Introduction

The objective of this practical work is to compute a disparity map from images to estimate depth. Using Normalized Cross-Correlation (NCC), reliable matches are identified as seeds and then propagated to generate a complete disparity map. The final output includes a 3D visualization, showcasing the depth information derived from the images.

Steps:

The practical work implements a computer vision technique to generate a disparity map and reconstruct 3D scenes using seed propagation. The process can be summarized as follows:

1. **Image Loading and Initialization**:
    - Two images are loaded, and parameters like minimum and maximum disparities are set. The disparity map and a priority queue for seeds are initialized.
2. **Normalized Cross-Correlation (NCC)**:
    - The algorithm uses NCC to compare patches between the images. A function computes the NCC score, which helps identify corresponding points across the pair.

$$NCC = \frac{\sum_{x,y}(I1(x,y) - m1)(I2(x,y) - m2)}{\sqrt{\sum_{x,y}(I1(x,y) - m1)^2}\sqrt{\sum_{x,y}(I2(x,y) - m2)^2}}$$

3. **Seed Detection**:
    - Seeds are selected by scanning the images for pixels with high NCC scores. For each pixel, the best disparity within the range is chosen, and those exceeding a threshold (nccSeed) are marked as seeds.
4. **Seed Propagation**:
    - The seeds are propagated to neighboring pixels to expand the disparity map. The algorithm refines disparities by searching around each seed and updating pixels based on the best NCC match found, the pixel Q is pushed into the priority queue.
5. **Disparity map**:
    - The final disparity map is used to estimate depth and visualize a reconstruction of the scene.

Results:

The implemented approach successfully generated an accurate disparity map from the images. By combining seed detection through NCC and efficient propagation, we notice that the closer we are to the camera the higher disparity values we obtain.