BAI-6B ANN Project Proposal

Image Matching Challenge 2025 (CVPR)

Image Matching Challenge 2025 | Kaggle

Image Matching Workshop 2025

Members:

Aarib Ahmed Vahidy (22K-4004)

Arham Hussain Khan (22K-4080)

Partham Kumar (22K-4079)

1. Introduction

The reconstruction of 3D scenes from 2D images is a pivotal task in computer vision, with applications spanning augmented reality, robotics, and urban planning. The CVPR Image Matching Challenge 2025 presents an opportunity to advance this field by addressing the complexities of image grouping and 3D reconstruction from diverse and unstructured image collections.

2. Objective

This project aims to replicate and build upon the methodologies presented in the paper titled "Silver Medal Solution for Image Matching Challenge 2024" by Yian Wang. The primary goals are:

To implement the original pipeline and validate its performance.

To introduce enhancements through data augmentation and architectural modifications.

To evaluate the impact of these enhancements on the accuracy and robustness of 3D scene reconstruction.

3. Base Paper Overview

The referenced paper outlines a comprehensive pipeline comprising:

Image Retrieval: Utilizing EfficientNet-B7 to extract global descriptors and filter image pairs based on cosine similarity.

Keypoint Detection: Employing both KeyNetAffNetHardNet and SuperPoint for robust keypoint extraction.

Feature Matching: Applying AdaLAM and SuperGlue to establish correspondences between keypoints.

3D Reconstruction: Leveraging Pycolmap for spatial analysis and reconstruction.

This approach achieved a commendable score of 0.167 on the private leaderboard, demonstrating its efficacy in handling challenging variations in real-world image datasets.

4. Proposed Enhancements

To improve upon the base methodology, the following strategies will be explored:

Data Augmentation: Introducing variations in lighting, perspective, and occlusions to enhance model generalization.

Architectural Modifications: Experimenting with alternative backbone networks, such as EfficientNet-B6, and integrating attention mechanisms to refine feature extraction.

Hybrid Matching Techniques: Combining traditional and deep learning-based matching methods to leverage their respective strengths.

5. Methodology

Implementation: Reconstruct the original pipeline using Python, integrating libraries such as PyTorch, OpenCV, and Pycolmap.

Augmentation: Apply transformations to the training dataset to simulate real-world conditions.

Evaluation: Assess performance using metrics like reconstruction accuracy, precision, recall, and computational efficiency.

6. Expected Outcomes

A functional replication of the original pipeline with validated performance metrics.

Enhanced reconstruction accuracy and robustness through the proposed modifications.

Comprehensive analysis detailing the impact of each enhancement on the overall system performance.

7. References

Wang, Y. (2024). Silver Medal Solution for Image Matching Challenge 2024. arXiv preprint arXiv:2411.01851.

[2411.01851] Silver medal Solution for Image Matching Challenge 2024