


Large Point Cloud Processing

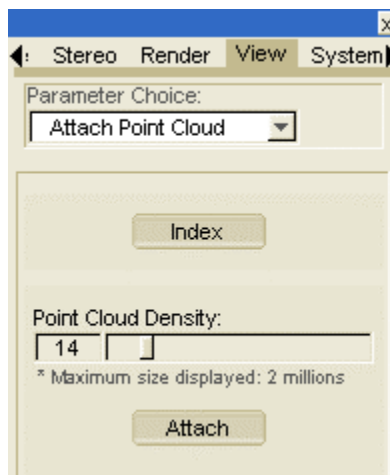
Objective

Learn how to process the extremely large data sets associated with laser scanning and LIDAR. Use the Index-Attach technology to retrieve inquiring points into a window. Use the Window Split tool to split a portion of the point cloud. Use the Denoise and Decimate functions to smooth and decimate the point cloud. Use the Point Cloud to Mesh function to triangulate the point cloud into a polygonal model.

Step 1: Attach Point Cloud File

Click the **Attach Large Point Cloud** command from the File menu (*File > Attach Large Point*

Cloud), or click the icon  at the top of the screen. The Index-Attach working panel appears in the Parameter Window on the right side of the screen, as shown below.



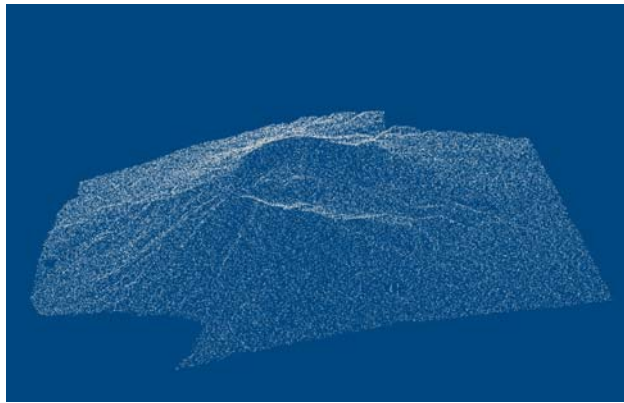
Note: The **Import** command in the File menu imports all data into the window. The **Attach Large Point Cloud** command only retrieves inquiring points into the window.

1. Index

Press the [**Index**] button. A dialog box will be opened to allow you to choose a name, directory, and file type (*.las, *.pts, *.3dd, *.dxf, and *.txt/asc/xyz) for the file. The program creates an index file with a *.PCP extension saved in the original folder. Generating the index takes a few minutes depending on the file size and number of points in the file. You only need to create an indexed point cloud file from a scan file once.

2. Attach


Press the [**Attach**] button to attach an indexed point cloud file to the current project. The **Point Cloud Density** slider controls the number of points (density) displayed in the window. Move the slider to increase/decrease the amount of points that can be displayed. The maximum number of points that can be displayed in the window is 2 millions. Please note that an attached file will be marked with an asterisk in the Object Tree Window, e.g., *Object**.

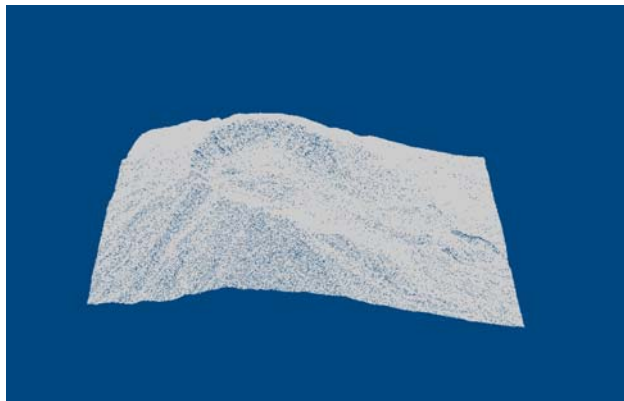


Point Cloud Density = 7%

Step 2: Split

Click the **Window Split** command from the Modify menu (*Modify > Knife > Window Split*), or


click the icon  at the top of the screen. Drag mouse to draw a rectangular window around a portion of your model to split the point cloud and work on the region of interesting.



Region of Interesting


Step 3: Denoise

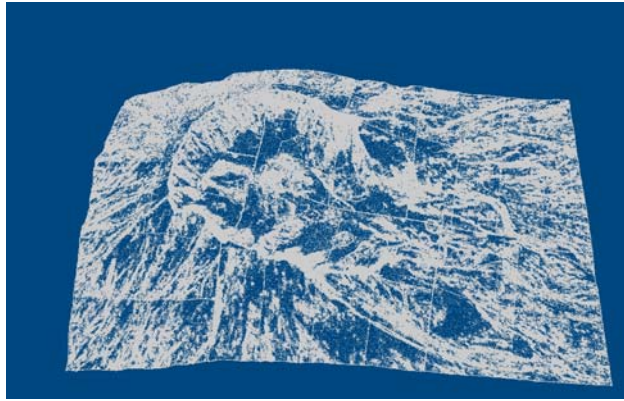
Click the **Denoise Point Cloud** command from the Cloud menu (*Cloud > Denoise Point Cloud*),

or click the icon  in the Toolbar. Specify the **Smoothing Iteration** at around 15, and press the [**Apply**] button to smooth the point cloud in the indexed file.

Step 4: Decimate

Click the **Decimate Point Cloud** command from the Cloud menu (*Cloud > Decimate Point*

Cloud), or click the icon  in the Toolbar. Specify the **Decimation Percentage**, and press the [**Apply**] button to reduce the size of the point cloud in the indexed file. It's better to decimate the amount of points under 1 million before converting point clouds into meshes.



Decimated 70% Off

Notes:


- The **Remove Redundant Points** command can also reduce the number of points. It removes redundant points according to a defined minimum distance and curvature weight. It makes a more uniform distribution of points on flat regions than the **Decimate Point Cloud** command does, but it takes a slightly longer time.
- The program will automatically save the processed result and create a new PCP file in the original folder by adding a prefix to the original file name. For example, a prefix "Dec_" will be added to the original file name after decimation, e.g., the decimated point cloud file will be named as "Dec_OriginalFileName.pcp". Only the processed result of an attached file will be automatically saved as a new indexed PCP file during each step of processing.

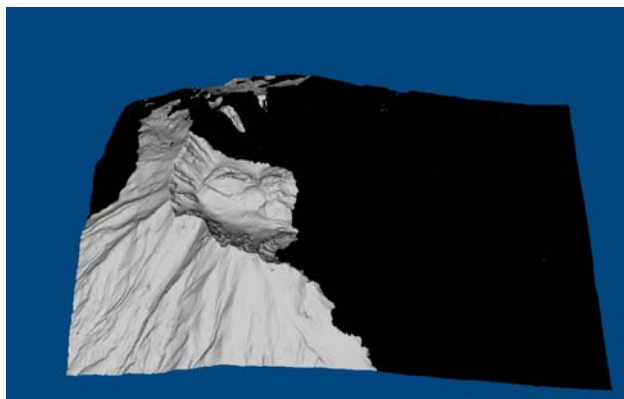
Step 5: Import the simplified PCP file

Please note that the **Point Cloud to Mesh** command in VRMesh doesn't work with an attached file. Therefore, we need delete the attached file in the window, and use the **Import** command (*File > Import*) to import the decimated point cloud PCP file "Dec_OriginalFileName.pcp" into the current project. You will notice that the imported file isn't marked with an asterisk in the Object Tree Window.

Step 6: Triangulate Point Clouds

Click the **Point Cloud to Mesh** command from the Cloud menu (*Cloud > Point Cloud to Mesh*), or

click the icon  in the Toolbar. Specify the noise level of the points in the Parameter Window, and press the **[Apply]** button to start the triangulation process.




Step 7: Repair Meshes


After triangulation, the object appears to have some dark areas. You may turn on two-sided lighting of surface using the shortcut **[Ctrl] + L**. The total part becomes visible. The flipped triangles are displayed in gray as well. You can then press **[Ctrl] + L** again to turn off the two-sided lighting. VRMesh uses single light in default to speed up displaying objects.

The suggested repair steps are:


1. Fill small holes

Click the **Fill Holes** command (*Modify > Fill Holes*), or click the icon  in the Toolbar. Specify the **Hole Radius**. Generally, it's not necessary to check the **Fill by Curvature** option when filling small holes. A red circle appears in the Drawing Window indicating the defined maximum area that a hole will be filled. You can drag the mouse across the text field and thus slide the value. Please note that filling small holes before unifying normals is an important step to produce a better result.


2. Extract floating parts

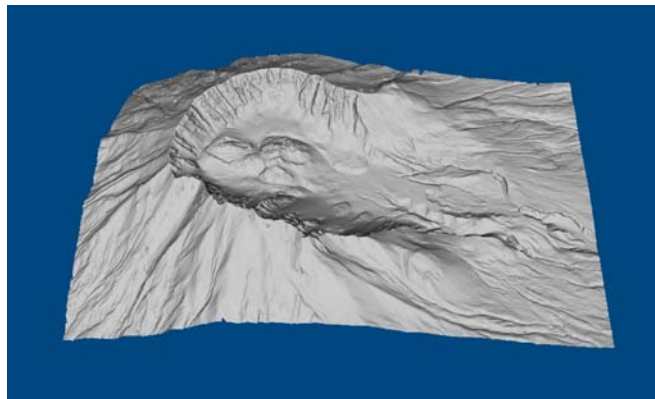
Click the **Extract Connected Region** command (*Modify > Extract Connected Region*), or click the icon  in the Toolbar. Specify the **Feature Angle** at 0. The program removes floating parts.

3. Unify normals

Click the **Unify Normals** command (*Modify > Unify Normals*), or click the icon  in the Toolbar. Select the **Fix Errors – In Depth** checkbox. The program will detect and delete ill-connected triangles while unifying the normals.

4. Fill holes again

Click the **Fill Holes** command (*Modify > Fill Holes*), or click the icon  in the Toolbar. Adjust the value of **Hole Radius** to fill remaining holes.



Final Model

End of Tutorial

Appendix:

The following commands can work with an attached file. An attached file will be marked with an asterisk in the Object Tree Window, e.g., *Object**.

- Denoise Point Cloud
- Decimate Point Cloud
- Remove Redundant Points
- Remove Isolated Points
- Offset Point Cloud
- Clip by Plane
- Sketch and Clip
- Window Split
- Merge Two Objects
- Merge Active Groups
- Manual Registration
- Numerical Transform
- Show Elevation

These commands perform operations on the whole point cloud in an indexed file regardless of the number of points displayed in the window.

Please note that the program will automatically save the processed result and create a new PCP file in the original folder by adding a prefix to the original file name. For example, a prefix "Dec_" will be added to the original file name after decimation, e.g., the decimated point cloud file will be named as *Dec_OriginalFileName.pcp*. Only the processed result of an attached file will be automatically saved as a new indexed PCP file during each step of processing.