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MICROSATELLITE CONSTELLATION-BASED HIGH-RESOLUTION EARTH OBSERVATION APPLICATION SYSTEM IN KOREA

Abstract

In highly developed and densely populated countries such as South Korea, there is a need for high-resolution earth observation to respond rapidly to emergency events and monitor infrastructure development and environmental changes. As part of Korea's national space program, a satellite constellation composed of 11 microsatellites with high-resolution optical payloads is under development and scheduled to be completed by 2027.

The microsatellite constellation-based application system aims to provide users with easy access to satellite data and analysis results. The system will offer analysis-ready satellite data products, including geographically rectified and atmospherically corrected surface reflectance, which will be calculated in real-time using atmospheric parameters (aerosol optical thickness, water vapor) derived from Korea's geostationary meteorological satellite, GEO-KOMPSAT-2A. Additional products will include surface reflectance-based spectral indices such as NDVI and NDWI, which will be composited spatially and temporally to cover wide areas for time-series analysis.

Users can download these data products for their own analysis, but the application system also provides web-based analysis processing. This includes AI-based object detection and image segmentation for geospatial intelligence analysis, and an automated algorithm for damage analysis to support emergency response.

Ongoing research focuses on the implementation of well-coordinated processes from satellite data preprocessing to thematic analysis adopting automated algorithms. However, the narrow swath width of the high-resolution optical microsatellites (less than 10km) poses challenges in covering wide areas at a short-term revisit period and compositing multiple satellite images considering the complicated topography of South Korea, which is largely mountainous terrain and high-rise built-up urban areas.

In conclusion, this paper highlights the potential of microsatellite constellation-based earth observation systems for providing high-resolution data and analysis services that can support a range of applications, from infrastructure monitoring to emergency response. Possible approaches to address the challenges of wide area coverage and compositing multiple satellite images are also discussed.