**Date handed out: 22 March 2024, Friday**
Date Submission due: 5 April 2024, Friday 23:00

Image Matching

Objectives: This assignment aims to familiarize you with image transformations, local invariant feature detection, description, and matching. The assignment is organized into two main parts, each of which requires different techniques. For each part, you are required to develop your algorithm based on only the techniques you learned in the lectures.

Description: In this assignment, you will write a code to detect discriminating features in an image and find the best matching features in other images as shown below.
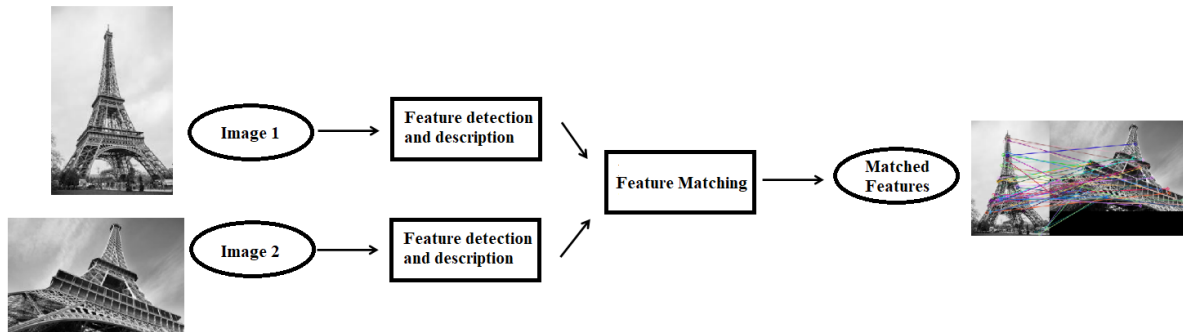
Three main parts of the assignment are as follows;

1) **Create your dataset (26 points):**
   a) (2 points) Choose 2 different images and name them as original_1 and original_2. Then, save them in a folder named *"Dataset"*.
   b) (12 points) Scale original images by a factor of 3 to create transformed images and name them scaled_1 and scaled_2. Then, save them in a folder named *"Dataset"*.
   c) (12 points) Rotate original images by 45 degrees to create transformed images and name them rotated_1 and rotated_2. Then, save them in a folder named *"Dataset"*.

   Hence, in total, you will have 6 images (2 original images and 4 transformed images) in your dataset.

2) **Feature matching (74 points):**

   a) (5 points) Read all the images in the *"Dataset"* folder.
   b) (10 points) Generate SIFT features (key points) for all read images.
   c) (10 points) Match all key points of each original image to the corresponding transformed images and sort matching key points according to the matching distance.

d) (10 points) Display the top ten matched key points for each pair of the original image and a transformed image (4 figures should be displayed).

e) (15 points) Plot the matching distance for the top 10 matched key points. Plot indices of key points on the x-axis and corresponding matching distance on the y-axis.

f) (10 points) Discuss the effect of increasing/decreasing the scale on the matching distance.

g) (10 points) Discuss the effect of increasing/decreasing the rotation on the matching distance.

h) (4 points) Explanation of code step by step and reasons for used techniques.

Regulations:

1) **Programming Language:** You must code your program in MATLAB or Python. You are expected to make sure your code runs successfully. If your code doesn't compile, your grade will be zero.

2) **Implementation:** You must use the same input and output format that is given to you, including file names. Check the above grading policy, if you fail to do any of them or do not obey the stated rules, your grade from that part will be zero or there will be a mark deduction.

3) **Late Submission:** Late submission is not allowed; your grade will be zero.

4) **Cheating:** Please read carefully the cheating policy from the course syllabus for more details.