STEREO DENSE RECONSTRUCTION

Task : We are given 21 pairs of stereo images with calibration matrix and their Respective ground truth values, and also the baseline values from this data we have to reconstruct a 3d Point cloud representing all the points from the images.

Steps to get the Point clouds:

1. Get the Disparity Map from stereo image pair.

   Math :

   D = x1 - x2

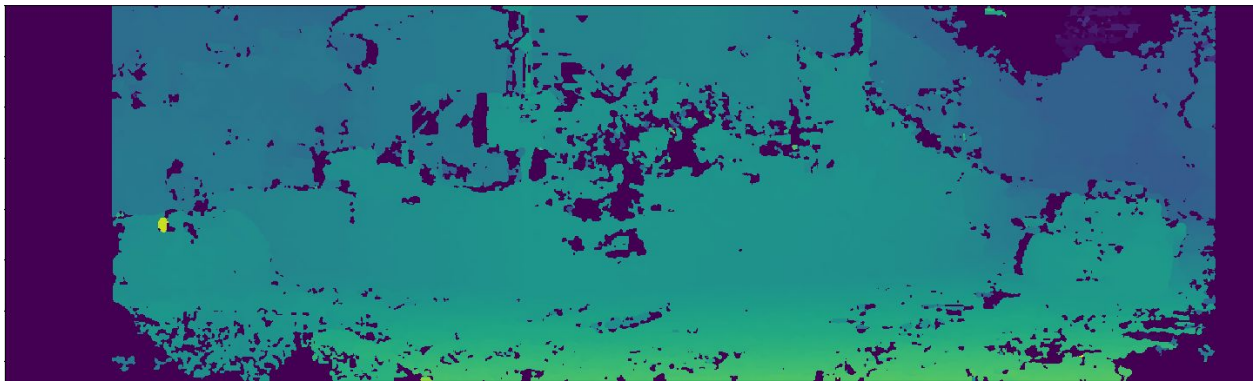
   Where x1 is the location of a point in the left image and x2 is the location of the point in the right Image.

   Code :

   Using the inbuilt function of Open CV, StereoSGBM_create using the tuning parameters of inspired by the blog post : http://timosam.com/python_opencv_depthimage

   And then using stereo.compute we calculate the disparity values.

   Output :



2. **Get the point cloud for a pair of images:**

   Math :

   The 3d Point cloud of the images can be obtained by using these disparity values. The formula will be

$$Z = (b * f)/(x1 - x2)$$
$$X = (Z * x) / f$$
$$Y = (Z * y) / f$$

   Where:

   b = baseline parameter provided in the question

   f = Focal Length obtained from the K matrix

   x = (x1+x2 /2)

   y = (y1+y2 /2)

   Code :

   We do this operation using the Q matrix way, Were the Q matrix as defined in the Slides Q matrix. And Multiplied the Q matrix using Disparity_map with is [x,y,d,1]

   Output :

3. **Register the generated points and into world frame using the given ground truth values (poses.txt)**
   Math :
   We have 3d point [w*x,w*y,w*z,w], and using the Projection matrices in ground truth we get the registered 3d point in the point cloud of a single world frame.

   Code:
   For each of the point in the point cloud multiply the point from the respective projection matrix and get and append these points into a single point cloud. And then visualize them.

OutPut: