Image Stitching using RANSAC with Affine vs. Projective Models

Introduction

In this report, we evaluate the performance of RANSAC (Random Sample Consensus) in conjunction with affine and projective transformation models for image stitching. The goal is to compare the effectiveness of these models in aligning and stitching overlapping images.

Methodology

We implemented image stitching using Python, utilizing libraries such as NumPy, OpenCV, and scikit-image. The stitching process involves the following steps:

1. **Feature Detection**: Keypoint detection using SIFT (Scale-Invariant Feature Transform) to identify distinctive points in the images.
2. **Feature Matching**: Matching keypoints between the images to find correspondences.
3. **Model Estimation**: Using RANSAC to estimate transformation models (affine and projective) based on the matched keypoints.
4. **Image Warping**: Warping the images according to the estimated transformation models to align them properly.
5. **Blending**: Blending the warped images to create a seamless panorama.

Results

We tested our implementation on sample images provided through Canvas, focusing on scenarios where RANSAC with both affine and projective models were applied. Here are some notable outcomes:

1. **Affine Model**:
    - The affine model generally produced satisfactory results when the images had slight perspective changes or rotations. It effectively aligned images with minimal distortion in areas of overlap.
2. **Projective Model**:
    - The projective model demonstrated superior performance when dealing with images that had significant perspective changes or viewpoints. It could handle more complex transformations, resulting in better alignment across the images.

Conclusion

In conclusion, both RANSAC with affine and projective models proved effective for image stitching tasks, albeit with differences in performance based on the nature of the transformations present in the images. The projective model excelled in handling more complex scenarios, while the affine model provided reliable results for simpler transformations.

This report highlights the versatility of RANSAC in estimating transformation models robustly and demonstrates the importance of choosing the appropriate model based on the specific characteristics of the images being stitched.

Code

The implemented stitching process is saved as `stitch_images.py`, integrating feature detection, matching, RANSAC-based model estimation, image warping, and blending functionalities.