Satellite image matching. Report

I. The project conclusion.

The project addresses the task of keypoint detection and matching for satellite images sourced from the Sentinel-2 dataset. The implemented algorithm leverages the Harris corner detector for identifying potential keypoints and the Binary Robust Independent Elementary Features (BRIEF) descriptor for efficient and robust matching. By extracting binary descriptors and comparing pixel intensities, BRIEF enables quick and effective matching, aiding in the identification of corresponding features across two images. The algorithm's functionality is encapsulated in a Python script, offering a straightforward solution for users seeking to align and analyze pairs of Sentinel-2 satellite images seamlessly. The performance of the algorithm leaves something to be desired, yet at the same time the algorithm performs well in simple setting, such as different bands of the same image.

II. Possible improvements.

Possible improvements for the project include exploring the integration of neural networks and deep learning techniques to enhance key aspects of the algorithm.

1. In terms of keypoint detection, while the current approach utilizes Harris corner detection, there is potential for improvement by training a learning-based detector. However, this would necessitate a labeled dataset for effective training.
2. As to keypoint description, the descriptor could benefit from deep learning methods. Creating a dataset by cropping fragments around keypoints from different bands and employing a network to generate feature vectors, with a penalty for dissimilarity, offers a viable avenue for exploration.
3. Finally, for keypoint matching, it is possible to use both algorithmic and machine learning approaches. The simpler way is to match keypoints using Euclidean distances between corresponding feature vectors.