Group Classification Tools Enable New Analysis Methods

TerraScan for CONNECT edition, versions 017.001 and above

GeoCue Group Support
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Introduction

Beginning in 2017, additional grouping tools were introduced to enable new methods of conducting above ground classifications, beyond the usual classification routines. These tools rely on group logic - grouping above ground points with probable relationships with the goal of designating a single group of points per physical object. In short, the usual classification routines classify individual points, but the grouping method enables classification on an object level basis. The end game of these new grouping tools is to become the preferred method for the classification of above ground features. The principles of this process and advantages are discusses in the previous group classification article. This article looks at a couple tools to demonstrate where group processing is advantageous over routine point processing, particularly for providing new data analysis options.

By centerline

There are now two separate classification tools called **By centerline**, one under the 'Classify -> Routine' menu and a new one under the 'Group -> Classify' menu. Both tools classify points based on their location relative to linear elements. However, while the routine tool classifies individual points based on location, the group tool classifies the entire group based on all or a subset of its points' location within a given distance from the linear elements. The MicroStation elements can consist of lines, line strings, arcs, shapes, or complex elements consisting these element types.

To determine which groups in a dataset are to be classified, groups with one or more points, a majority of points, or all points in the source class will be considered for reclassification. The linear element to be used as the centerline can be selected manually in MicroStation or assigned by level in the DGN file.

Which groups to be classified can be determined by one of several 'Centerline rules'. The 'One or more points' rule classifies groups if one or more points in the group fall within the offset distance. The 'Average XY' rule classifies groups if the average XY position of the group falls within the offset distance. The 'Majority of points' rule classifies groups for which most of the points fall within the offset distance. Lastly, the 'All points' rule classifies groups which entirely exist within the offset distance. The horizontal offset distance can be applied to the left, right or either side of the centerline of any line or the closest line. The vertical offset distance can also be defined.

In the example in Figure 1, groups with a majority of points in the tree class will be investigated to see how close they are to the centerline. The groups that are determined to be within the offset distance will be reclassified as Tree Obstruct points. The linear element is the centerline of a neighborhood street and is represented by Level 3 in the DGN file. The rule selected is 'One or more points'. The offset distance covers the width of the street, starting at the centerline (0m offset) and offset to 3.5m from the centerline. This will result in groups that contain one or more points that fall within 3.5m of the

centerline to be reclassified. The results of this process can be markedly different from the routine 'By centerline' tool.

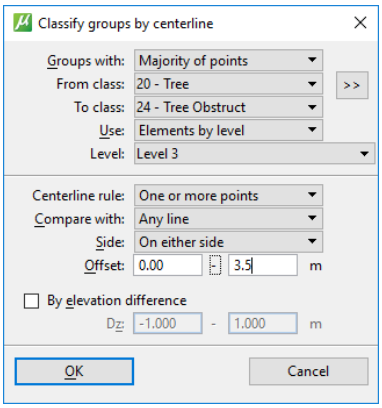

Figure 1: Classify groups by centerline settings dialog

The results of the settings in Figure 1, as well as a comparison with the routine results can be seen in Figure 2. Figure 2A shows the routine results using the same offset distance of 3.5m. Hence, it shows the classification of individual points that fell within that distance. Figure 2B shows the classification of whole tree groups that overlapped into the offset distance. Figure 2C shows the same results as Figure 2B, but represents the points by group and only shows the reclassified groups. This tool allows us to not only know that there might be an obstruction along that road, but also tells us the number and type of obstacles. In this example, eleven trees will be effected by any obstruction mitigation measures taken along this road.

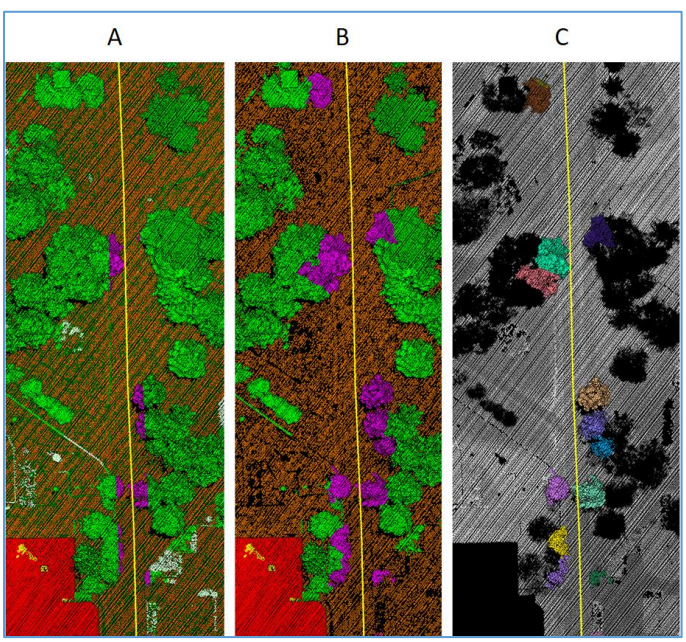

Figure 2: Comparison of routine and group centerline classification. A: Routine Classification. B: Group Classification. C: Display by group showing only groups that were classified.

By distance

Like the centerline tools there are now two 'by distance' classification routines, one for individual points (Classify -> Routine), and the other for groups of points (Group -> Classify). Both tools require that the 'Compute distance' command has been run and their results depend on the measurement used for that computation. For this example, we want to classify points within a specified distance from a feature, such as a powerline, so the compute distance command needs to measure distances from that feature to the points. TerraScan stores this distance information in the FBI format allowing it to be used in other processes. For other data storage formats the Compute Distance and Classify/ Group Classify by Distance would need be executed within the same macro.

With the distance values assigned to points, the **Classify group by distance** tool can reclassify groups based upon their proximity to the object. Similar to the **Classify Group by Centerline** tool, this will determine which groups will be considered for classification using the options: 'One or more points', 'Majority of points', or 'All points'. The distance a group is from the object can be described using one of several distance values: 'Biggest', 'Median', 'Average', or 'Smallest'. This tool can also be applied within a fence or selected polygons and the determination of which groups fall within the boundary can be determined using one of the following rules: 'One or more points', 'Average xy', 'Majority of points', or 'All points'.

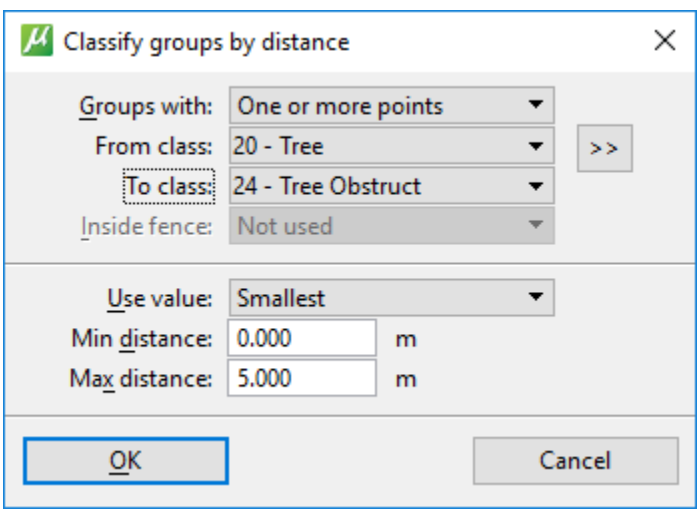

Figure 3: Classify groups by distance settings dialog

In this example (Figure 3), Groups with one or more points in the tree class will be investigated to see how close they are to powerlines. The groups that are determined to have their smallest distance value be within a 5m 3D distance of the object will be reclassified to Tree Obstruct points. The results of this process can be seen in Figure 4. Akin to the 'Classify group by centerline' tool, the individual trees are reclassified instead of individual points.

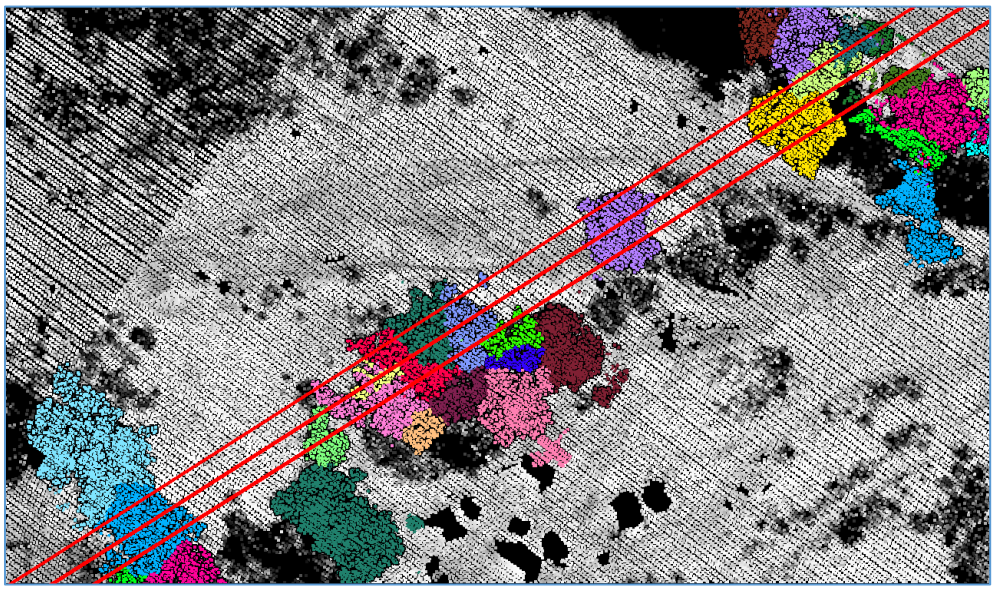

Figure 4: Example of Classify groups by distance results

One point in group

While both the Classify groups by distance and by centerline tools identify groups of points based on proximity to line features, it would be useful to be able to generate XYZ locations for each of them. This information is attainable using the 'Classify one point in group' tool (Figure 5). This selects a single point to represent a group spatially. This point can be selected based on one of the following criterions: highest Z, lowest Z, closest to 3D center, highest intensity, lowest intensity, biggest distance, or smallest distance. The point that meets the criteria is then reclassified into a unique class. This class of points can then be written into the design file or exported as a text file in a user defined point format to supply a list of the locations of the points representing these groups. These locations can even be exported as Lat/Lon or geographic coordinates using the TerraScan projection transformations.

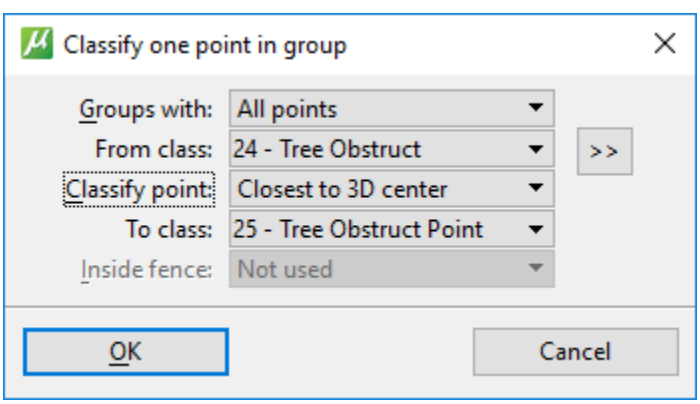

Figure 5: One point in group tool applied to the by centerline group results

The example in Figure 1 classified groups in which one or more points were within the horizontal offset distance of a road centerline. Figure 5 classifies single points in those same groups to give us their XYZ locations. In this case, the point selection criterion is 'Closest to 3D center' which will find the point closest to the geographic center to each group. Exporting this new class in the ENZ format will create a text file which lists the XYZ location of the centers of the trees obstructing the road.

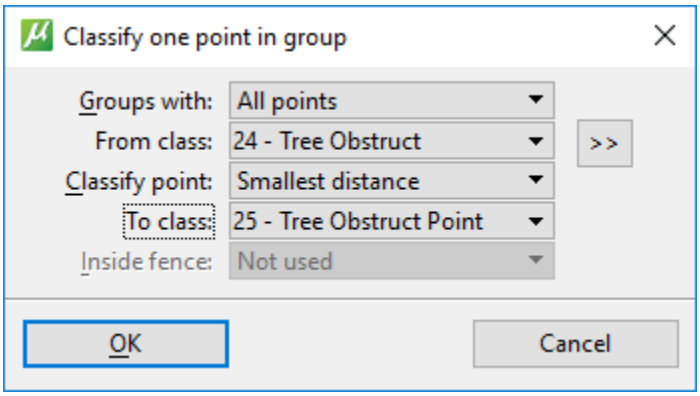

Figure 6: One point in group tool applied to the by distance results

The example in Figure 3 classified groups in which one or more points were within a 3D distance of powerlines. Figure 6 classifies single points in those same groups to give us their XYZ locations. In this case, the point selection criterion is 'Smallest distance' which will find the point with the shortest distance or closest to the wire. Exporting this new class in the ENZ format will create a text file which lists the location of the closest approach each obstructing group comes to the wires.

As you can see these new routines provide some powerful tools for automating analysis routines using LIDAR data. For additional information concerning the new classify group by centerline or classify group by distance routines in TerraScan please contact the GeoCue Group Support Team at support@geocue.com.