Three Dimension Reconstruction of Landmark using 2D Images

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Problem Definition

- 3 Subproblems in 3D reconstruction
  - Feature Recognition and Matching
  - Mapping points in 2D images to 3D co-ordinates
 - Rendering based on Points to create 3D model

Dataset

- 715 Images of Notre Dame Cathedral
- Size of the Dataset: 1.8 Gb

Feature Recognition and Matching

- Feature Extraction

  – Algorithm: SIFT

- Feature Matching

  – Algorithm: Approximate Nearest Neighbor

- Removing False Matches

  – Removing multiple matches to same point

  – Determination of fundamental matrix using RANSAC

Representation After Matching

- Represented Using graph
- Images are nodes
- Edges exists if consistent matches are found
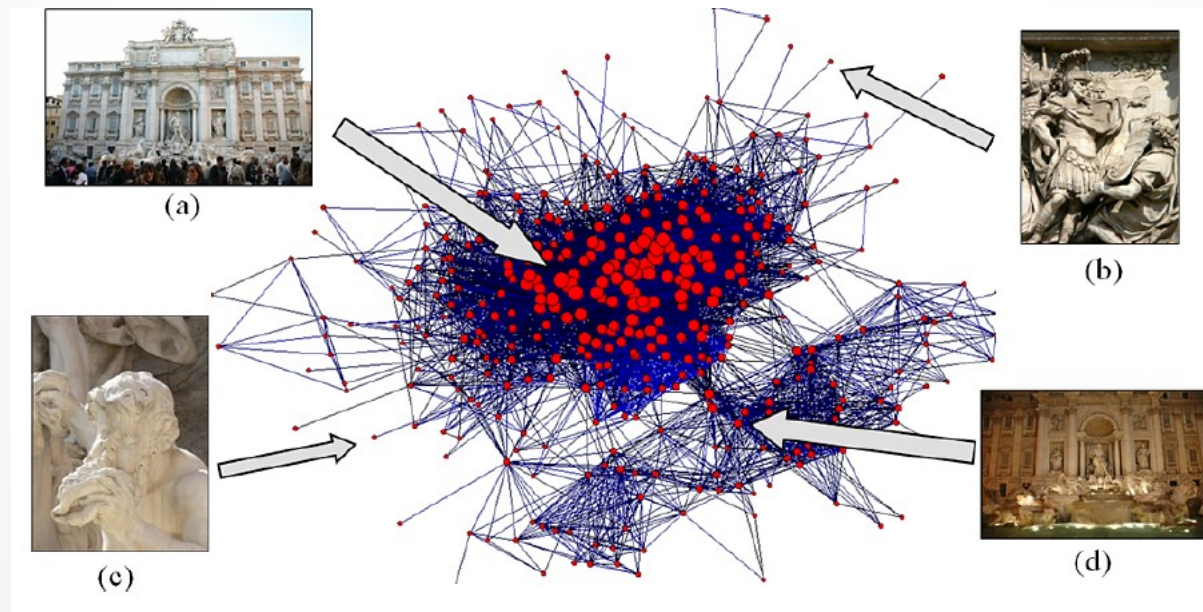
Structure From Motion

- Baseline:
  - 2 images with maximum feature matches
  - Homography between two can't be modeled accurately
    - Algorithm: RANSAC to determine minimum inliers
- Determination of Essential Matrix
- Reconstruction of Tracks using essential matrix determined

Structure From Motion

- Incremental Addition of Cameras based on highest number of previously reconstructed 3D points

- A point is added when it is observed by more than one recovered camera

- Termination Criteria: Number of reconstructed points observed by the current camera is less than a threshold

Optimizations

- Adding multiple cameras rather than single camera to the optimization

  – Let M be the maximum previously reconstructed points observed by the current camera, than any camera with 0.75M is added to the model.

References

- Snavely, N., Seitz, S. M., & Szeliski, R. (2006, July). Photo tourism: exploring photo collections in 3D. In ACM transactions on graphics (TOG) (Vol. 25, No. 3, pp. 835-846). ACM.

Thank You