Important Note: Submit all your codes to SUCourse as a single zip file. Deadline for submission to SUCourse is **until the end of the lab**.

Things to do:

- First we will utilize our previous code regarding to estimation of essential matrix and pose recovery. Once we obtain 4 possible rotation and translation solutions, we will select one pair of them appropriately.
- Euclidean transformation of a point in one view to the second view can be written as follows:

$$\lambda_2 x_2 = R\lambda_1 x_1 + \gamma T \tag{1}$$

- In order to eliminate the number of unknowns, both sides of the equation can be multiplied with $\hat{x}_2$ (skew-symmetric form of x_2). Simplified version of (1) for each correspondence can be found as:

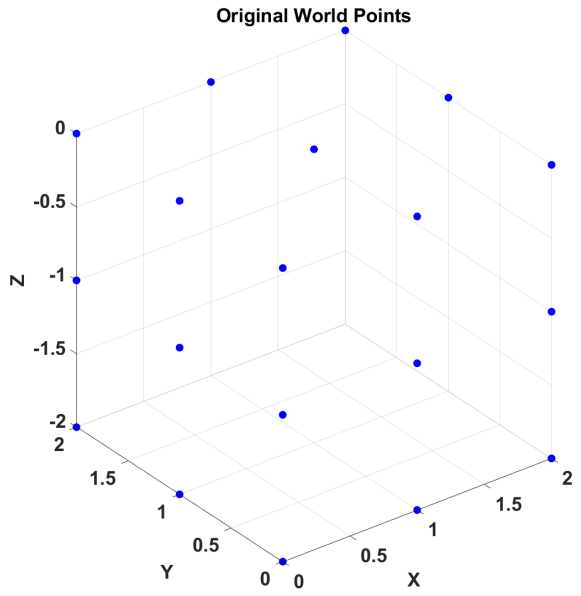
$$\lambda_1^j \hat{x}_2^j R x_1^j + \gamma \hat{x}_2^j T = 0, \qquad j = 1, 2, ..., n \tag{2}$$

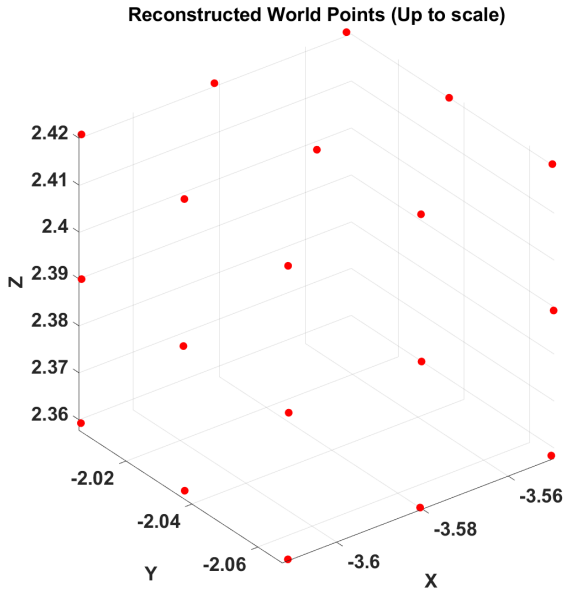
where the superscript j refers to the correspondence pair and n is the total number of correspondences.

- In order to find the unknown parameters by solving LLSE problem, (2) can be written as follows:

$$\mathbf{M}\Lambda = \begin{bmatrix} (\hat{x}_2^1 R x_1^1)_{3\times1} & 0_{3\times1} & \dots & 0_{3\times1} & (\hat{x}_2^1 T)_{3\times1} \\ 0_{3\times1} & (\hat{x}_2^2 R x_1^2)_{3\times1} & & \vdots & (\hat{x}_2^2 T)_{3\times1} \\ \vdots & & \ddots & 0_{3\times1} & \vdots \\ 0_{3\times1} & \dots & 0_{3\times1} & (\hat{x}_2^n R x_1^n)_{3\times1} & (\hat{x}_2^n T)_{3\times1} \end{bmatrix} \begin{bmatrix} \lambda_1^1 \\ \lambda_1^2 \\ \vdots \\ \lambda_1^n \\ \gamma \end{bmatrix} = 0 \tag{3}$$

- Eigenvector associated with the smallest eigenvalue of $\mathbf{M}^T\mathbf{M}$ gives us a solution of Λ.
- Since any multiple of the solution Λ can also satisfy the (3), we recover the Λ up to a scale. Multiply the first view points with their depth values, transform the points to world coordinates and plot the 3D points like the figure below.





Post Lab

Provide the resultant images. How can you estimate the structure in a correct scale? Implement and explain your method in detail. Compare the results and find the error between the reconstructed and original world points in your accurate structure estimation. Comment and discuss your results.

Deadline for post lab report submission to SUCourse: **24 December 2018, 23:55**.