TECHNOLOGY OF OBJECT RECOGNITION SITUATION, BASED ON THE DATA OF AIR LASER SCANNING

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Various sources of information can be used as input data for surface modeling. However, laser scanning of the area is a priority. The key advantage of laser scanning is the maximum detail of the object, which allows to make many decisions remotely based only on the survey data and thus save resources, up to remote work instead of specialists visiting the object [3]. In addition, the terrain can be surveyed in a variety of ways, including ground, mobile and aerial laser scanning, which also affects the nature, scale and volume of the data and, accordingly, the processing tools.

The classification process of a dense point cloud is a prerequisite for most object modeling processes. Classification of clouds, in a General sense, is a division of points into different kinds of classes, for example, vegetation, ground and building classes, etc[1]. Each of these classes implies a unique parameter that would allow to identify each class separately. To implement the method, 55 569 142 points of a dense cloud of the studied territory of the Tomsk region (Rybalovo village) with an area of 21.72 km2 were obtained.

Classification of dense cloud points allows the user to focus on the necessary areas of the scene, as well as to specify the individual classes of points that will be used as a source of data for further manipulations. At the heart of any classification is the selection and determination of suitable for the purposes and objectives of the study classifier (parameter filter), based on the value and assumptions which is divided into classes. As the specified filter can be: color, surface angle, terrain slope, distance from the base point, the presence of sharp differences in elevation, surface types (smooth, rough), the presence of "holes", etc. Thus, according to the orthophotoplan of the object under study, the following objects were identified within the boundaries of the area: water bodies; buildings, structures; agricultural land; trees and shrubs (shards); as well as road network objects. Based on the definitions of each of the classification parameters of the dense point cloud, as well as taking into account the features of the relief of the study area and the tasks set, the dense point cloud was divided into seven classes.

In the software "PhotoScan" it is possible to automatically divide all existing points into two classes – points of the earth and the remaining points. In this case, the user must specify the specific values of the classification parameters: maximum angle (deg); maximum distance (m); cell size (m). The maximum angle determines the angle between the elevation model and the line connecting the point to be verified and the point from the elevation point class. It is recommended to use the default value (15 deg) for plains and near-plains surfaces. If there are steep slopes within the scene, it is recommended to increase the parameter value [1]. Maximum distance of the distance value from the verified point to the elevation model. In fact, this parameter determines the maximum expected value of the height difference within the scene[1].The cell size (m) Determines the size of the cells into which the point cloud is split in the preparatory phase of the point classification procedure. The cell size should be determined depending on the size of the largest area of the reconstructed scene that does not contain any relief points (for example, a building or a dense forest)[2].

The values of the above parameters are not constants they are individually selected taking into account the peculiarities of the terrain, as well as the necessary research tasks. The most acceptable result was achieved by combining the following classification parameters: maximum angle (degrees) – 1.5; maximum distance (m) - 1.9; cell size – 100 m. A color was chosen as the filter for determining the points for all other classes except vegetation, i.e. the interval of changing the brightness value of each point of the dense cloud. Thus, in the PhotoScan module it is possible to set a certain color class for points (figure 1). The classification was made using color parameters: R=48 G=69 B= 105 for water bodies and for the road R=230 G=227 B=226.

In a detailed analysis of aerial photographs, it was found not only the presence of high-barreled trees on the ground, but also the widespread shrub vegetation. Thanks to the built-in module Classify\by height from ground in MicroStation\TerraScan among all points of tree-Bush vegetation zones of distribution of bushes were allocated. The module assigns a separate class to points according to the max height = 1.0 condition, namely by analyzing the Z (m) mark of each point.

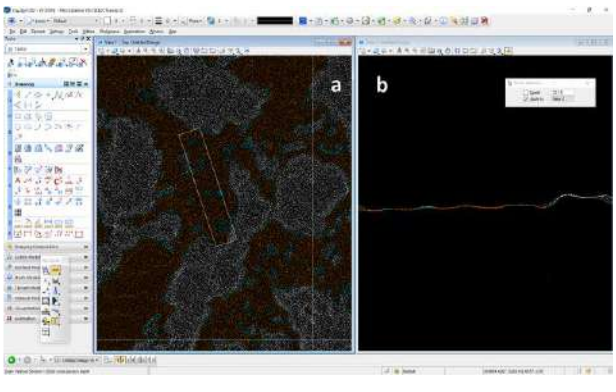

Fig. 1 Fragment of shrub vegetation filtration in plan (a), cross-section (b)

Figure 1 clearly identified the zone of distribution of tall trees (white color) and bushes (blue color). In addition, on the cross section, made along the line shown in the figure on the left, you can clearly see a significant difference in the height of the class of shrubs (height 1-2 meters) and high-forest (white).

It was possible to allocate in a separate class objects of capital construction in the presence of" holes " in the class of the earth in places of their placement. When using air laser scanning technologies, capital construction projects can be identified only by their roofs (figure 2). Since the shooting is from the air, the ground points under the roofs will not. Accordingly, the shape of the roof can be judged on the configuration and location of the capital construction project (Fig. 2).

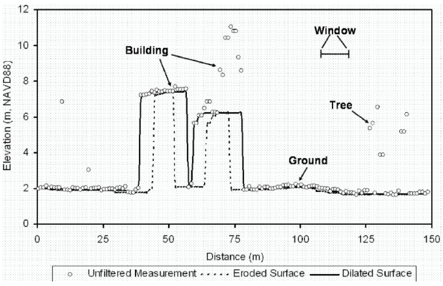

Fig. 2 Scheme of distribution of dense points clouds, obtained using the UAV

Based on this classification, the "Tools - Draw polygon" module in MicroStation\Terracan software has built vector contours exactly along the boundary of individual classes of points (Figure 3).

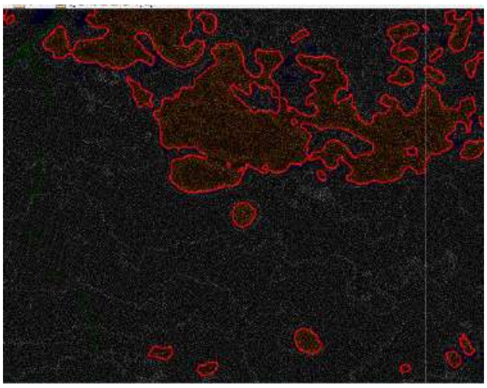

Fig. 3 Vector contours of tree and shrub vegetation of the study area

According to the results of the study, the areas of thematic layers were determined the results are presented in the table.

Table

The values of areas of vector layers obtained during the study

Class name	Number of points	Obtained area, m2
Agricultural land	3 184 688	14084728.68
High-tree forests	2 066 964	6690666.66
Shrubs	233 626	571290,29
Capital construction projects	1 684	5682,08
Water bodies	71 068	315644,17
Road	22 124	77354,54
Low points	314	-
Total	5 580 468	21745366,33

Analyzing the calculation materials of table, as well as the materials of figure 3, it should be noted that the agricultural lands of the study area have small-scale, a large number of inclusions, ranging in size from 1 m2 to several thousand square meters. In addition, there is an active movement of agricultural land with forest. Thus, the area of trees and shrubs, taking into account the fragments, is 7.2 km2, which, in turn, is about 33.4% of the total area of the study. Thus, the obtained materials of the study allow not only to quantify the territory, but also can be used as a source of data in the creation of terrain and various kinds of vector maps, where each layer contains attribute information that can qualitatively and quantitatively characterize it.

References

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