Color Conceptualization

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Motivation

To define colors from a statistical perspective
To provide a holistic, global level operation on images
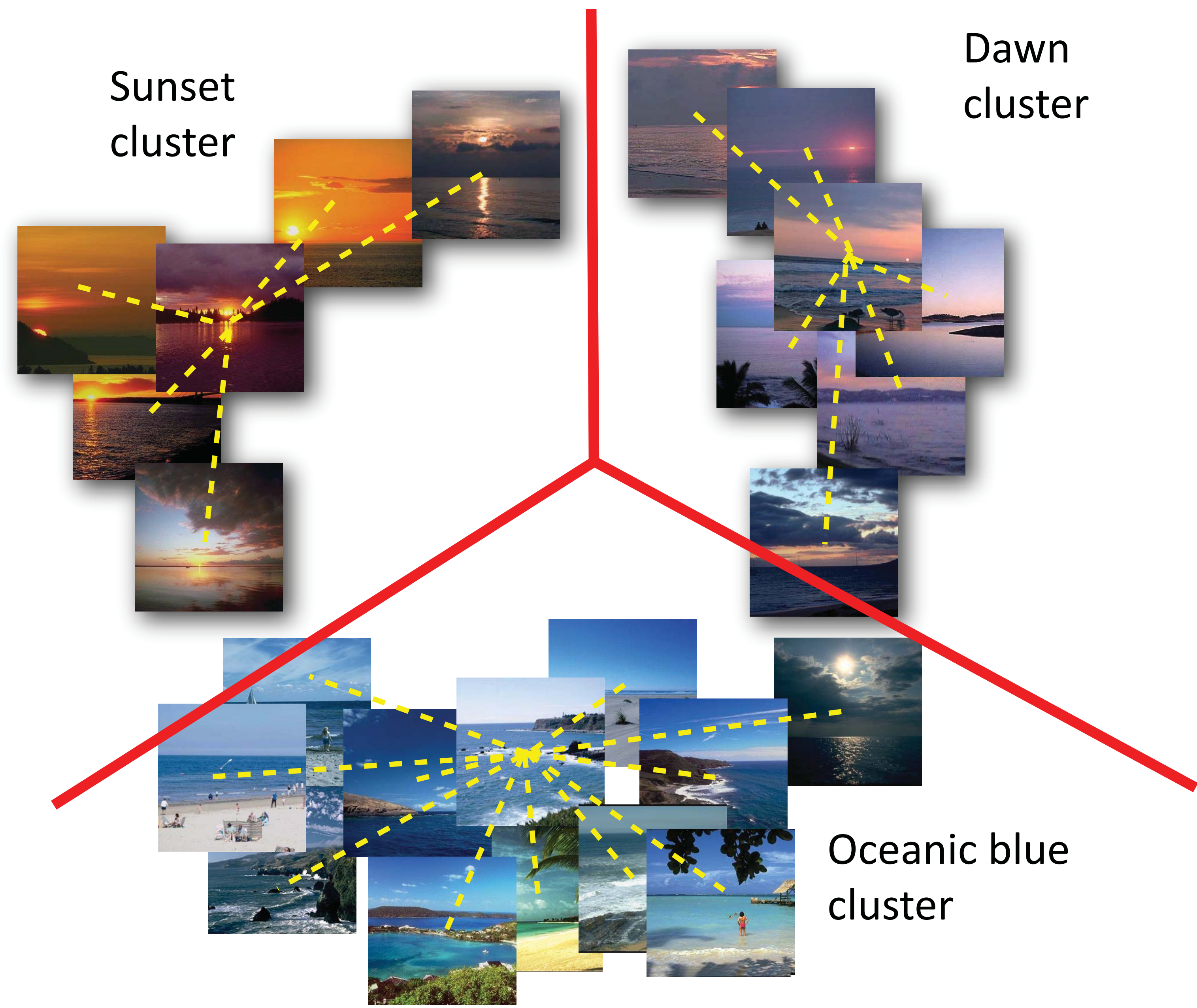To optimize colors automatically

Hue Wheel Representation
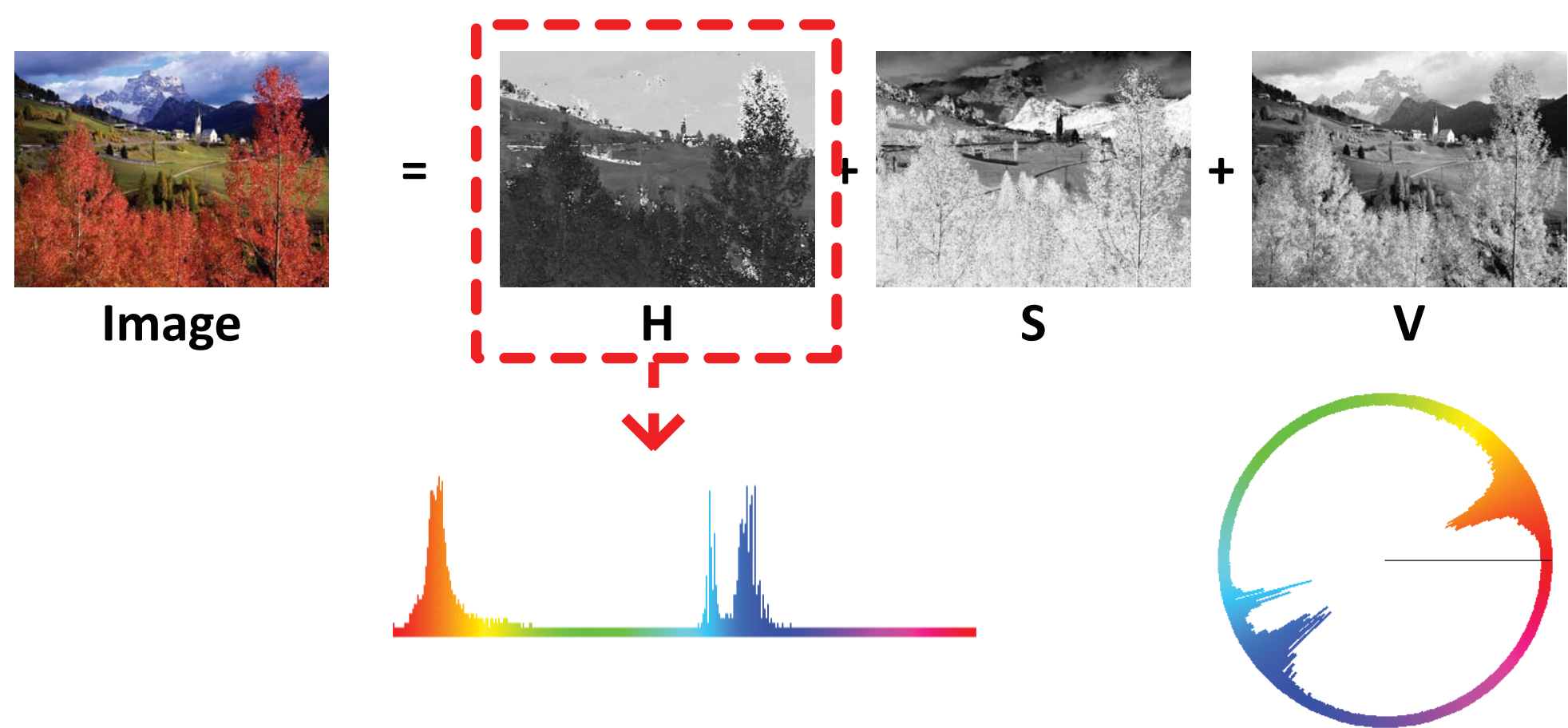
We use the weighted hue info`rmation to calculate the hue histogram

Concetpualization of Colors

The distance between distributions is defined by Kullback-Leibler divergency

Sunset cluster

Dawn cluster

Oceanic blue cluster

To make the clustering process more stable, we adopted CVCL library who has been manually categorized its natural images by their semantic content.

Applying a concept

A concept is a "peak" in the average histogram of a cluster. Pixels corresponding to a concept is selected globally without regarding to their spatial position.
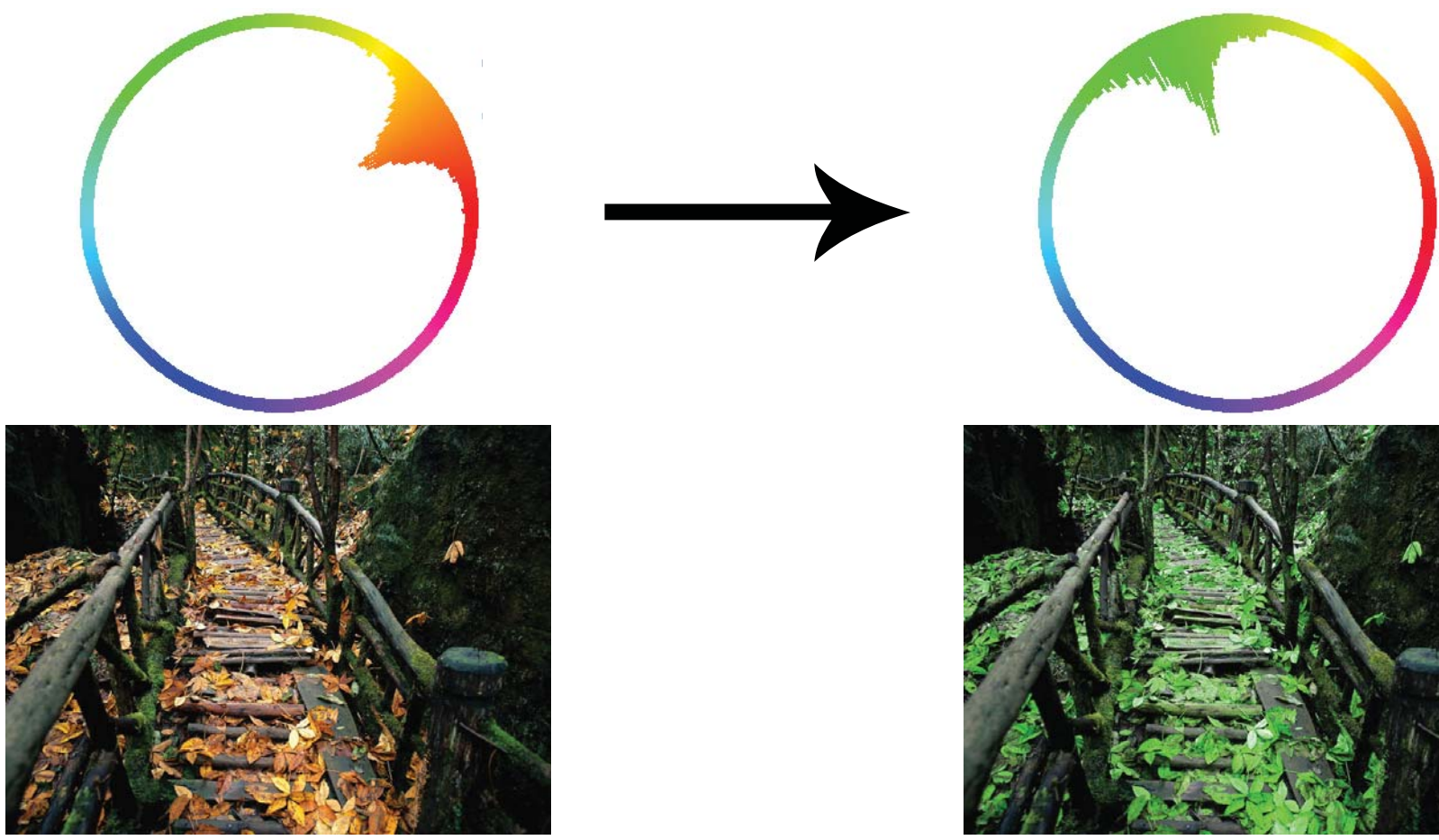
In this example, we first select the distribution peak that corresponds to leaves, and then "shift" this distribution to fit a given concept (Forest concept 1, green).

Eliminating Discontinuities

Discontinuity occurs when we by shifting the hue, separate the spatially neighboring pixels.
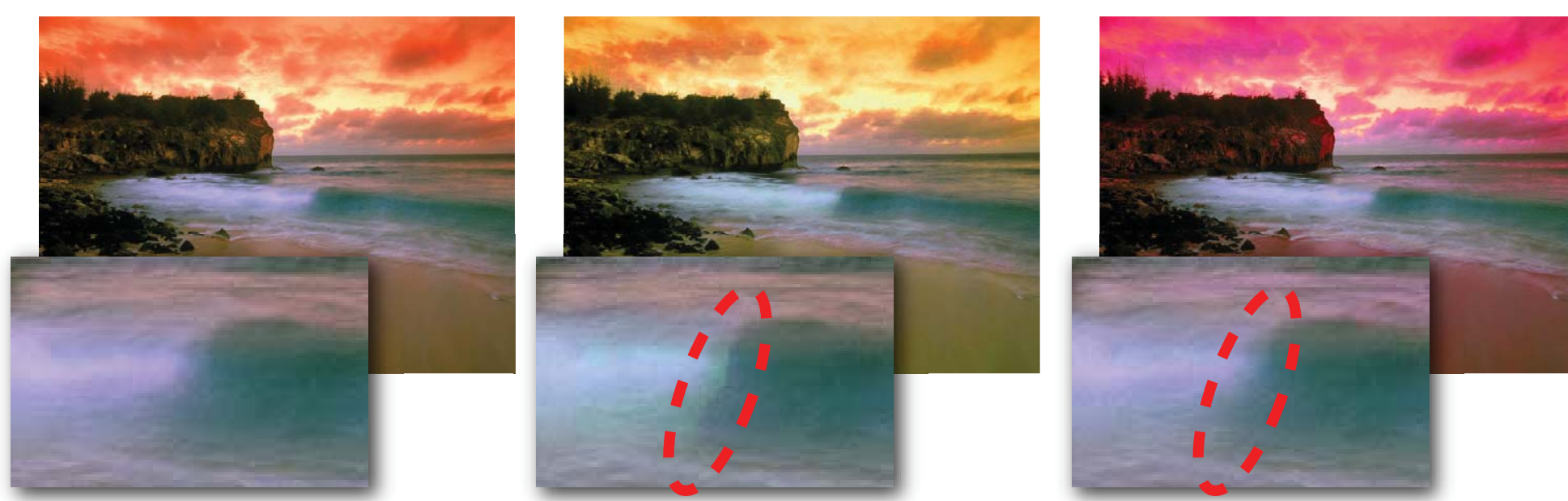
To mak a visually pleasing color change, we can:
1. Cut a peak at local minimum, so that only a small number of pixels are involved
2. Smooth the stern change by a smooth factor.

Discussions

Average is good -- at least not bad!

Given an improperly colored (faded) image, color conceptualization can automatically restore a plausible color set.

In this example, we used autumn forest and autumn countryside to restore image colors separately. Both provide better result than the diagnostically colored input image.

Further Work

In order to find a balance between *pixel* level operation and *global* level operation, we may incorporate segmentation techniques to manipulate *regional* color configurations.

More analysis on the library may also facilitate the conceptualization result, for example, we can crop a particular semantic content (the sea) without being disturbed by foreground objects.