CS 4363/5363 Computer Vision

Spring 2021

Exam 1

This exam consists of five questions that involve computer vision problems that we ask you to solve using one or more of the techniques described in class. For each question, describe in detail a solution to the problem and then implement your solution.

For 4363, your grade will be computed from your best 3 answers (additional correct answers will be extra credit). For 5363, your grade will be computed from your best 4 answers and the other answer will be extra credit.

For any question, the description of the solution is worth 25% of the points and the implementation is worth the remaining 70%.

Additionally, we will give extra credit for complete submission of solutions to all the problems by 9 a.m., March 30.

1. Write a program to find stop signs by finding the reddest region in the image. We define the reddest region as the region with the largest sum of red indices. If R, G, B are the three channels in an image, the red index R_i is given by $R_i = 2R - G - B$.

2. Write a program to count the number of coins in images like the ones included.

3. Write a program to generate a video combining a green-screen video and an image. Your program should prompt the user to click on the position where the video should be inserted. See the included inputs and expected results.

4. The attached program uses ORB descriptors to find the model stop sign in the images provided. However, since too many matches are found, results are not satisfactory. Modify the code to try to find only the matches that are geometrically consistent using ransac.

5. A simple way determine if an image consists mostly of man-made structures such as buildings relies on the observation that gradients in man-made images tend to have either vertical or horizontal directions. If we compute gradients in 8 directions (for example, in the intervals $[-22.5^o, 22.5^o], [22.5^o, 67.5^o], ..., [292.5^o, 337.5^o]$), the sum of gradients in intervals that correspond to vertical or horizontal lines should be significantly larger than the sum of gradients in intervals that do not correspond to vertical or horizontal lines. Extend the code provided to implement this rule.