라이다 자료를 이용한 하천지역 인공 제방선 추출
Construction of a artificial levee line in river zones using LiDAR Data

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요 지

Mapping of artificial levee lines, one of major tasks in river zone mapping, is critical to prevention of river flood, protection of environments and eco systems in river zones. Thus, mapping of artificial levee lines is essential for management and development of river zones. Coastal mapping including river zone mapping has been historically carried out using surveying technologies. Photogrammetry, one of the surveying technologies, is recently used technology for national river zone mapping in Korea. Airborne laser scanning has been used in most advanced countries for coastal mapping due to its ability to penetrate shallow water and its high vertical accuracy. Due to these advantages, use of LiDAR data in coastal mapping is efficient for monitoring and predicting significant topographic change in river zones. This paper introduces a method for construction of a 3D artificial levee line using a set of LiDAR points that uses normal vectors. Multiple steps are involved in this method. First, a 2.5-dimensional Delaunay triangle mesh is generated based on three nearest-neighbor points in the LiDAR data. Second, a median filtering is applied to minimize noise. Third, edge selection algorithms are applied to extract break edges from a Delaunay triangle mesh using two normal vectors. In this research, two methods for edge selection algorithms using hypothesis testing are used to extract break edges. Fourth, intersection edges which are extracted using both methods at the same range are selected as the intersection edge group. Fifth, among intersection edge group, some linear feature edges which are not suitable to compose a levee line are removed as much as possible considering vertical distance, slope and connectivity of an edge. Sixth, with all line segments which are suitable to constitute a levee line, one river levee line segment is connected to another river levee line segment with the end points of both river levee line segments located nearest horizontally and vertically to each other. After linkage of all the river levee line segments, the initial river levee line is generated. Since the initial river levee line consists of the LiDAR points, the pattern of the initial river levee line is being zigzag along the river levee. Thus, for the last step, a algorithm for smoothing the initial river levee line is applied to fit the initial river levee line into the reference line, and the final 3D river levee line is constructed. After the algorithm is completed, the proposed algorithm is applied to construct the 3D river levee line in Zng-San levee nearby Ham-Ahn Bo in Nak-Dong river. Statistical results show that the constructed river levee line generated using a proposed method has high accuracy in comparison to the ground truth. This paper shows that use of LiDAR data for construction of the 3D river levee line for river zone mapping is useful and efficient; and, as a result, it can be replaced with ground surveying method for construction of the 3D river levee line.

핵심용어 : levee line, river, LIDAR

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