CS 4476: Computer Vision, Fall 2020
PS4

Instructor: Devi Parikh

Due: Wednesday, October 23, 11:59 pm

Instructions

1. The deliverables for this assignment must be submitted on Gradescope. Please follow the submission instructions carefully.

   - Save your written answers to a pdf file. LaTeX is strongly encouraged.
   - Answers to each problem must be on a separate page (or pages). On Gradescope uniquely assign each page to a single problem. Multiple sub-problems can be included on the same page.
   - Do not include your name on the answer sheet.
   - Upload your pdf to the PS4 assignment on Gradescope.
   - Export your code into a file named ps4.py.
   - Upload ps4.py and ps4.ipynb to the PS4 Code assignment on Gradescope.

1 Short answer questions [25 points]

1. When performing interest point detection with the Laplacian of Gaussian, how would the results differ if we were to (a) take any positions that are local maxima in scale-space, or (b) take any positions whose filter response exceeds a threshold? Specifically, what is the impact on repeatability or distinctiveness of the resulting interest points?

2. What is an "inlier" when using RANSAC to solve for the epipolar lines for stereo with uncalibrated views, and how do we compute those inliers?

3. Name and briefly explain two possible failure modes for dense stereo matching, where points are matched using local appearance and correlation search within a window.

4. What exactly does the value recorded in a single dimension of a SIFT keypoint descriptor signify?

5. If using SIFT with the Generalized Hough Transform to perform recognition of an object instance, what is the dimensionality of the Hough parameter space? Explain your answer.

2 Programming problem [75 points]

For this problem, you will implement a video search method to retrieve relevant frames from a video based on the features in a query region selected from some frame. We are providing image data and some starter code for this assignment. Follow the instructions in the ps4.ipynb file from this zip file.

3   OPTIONAL: Extra credit (up to 10 points each, max 20 points total)

1. **Stop list and tf-idf**. Implement a stop list to ignore very common words, and apply tf-idf weighting to the bags of words. Discuss and create an experiment to illustrate the impact on your results.

2. **Spatial verification**. Implement a spatial consistency check to post-process and re-rank the shortlist produced based on the normalized scalar product scores. Demonstrate a query example where this improves the results.

This assignment is adapted from PS4 of Kristen Grauman's CS 376: Computer Vision at UT Austin.