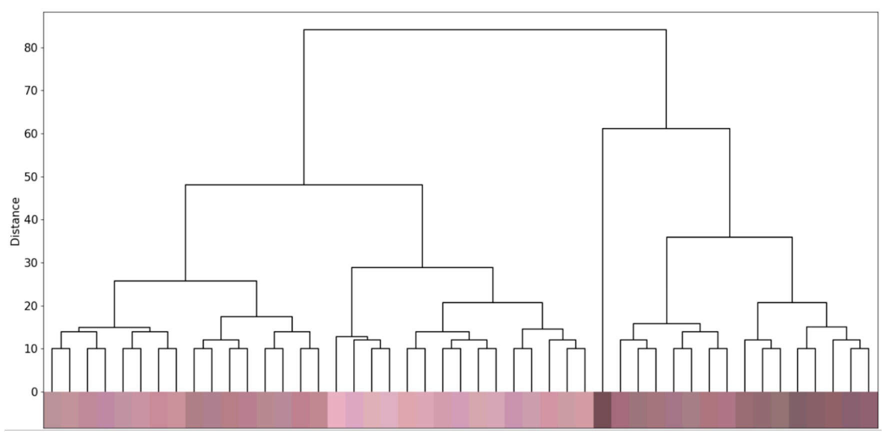


Figure 29: The Dendrogram at Threshold Distance 0 for the Skin of Image 4

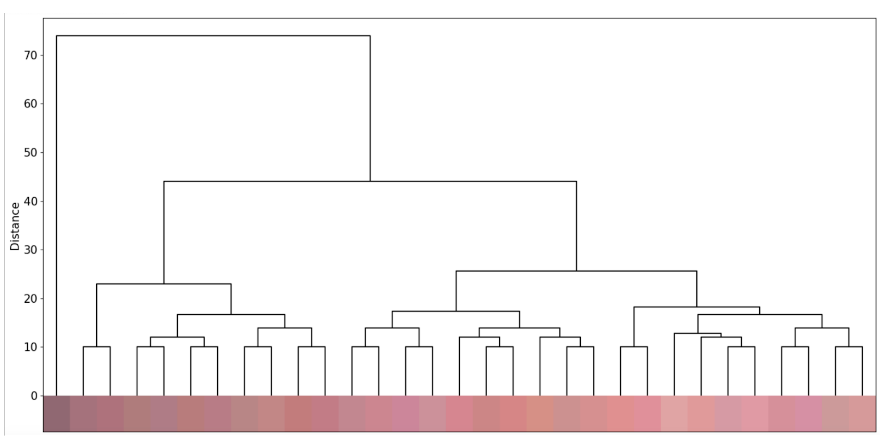


Figure 30: The Dendrogram at Threshold Distance 0 for the Skin of Image 5

XI. REFERENCES

Hsieh, F (2023), *Data Analysis from Scientific Perspective.*, UC Davis.

Liao, S (2023), *discussion notes*, UC Davis.

The Interior Review (2022), "*A Visual Critique of Warhol's Shot Sage Blue Marilyn, 1964"*.