

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

This project demonstrates the use of ArcGIS Pro's Deep Learning tools to automate the extraction of building footprints from high-resolution aerial imagery in Depok City, Indonesia. By utilizing the "Detect Objects Using Deep Learning" tool, buildings were efficiently detected and vectorized, reducing manual digitizing efforts and creating accurate baseline data for urban analysis.

The extracted building data were spatially overlaid with the official zoning map (RTRW – Regional Spatial Plan) to assess conformity with designated land use zones. This analysis helped identify both compliant and non-compliant areas — such as residential buildings located in commercial zones — thereby supporting KKPR (Kesesuaian Kegiatan Pemanfaatan Ruang / Spatial Suitability Permit) assessments for regulatory enforcement.

To complement zoning evaluation, a building density heatmap was generated based on the spatial distribution of extracted footprints. This heatmap, built on a 100×100 meter grid, highlights zones of high development intensity and potential overutilization. By quantifying built-up concentration, the map serves as an additional indicator of urban pressure, useful for detecting early signs of spatial violations and guiding future growth control.

The project also introduces GeoDAL — a custom ArcGIS Pro plugin developed by Indonesia's Ministry of ATR/BPN to standardize KKPR geospatial data. A proposal was made to integrate Deep Learning-based extraction into GeoDAL's workflow, offering scalable and consistent automation for KKPR data generation.

By publishing the outputs to ArcGIS Online, this solution enables broader access and real-time visualization for stakeholders. Altogether, the project exemplifies how ArcGIS technology and GeoAI can support data-driven, efficient, and sustainable urban planning and governance.