Smart Urban Mapping: Deep Learning-Driven Building Extraction for Future Growth Monitoring

This project demonstrates the application of ArcGIS Pro's Deep Learning tools to automate the extraction of building footprints from high-resolution aerial imagery of Depok City, Indonesia. Using the "Detect Objects Using Deep Learning" function, buildings were identified and digitized into vector features efficiently, significantly reducing manual mapping efforts.

The extracted building data were overlaid with the official spatial zoning plan (RTRW – Regional Spatial Plan) to evaluate spatial conformity. This spatial analysis identified areas where building uses aligned with zoning regulations and areas where discrepancies existed, such as residential structures within commercial zones. Such assessments are essential to support KKPR (Spatial Suitability of Land Use Activities) evaluations for better regulatory compliance and urban planning.

In addition to the building extraction workflow, the project also highlights GeoDAL — a customized ArcGIS Pro plugin developed to standardize KKPR spatial datasets within the Ministry of Agrarian Affairs and Spatial Planning/National Land Agency (ATR/BPN). An initiative was proposed to integrate Deep Learning-based extraction into the GeoDAL workflow, aiming to automate and accelerate KKPR data preparation with higher accuracy and consistency.

Furthermore, by leveraging ArcGIS Online for publishing and sharing the extracted building data, the project ensures wider accessibility for stakeholders and decision-makers. Real-time visualization of urban growth patterns enables faster, more informed planning interventions, aligning with the goals of smart city development initiatives and sustainable land use management.

By combining Deep Learning automation with institutional spatial data governance, this project illustrates how ArcGIS technology can drive smarter urban monitoring, enhance spatial suitability evaluations, and support sustainable land management. It emphasizes the potential of GeoAI to optimize public sector geospatial workflows, ensuring scalable and data-driven urban development solutions.