Project Proposal

Stereo Reconstruction

1 Abstract

Reconstruction of 3D data is used in many fields, starting from the object reconstruction of sites, and cultural artifacts both on the ground and below the surface of the sea, as the scientist used this to preserve the environment due to extinction. One of the most famous approach of 3D reconstruction is stereo reconstruction. Stereo matching is a core technology in computer vision that utilizes 2D images of the real world to reconstruct 3D structures.This technology has been widely used in areas such as autonomous driving, augmented reality, and robotic navigation. The goal of Stereo Matching, given a pair of rectified stereo images, is to compute the disparity for each pixel in the reference image, where disparity is defined as the horizontal distance between corresponding pixels in the left and right images. Our pipeline will be as illustrated in Figure 1. We will be starting with computing the matching points (correspondence points) in to different views for the same object[3]. Then, the fundamental matrix will be computed [3]. After that, computing the Disparity map. Afterwards, reconstruct the 3D object using Triangulation[2]. Lastly, we will be comparing different point matching algorithms.

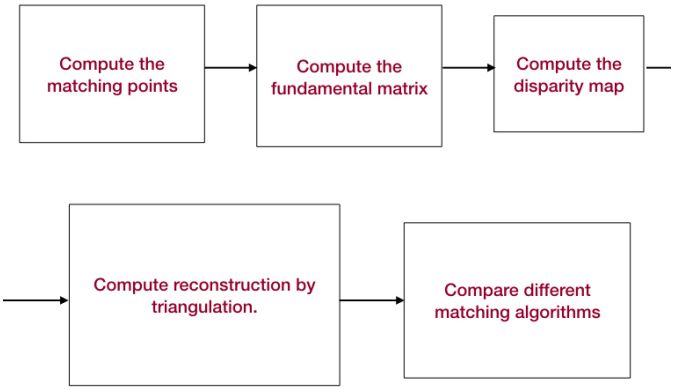

Figure 1: Milestone steps.

2 Requirements

2.1 Data Set

We are going to use one of the data sets provided by The Middlebury Computer Vision, The 2021 Mobile stereo data sets with ground truth. Each data set consists of 2 views taken under several different illuminations and exposures. However, we are going to use the views with the original ambient[1].

2.2 Library

We are going to use **OpenCV**. As **OpenCV** provides a real-time optimized Computer Vision library, tools, and hardware.

3 Team

- Momen Amgad Khalil, 03736400.
- Omar Elsobky, 03737994.
- Loay Nasser, 03748555.
- Abdelrahman Amr Abdelaziz Mohamed Salem, 03721419.

4 Milestones

List your weekly milestones for this project proposal.

1. **Literature review, setup the environment for the project and prepare the data-set.**
2. **Compute the matching points :** finding some point matches between the two given images.
3. **Compute the fundamental matrix:** estimate the fundamental matrix from the point correspondences (using 8 points algorithm for example) and estimate the rotation and translation between the two images(Extrinsics).
4. **Compute the disparity map.**
5. **Compute reconstruction by triangulation :** estimate the 3D points given the matches by triangulation method to be able to reconstruct the 3D .
6. **Compare different matching algorithms:** Trying different algorithms for points matching and report the results.

References

[1] Y. Kitajima G. Krathwohl N. Nesic X. Wang "D. Scharstein, H. Hirschmller and P. Westling.". High-resolution stereo datasets with subpixel-accurate ground truth. *In German Conference on Pattern Recognition (GCPR)*, 2014.

[2] Richard Hartley and Andrew Zisserman. *Multiple View Geometry in Computer Vision*. Cambridge University Press, 2 edition, 2004.

[3] Longuet-Higgins. Eight point algorithm. 1981.