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Integrated spatial-temporal data mining for discovering illegal land-use patterns in Taiwan

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Taiwan is a relatively small and densely populated island that has an area of 36,197 km2 with 650 people per km2. Overall, around 400 illegal land-use incidents happen per year. Take year 2015 for example, 654 illegal cases led to damages about 7,328,769 m2 of land area. Subsequently, it has been increasingly important to extract information from human activities containing environmental factors to assist land policy makers. Remote sensing, which provides spatiotemporal data source for monitoring purposes on local, regional, and global scales, is the most feasible way to conduct land use assessments and detect land cover changes. Data mining is a commonly used tool to explore implicit information from a massive amount of spatial and temporal data, which can capture the correlation between spatial-temporal data and behavioral elements in the complex human-environment interactions. The main objective of this study is to discover knowledge and reveal significant patterns in illegal land exploitation from multidimensional data sets. This study utilizes C5.0 package for decision trees in R that integrated data mining and GIS (Geographic Information Systems) tools to uncover patterns from relevant data using temporal satellite images, field investigations, spatial circumstances and socioeconomic indexes from 2003 to 2018. Through this case study in Taiwan, illegal land-use patterns enables enable the understanding of practical relationship between land plan, socio-economic and environmental interactions. Based on empirical land-use patterns are then further tested and modeling to land policy simulation so that an effective land management policy and land resource management could be adopted in Taiwan.