

# Project Proposal

## ”Stereo Reconstruction using Block Matching”

### 1 Abstract

We propose to implement Stereo Reconstruction using a pair of stereo cameras. We plan to use block matching algorithms to find the depth map using the stereo images from the stereo camera. For block matching algorithms we would need calibrated cameras with simple stereo configuration where the epipolar lines match the rows of the image. Using the intrinsic and extrinsic parameters of the stereo system we can convert any general stereo configuration to a simple stereo configuration. The reason for doing the above is to reduce the matching to 1-Dimension from 2-Dimensions. Here we assume that the stereos are simultaneous which is the case in a stereo camera system. Using various matching algorithms (discussed below) we compute the depth images or the disparity map. We plan to implement the following algorithms to get the disparity map.

1. Block matching Basic idea here is to move along the epipolar line and try to minimize the sum of absolute difference(SAD) of the intensities of the pixels. We use a window(block) around the pixel while calculating the SAD

2. Census Transform Here we transform each block to a binary string where 1 implies that the surrounding pixel is brighter than the center pixel and 0 implies that the surrounding pixel is darker than the center pixel. Then we use the hamming distance as the cost measure.

3. Dynamic Programming Then we use dynamic programming which uses the information from the other pixels on the epipolar line to improve the accuracy

4. Graph Cut(GC): Then we plan to implement a Graph Cut algorithm where we add costs to smooth-en the disparity map. The cost function will have two terms - One term can be the regular SAD cost or Birchfield Tomasi Measure - The second term is the smoothing term which can be 0 for exact intensity and a higher number of different intensities.

Then we implement the triangulation to calculate the depth map from the disparity map.

Few other costs functions are discussed in this paper( [1]).

The exact pipeline for the project has been discussed in the section 4

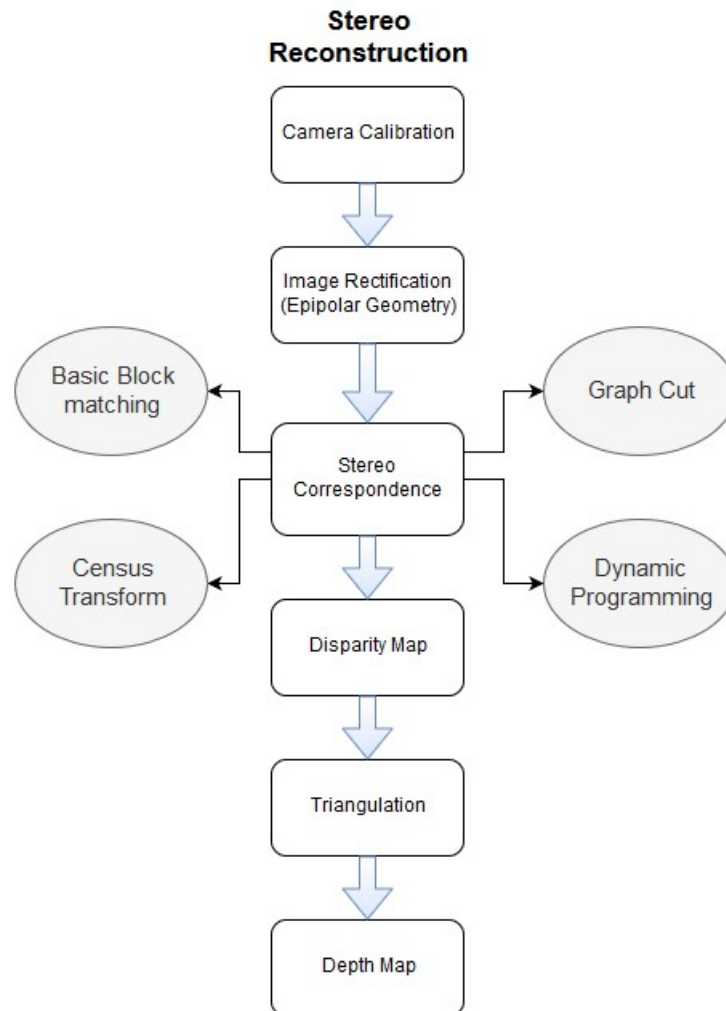
### 2 Requirements

Stereo Cameras(with global shutter, with standard view or wide field of view)

### 3 Team

Yu Wang; Schnaubelt Max; Harinandan Teja Katam; Meng Liu

## 4 Work Plan



Everything algorithm above can be implemented.

## References

- [1] Carlo Tomasi Stan Birchfield. Depth discontinuities by pixel-to-pixel stereo. *Computer Science Department, Stanford University*.