Classification of points in order to construct a digital terrain model using point clouds extracted from satellite images .

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Abstract—The main purpose of this paper is to evaluate some methods to extract a Digital Terrain Model (DTM) from a Digital Surface Model (DSM) represented as a point cloud obtained by high resolution satellite stereo images.

Keywords—classification, satellite images, DTM, point clouds.

I. Introduction

THE DTM are very precious in numerous fields, for example they are used in hydrology to predict flood or to improve water circulation in an geographic area. However, DTM are difficult to obtain due to human construction and vegetation that hide the natural topology of an area. We are able to get DSM for a very large area using High Resolution Satellite as Pliades in addition to stereo matching methods. Extracting DTM from a DSM consist in removing all points that are considered as vegetation (trees essentially) or human constructions (house, building, road, electrical tower,...). There is plenty of methods that can classify points in an cloud but most of them are based on LiDAR data which are way more accurate than satellite data. The following parts refer to methods that are WIP

II. Multi-directional Slope Dependent (MSD)

The method described in [**?**] is an improvement of a previous method developed by Meng and al. in 2009 [**?**]

A. DTM filtering Concept

The process that start from a DSM to a DTM can be divided in 3 steps: find which points of the cloud represent the bare-gound, remove all other points, fill the holes by interpolating with the DTM points. Of course, the most critical and difficult part is the first step.

1) Directional filtering: In 2009, Meng and al. defined a first method: the directional filtering method which works on 1D region profile but not on 2D: the DSM is divided in rows that are processed separately. A sliding window process a set of points. The minimal value of the window is considered as the bare-earth. Each point of the window is analyzed like this: - If the points has a difference with the bare-earth (window's minimal value) larger than a (previously fixed) threshold then this point is a non-ground point. - If the difference is not larger than the threshold and the slope between the pixel and the next pixel to be analyzed is larger than another threshold then the point is a non-ground point. If the slope is positive but smaller than the threshold the point take the same label as his previous neighbor. If the slope is negative then the distance to the minimal value is used to determine whether the point is a non-ground point or not.

2) Directional filtering to Multi-directional Slope Dependent: The previous method has some disadvantages: the local slope is not considered and obviously the fact that using only one scanline process for each point can lead to filtering mistakes. WIP

III. Random Forest

Random Forest is a robust and powerful supervised learning classifier, which is capable of processing large datasets **??**. The random forest consists of several decision trees, also called classification trees. These classification trees are grown based on training sets. **??** We can use random forest method to classify areas in satellite images. In their paper, **??** offer an approach to separate buildings, ground, high forest and low forest from satellite images in order to generate a DTM. Even if they have good results, the authors do not give the features they used.

WIP

IV. Conclusion

The conclusion goes here.

References

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