Performance Analysis Report

Feature Extraction and Matching Techniques

1. Comparison of SIFT, SURF, and ORB

Keypoint Detection Accuracy:

- SIFT: Performs well in detecting accurate and stable keypoints, robust to scale and rotation changes.

- SURF: Similar to SIFT but often detects fewer keypoints. Prioritizes speed over fine-tuned accuracy.

- ORB: Less accurate in significant scale or rotation changes, balances speed and accuracy.

Number of Keypoints Detected:

- SIFT: Detects a large number of keypoints, robust matching.

- SURF: Detects fewer keypoints than SIFT but more than ORB.

- ORB: Detects fewer keypoints but is faster.

Speed (Execution Time):

- SIFT: Slowest, especially with high-resolution images.

- SURF: Faster than SIFT but slower than ORB.

- ORB: Fastest method, suitable for real-time systems.

2. Comparison of Brute-Force Matcher vs FLANN Matcher

Brute-Force Matcher:

- Compares descriptors in one image with all descriptors in the other.

- More accurate but can be slow.

- Works with both binary and floating-point descriptors.

FLANN Matcher:

- Uses an approximate nearest-neighbor search algorithm.

- Faster than Brute-Force, especially for large datasets.

- May return approximate matches, slightly less accurate.

3. Observations and Conclusions

Best Feature Extraction Algorithm:

- SIFT: Best for accuracy and robustness, but slow.

- SURF: Balanced between speed and accuracy.

- ORB: Fastest, but lower accuracy.

Best Feature Matching Technique:

- Brute-Force: Best for accuracy but slower.

- FLANN: Faster, best for real-time systems, though slightly less accurate.

Recommendation:

- SIFT + Brute-Force for accuracy-critical tasks.

- ORB + FLANN for real-time applications.

- SURF + FLANN for balanced performance.