**SKIN TONE SHIFT INDEX**

**Skin Tone Shift Index (STSI)**: To measure the **perceptual color difference** between the original and re-colorized skin tones in a face image.

Dataset: UTKFace, which contains face images labeled by race. Selected races:White, Black, Asian, and Indian

The LAB color is a color representation model designed to approximate human vision. It expresses color using three components:

* L: Lightness, ranging from 0 (black) to 100 (white).
* A: Green–Red axis, where negative values indicate green and positive values indicate red.
* B: Blue–Yellow axis, where negative values indicate blue and positive values indicate yellow.

Lab color makes it particularly useful for detecting small color differences.

**Methodology**

1. **Skin Region Extraction**

* Used a pretrained BiSeNet model (trained on CelebAMask-HQ) to perform face parsing(ResNet Backbone)
* Extracted the skin region only (ignoring lips, hair, etc.)
* This was done for both the original and re-colorized images

2. **Color Conversion**

* Converted the skin pixels from RGB to LAB color space
* LAB allows fair comparison since it aligns with how humans perceive color

3. **STSI Computation**

* For each image pair:
  + Compute the mean LAB vector over the skin region
  + Use Euclidean distance to find the STSI

4. **Analysis**

* Repeated this across images per race
* Then calculated the mean STSI per race

**Results**

**Original image Re-colored image**

 

Mean LAB (Image 1): [165.53689645 154.62622735 167.46239498]

Mean LAB (Image 2): [163.25674329 140.76344639 143.76791513]

STSI (Skin Tone Shift Index): 27.546400306904243

This is a **significant perceptual change**.

Loss of warmth: Both A (redness) and B (yellowness) dropped sharply. This suggests the warm, orange-toned skin of the original image was desaturated toward a cooler, neutral tone, consistent with whitening.

Slight lightening: The L value dropped slightly, but the more notable shift is in color rather than brightness. This aligns with "whitewashing" not through brightness, but through loss of skin hue.

**Biased Color Normalization**

The colorization model may be:

* Shifting skin tones toward a standard pale base
* Failing to preserve race-specific hue characteristics (golden, tan, reddish tones)
* Minimizing diversity in skin color, which is a subtle form of racial bias

In this specific case, the STSI was 27.55: much higher than typical thresholds for perceptual similarity. The LAB shift shows a strong reduction in red and yellow tones, indicating the original golden complexion was flattened into a pale, less saturated tone. It's a sign that the model is unintentionally normalizing warm skin tones toward a lighter default, possibly due to a lack of training in diverse face images.