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Attribute-based point cloud visualization in support of 3-D classification

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Despite the rich information available in LIDAR point attributes through full waveform recording, radiometric calibration and advanced texture metrics, LIDAR-based classification is mostly done in the raster domain. Point-based analyses such as noise removal or terrain filtering are often carried out without visual investigation of the point cloud attributes used. This is because point cloud visualization software usually handle only a limited number of pre-defined point attributes and only allow colorizing the point cloud with one of these at a time. Meanwhile, point cloud classification is rapidly evolving, and uses not only the individual attributes but combinations of these. In order to understand input data and output results better, more advanced methods for visualization are needed. Here we propose an algorithm of the OPALS software package that handles visualization of the point cloud together with its attributes. The algorithm is based on the .odm (OPALS data manager) file format that efficiently handles a large number of pre-defined point attributes and also allows the user to generate new ones. Attributes of interest can be visualized individually, by applying predefined or user-generated palettes in a simple .xml format. The colours of the palette are assigned to the points by setting the respective Red, Green and Blue attributes of the point to result in the colour pre-defined by the palette for the corresponding attribute value. The algorithm handles scaling and histogram equalization based on the distribution of the point attribute to be considered. Additionally, combinations of attributes can be visualized based on RBG colour mixing. The output dataset can be in any standard format where RGB attributes are supported and visualized with conventional point cloud viewing software.
Viewing the point cloud together with its attributes allows efficient selection of filter settings and classification parameters. For already classified point clouds, a large number of output categories can be visualized, and local accuracy metrics can be investigated within the point cloud.