To improve sorting by color temperature, especially if you’re not getting consistent warm-to-cool order, consider the following approaches that incorporate new methods or refine the existing process. Here are some methods that could potentially improve sorting:

**1. Histogram-Based Warmth Analysis**

* **Method**: Calculate the distribution of pixel temperatures in each image and create a histogram. For example, you could use bins to separate different temperature ranges (e.g., very warm, warm, neutral, cool, very cool).
* **Sorting**: Sort based on the “weight” or concentration of warmer vs. cooler bins. Images with higher counts in warmer bins would be ordered before images with more pixels in cooler bins.
* **Benefits**: This approach captures the overall warmth distribution rather than relying solely on a single average or dominant temperature value.

**2. Weighted Temperature Mean**

* **Method**: Instead of calculating a simple average, calculate a weighted mean that gives more significance to extreme temperatures. For instance, you could assign higher weights to pixels in warmer ranges and lower weights to cooler ranges (or vice versa, depending on your desired order).
* **Sorting**: This adjusted average can produce a “warmth score” that emphasizes the presence of warmer colors more strongly than cooler ones, allowing for a more intuitive warm-to-cool order.
* **Benefits**: This can be particularly useful if images with subtle warm tones are currently appearing too low in the sorted order.

**3. Dominant Hue-Based Sorting**

* **Method**: Convert each pixel’s RGB values to the HSV (Hue, Saturation, Value) color model, which separates color into distinct hue, saturation, and brightness components. Calculate a dominant hue value for each image, as warm colors typically correspond to specific hue ranges (e.g., reds and oranges).
* **Sorting**: Sort based on the average or dominant hue in the image. You could even incorporate both hue and saturation to prioritize images with stronger warm tones.
* **Benefits**: Hue-based sorting can be effective for categorizing images with distinct warm or cool colors, especially if the RGB-based color temperature methods struggle to differentiate between subtle shades.

**4. K-Means Clustering of Pixel Temperatures**

* **Method**: Apply a clustering algorithm like K-Means to the temperature values of the pixels in each image, grouping the colors into clusters (e.g., warm, neutral, cool). The resulting cluster centroids can then represent key “temperature centers” in the image.
* **Sorting**: Use the centroids to rank images based on how much of their color space is occupied by warmer clusters, with images that have higher warm clusters ordered first.
* **Benefits**: This method is data-driven and adaptive, making it more flexible and possibly more accurate in detecting complex color distributions.

**5. Principal Component Analysis (PCA) on Temperature Values**

* **Method**: Perform PCA on the RGB values or the color temperature values of the image pixels to find a single “principal color temperature component” for each image.
* **Sorting**: Use the principal component as a warmth-coolness score to order images. Images with a high value in the first principal component (which should ideally correspond to warmth) are shown first.
* **Benefits**: PCA can reduce the dimensional complexity and emphasize the most prominent temperature trends in each image, producing a sorting order that’s less prone to noise from minor color variations.

**6. Gaussian Mixture Model (GMM) for Temperature Distribution**

* **Method**: Use a Gaussian Mixture Model to model the distribution of color temperatures in each image, identifying the number and mean of the dominant temperature “modes.”
* **Sorting**: Rank images based on the presence of warm vs. cool Gaussian components. You could use the proportion of warm modes to determine image order.
* **Benefits**: This statistical approach can adapt to complex, multimodal color distributions, providing more refined warmth categorization.

**Example Integration of Histogram-Based W**