Analysis of the Possibility of Classification the Types of Utilities Networks on the GPR Images

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Key words: Engineering survey; Photogrammetry; ground penetrating radar; automatic detection; object classification

SUMMARY

The assessment of the condition of the technical infrastructure is a crucial role in civil engineering, the implementation of BIM technology, 3D cadasters, for the existing infrastructure modernization works and other specialized technical activities. In the time of dynamically developing investment processes, the exact location of the utilities network is important in the context of their subsequent modernization and construction works located in its immediate vicinity. Accurate location data are important not only in the context of construction works, but also in the context of occupational health and safety. In the event of backfilling a non-inventoried underground network, the inventory of such an object may only be performed by non-invasive measurements, e.g. a GPR – Ground Penetrating Radar. Currently, the classification of the network from GPR images was based on the existing reference data obtained from the National Geodetic and Cartographic Resource — NGCR. The aim of the study was to analyze the possibility of using various methods of extraction and classification to distinguish types of utilities networks on the images obtained by GPR. The authors proposed a new algorithm of hyperbolic detection based on appropriate data filtering It shortened the time of image interpretation and automates the process of selecting underground objects. The authors' motivation to take up the research topic was the automation of the process of detection and classification of underground objects, and thus the reduction of data processing time. GPR test images (radargrams) were acquired in several series of measurements and in various areas located on the campus of the Military University of Technology in Warsaw. The work presents the preliminary results of the detection and classification of objects using geometric, wavelet and fractal analysis and optimization methods based on the analytic hierarchy process (AHP). A new methodology of the detection and extraction of hyperbolas was presented based on the analysis of geometric, radiometric and textural objects contained in GPR images. The detection results are promising as preliminary studies have shown the detection of hyperbolas at 79-91%. The effectiveness of hyperbola detection was assessed by comparing the number of objects detected in the target image and the original image (after pre-processing).