Extractions User Guide

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1 Introduction

This document aims to provide technical process guidance and simple operation instructions for users who use CoProcess software to extract road elements. Taking point cloud data produced by a project as an example, this document briefly shows the whole process of extraction.

2 Guide

2.1. Element extraction process

Once each operator has the production data, they can begin their own extraction. Before the extraction, it is necessary to create a new project, import the point cloud and panoramic data, adjust the rendering effect and view Angle and other operations. In order to focus on the intelligent extraction process, the operation process is not described in detail here. For the operation process, refer to the Intelligent Extraction Operation manual in Chapter 3.

From the process of element extraction, the general principle is: first extract line elements and surface elements, and finally extract point elements. The reason is that the landing elevation of point elements can refer to the elevation of the nearest line and plane elements.

Referring to the actual production experience of a project, the overall factor extraction process is summarized as follows.

2.1.1. Side Line

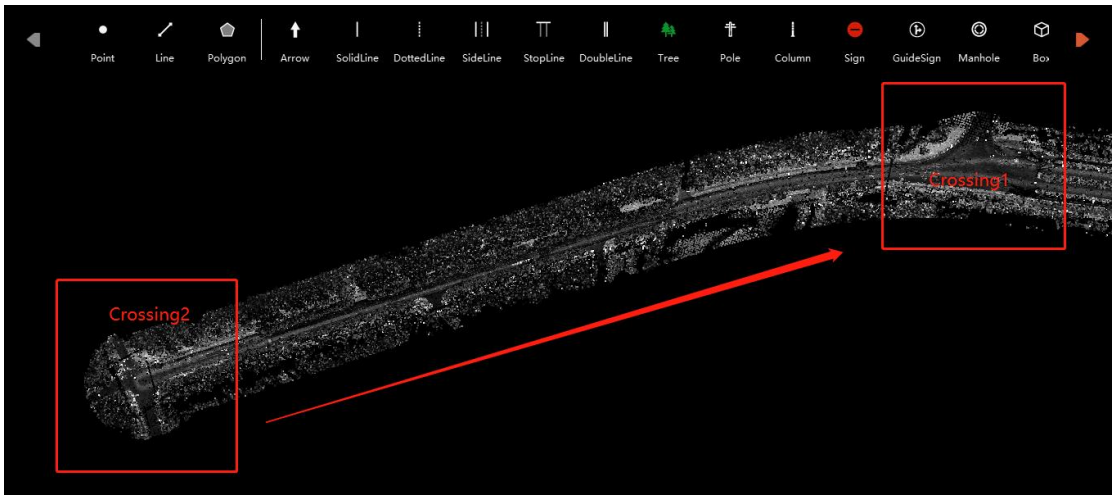
Generally speaking, the road edges are all over the whole measurement area. Firstly, the road edges are extracted, which is helpful to have an overall understanding of the whole measurement area. On the other hand, it is helpful to control the elevation of the whole survey area and facilitate the extraction of some ground objects.

In addition, the edge extraction algorithm has high efficiency and stable effect,

which is also helpful to the overall efficiency improvement.

2.1.2. Road Segment

The area between two adjacent intersections is called the road segment. The road section is taken as the basic unit in the extraction process, and the vector line within the range of a single road section is preferentially extracted.



2.1.3. Linear Elements Along The Road

After the extraction of the main linear elements in the middle of the road, the linear elements at the edge of the road should be extracted next. The road edge is far away from the lane line, affected by factors such as occlusion, and the data is often incomplete. In this case, manual extraction is mainly used to extract.

The elements of road edge mainly include: ground boundary, blind road, non-motorized lane, etc. The drawing work of this part mainly relies on manual drawing. The drawing of these elements can be completed according to the order of these categories.

This process is mainly used to detect and fill the gaps in order to complete the drawing of linear elements.

2.1.4. Dot Elements

Point elements mainly include: street tree, pole, street lamp, probe, sign, manhole cover, rain grate, arrow and so on.

Rod-shaped ground feature extraction: After the street tree extraction is completed, rod-shaped ground feature can be extracted according to the road section.

At the same time, if there are signs, probes and other information on the rod, it can be extracted simultaneously. The rod - shaped ground objects and connectors are extracted here.

Ground point element extraction: can be extracted according to the road section of manhole cover, rain grate and other point elements, leak filling, complete the extraction of point elements.

2.1.5. Planar Elements

Planar elements, such as diversion areas, parking Spaces, pedestrian crossing lines and flower beds, are small and relatively independent in the sample data, which can be extracted at the end.

2.2. Generate Results

Through the previous process, the elements of each area are extracted. In order to obtain the final product, the following work needs to be done:

2.2.1. Check

After each operator completes their element extraction, they need to check their results to ensure the quality of the results. For the contents of the results inspection, see the results inspection report.

2.2.2. Merge

The results of each operator are merged and imported, and special personnel are required to deal with the edge connection problem, to ensure the accurate and natural transition of the edge, and finally get the preliminary results.

2.2.3. Inspect&Revise

Check the preliminary results, modify the imperfect places, and finally get the results in line with the specification.

2.2.4. Acceptance

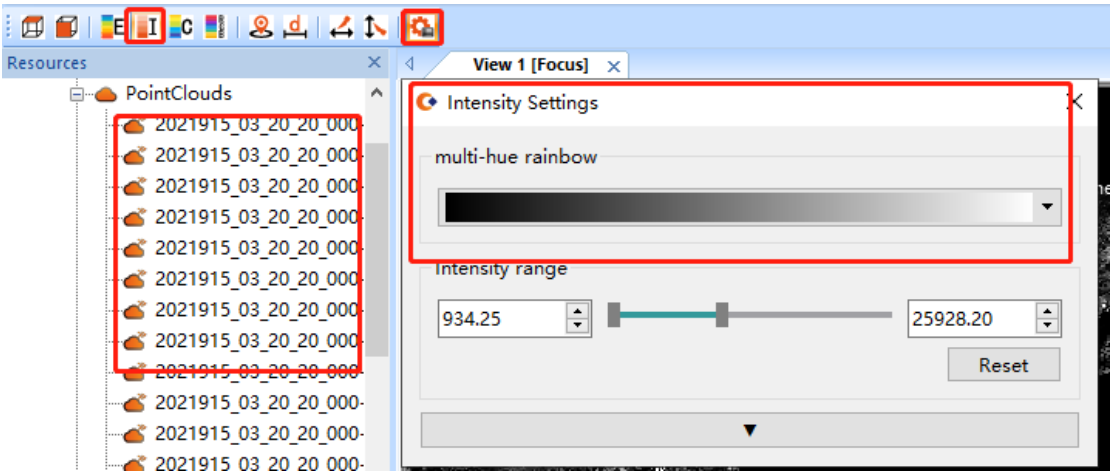
Check and accept the results and submit the extraction results in line with the specification.

3 Operation Manual

The whole process from raw point cloud data (LAS) to extracted elements can be divided into the following four steps: open point cloud, extract elements, edit elements, and save project.

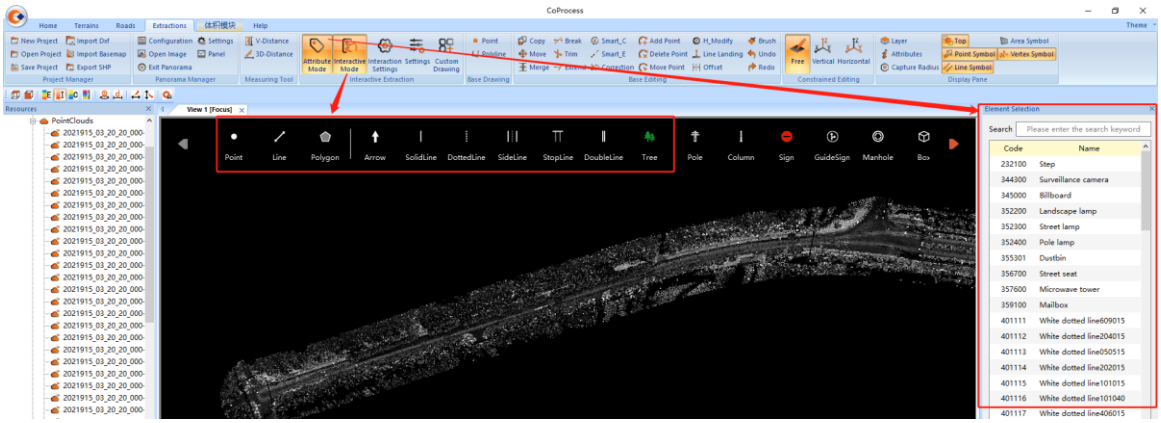
3.1. Open Point Cloud

After importing codata, you can adjust the render mode, such as switching to "intensity render" mode.



3.2. Extract Elements

Element extraction supports two modes, namely, attribute mode and interaction mode. Attribute mode refers to the right of the factor selection panel, select the corresponding factor from the factor list for extraction; The interactive mode refers to the interactive extraction by clicking the element category template above the view, and then selecting the element encoding (if necessary).



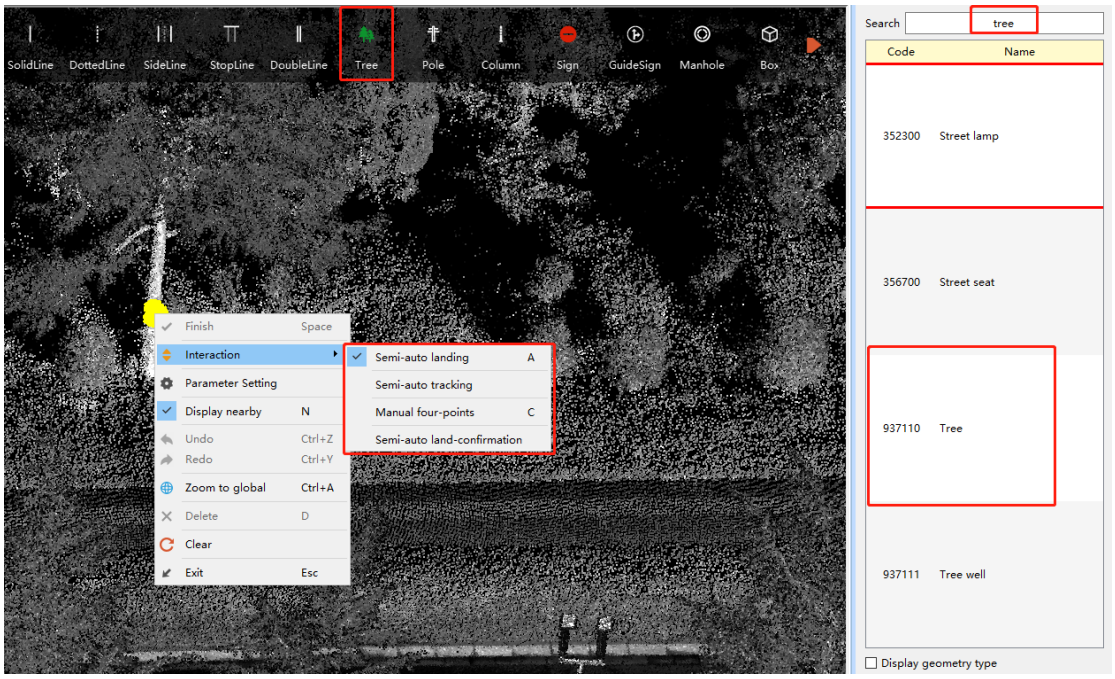
The difference between these two methods is that the former selects small classes (including attribute codes) for direct extraction, while the latter extracts by

large classes (such as poles, which are divided into light poles, electric poles, street lamps, etc.), and it may be necessary to select factor codes later.

Taking street tree extraction as an example, two extraction modes are explained:

Method：

a） To extract in attribute mode, double-click the row where "street tree" is located on the left; If extraction is performed in interactive mode, click "Street Tree" above the view to start the extraction command of the street tree.



b） The right-click menu supports switching between different interactive modes. For example, A (default) is usually semi-automatic extraction mode, and C (manual extraction mode) is generally manual extraction mode, which supports switching between interactive modes through shortcut keys.

c） After the mode is selected, the mouse click on the tree can be extracted. (A) Automatic tree fitting and landing; C, manually select points).

d） In interactive mode, the extraction of some elements may pop up a dialog box for selecting the type of elements, and the actual corresponding elements can be selected.

The details and procedures of the entire extraction process are described below.

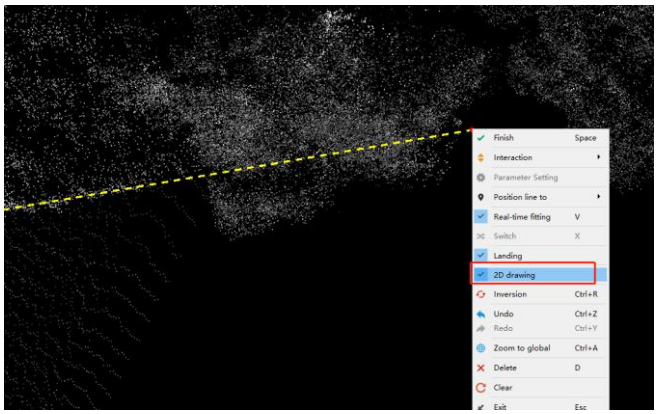
The general principle of element extraction is: **line and surface elements are extracted first, and point elements are extracted last.** The reason is that the landing elevation of point elements can refer to the elevation of the nearest line and plane elements, and the landing reference of point elements can be set in the parameter setting.

Number	Name	Priority	Type
1	Side line	1	Line
2	Stop line	2	Line
3	Solid line	3	Line
4	Dotted line		Line
5	Class boundary	4	Line
6	Blind line		Line
7	Non-motorized lane		Line
8	Sidewalk	5	Surface
9	Parterre		Surface
10	Tree	6	Point
11	Pole		Point
12	Arrow	7	Point
13	Street lamp	8	Point
14	Creama		Point
15	Sign		Point
16	RainGrate	9	Point
17	Manhole		Point
.....	.....	.....	.....

Some features in typical scenes are taken as examples to explain the extraction sequence. For features not mentioned, the above table can also be referred to for further improvement.

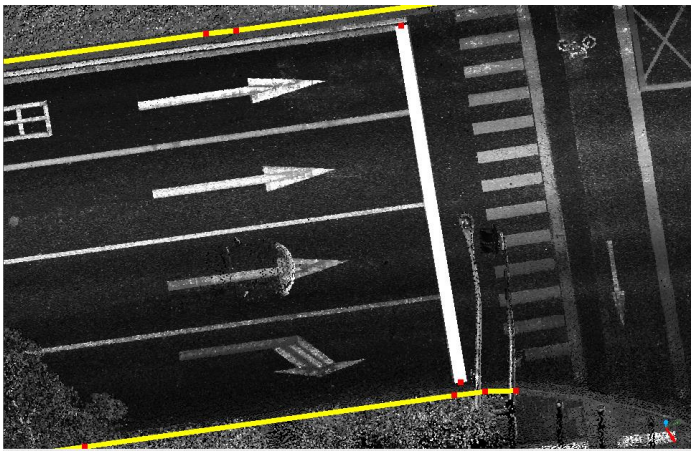
3.2.1. Side Line

Under various conditions, can try to use semi-automatic extraction of road line (A), in the presence of large block, using manual (C), if you need to place added point blank, right-click menu and switch to the C first, then check the 2 d drawing, then you can supplement where there is no point cloud point.



3.2.2. Stop Line

Manually select the two endpoints and extract the stop line, which can only be manually extracted at present.

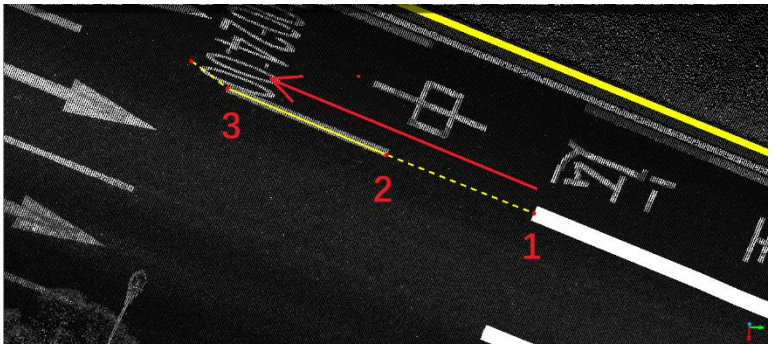


3.2.3. Solid Line

Next, the short solid line is extracted. According to different situations, semi-automatic (A) or manual (C) can be selected for extraction. The places blocked by cars can also be drawn in two dimensions.

3.2.4. Dotted Line

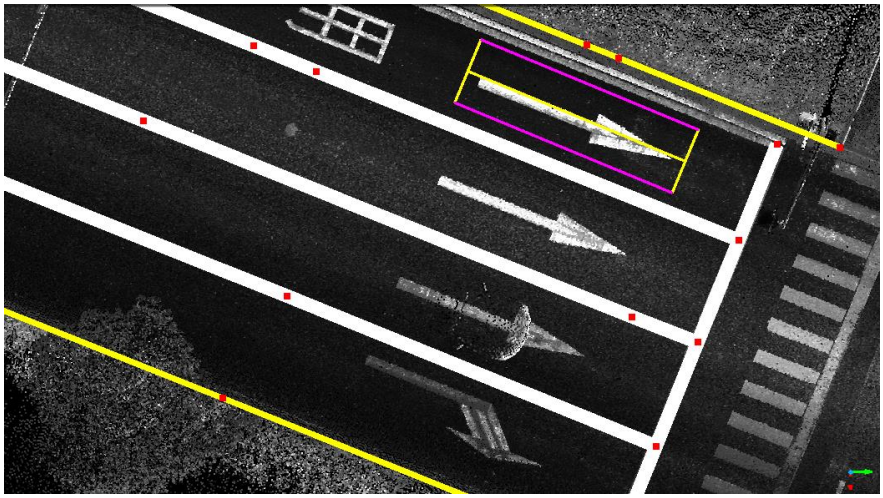
After the solid line is extracted, you can extract the dotted line, or you can extract the arrow, which is the dotted line first. The dotted line semi-automatic lift (shortcut key A) needs to click three points, which are the end points of virtual step and real part respectively.

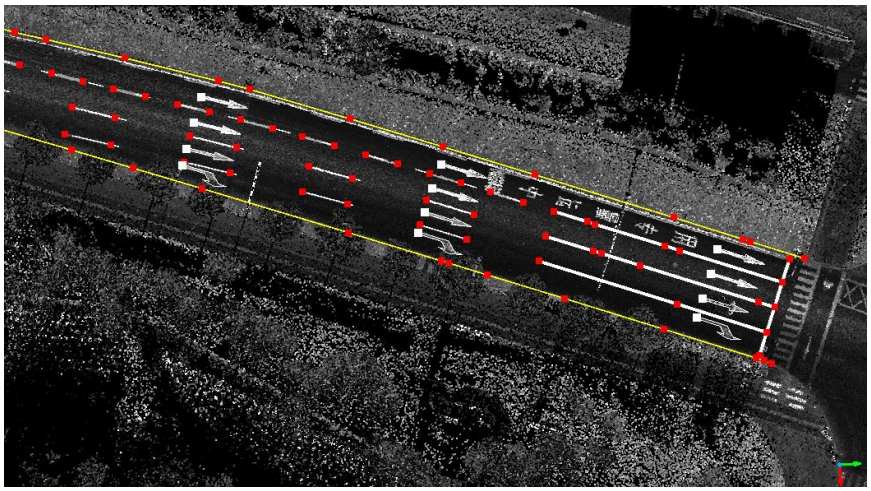


3.2.5. Arrow

The arrow can be extracted according to the intensity, either semi-automatically (shortcut key A) or manually (shortcut key C).

Semi-automatic extraction requires the mouse to click two points to draw a box, and ensure that the box can better cover the range of the arrow.





3.2.6. Pavement and Side Facilities

Using semi-automatic extraction (shortcut key A), select the top of the two columns, and the software will automatically track the railings. The algorithm is applicable to any situation where the data is relatively complete.

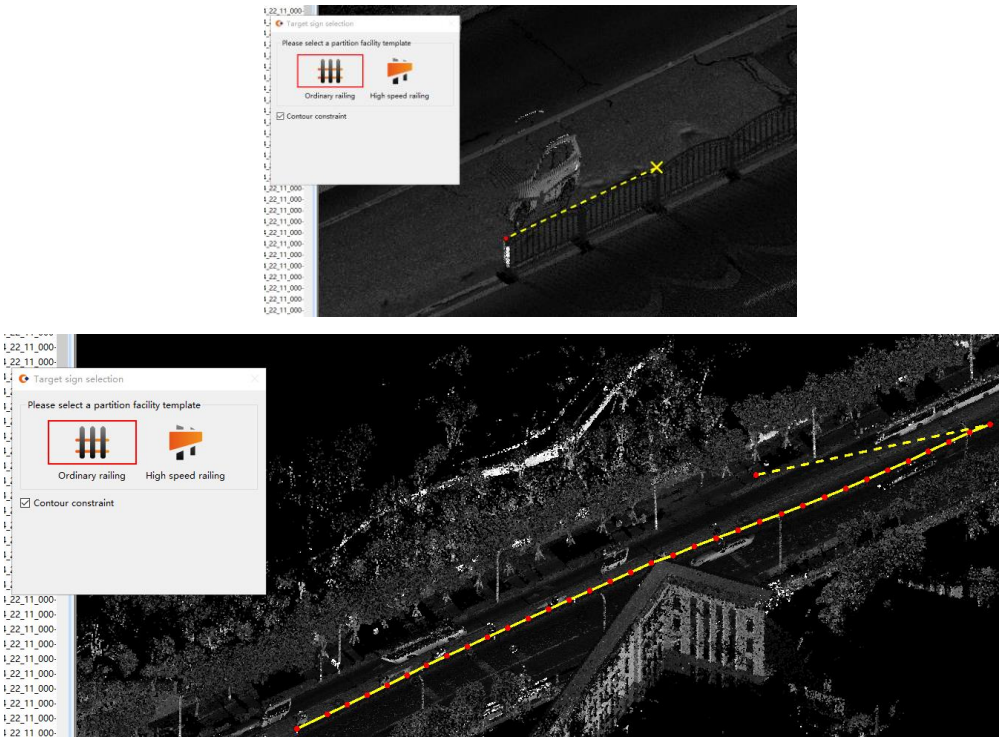
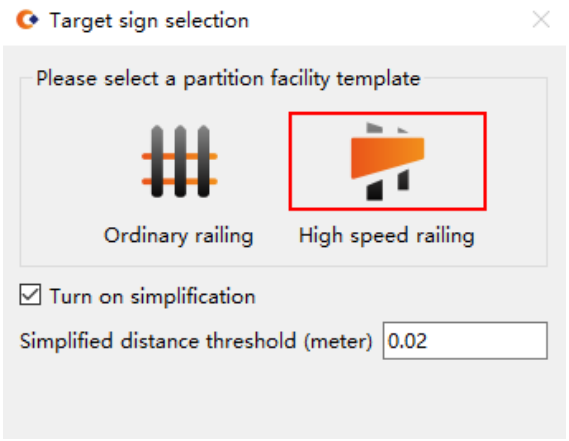


图 2. 14 栏杆提取

The software makes a special distinction for the "W" shaped railings on the highway or elevated road: Select the high-speed railings on the pop-up panel and you can extract them.



At this point, the elements on the road surface have been extracted. Then start extracting elements from both sides of the road.

3.2.7. Tree

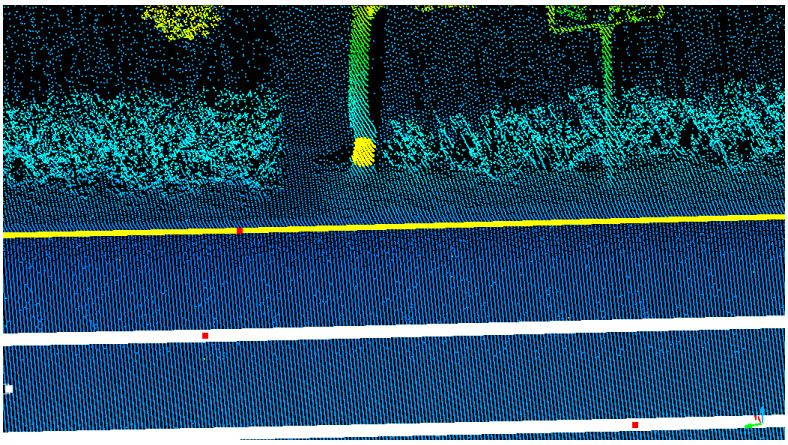
For point-like ground objects that need to be landed, such as street trees, extraction is mainly divided into three steps:

1. Set the landing mode in the parameter setting. Generally, we choose "automatically find the nearest vector line".
2. Set the elevation offset value to 0.15. You are advised to set the parameters based on the actual situation. For details, see the manual.
3. The extraction starts after the setup is complete.

3.2.7.1. Ensure positioning accuracy

Click the street tree extraction function in the interactive mode, and click the tree pole for extraction.

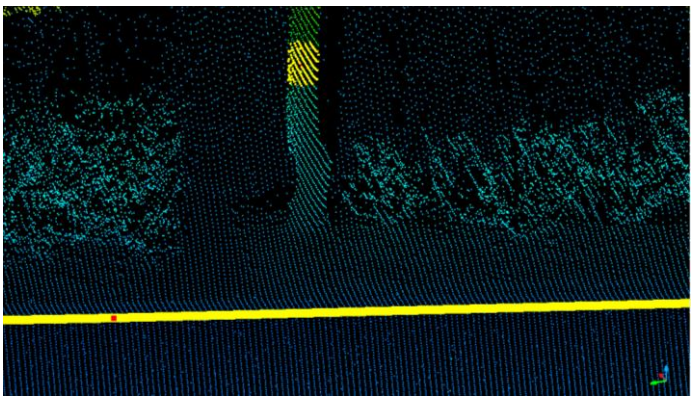
For occasions with high positioning accuracy requirements, we suggest clicking on the tree pole near the ground as far as possible.

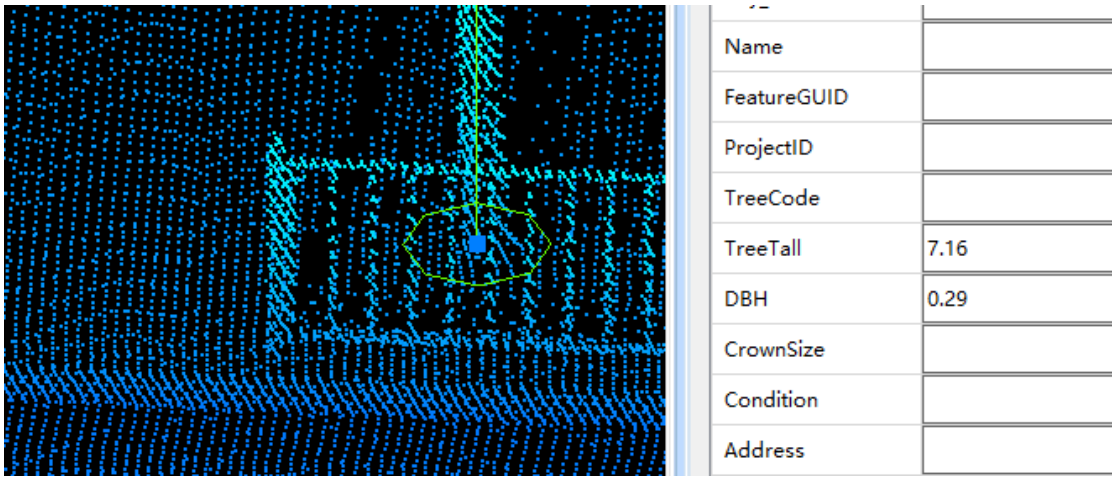


3.2.7.2. Ensure precision of DBH

When extracting street trees, the software will also automatically extract tree height and DBH.

If accurate DBH value is required, it is recommended to click on the trunk about 1.3 meters in accordance with relevant standards, so that a more accurate DBH can be obtained.





3.2.7.3. Check the properties

As soon as a tree is extracted, you should open the property sheet and check its properties.

In addition, after ensuring that there is no error in the attribute, it is necessary to check whether the plane position of the extraction point is accurate in the overlooking perspective, and then select the view to confirm the elevation of the extraction point.

If any property error is found in the preceding check, modify it in the property panel.

3.2.8. Other rods

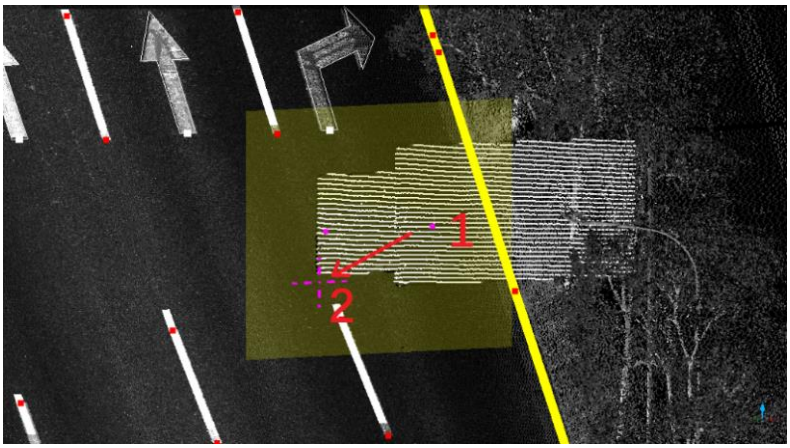
Same thing as tree extraction.

3.2.9. Sign

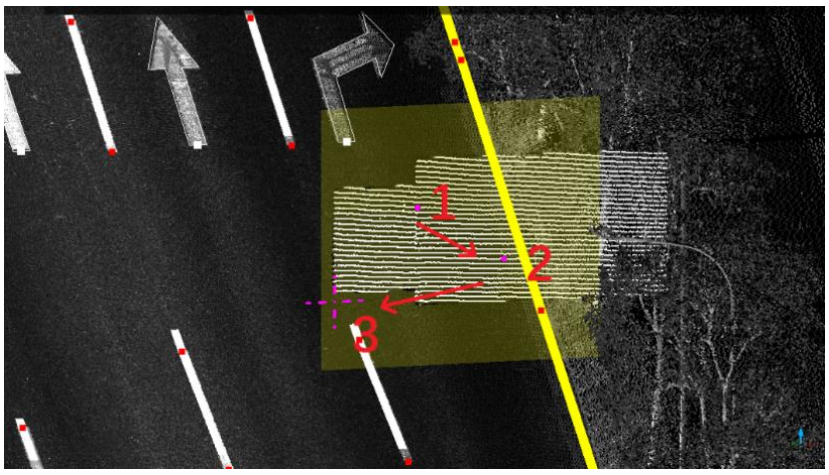
For the more complete situation of the sign, the extraction process is as follows:

1. Activate two-point extraction (shortcut key A);

2. The first bit hits the surface of the sign, so the algorithm automatically determines the best plane;
3. According to the plane display, move the cross cursor, select the lower left corner of the sign, determine the position of the second point;
4. When both points are clicked, the tag will be accurately extracted.



For sign surface fluctuation, the automatically determined plane may not be correct, then you can use the three point extraction (shortcut key C). Compared with two points extraction, it is necessary to manually select two points on the sign to determine a plane, and then click the lower left corner of the sign to submit the vectorization result.



For the rest of the ground features, refer to the general large-scale mapping requirements, and refer to the CoProcess User Manual for specific software functions.

3.3. Element editor

Support common vector element editing operations, such as common basic

editing commands, copy (_CPOY), move (_MOVE), merge (_JOIN), break (_BREAK), trim (_TRIM), extend (_EXTEND), quick point, quick delete point, etc. In addition, to make vector elevation landing more accurate, we provide advanced editing functions such as vertex correction, elevation modification, and line landing.

The use of the editing tool has been described in detail in the User's Manual.

3.4. Save Project

After completing the entire factor extraction and editing process, the project can be saved. The project will record data such as point cloud path and results, so that it can be opened directly next time.

The drawn vector file is named DBDrawing.dxf and is located in the Result folder of the project directory. You can directly open it with AutoCAD or other software.

The default saving interval is 20 minutes. You can set the interval on the system Settings page. You can also manually save the project during the drawing process to better ensure the integrity of the drawing data.

4 conclusion

This paper mainly summarizes the intelligent extraction process, which is convenient for readers to understand the whole extraction process and the extraction sequence of elements, so as to improve the efficiency of drawing. For specific function points and function details, refer to the CoProcess User Manual.