FAST PANORAMA STITCHING ON MOBILE DEVICES

Digital Image Processing Project

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- Transition Smoothing
- Optimal Seam Finding

- **Transition Smoothing**
  Transition smoothing approaches reduce color differences between source images for hiding seams.

- **Optimal Seam Finding**
  Optimal seam finding approaches search for optimal seams in overlapping areas. Labels for pixels of the composite can be created according to the optimal seams.

COLOR CORRECTION

Differences in color and luminance of source images may cause artificial edges in result panoramic images. We perform color correction in the gamma-corrected RGB color space for each source image.

$$\alpha_{c,i} = \frac{\sum_p P_{c,i-1}(p)^\gamma}{\sum_p P_{c,i}(p)^\gamma} \tag{1}$$

Where $P_{c,i}(p)$ is the color value of pixel p in image S_i in the overlapping area between S_i and S_{i-1} in color channel c and γ is a gamma coefficient. With the color correction coefficients, we can perform color correction for source image S_i by

$$P_{c,i}(p) \leftarrow \alpha^{\frac{1}{\gamma}} P_{c,i}(p) \tag{2}$$

- DP for Optimal Stitching Path

We want to merge two images on pixels where they match best. Suppose I_c^o and S_i^o are the overlapping images of the current panoramic image I_c and the current source image S_i respectively. We compute a squared difference exp between I_c^o and S_i^o as an error surface,

$$e = (I_c^o - S_i^o)^2 \tag{3}$$

We find errors of all possible seams using Dynamic Programming paradigm

$$E(h, w) = e(h, w) + min(E(h-1, w-1), E(h-1, w), E(h-1, w)) \tag{4}$$

The optimal path can be obtained by tracing back with a minimal cost from bottom to top. For the last row, the minimum value can be used say (h_o, w_o) For the next upper row, if

$$E(h_o - 1, w) = E(h_o, w_o) - d(h_o, w_o), w \in \{w_o - 1, w_o, w_o + 1\} \tag{5}$$

- **Weighted Stitch around Optimal Path**

In order to further smooth color transition across the seam, we perform image blending in the area along the seam with a width δ in each side.

$$P_{I_c,new}(p) = \frac{d_1^n P_{I_c}(p) + d_2^n P_{S_i}(p)}{d_1^n + d_2^n} \tag{6}$$

Where d_1 and d_2 are distances between current pixel p to the boundaries. Different n results in different color transition.

The End