Development of Visualization Technology for Administrative Big Data Spatial Data Cubes

Yong Gu Jang
Korea Institute of Civil Engineering and Building Technology (KICT), (Daehwa-Dong) 283, Goyangdae-Ro, Ilsanseo-Gu, Goyang-Si, Gyeonggi-Do, 10223, Korea

Ji Song Ryu *
Korea Institute of Civil Engineering and Building Technology (KICT), (Daehwa-Dong) 283, Goyangdae-Ro, Ilsanseo-Gu, Goyang-Si, Gyeonggi-Do, 10223, Korea

Min Song Seo
Korea Institute of Civil Engineering and Building Technology (KICT), (Daehwa-Dong) 283, Goyangdae-Ro, Ilsanseo-Gu, Goyang-Si, Gyeonggi-Do, 10223, Korea

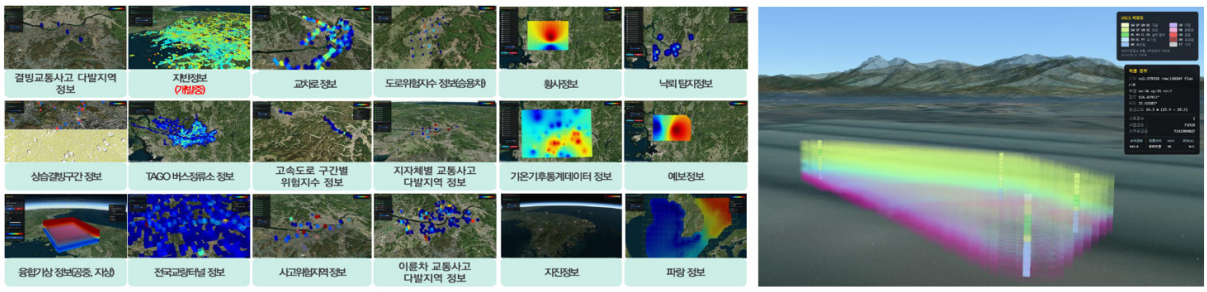
Abstract

IIn Korea, spatial data cube technology based on a three-dimensional grid system is being developed to generate Human–Computer/Machine Interaction (HCMI) maps operable across all spatial domains. This study develops application data cube generation and visualization technologies for convergence applications using basic data cubes collected from administrative big data such as road, transportation, meteorological, and geotechnical data.

Administrative big data collected in real time are converted into standardized spatial data cube data to generate basic data cubes, which are then overlaid and analyzed to generate application data cubes. For this purpose, 619 administrative big data APIs from seven domestic public data platforms were collected. Among them, 467 APIs providing location information were classified, and further screening for Z-values (vertical coordinates) required for a 3D grid system resulted in 188 APIs. Finally, 28 types of administrative big data basic data cubes were selected through review by information-user organizations.

Application data cube generation and visualization technologies were implemented using the 28 selected basic data cubes. Twenty-eight application data cubes were generated by overlaying basic data cube layers, and two additional application data cubes were generated through convergence analysis of above-ground and underground basic data cubes.

The developed technology improved implementation speed by more than 1.5 times compared with conventional 3D spatial information generation and visualization technologies. Adjusting voxel size also confirmed the feasibility of representing detailed spatial information at the centimeter level or finer. In Figure 1, the left image shows an application data cube generated by overlaying basic data cube layers, and the right image shows a geotechnical application data cube generated through convergence analysis of borehole and stratigraphic information.



Layer-overlay application data cube　　Convergence-analysis application data cube

Figure 1. Generation and visualization of administrative big data-based application data cubes

This study is expected to secure foundational technologies for the national development of spatial data cube-based digital twins and accelerate the establishment of digital twin systems.

Keywords

Administrative Big Data, Application Data Cube, Generation, Convergence, Visualization.

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