

Panoramic image stitching



steps

- Feature Matching

- Extract and match SIFT features between all images

- Image matching

- Use the same algorithm in the class that calculate matrix H in coplana camera calibration (RANSAC) to calculate Homography matrix between images

- accept an matched image pair only if : $N_i > 8.0 + 0.3 * N_j$

- Bundle Adjustment

- Multi-Band Blending

Bundle Adjustment

- Use Levenberg-Marquardt to minimize:

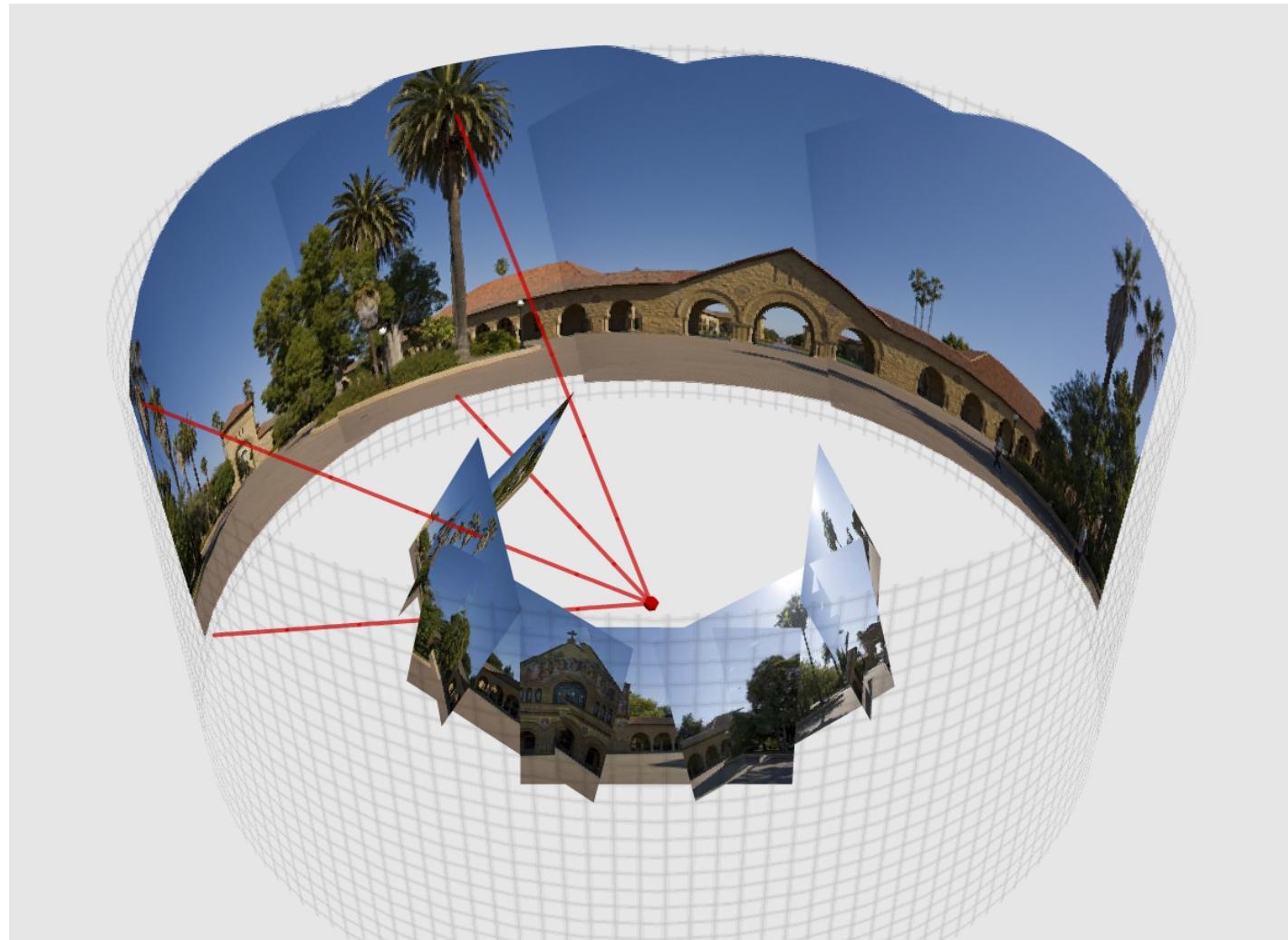
$$e = \sum_{i=1}^n \sum_{j \in \mathcal{I}(i)} \sum_{k \in \mathcal{F}(i,j)} h(\mathbf{r}_{ij}^k)$$

$$h(\mathbf{x}) = \begin{cases} |\mathbf{x}|^2, & \text{if } |\mathbf{x}| < \sigma \\ 2\sigma|\mathbf{x}| - \sigma^2, & \text{if } |\mathbf{x}| \geq \sigma \end{cases}.$$

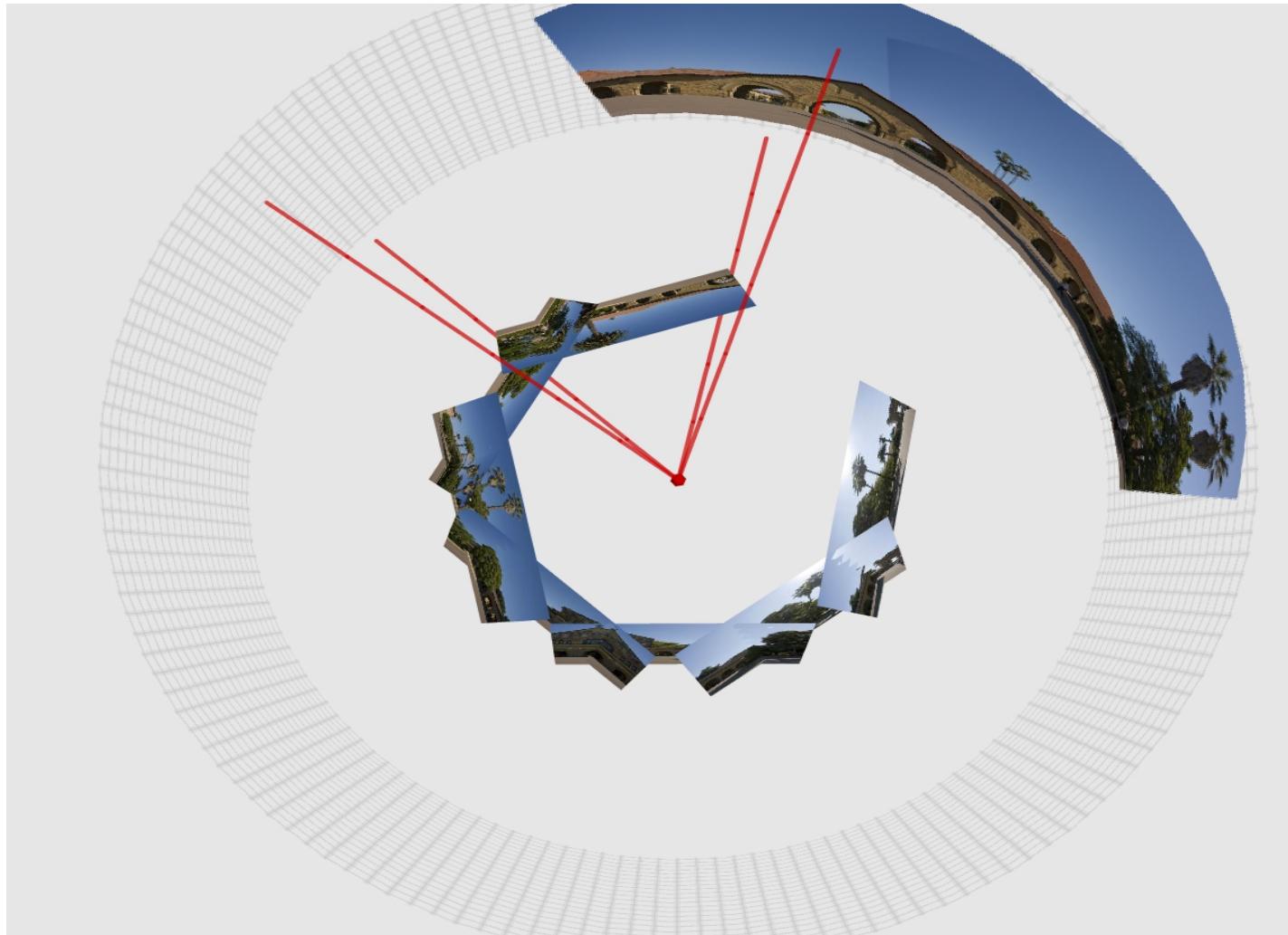
$$\tilde{\mathbf{p}}_{ij}^k = \mathbf{K}_i \mathbf{R}_i \mathbf{R}_j^T \mathbf{K}_j^{-1} \tilde{\mathbf{u}}_j^l.$$

$$\mathbf{r}_{ij}^k = \mathbf{u}_i^k - \mathbf{p}_{ij}^k$$

Project to Cylindrical/spherical Coordinate



Project to Cylindrical/spherical Coordinate





Multi-Band Blending



Multi-Band Blending



Without blending



With blending

Multi-Band Blending

- Decompose the image into several frequency ranges
- Blend low frequencies over a large spatial range
- Blend high frequencies over a small spatial range
- Difference of Gaussian

Multi-Band Blending



Multi-Band Blending



Multi-Band Blending



Multi-Band Blending



Multi-Band Blending



Multi-Band Blending



Thank you

END