CENG 391 Introduction to Image Understanding

December 15, 2016

3D Measurements from Known Geometry

Write a C++/Python program that operates the following tasks.

1. Read the cube corners from the file "cube_corners.txt"
2. Construct calibration matrix K with the following elements:
   - $f_x = 100$
   - $f_y = 100$
   - $p_x = 10$
   - $p_y = 10$
3. Construct rotation matrix R as follows with $\theta = 0, \beta = 0, and\ \gamma = 0$:
   - $R_x = \begin{bmatrix} 1 & 0 & 0 \\ 0 & cos\theta & -sin\theta \\ 0 & sin\theta & cos\theta \end{bmatrix}$
   - $R_y = \begin{bmatrix} cos\beta & 0 & sin\beta \\ 0 & 1 & 0 \\ -sin\beta & 0 & cos\beta \end{bmatrix}$
   - $R_z = \begin{bmatrix} cos\gamma & -sin\gamma & 0 \\ sin\gamma & cos\gamma & 0 \\ 0 & 0 & 1 \end{bmatrix}$
   - $R = R_z R_y R_x$

4. Construct Rt with R computed in previous step and t with 0 translation for each dimension.

5. Compute projection matrix $P = K[R|t]$.

6. Project 3D points to the 2D image plane by using $PX = x$

7. Draw points on the image and edges between the points

8. Save the image as "projected_points.png"

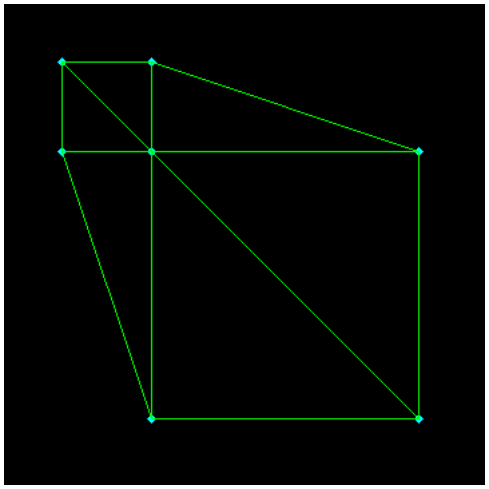

Figure 1: Expected Output