CIE 552 mini-project 2

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**Local feature matching**

**Introduction**

This project focuses on feature matching between two images. It consists of three main steps:

• Interest points detection: using Harris Corner Detector algorithm.

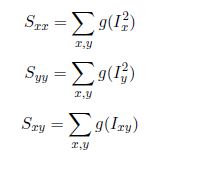
• Local feature description: Representing the features and regions around the location in the image as a vector called feature vector using Scale-Invariant feature transform (SIFT) technique.

• Feature matching: Matching features by calculating the distance between

features and find similarities by implementing the Nearest Neighbor Distance Ratio algorithm.

**Interest points detection algorithm**

* Blur the image using the gaussian filter.
* Calculate the gradient of the image using the following equation:, *.*
* Calculate the following parameters:



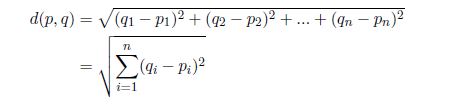
* Calculate the C matrix using the following equation:
* Select interest points based on a certain threshold.

**SIFT implementation algorithm**

* Represent the points in a 128-point vector.
* Blur the image using the gaussian filter.
* Calculate the gradient of the image using the following equation:, *.*
* Calculate the magnitude and angle gradients using the following equations:
* Apply a gaussian filter on a 16x16 size window.
* Divide the 16x16 slots into 16 4x4 slots.
* On the edge of the 4x4 table, calculate the histogram with bins=8 for the 128-point vector at each interest point.
* Reshape the 16x8 matrix into a 128-point vector.
* Normalize the vector.
* Clamp all vector values > 0.2 to 0.2.

**Feature matching**

* Compare the points using the nearest neighbor distance ratio.
* Calculate the Euclidean distances using the following equation:

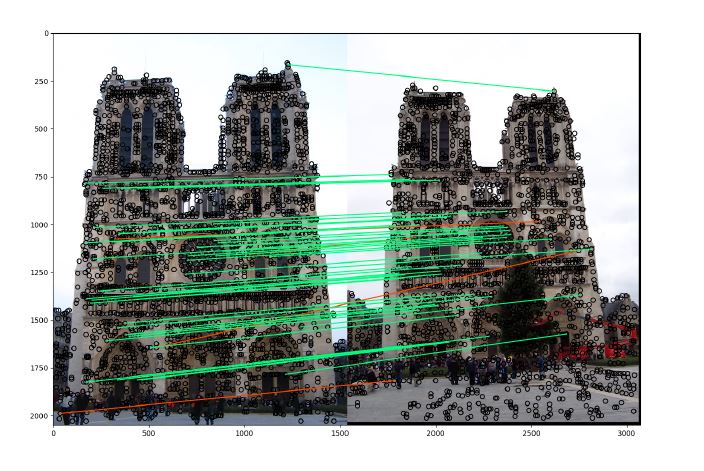


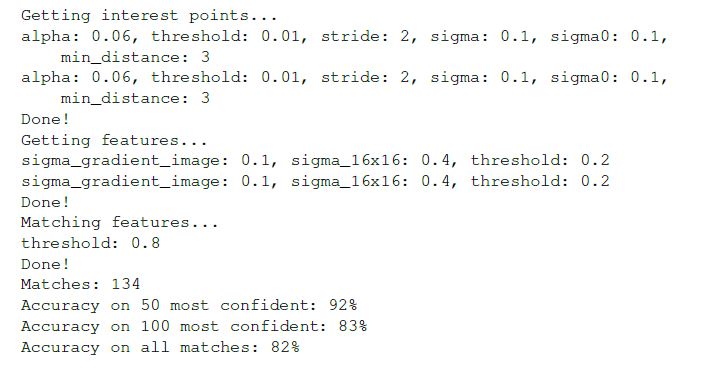
* If the 0.8 distance is equal the 2nd distance, then the value vector with minimum distance is calculated as a match between two keys points.

**Results**

**Notre Dame**

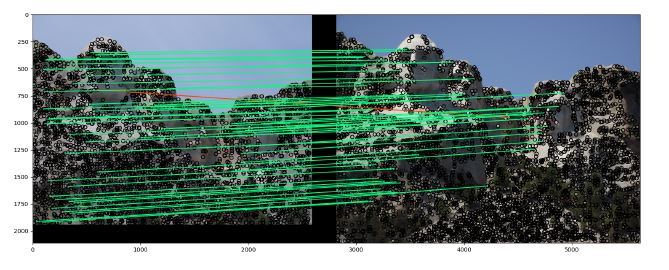
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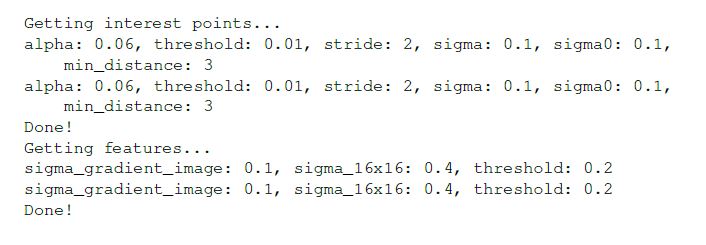
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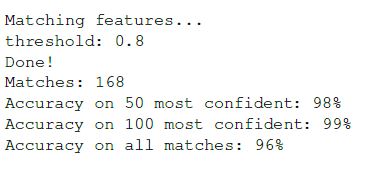
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**Mount Rushmore**

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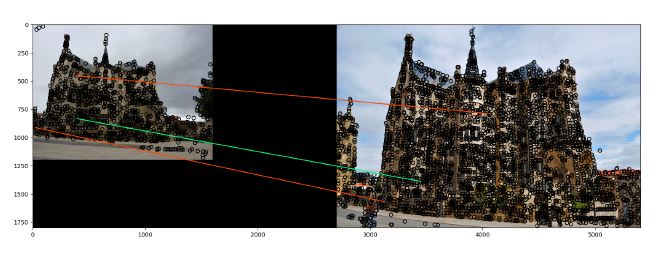
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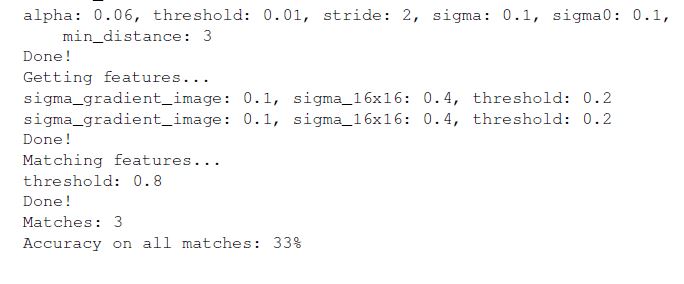
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