COLTOP 3D: A software dedicated to analyze relief using large DEM and massive 3D-imaging cloud points

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The increasing precision of ground-based Lidar technologies makes possible to perform more detailed systematic structural and morphological analyses than ever reached before. Using the orientation of each single collected vertex, a point cloud data set can be represented by a 3D image where each single point has a color defined by the local dip and strike direction, which allows a very simple slope analysis. This can also be applied to any surface reconstructed through the data set, making the detection of planar structures within a cliff, i.e. in the presence of overhangs, possible, which is not with classical 2D digital elevation models. Such simple analyses applied to 3D clouds of points make it possible to quickly identify structural features affecting topography, such as the main joints set shaping rock face leading to the identification of the main structural features shaping a relief. They open new perspectives in relief analysis.

Although the principle of the analysis is simple, it is not straightforward to manage and thus analyze clouds points, since modern devices, such as terrestrial laser scanners, allow for capturing dense 3-dimensionnal data set (up to millions of points) on the surface of an object, within a few minutes.

We describe here the principles of a software (Coltop-3D) which is dedicated to perform the data handling and computation of such data sets, notably:

1.) The spatial indexing of massive unstructured point clouds;

2.) The computation of the local dip and strike direction, by means of eigen values

analysis;

3.) The unique data representation according to dip and strike direction, by means of a lower Schmidt stereonet;

4.) Vegetation detection and removal, by means of eigen values analysis;

5.) Other capabilities of the software.

These capabilities are illustrated with case studies, located in the Swiss Alps and in Canada.