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Exercise 1.2: Box Detection - Discussion

This simple implementation comes with several weaknesses. Identify some of these drawbacks and make suggestions on how to make the algorithm more robust, more accurate or faster.

1. **Noise**: Ransac algorithm is sensitive to outliers. Although we used filtering to ignore noise, there might be some other noises that cannot be removed that easily. Moreover, we were informed that the points with z=0 should be considered as outliers. In the real world we might not have such information. However, we might be able to improve the algorithm by doing some preprocessing steps and using outlier rejection techniques, such as M-Estimators or robust cost functions, to make it more robust to noisy data.
2. **Parameters**: In several parts of the algorithm, we decided on parameters such as thresholds and number of iterations. This process takes time. Moreover, it can affect the result significantly as it might not be optimal for all cases. This problem can be solved by using automated parameter tuning method or machine learning techniques.
3. **Only have 2 main planes**: in this exercise it was described that the first and second dominant planes are the floor and top of the box. However, this is not the case in the real world. There are other planes and even other objects that affect the detection of the desired planes. One solution can be making the algorithm more sophisticated such as clustering techniques to separate the box from other objects in the point cloud.
4. **Run Time**: Ransac might not be very time efficient for high number of iterations or large point clouds. The solution to this problem might be using parallel processing, or other variations of RANSAC.