A Study on Real-Time Integration through Structural Analysis of Administrative Big Data

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Abstract

Digital twin-based national spatial information requires administrative big data produced by public institutions to be linked with geospatial information and kept up to date. However, public datasets differ among institutions and platforms in data structure, provision method, location representation, and update characteristics. This study analyzes the structural, spatial, and temporal characteristics of administrative big data APIs and proposes an approach for continuously linking them with spatial data cubes based on a three-dimensional (3D) grid system.

A total of 618 APIs from seven public data platforms were reviewed with respect to location information and applicability to spatial data cube construction. Among them, 188 APIs from five platforms were classified as candidates for spatial linkage. Practical data requirements were also investigated, resulting in 26 datasets being identified for research applications. These analyses were used to establish a procedure for selecting administrative big data according to data provision structures, location information types, and application requirements.

The selected datasets were analyzed by spatial representation, attribute structure, and update characteristics. Coordinates and other location information were associated with corresponding 3D grid units so that updated attributes from source APIs could be reflected in spatial data cubes. Continuously changing datasets, including fine particulate matter in underground stations, indoor air quality, bus locations, meteorological and precipitation information, and fire dispatch information, were considered as major linkage targets. This provides a basis for continuously reflecting changes in source administrative data within 3D grid-based spatial data cubes.

For continuous linkage, the integration process considers source identification, data structure, spatial keys, update characteristics, and 3D-grid matching. This is important because administrative data include both relatively static spatial objects and dynamically changing observations. Bus locations, meteorological and precipitation information, indoor air quality, and fire-dispatch information can be associated with fixed 3D grid units while their attribute values are refreshed as new API records are received. The grid therefore functions as a common spatial key for integrating heterogeneous datasets from different platforms.

Future work will expand the linkage to additional administrative datasets and evaluate update cycles and integration performance to establish a 3D grid-based administrative big data integration framework capable of representing up-to-date national spatial conditions.

Keywords

Administrative Big Data, Data Structure, API, Real-Time Integration, 3D Grid System.

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