POINTLY

Pointly

Vectorization Tools User Guide

Last change: 2023-10-04

Index

1. Goal of this User Guide

Pointly is a cloud-based SaaS solution allowing to manage and classify 3D point clouds. It enables an accelerated manual classification of data points within point clouds using innovative artificial intelligence (AI) techniques.

This User Guide is intended for the new set of Vectorization tools. To learn more about other Pointly features, check the Pointly User Guide. The Vectorization tools are still in development, and if you have any feedback or features that you would like to see, let the team know by filling out the feedback form or by sending an email to support@pointly.ai.

2. Vectorization tools in Pointly

The current version of the Vectorization tools in Pointly allows for the following manipulation of Vector models and elements:

- Create and manage vector models.
- Create and place Point, Polyline and Polygon elements in 3D space.
- Make your element placement more precise with *Snap to Points* mode or use *Ground operational mode* for a more flexible placement.
- Manage layers, their assigned colors and icons and their names according to your project specifications.
- After designing, export your Vector models in a *GeoJSON* format for importing in any other software suite that you use in your Vectorization workflow.

2.1. Essential concepts for Vectorization in 3D space

We start with a short introduction to vector models, the type of elements they have and how they are placed in 3D space. Point clouds can be referenced to a coordinate reference system, which is automatically detected in Pointly and can be seen in the Viewer Settings. Any vector elements will be placed in the 3D coordinate system of the point cloud, no matter if the point cloud is referenced to any.

3D space refers to a three-dimensional environment where points can be located using a set of three coordinates: X, Y and Z. These coordinates specify a point's position in the horizontal, vertical and depth axes, respectively.

Vector models are made up of different types of elements. Currently the Pointly vectorization tools support Point, Polyline and Polygon elements. Point elements are the simplest and refer to a single location in 3D space. Polyline elements and Polygon elements are multi-point elements. This means they are made up of a set of points, also called *vertices* or *nodes*, and connected by lines (called *edges* or *links*). A Polyline is defined as multiple such vertices and the edges between them, with the limitation that each vertex can be connected with an edge to at most 2

other vertices, and there is no loop in the line, while a Polygon is a Polyline which is closed and has a loop.

2.2. Essential Point cloud Viewer features

The familiar Viewer features for viewing the point cloud are still present when the vectorization tools are enabled.

- Use our Standard Classifiers to classify the point cloud into a set of classes from a Catalog.
- Hide or show classes in the Catalog panel.
- Use Transparent mode to make points from hidden classes transparent. This will also disable Snap to Points mode from snapping to the hidden points.
- Use the Segments view to view the automatically computed segments.
- View the available dimensions in the point cloud and change the colors in which you display them. For example, you can toggle all classes and view the Intensity dimension in grayscale.
- Switch between the different base maps available or manage how the point cloud appears in the Viewer settings.
- Learn more about these features in the Pointly User Guide.

2.3. Creating and opening a Vector model

Only the owner of a project can create new vector models. To create a new vector model, open a point clout in the Viewer and click **Open Vector model**. Create a new model by clicking ＋ . Name your model and save it.

To open a model while in the **Open Vector model** dialog, select a model from the table and click **Open**. The model will be opened in the Viewer. In case you do not see the model, it might be referenced to different coordinates than the point cloud. Use the Model explorer to find where in 3D space the elements are located.

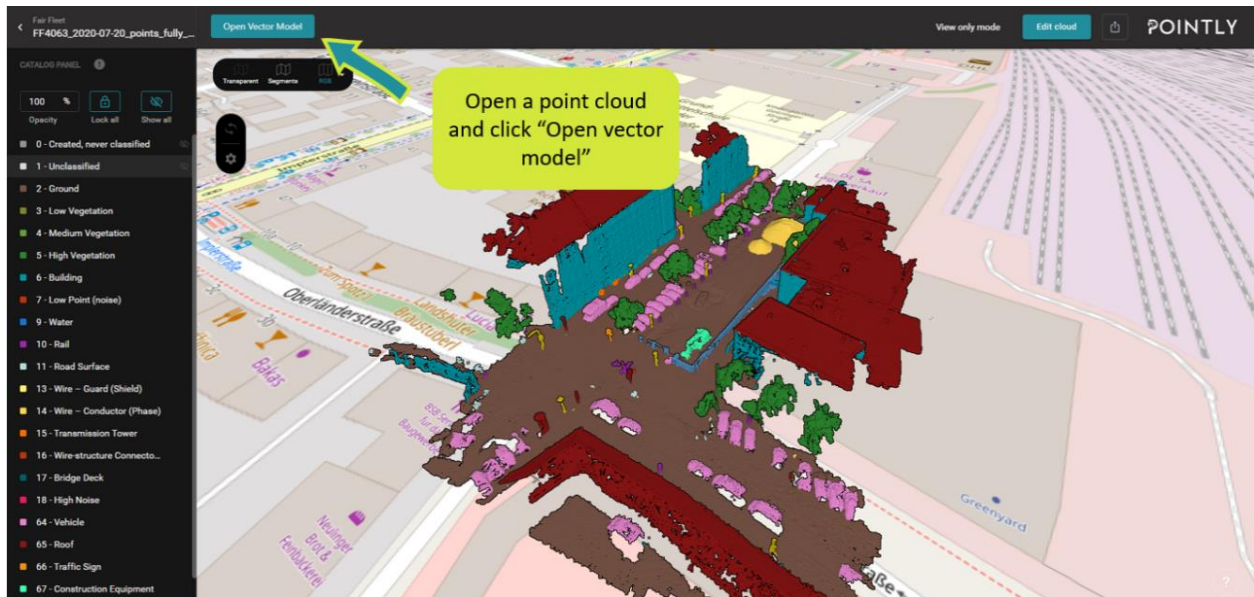From this dialog, you can also rename or delete existing models by clicking the ✏ and 🗑 icons.
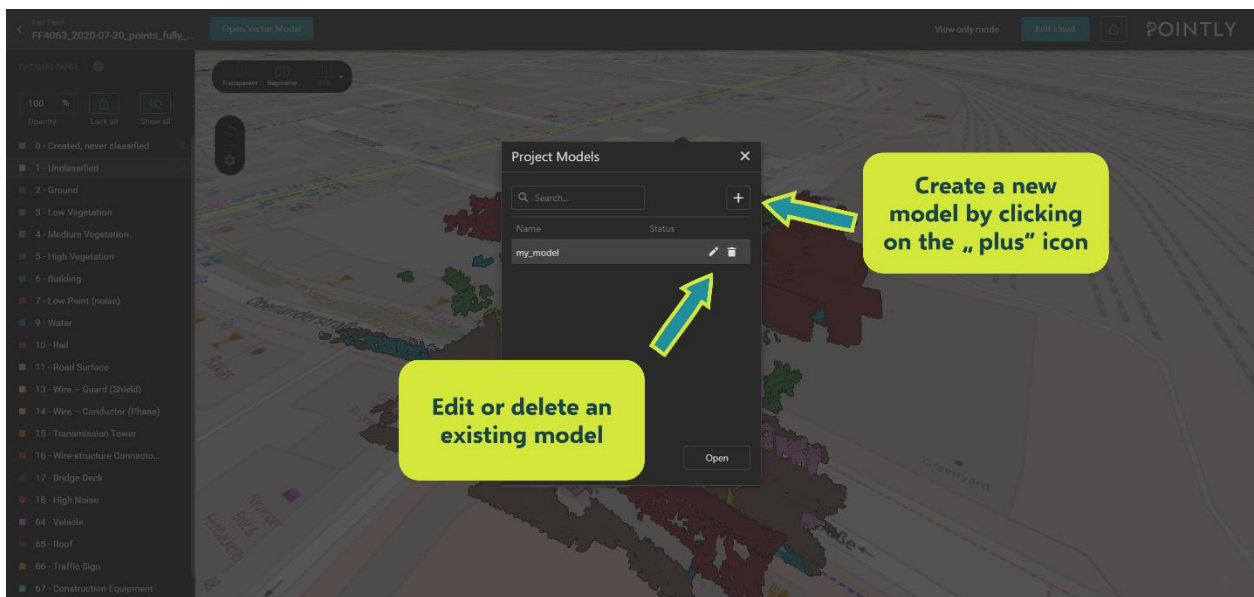
Figure 1: How to open a Vector model.

Figure 2: Creating, editing, or deleting a model.

2.4. Editing a vector model

Any user with access to the project can edit vector models in the project. Each vector model in the project can be opened together with any point cloud, but first the point cloud must be opened.

2.4.1. Vector model Panel

Figure 3: Vector model panel.

Button	Action	Description
←	**Close model**	Close the current model.
✏	**Edit opened model**	Enter Editing mode.
🔒	**Read-only mode**	Lock the model from further editing.
⬆	**Export opened model**	Export the currently opened model.

2.4.2. Enter Editing mode

When you first open a vector model, it will be opened in *Read-only* mode. To start editing, click the ✏ icon in the top ribbon.

Each model can find itself in one of three statuses, and the current status of each model can be seen in the Open Vector model dialog. When there is no entry for the status of the model, it can be edited by any user with access to the project. When the status is *Editing*, a user is currently editing the model and thus no other user can edit it until they are done, but the model can still be opened and viewed. The model will automatically lose its *Editing* status when no changes are made to the model for 4 hours. When the status is *Read-only*, the model can be viewed by all users, but no user can edit it. To change the status of a model to *Read-only*, open the model and click 🔒 in the top ribbon.

2.4.3. Navigation in the point cloud

Navigation in the point cloud is necessary to carefully check the cloud and model from different angles. Navigation in the Viewer is possible with the mouse or by using keyboard shortcuts. We

recommend using the keyboard shortcuts for detailed navigation, and the mouse navigation for making large movements around the 3D space.

2.4.3.1.   Mouse Navigation

To navigate around the point cloud, you can use the mouse as described in the Pointly User Guide. When a vector element tool is enabled, mouse navigation is disabled but can be enabled by the Toggle mouse navigation ⊕ button. Learn more about Toggling mouse navigation in 2.4.3.2. Toggle mouse navigation

2.4.3.2.   Keyboard Navigation

Navigation hotkeys on the keyboard help you to move and rotate the cloud and model.

Hotkeys	Description
W, A, S, D	Move forward, back, left, right
Q, E	Move down, up
←, ↑, →, ↓	Rotate view left, up, right, down
+, -	Zoom in, zoom out
R	Reset view
T	Top view
B	Bottom view

Some of these shortcuts can be used simultaneously. For example, you can combine **W** and **→**, **S** and **+**, **W** and **D**.

2.4.4.   Vectorization Settings panel

The Vectorization Settings panel can be found in the upper right corner of the Viewer when a Vector model has been opened in *Read-only* or *Editing* mode.
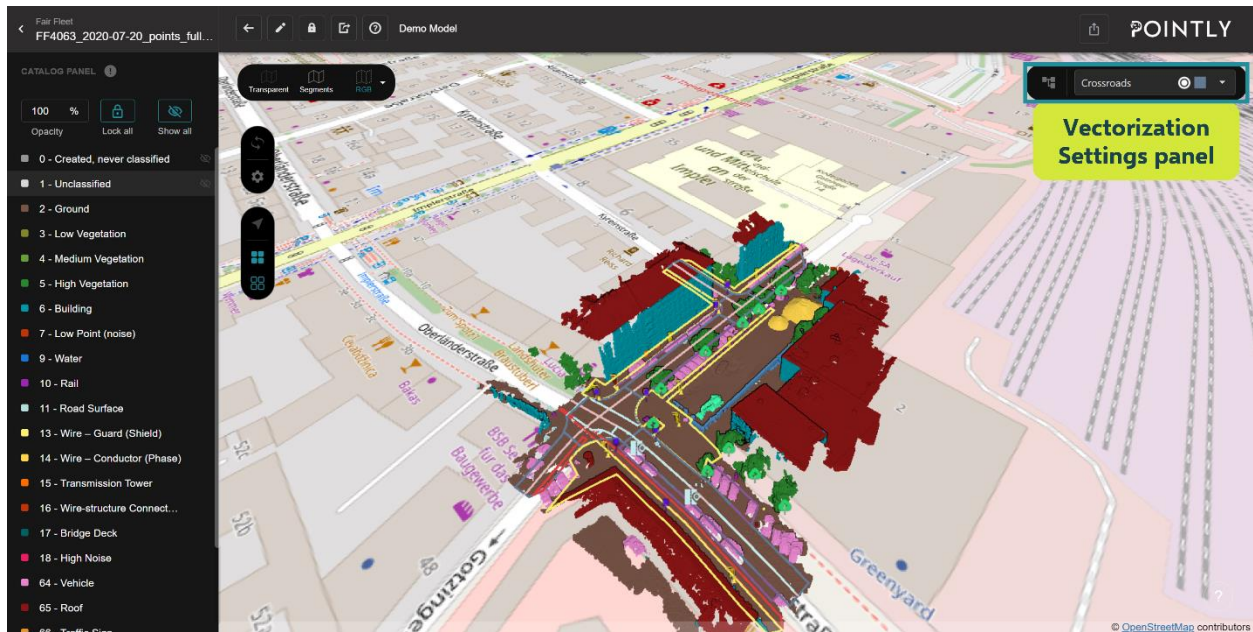
Figure 4: Vectorization Settings panel in Read-only mode.

In *Read-only* mode, the panel looks as above.

Button	Action	Description
	Open Model explorer	Use the Model explorer to view all elements in the model and their attributes. Learn mode in 2.4.4. Model Explorer.
Drop-down menu	**View layers**	View the layers of the model. Learn more in 2.4.5. Layer Management.

Use the drop-down menu in the right to view the layers in the model. To edit them, enter Editing mode.
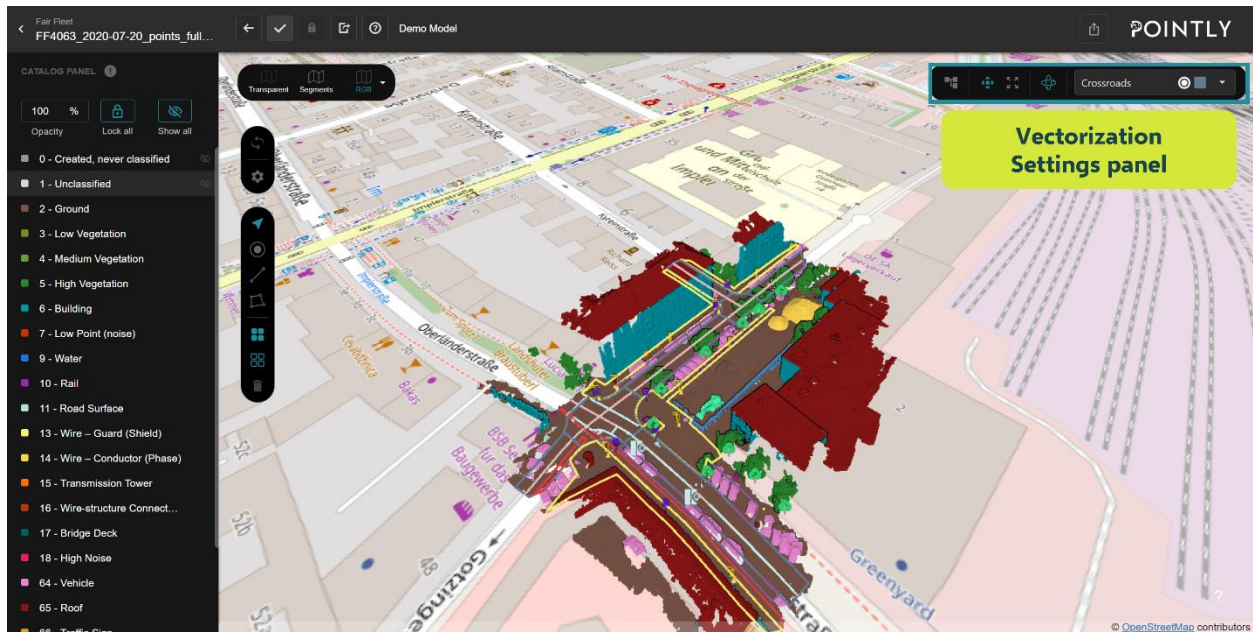
Figure 5: Vectorization Settings panel in Editing mode.

In Editing mode, the panel looks as above.

Button	Action	Description
⊟	**Open Model explorer**	Use the Model explorer to view and edit all elements in the model and their attributes. Learn mode in <u>2.4.4. Model Explorer</u>.
⊕ ⤢	**Switch between Operational modes**	Learn more about Operational modes in <u>2.4.2.1. Choose an Operational mode</u>.
⊕	**Toggle mouse navigation**	Learn more about Toggling mouse navigation in <u>2.4.2.2. Toggle mouse navigation</u>.
Drop-down menu	**View layers**	View and edit the layers of the model. Learn more in <u>2.4.5. Layer Management.</u>

2.4.4.1. Choose an Operational mode

Operational modes allow the user better control over where the vectorization elements will be placed. The current two options are Snap-to-Points mode ⊕ and Ground operational mode ⤢.

2.4.4.1.1. Snap-to-Points mode

Select Snap-to-Points mode by clicking ⊕ in the Vectorization Settings panel. When Snap-to-Points mode is selected, placed or moved vertices of elements will snap to the same 3D locations as points in the point cloud.

2.4.4.1.2. Ground operational mode

Select Ground operational mode by clicking ⛶ in the Vectorization Settings panel. When Ground operational mode is selected, any vertices placed will have their **Z** coordinate equal to the ground height. The ground height is found automatically from the point cloud or can be edited in the Viewer Settings (see Pointly User Guide). Moving one or more vertices is possible, without any changes to their **Z** coordinate. This means that if the vertex was placed with Snap-to-Points mode, the **Z** coordinate will not change, only the **X** and **Y** coordinates will change. If the vertex was placed in Ground operational mode, the **Z** coordinate will be equal to the ground height.

2.4.4.2. Toggle mouse navigation

Toggle mouse navigation on or off by clicking ✥ in the Vectorization Settings panel. Toggling mouse navigation on will allow using the mouse to move around the point cloud while an element is being placed. When mouse navigation is off (indicated by a gray ✥ in the Vectorization Settings panel), the only way to navigate when one of the Element tools is selected is to use the keyboard. We recommend using mouse navigation sparingly while placing elements, and to use keyboard navigation around the point cloud whenever possible.

2.4.5. Vector model tools

The Vector model editing tools can be found in the panel on the left of the screen.
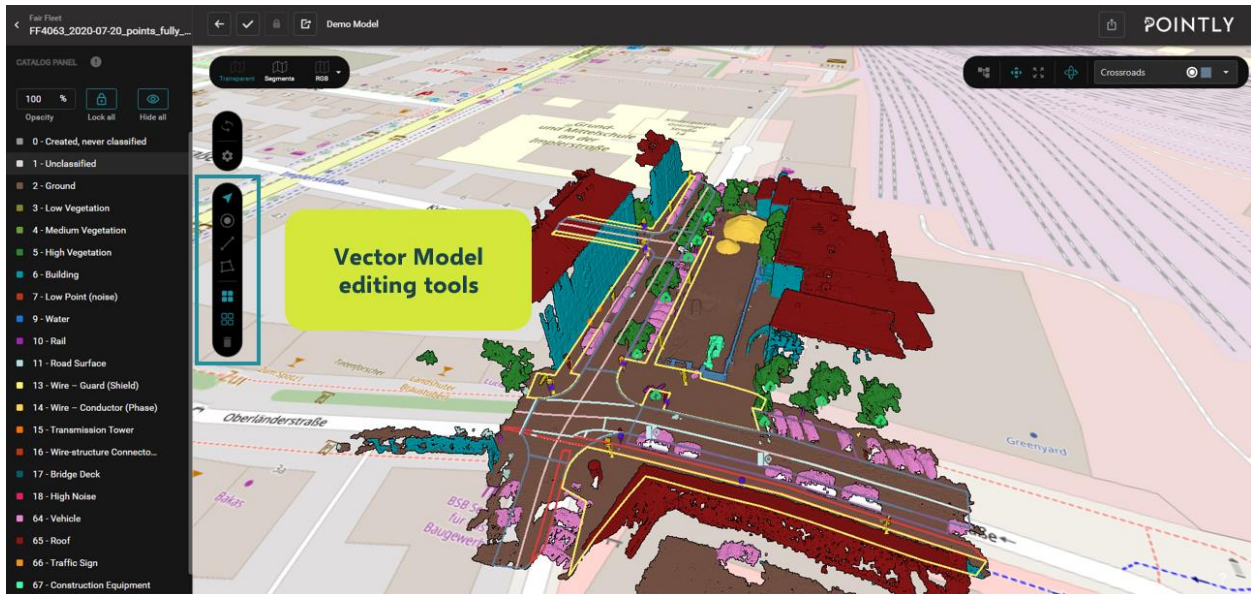

Figure 6: Vector Model tools

Button	Tool	Description
◹	**Selection and express editing**	Select, move, and delete elements and their vertices. Learn more in 2.4.4.4. Selection and express editing.

⦿	**Point tool**	Place point elements. Learn more in 2.4.4.1. Point tool.
⟋	**Polyline tool**	Place polyline elements. Learn more in 2.4.4.2. Polyline tool.
⬠	**Polygon tool**	Place polygon elements. Learn more in 2.4.4.3. Polygon tool
▦	**Select all**	Select all elements in the model.
▢▢	**Clean selection**	Deselect all selected elements.
🗑	**Delete selection**	Delete selected elements.

2.4.5.1.   Point tool

The Point tool can be selected by clicking ⦿. The Point tool allows placement of point elements according to the selected Operational mode. Simply left click on the place where you want to place your point, and it will be placed. Pressing *ESC* while the Point tool is selected will de-select it and activate the Selection and express editing tool.
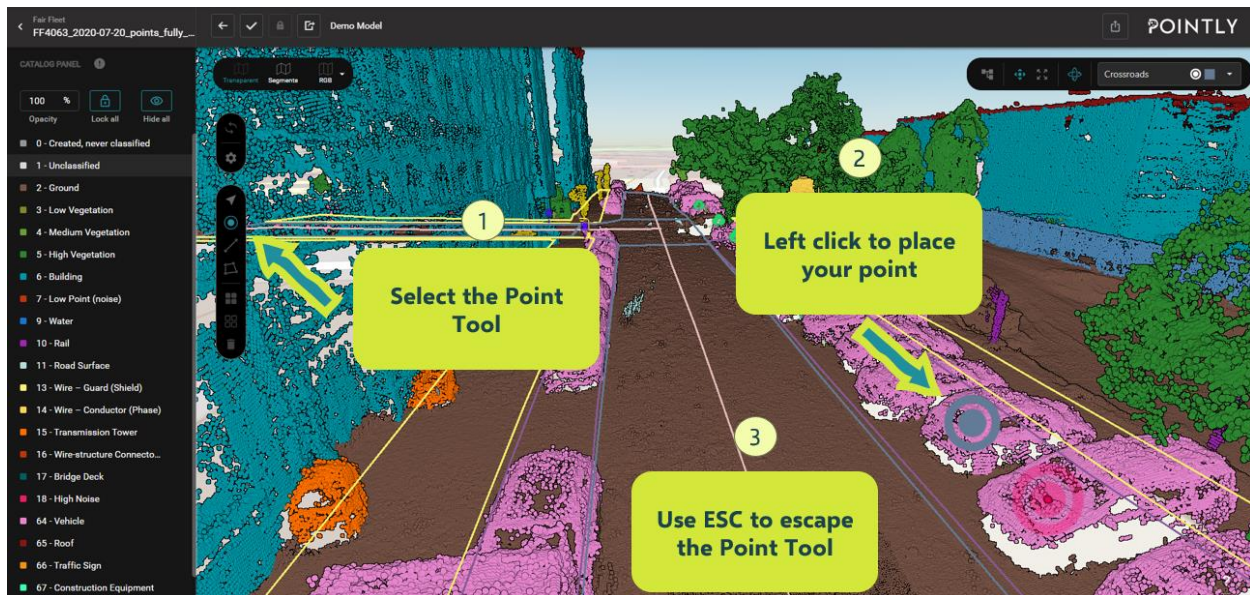

Figure 7: Select and use the Point tool.

2.4.5.2.   Polyline tool

The Polyline tool can be selected by clicking ⟋. The Polyline tool allows placement of the vertices of a polyline element according to the selected operational mode.

- Left click on the location of the first vertex to start the placement of a polyline element.
- You can use right-click to remove the last placed vertex (before the element has been finished).
- Continue left clicking to place all the vertices of your polyline at the desired locations.

- To finish placing vertices in your polyline, double-click on the left mouse button when placing the last vertex. Alternatively, after placing the last vertex you can use *Enter* on the keyboard.
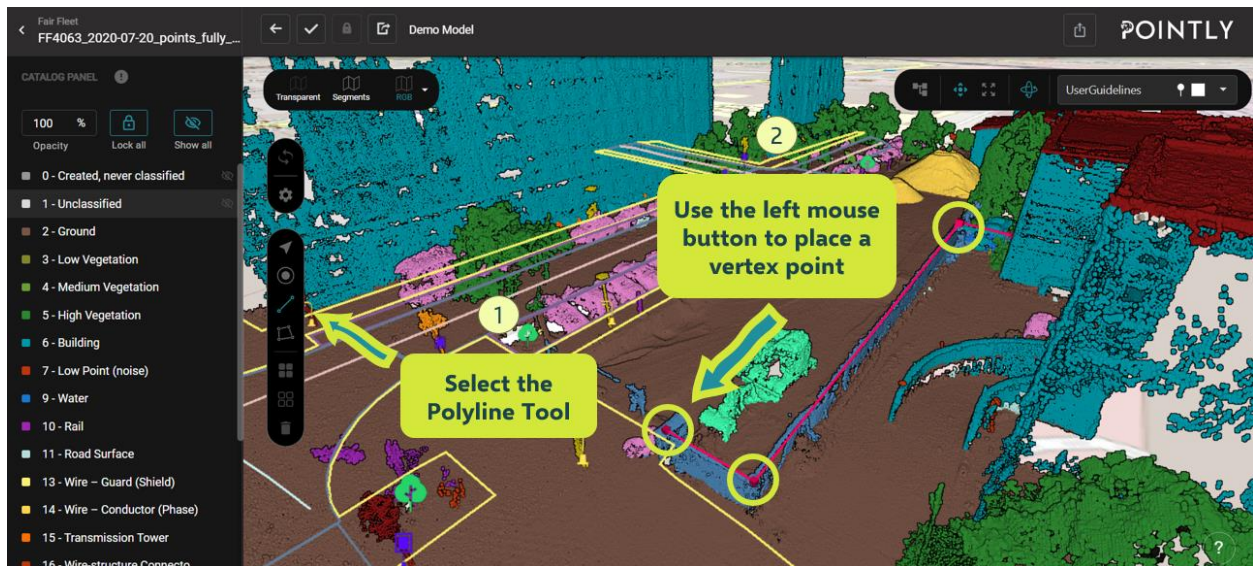

Figure 8: Select and use Polyline tool.

Figure 9: Finish editing your Polyline.

2.4.5.3.   Polygon tool

The Polygon tool can be selected by clicking ⬠. The Polygon tool allows placement of the vertices of a Polygon element according to the selected operational mode.

- Left click on the location of the first vertex to start the placement of a Polygon element.
- You can use right-click to remove the last placed vertex (before the element has been finished).

- Continue left clicking to place all the vertices of your polyline at the desired locations.
- To finish placing vertices in your Polygon, double-click on the left mouse button when placing the last vertex. Alternatively, after placing the last vertex you can use *Enter* on the keyboard.
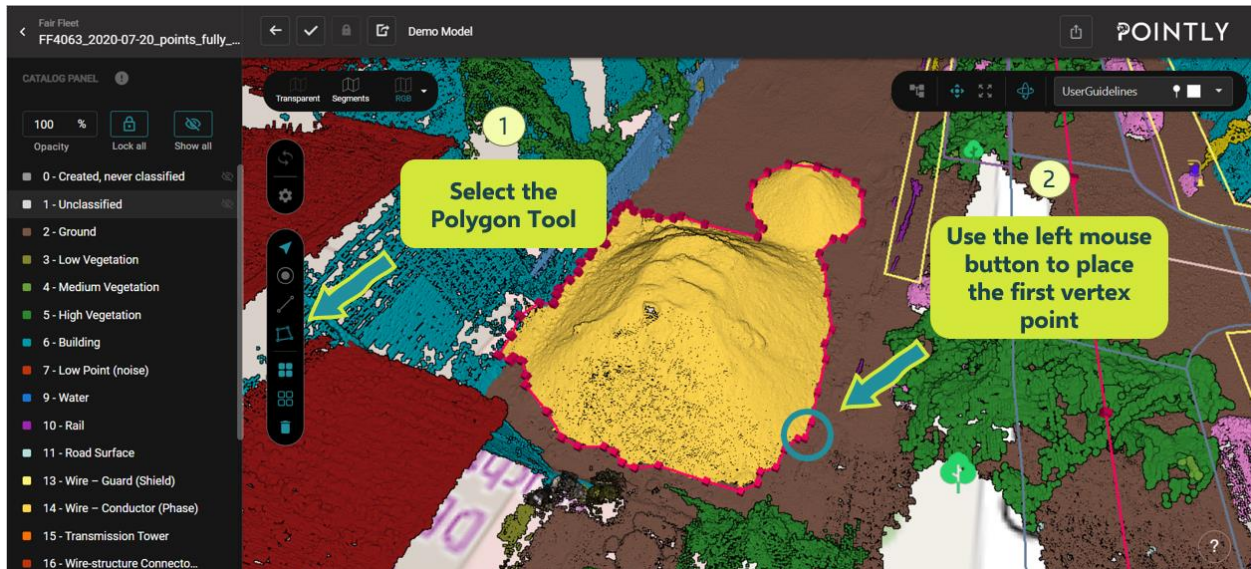
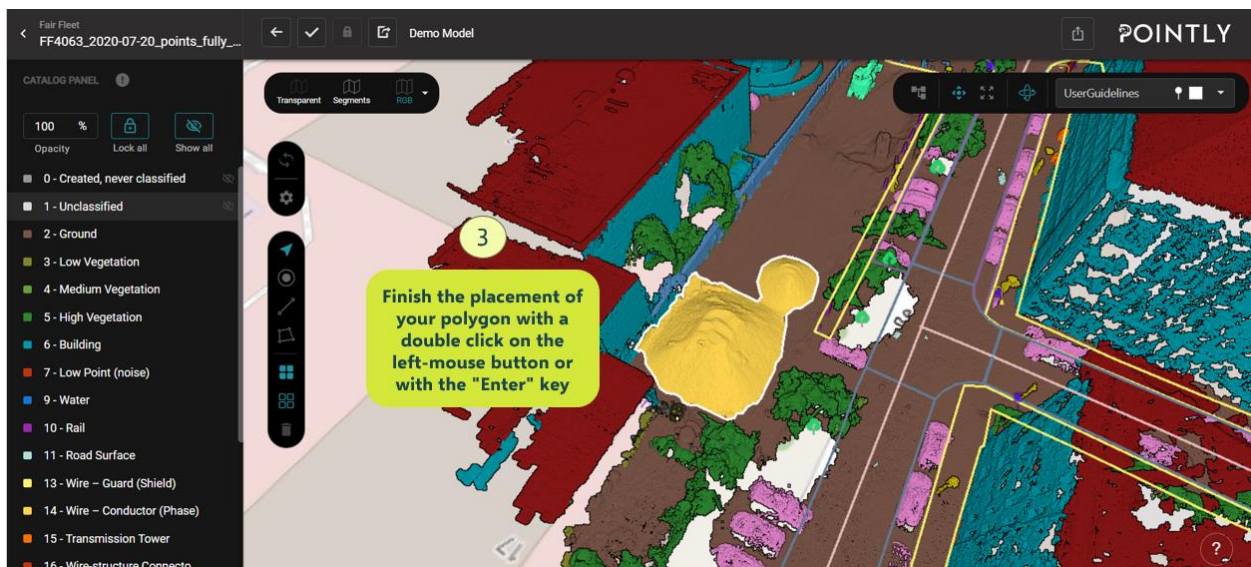

Figure 10: Select and use the Polygon tool.

Figure 11: Finish editing your Polygon.

2.4.5.4. Selection and express editing

Click ◁ to enable the Selection and express editing tool. While another tool is selected in Editing mode, a right click or pressing *Esc* on the keyboard will automatically enable the Selection and express editing tool. This tool allows for selecting multiple elements, changing the location of the elements and their vertices, and deleting elements.

2.4.5.4.1. Selecting elements

Selecting one or multiple elements is possible with the tool.

- Click on elements in the Viewer to select them.
- Hold *Ctrl* and click on elements to select multiple of them.
- Hold the middle mouse button to create a Selection box and select all elements inside it. Release the middle mouse button when you are ready with your selection.

Some additional quick action buttons are available in the Vectorization tools panel.

Button	Action	Description
⚏	**Select all**	Select all elements in the model.
⚏	**Clean selection**	Deselect all selected elements.
🗑	**Delete selection**	Delete selected elements.

2.4.5.4.2. Moving elements

The way that elements can be moved depends on the currently selected operational mode, as well as the type of element that you want to move.

2.4.5.4.2.1. Moving elements in Snap-to-Points mode

Snap-to-Points mode is more restrictive and allows to move only single vertices, i.e. move Point elements or move single vertices of Polyline or Polygon elements. All 3 coordinates of the elements in the 3D space will change to the same coordinates as the point which the vertex is bound to.

To move a selected Point element, use the left mouse button to drag the vertex to the desired location. In Snap-to-Points mode, the element will snap to the nearest point in the point cloud.

To move a vertex of a Polyline or Polygon element, use the left mouse button to drag the vertex to the desired location. In Snap-to-Points mode, the element will snap to the nearest point in the point cloud.

2.4.5.4.2.2. Moving elements in Ground operational mode

Multiple elements and vertices can be moved in Ground operational mode. Moving the elements will not change the height of the elements (the Z coordinate in 3D space) but will change the other coordinates (X and Y).

To move a selection of elements, select them with the Selection and express editing tool, and then use the left-mouse button to drag the elements to the desired location. Note that in this case the elements will not be snapped to points in the point cloud, but instead their *X* and *Y* coordinates will change to precisely the place you drag them to.

2.4.6. Layer Management

Use layers to make your vector model appear cleaner and to organize the elements in it. For example, if working in a point cloud showing a city after using our *Leica CityMapper-2 Standard Classifier*, some examples of layers you can create are Trees, Parking spaces, Road surfaces, Road markings or Traffic signs, each containing relevant 3D elements describing the point cloud content. Choose the color that each layer will be displayed in directly in the Viewer and pick an icon for point elements from a range of different options suited to a variety of applications.

The layers can be seen by clicking on the drop-down menu in the Vectorization Settings panel. The layer shown in the Vectorization Settings panel is the currently active layer. Any elements placed will be placed in this layer.

A user can create new layers and change existing layers. Each layer has a name, a color in which elements belonging to it are displayed, and an icon which will be used to display point elements in the layer.
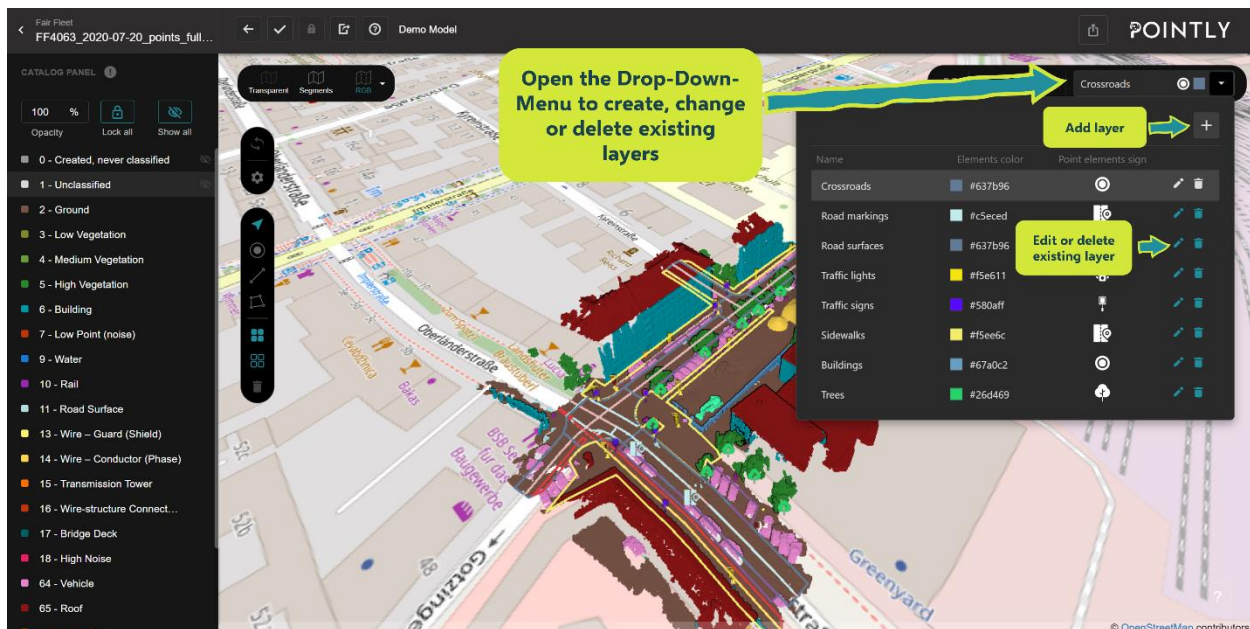

Figure 12: Layer management panel.

2.4.6.1. Create a new layer

To create a new layer, click on the ➕ in the Layer management panel. Name your layer, choose color for elements and the icon for point elements. When you are ready, click **Save**. The new layer will be automatically selected as the active layer.

To choose the color, you can enter a HEX code directly or click ▸ to choose the color. The box can be used to choose the brightness and saturation of your color, and on the side is a slider to choose the hue. In the right corner of the panel is a box with the currently selected color. Use the fields below it to enter RGB values or the HEX code.
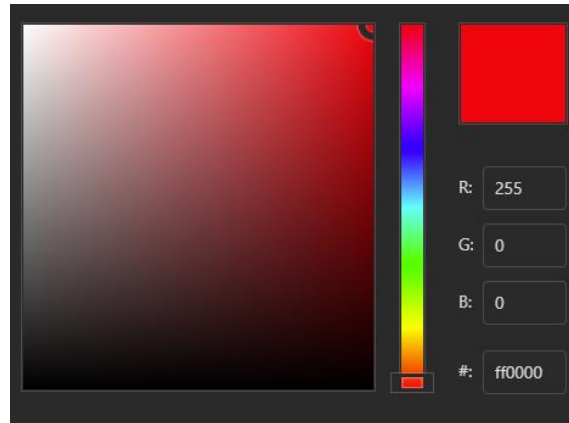

Figure 13: Layer color selection.

2.4.6.2. Edit existing layers

To edit an existing layer, click on ✎ next to the layer details. There you can change the name, color, and icon as when creating a new layer.
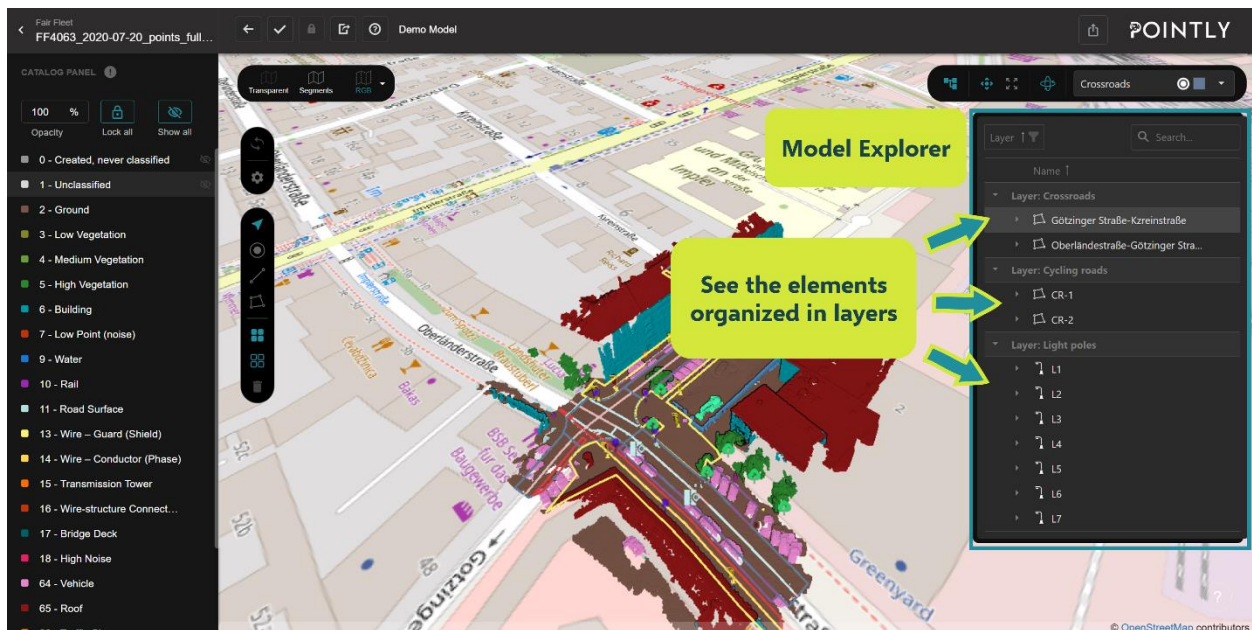
2.4.7. Model explorer

Figure 14: Model explorer.

The Model explorer can be opened by clicking ▪┇ in the Vectorization Settings panel. The Model explorer allows you to have an overview of all the elements in the model, as well as to manage their attributes.

2.4.7.1. Using the Model explorer

In the Model explorer, you can see all the elements in the model, organized by layers.

The name of each element can be changed by clicking on the displayed name in the Model explorer.

The attributes of the element can be seen by clicking the ▸ symbol. Learn more about attribute management in 2.4.6.2. Attribute management.
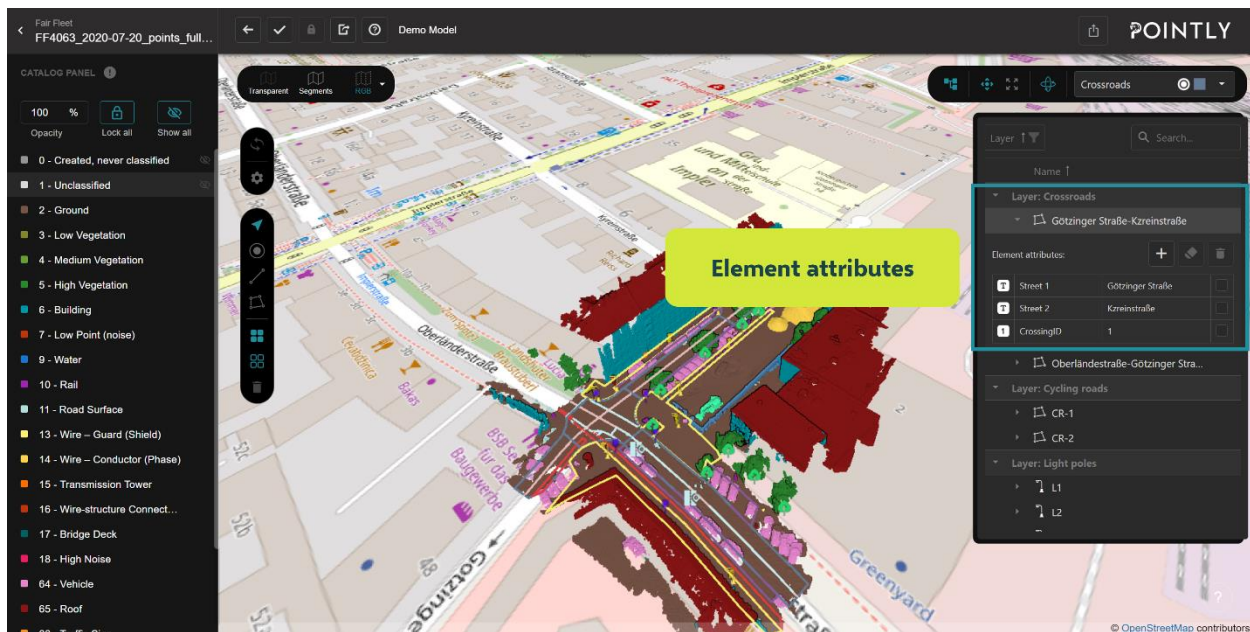
2.4.7.2. Attribute management

Figure 15: Element attributes.

Attributes are properties which can be assigned to model elements. In the current version, it is only possible to assign them manually. To see the attributes, click the ▸ to the left of the element name.

2.4.7.2.1. Add a new attribute

To create a new attribute, click on the ⊞ icon above the table of attributes. The attribute can have different types, described in 2.4.6.2.2. Element attribute types.

To edit the attribute name and value, click on the field in the table. The names of the attributes must be unique for the element. When you are ready with the attribute creation, press the *Enter* key on your keyboard.

2.4.7.2.2. Element attribute types

Attributes can have one of four types: text, number, date, and Boolean. The type of the element can be changed by clicking on its icon in the table.

Icon	Type	Description
T	**Text attribute**	Text-based attribute. Enter alphanumeric characters or symbols.
1	**Number attribute**	Numeric attribute. Enter numeric quantities, such as measurements.
📅	**Date attribute**	Date-based attribute. Pick a date by clicking 📅 in the right side of the table.
☑	**Boolean attribute**	A True or False value. Select True by checking the box.

2.5. Finish editing

When you are finished with editing your model, click ☑. Only one user at a time can edit a model, and the status of the model is displayed when opening a model. When a model is in Editing status, it cannot be edited by any other user. When a model is in Editing mode without any changes made for 4 hours, Editing mode will automatically be disabled.

2.6. Exporting vector models

When you are done with creating your vector model with the tools available in Pointly, you can export it and continue working with it in a different software. To export your model, click ⬈. The file will be saved in a (Geo)JSON format. This file can be opened with GIS tools for further use. If the point cloud is not referenced to a coordinate reference system (CRS), the model elements will be placed relative to the internal point cloud coordinate system, without referring to any CRS.
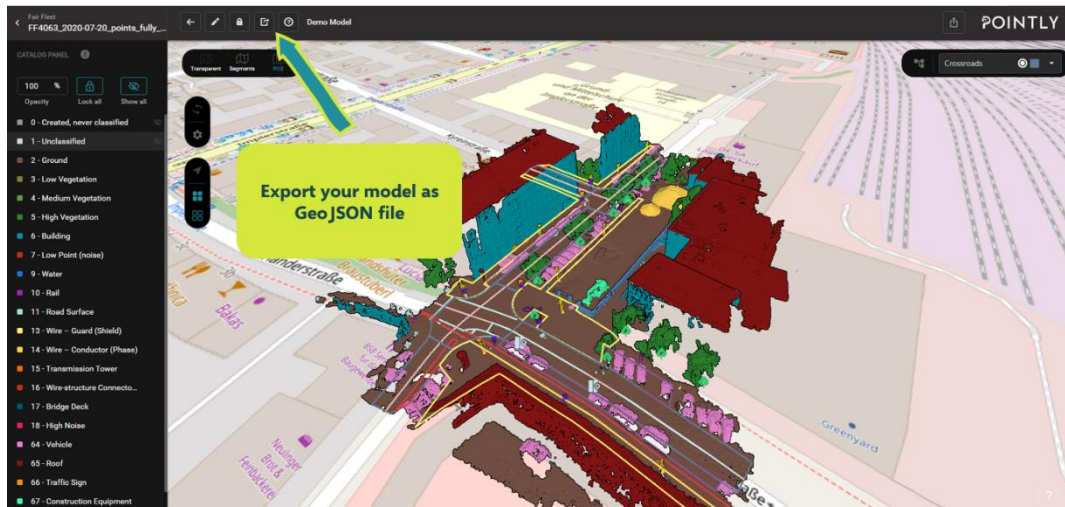
Figure 16: Export your model.

3. Limitations and upcoming features

As the vectorization tools are still in development, limitations are present in the platform. This section of the User Guide describes some of these limitations and will indicate if this feature is planned for future development. The Vectorization features will also be developed based on user feedback - if you have any feedback or features that you would like to see, let the team know by filling out the feedback form or sending an email to support@pointly.ai.

3.1. Undo and re-do

Currently, none of the vectorization tools support undo or re-do of actions. This is a planned feature for the development of vectorization tools and will be available soon.

3.2. Automatic creation of attributes

Currently, automatic creation of attributes e.g. measurements, is not supported in the vectorization tools. All attributes should be entered manually. Automatic measurements are a planned feature for the development of vectorization tools and will be available soon.

3.3. Isolated selection per layer

Currently, selection by clicking or a selection box will select all elements in the model and not isolate layers. This is a planned feature for the development of vectorization tools and will be available soon.

3.4. Importing vector models

Currently, it is not possible to import vector models into the Viewer. The only way to view a vector model is to create it in Pointly. Importing vector models of different formats is a planned feature for the development of vectorization tools and will be available soon.

3.5. Automatic computation of 3D vector models

A key functionality in Pointly's point cloud classification toolkit is the inclusion of Standard Classifiers tailored for distinct use scenarios. While the present iteration of our vectorization tools doesn't offer automatic generation of 3D models, it lays the groundwork for future AI-driven 3D vector model extraction, starting with extraction of 3D vector lines for specific use cases. Stay tuned for our upcoming features!