

# Project 2: Feature Detection and Matching

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## Summary

In this report, we would include benchmarking results in terms of ROC curves and AUC on the Yosemite dataset, as well as the harris image.

## Benchmarking Results

We ran the benchmark in featuresUI.py on the Yosemite dataset and we got the feature matching results for all 4 config, shown in the following figures.

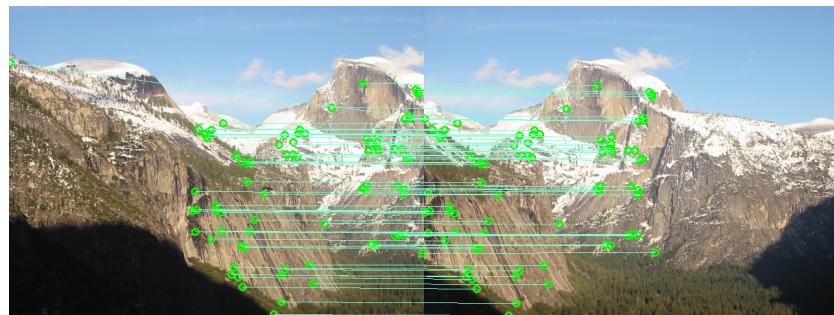


Figure 1: Simple descriptors with Ratio distance

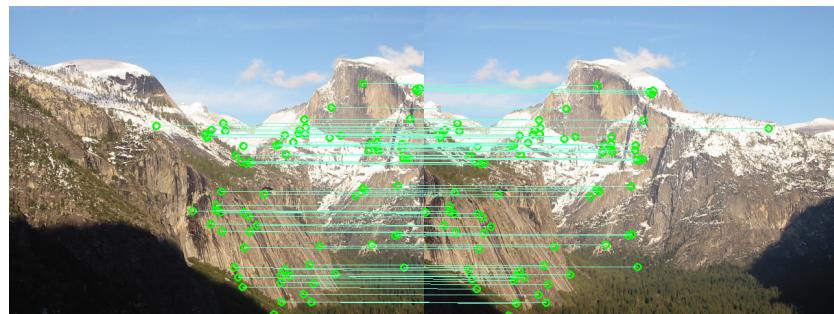


Figure 2: Simple descriptors with SSD distance

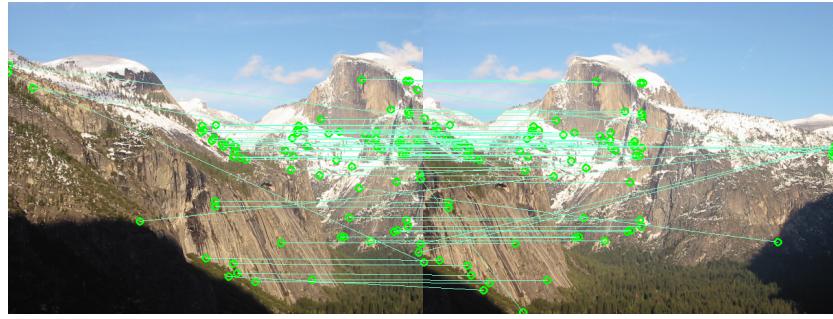


Figure 3: MOPS descriptors with Ratio distance

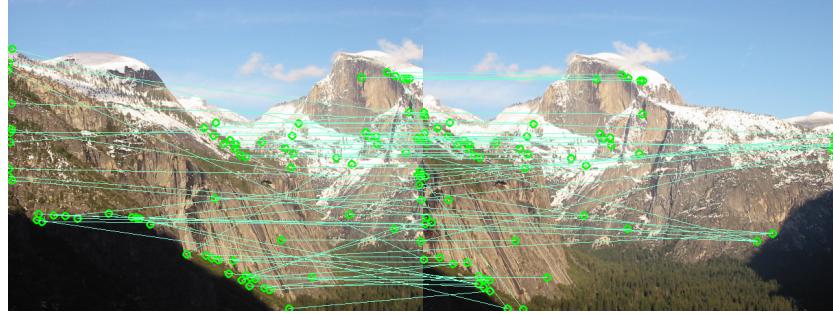
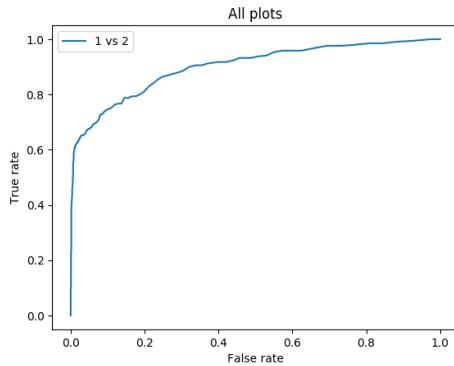
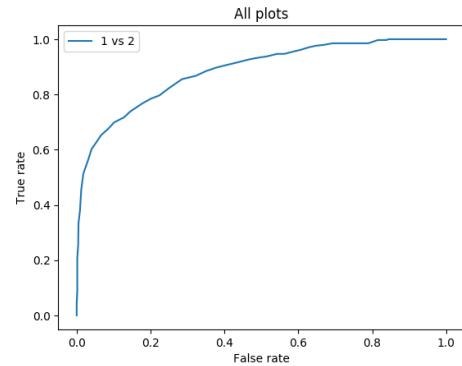


Figure 4: MOPS descriptors with SSD distance

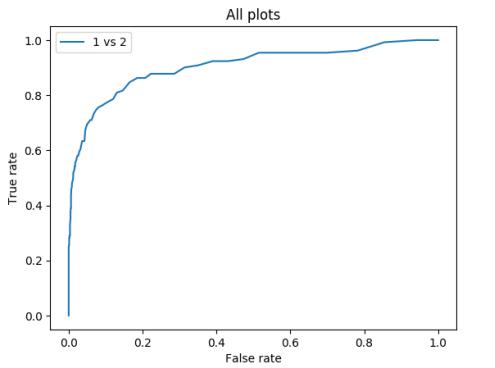
Benchmark results and corresponding ROC curves for each configurations were shown in the following figures.



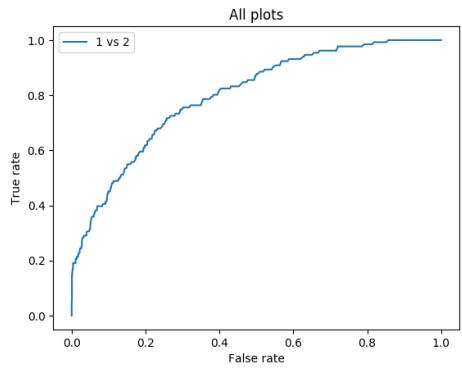
(a) Simple descriptors + Ratio dist



(b) Simple descriptors + SSD dist



(a) MOPS descriptors + Ratio dist



(b) MOPS descriptors + SSD dist

**Which method is the best?** Comparing Simple Descriptors and MOPS Descriptors, we found that **MOPS** method generally performs better. In terms of Ratio Distance and SSD Distance, we noticed that **Ratio Distances** gives better performance and empirically speaking, Ratio Distance runs even faster.

Corresponding AUC data is shown in the following table:

	<i>Ratio Distance</i>	<i>SSD Distance</i>
Simple Descriptors	0.900	0.885
MOPS Descriptors	0.904	0.799

Table 1: AUC for all four configurations

## Harris Image

Harris image on yosemite1.jpg is shown in the Figure 7 with a default threshold of  $10^{-2}$ . We noticed that the mountain part of the image is greatly highlighted. However, the sky as well as the shadow is not, which is because those regions have less gradients in both directions.

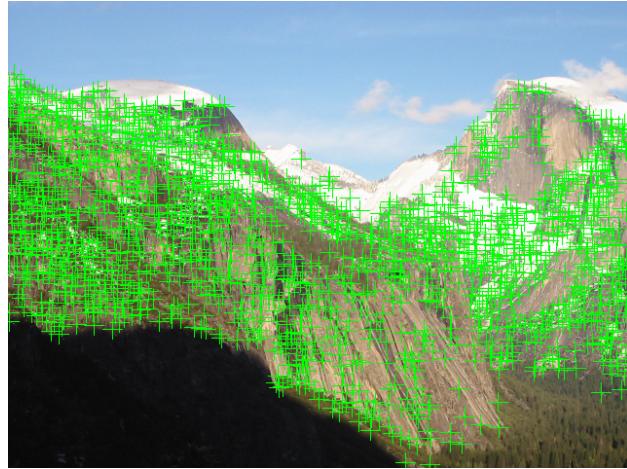


Figure 7: Yosemite Image Harris Keypoints

## Our Own Creation

We chose a photo we took this morning, and its Harris keypoints with a threshold of  $10^{-2}$  are shown in the Figure 9.

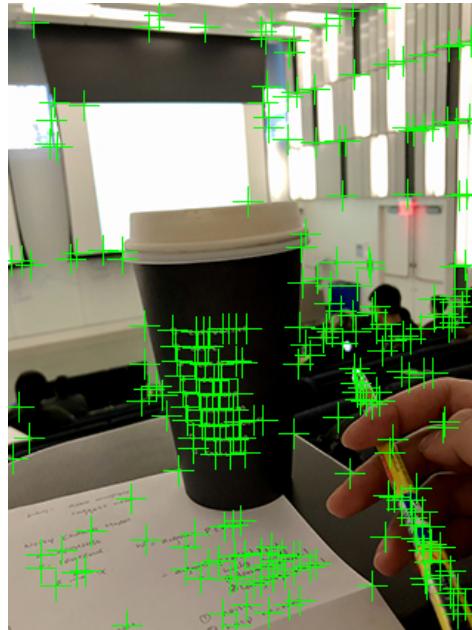


Figure 8: Coffee Image Harris Keypoints

Feature matching performance of MOPS + Ratio distance is shown in the Figure 9. Screenshot is shown in the Figure 10.

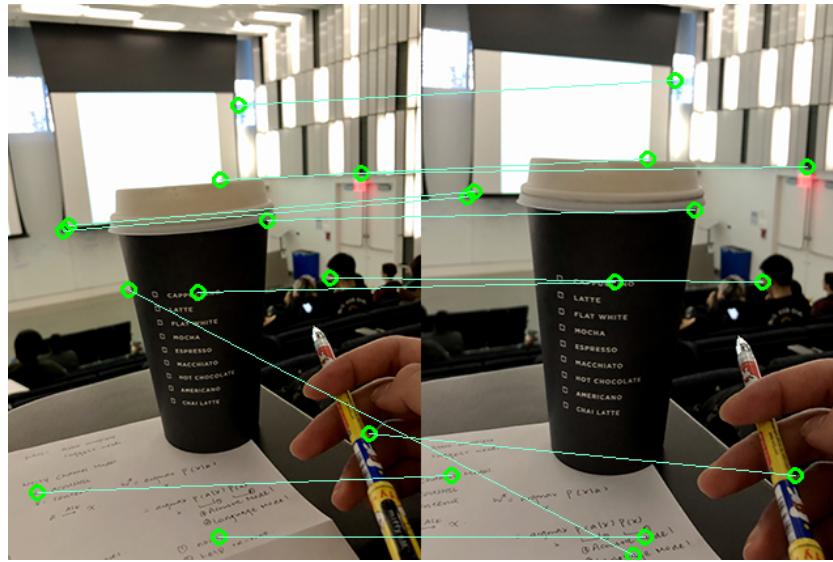


Figure 9: Coffee Image Matching (MOPS+ratio)

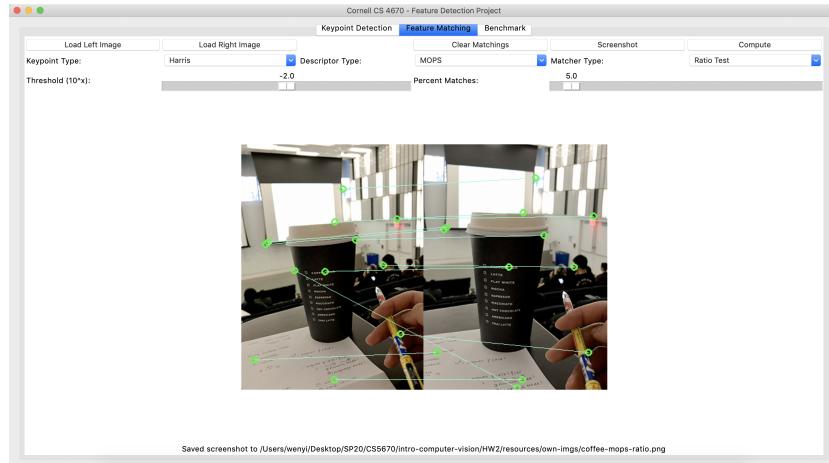


Figure 10: Coffee Image Screenshot