

Automatic Recognition of Edges in 3D Point Clouds

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Introduction

Laser scanning technology has been widely used to detect detail information of infrastructures such as buildings, roads and relics and realize reconstruction of 3D building models. Here two methodologies, Angle Criterion and BAO Algorithm are introduced, to extract feature points (edges here) from unorganized point clouds which can also be derived from photogrammetry technology, and compare their effects in feature detection. The edge information can be further used to do data alignment, model reconstruction and building information modeling (BIM).

Figure1 shows a Faro focus laser scanner which is used to get point cloud data. The measurement speed is up to 976,000 points/second, distance accuracy up to 2mm.



Figure1 Faro focus 3D laser scanner

Angle Criterion

Angle Criterion is a conventional way to detect edge information efficiently and accurately. Steps of implementing the algorithm is shown as flow chart below and some results are demonstrated as well.

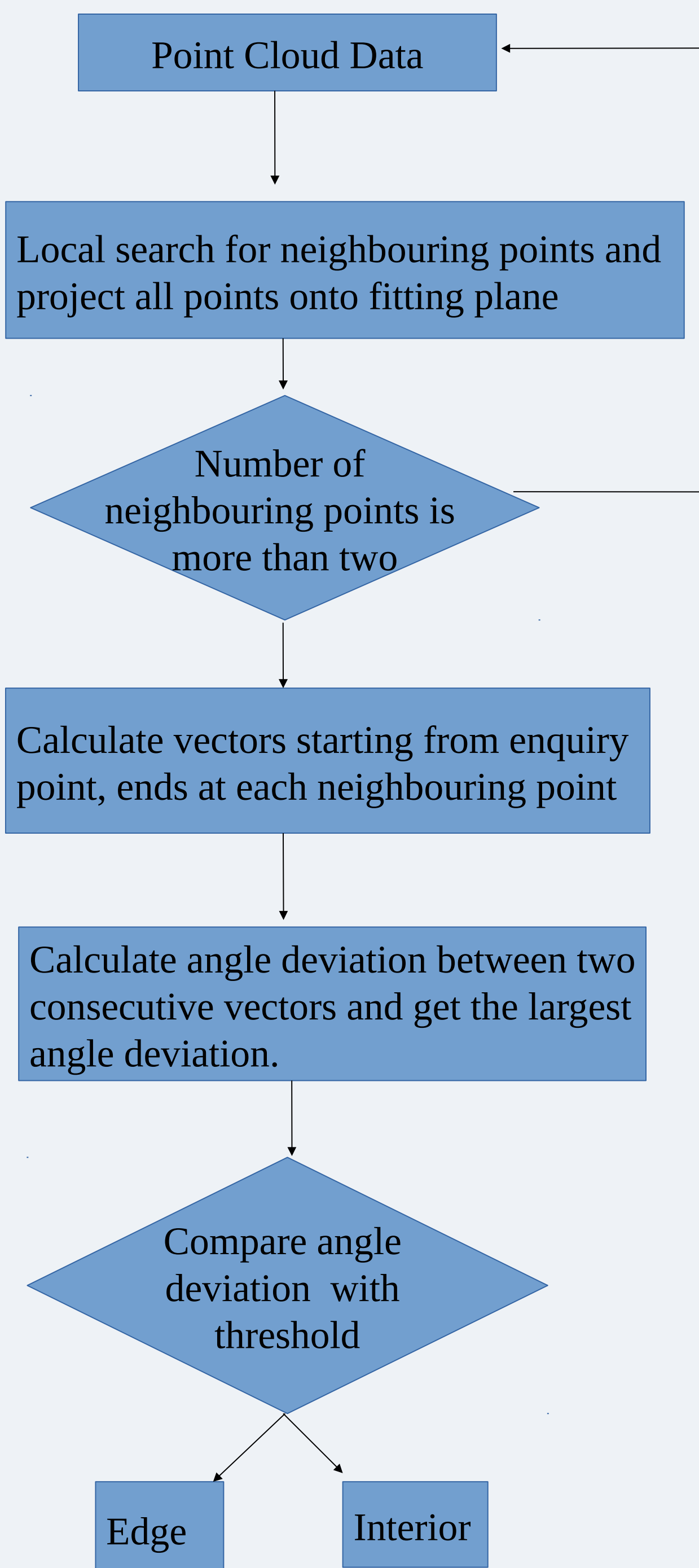


Figure3 Boundary of wall

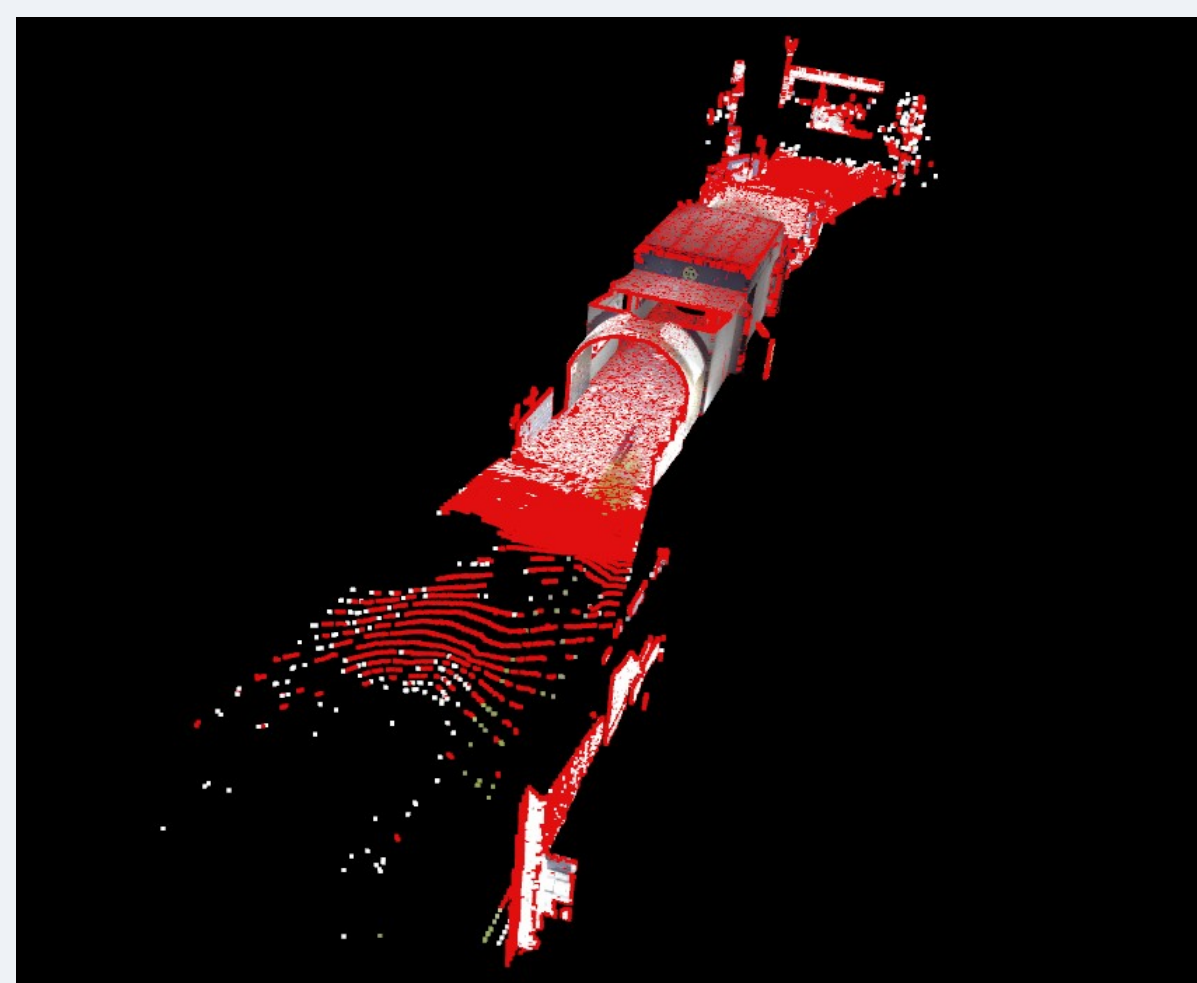


Figure4 Boundary of tunnel

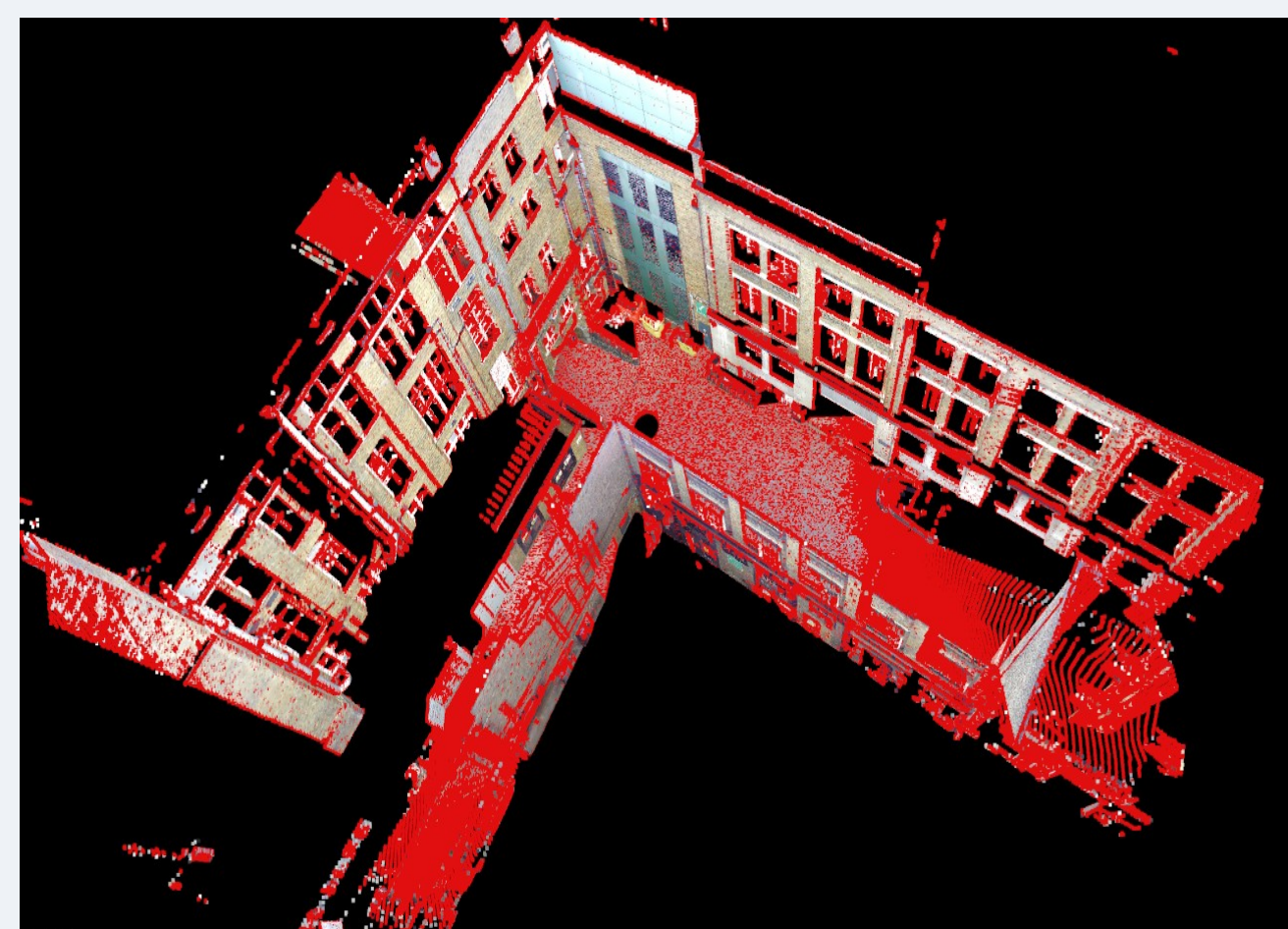


Figure5 Boundary of buildings around Malet place in UCL

Figure2 steps in implementation of Angle Criterion

BAO Algorithm

BAO Algorithm differs from Angle Criterion after projecting cloud points onto a fitting plane by forming a grid pattern for projected cloud points. Steps of implementation and results are demonstrated below.

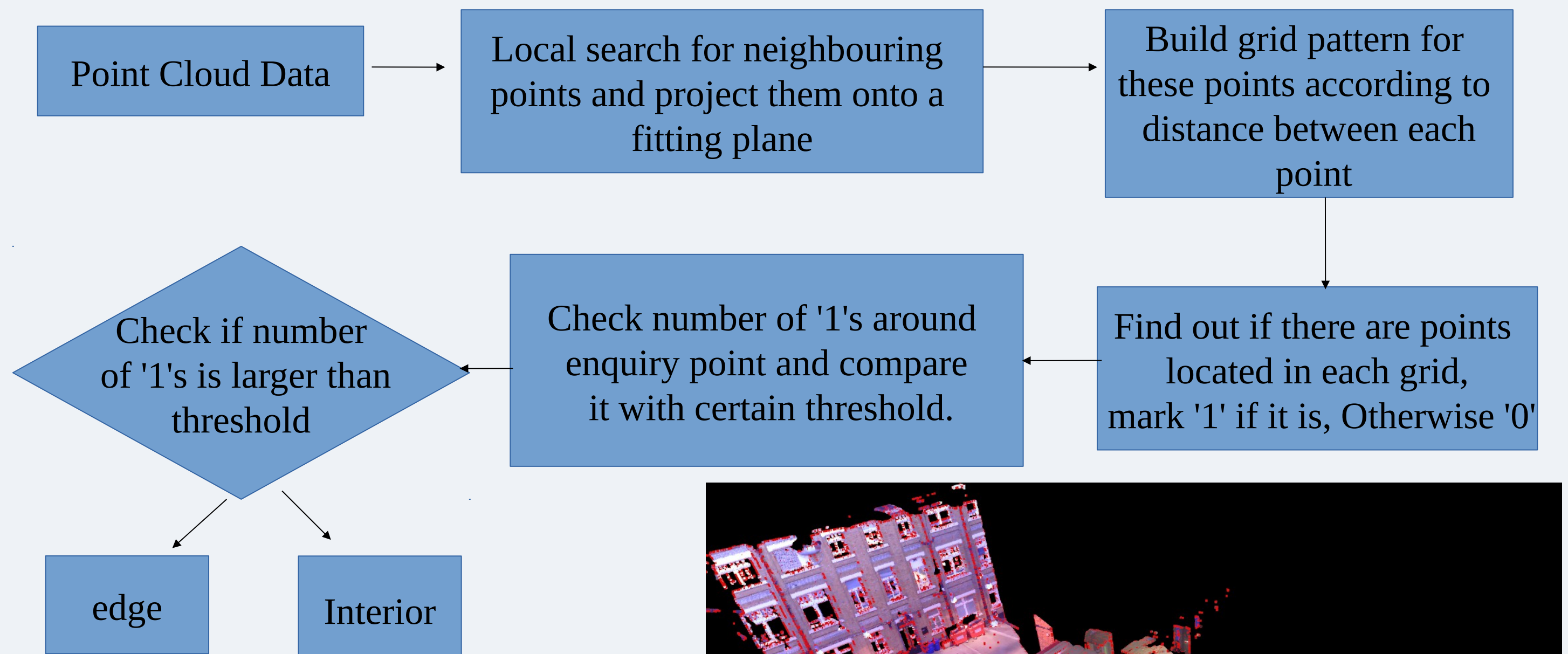


Figure6 Boundary of wall and windows

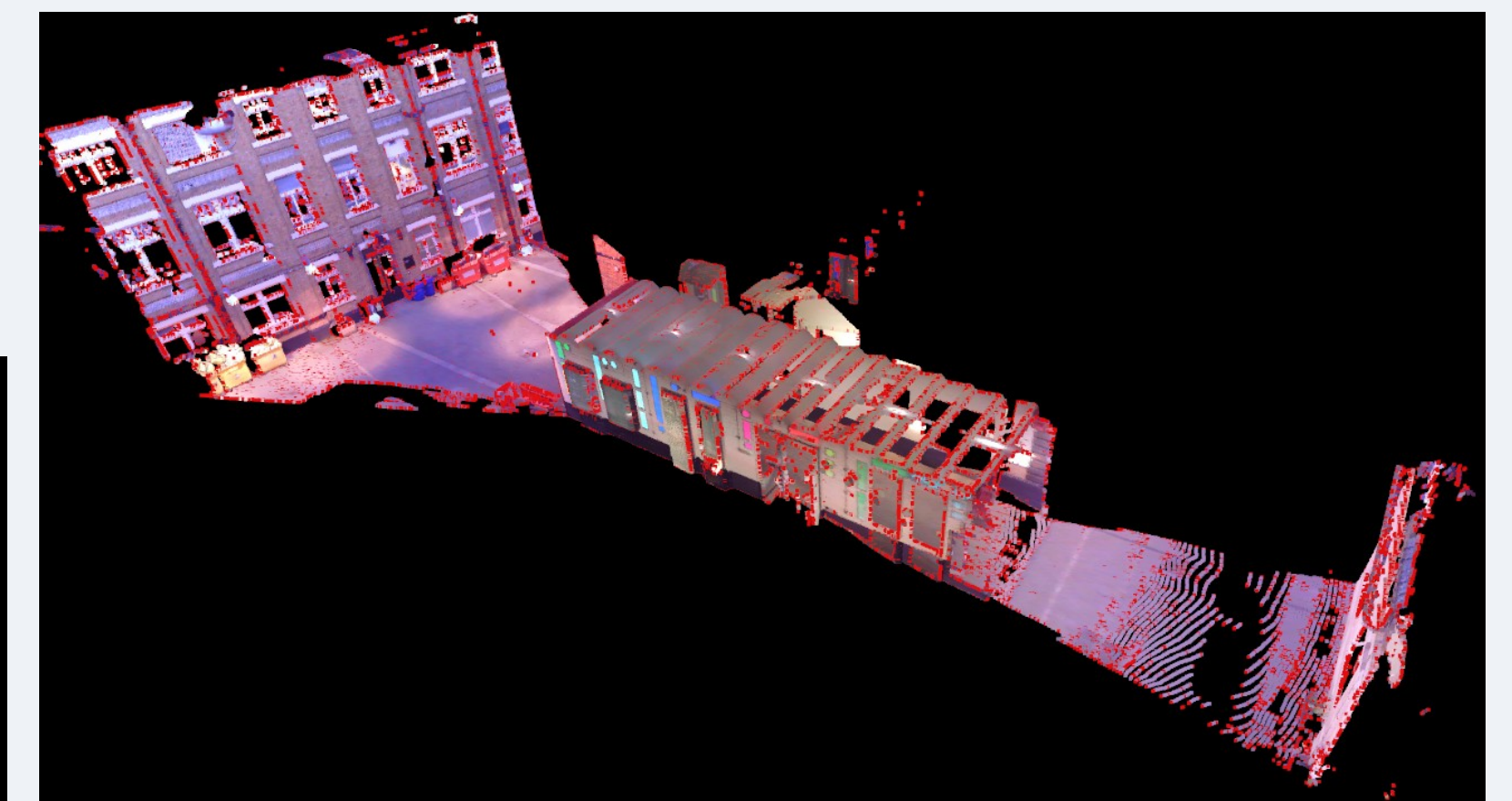


Figure7 Boundary of tunnel in Malet place

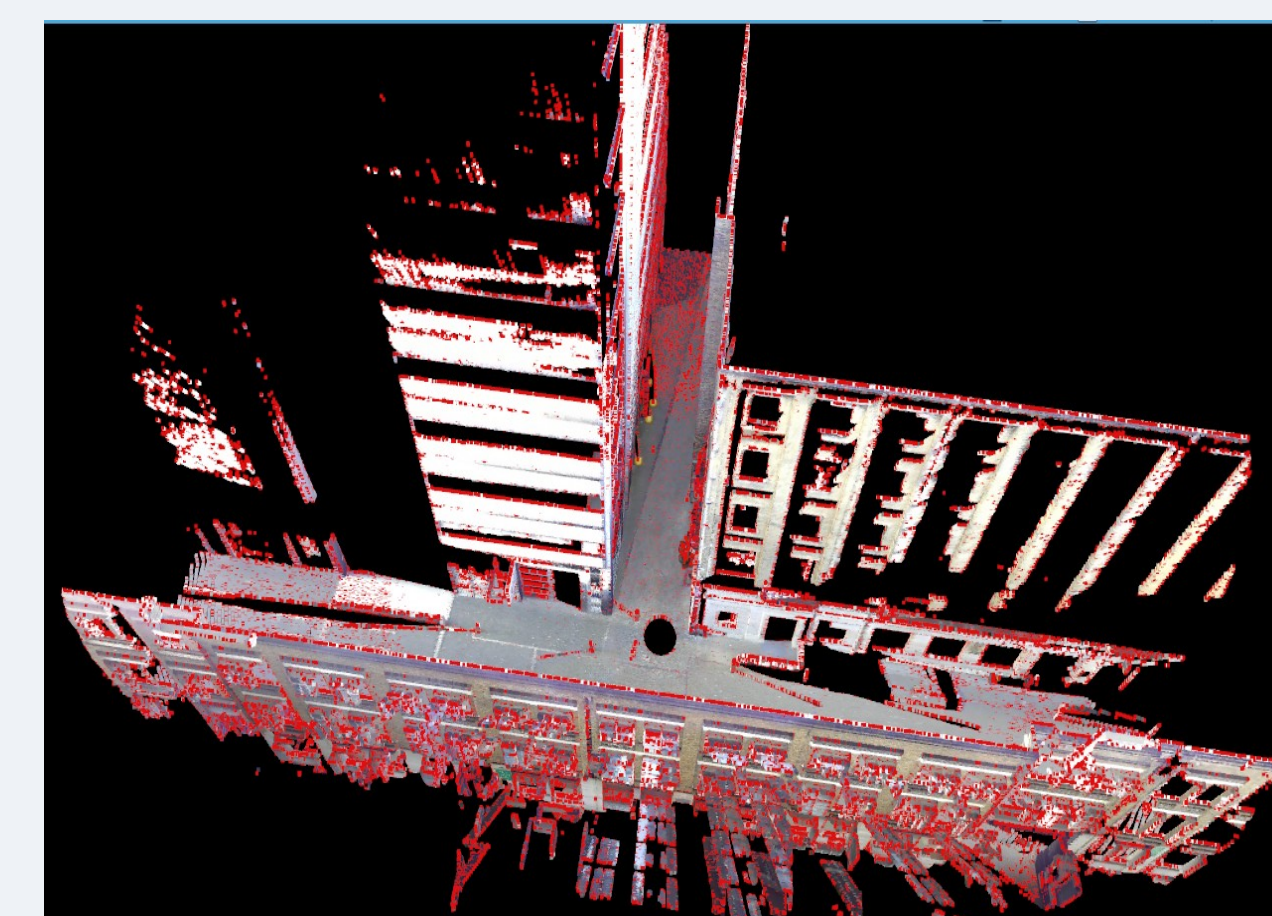


Figure8 Boundary of Roberts Building in UCL

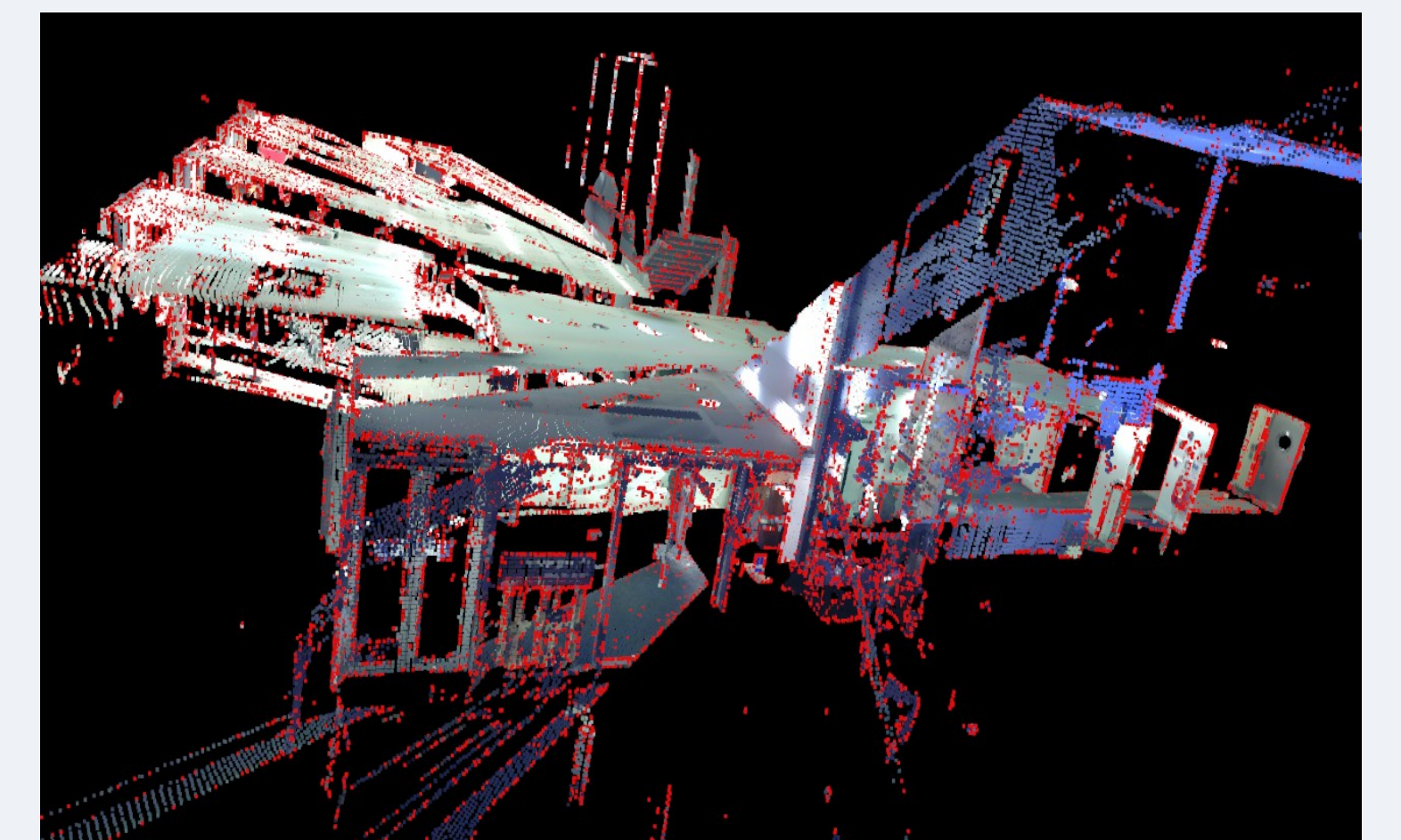


Figure9 Boundary of ground floor of Roberts Building

Compare Two Algorithms

The effects of two algorithms are compared here and more results are demonstrated. Red points in pictures indicates accurate boundary points, while green ones represent boundary points detected by the algorithm.

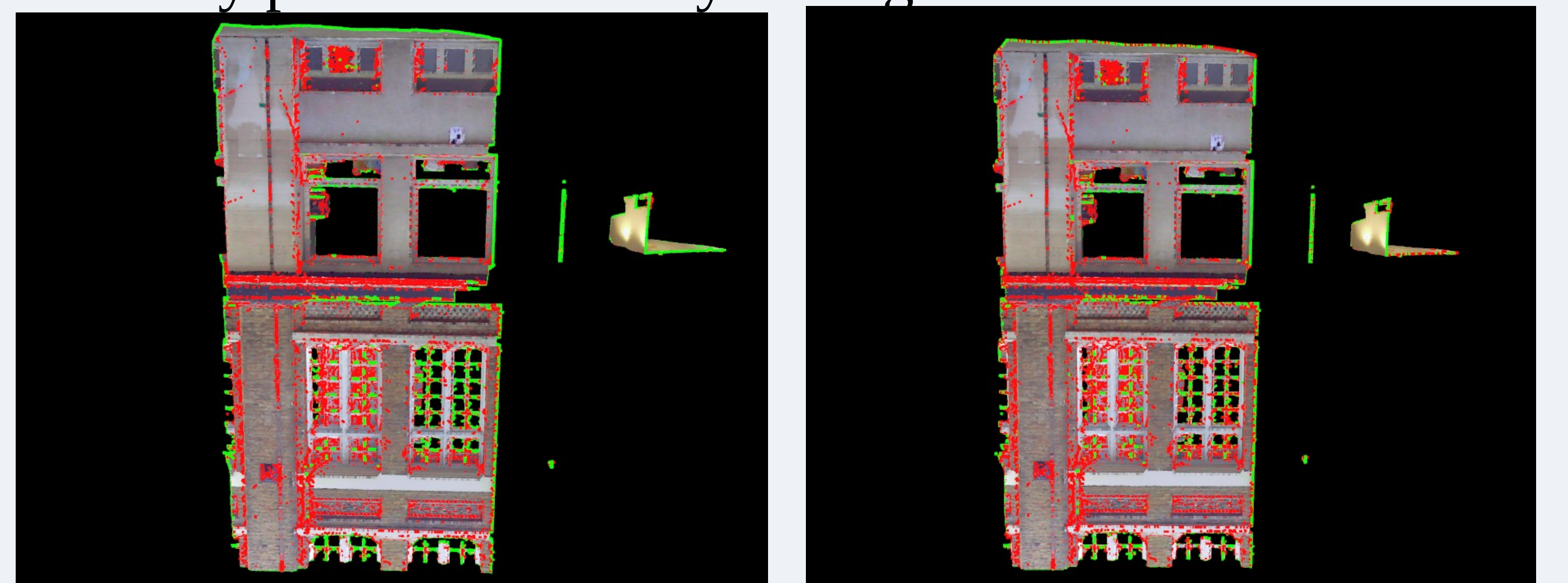


Figure10 Boundary of a building detected by Angle Criterion (left) and BAO algorithm (right)

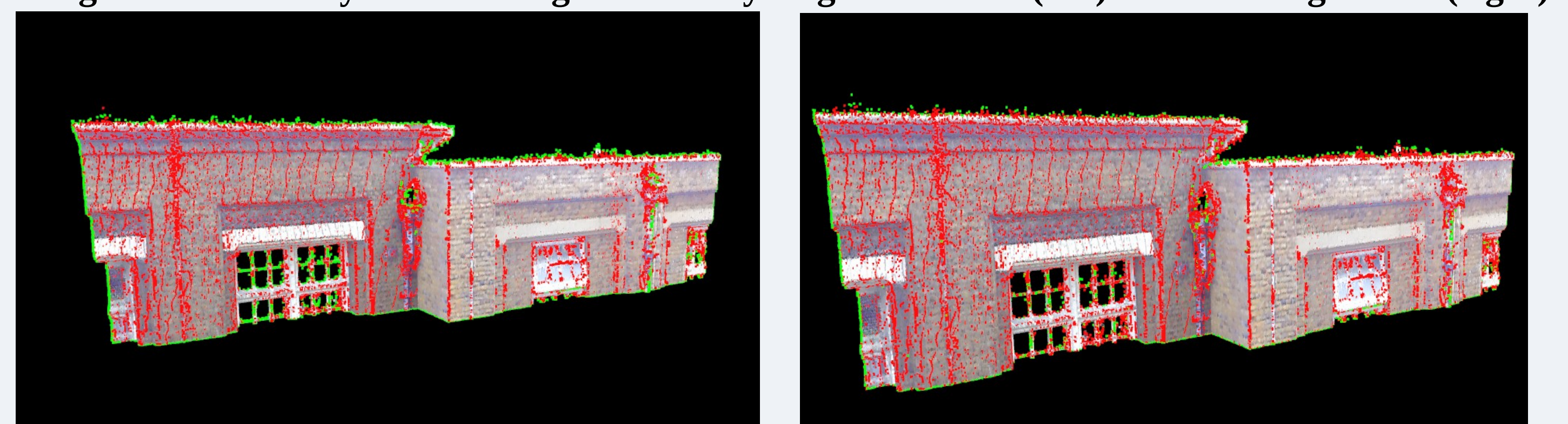


Figure11 Boundary of roof detected by Angle Criterion (left) and BAO algorithm (right)

Acknowledgement

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Reference

1. Angle Criterion, "Combining an Angle Criterion with Voxelization and the Flying Voxel Method in Reconstructing Building Models from LiDAR Data", Linh Truong-Hong.
2. Bao Algorithm, "A RANSAC based line features detection algorithm for point clouds", Li Bao