COS 429 PS3: Stitching a Panorama

Due November 4th

Goal

- Find key features in images and correspondences between images
- Use RANSAC to find the best correspondences
- Map one image plane to another to create a panoramic image

Problem 1: Preprocessing

- Most feature descriptors only work with grayscale images

- Task:

  – Convert color images to grayscale

    - You can use Matlab function **rgb2gray**

  – Copy the lines of code you wrote **in the report**

Problem 2: Detecting Key Points

- Want to detect the key points in both images and find corresponding key points between both images

- Task:

  - Find SURF features in both images

    - You can use Matlab function **detectSURFFeatures**

 - Copy the lines of code you wrote **in the report**

Problem 3: Extracting Descriptors

- Extract feature descriptors at each key point detected in Problem 2

- Task:

  - Extract feature for each key point

    - You can use Matlab function **extractFeatures**

  - Visualize the descriptors and include **in the report**

 - Copy the lines of code you wrote **in the report**
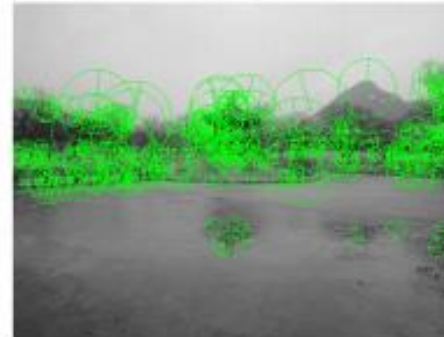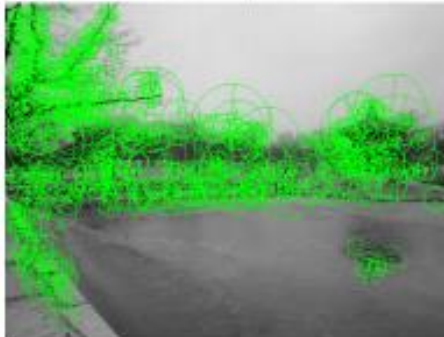
Problem 4: Matching Features

- Task:
  - Find matching features between both images
    - You can use the Matlab function **matchFeatures**
  - Visualize the matching results and include a figure **in your report**
  - Copy the lines of code you wrote **in the report**
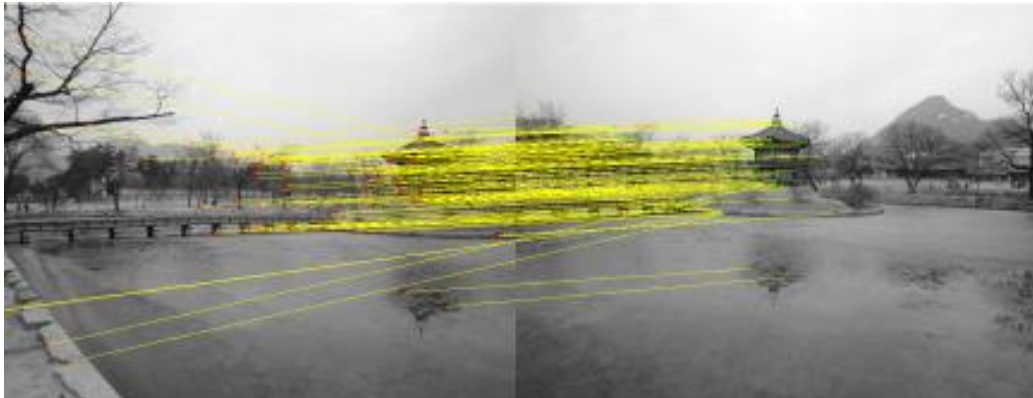
Problem 5: RANSAC to Estimate Homography

- We want to exclude outlier matches and compute a homography to map one image plane to the other
- Task:
  - Use RANSAC to estimate a homography
  - You can use Matlab function **estimateGeometricTransform**
  - Visualize the matching results and include **in your report**
  - Copy the lines of code you wrote **in the report**
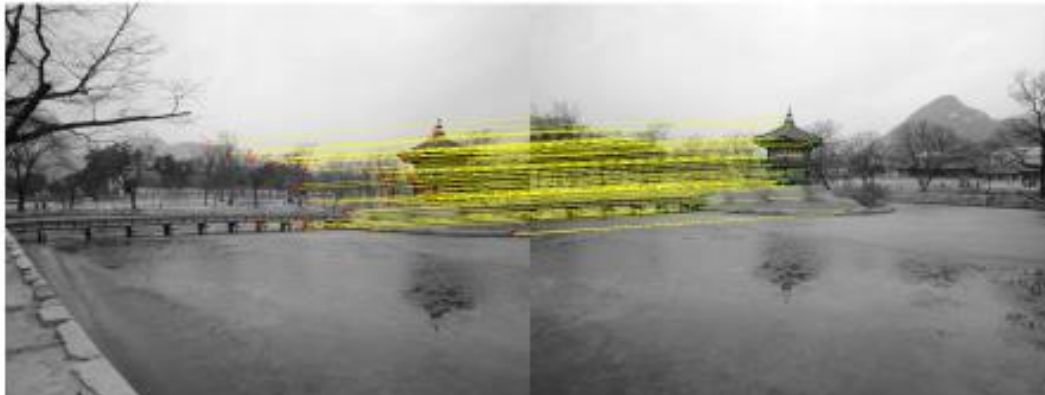
Problem 6: Stitching Panorama

- Need to warp images to make a panorama
  - Map pixels in the warped image to pixels in the input image to avoid holes in the final image
  - Code provided to warp the first image
- Task:
  - Write similar code to warp and paste the second image to produce a final panoramic image
    - You can use MATLAB functions **imwarp, vision.AlphaBlender,** and **step** to overlay the second image on the first
  - Add the resulting panorama **to your report**
  - Copy the lines of code you wrote **in the report**

- Notes:
  - Don't worry about blending (visible seams)
  - Results will vary since RANSAC is a randomized algorithm

Problem 7: Take Your Own Pictures for Princeton Campus

- Task:
  - Take two pictures of Princeton's campus, run the code to stitch them together
  - Include the original two photos and the final panorama **in your report**

Extra Credit

- Many possible ways to get extra credit:
  - Try alpha blending to merge the overlapping image regions to get rid of boundary
  - Use Graph Cut to find an optimal seam between the two images
    - Use Poisson blending to blend the two images
  - Handle more than 2 images
  - Combine photographs into a 360° x 180° panorama (equirectangular projection)
  - Convert the panorama into a stereographic projection
  - Reconstruct the 3D geometry of the panorama

What to Submit:

- One PDF file report
- One ZIP file containing all the source code, and a "ps3.m" file that takes no parameters as input and runs directly in Matlab to generate the results in the pdf report