Automatic Panoramic Image Stitching using Local Features

Introduction

- 1D rotation(θ) Ordering
- 2D Rotation(θ, ϕ) Matching images

Automatic Stitching

Feature Match(SIFT)

$\forall NN(j) = argmin_i ||x_i - x_j||, i \neq j$

Nearest Neighbor search(FLANN)

Good for high dimension desciptor like SIFT, the speed is also fast

2D Motion/Transformation model (P23)

Homography for rotation

- Projection equation $u = \bar{K}(R|T)\bar{X}$

$$\bar{u_i} = K_i(R_i|0)\bar{X} = K_i R_i X$$
$$\bar{u_j} = K_j(R_j|0)\bar{X} = K_j R_j X$$
$$\bar{u_i} = H_{ij}\bar{u}_j$$
$$H_{ij} = K_i R_i R_j^T K_j^{-1}$$

Image Alignment

Bundle adjustment

- Sum of square error(solve non linear square problem)
- Adjust rotation, focal length of each image to minimize error in match feature.

Gain Compensation

Improve the quality of stitch

Multi-band Blending

Combine two image band(see P42). * No blending
Each is a weighted sum

$$I^{linear} = \frac{\sum_i I^i W^i}{\sum_i W^i}$$

Pyramid blending

Seam Selection

- (simple) Choose image with max "weight"
- (better) also minimize error on seams

Conclusion

- Feature match
- Multi-image match framework(RANSAC)