

INTISARI

INTEGRASI CITRA MULTISPEKTRAL DAN MORFOMETRI URBAN UNTUK KLASIFIKASI *BUILDING FOOTPRINTS* DI SEBAGIAN KOTA YOGYAKARTA DAN KABUPATEN SLEMAN MENGGUNAKAN MODEL GEOAI

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Pertumbuhan penduduk Indonesia mendorong kepada kebutuhan hunian di kawasan urban, peri-urban, dan rural yang punya karakteristik berbeda. Geospatial Artificial Intelligence (GeoAI) menawarkan kemampuan untuk pengelolaan kawasan permukiman berbasis data geospasial berukuran besar dan kompleks seperti *building footprints*. Penelitian ini bertujuan mengevaluasi performa tiga algoritma GeoAI yakni Random Forest (RF), Gradient Boosting (GB), dan Extreme Gradient Boosting (XGBoost) dalam klasifikasi *building footprints* dengan kelas permukiman dan non-permukiman. Data yang digunakan adalah *building footprints* dari Global Google-Microsoft Open Buildings Dataset yang diekstraksi sebanyak 43 fitur morfometriknya. Selain itu, informasi penggunaan lahan yang berasal dari klasifikasi multispektral menggunakan citra PlanetScope akan memberi konteks atau label pada data *building footprints*. Wilayah kajian mencakup beberapa kecamatan di sebagian Kabupaten Sleman dan Kota Yogyakarta yaitu, Depok, Gamping, Gondokusuman, Jetis, Mlati, Ngaglik, Ngemplak, Sleman, dan Tegalrejo. Hasil menunjukkan bahwa XGBoost memiliki performa paling representatif dengan *Overall Accuracy* 79.47%, serta kemampuan lebih baik dalam mengenali kelas *building footprints* permukiman maupun non-permukiman. Model GB hanya menghasilkan satu kelas dalam prediksi, sehingga dikatakan gagal dalam mengidentifikasi pola morfometrik. Sedangkan RF cenderung memprediksi banyak *no class* akibat terlalu sensitif terhadap *impurity* dalam data yang tidak seimbang. Keunggulan utama XGBoost adalah *sparsity aware* yang mampu menangani *missing value* dari data yang menjadikannya lebih adaptif terutama pada *uncertainty* kualitas data spasial seperti *building footprints* dengan volume besar.

Kata kunci: Permukiman, Geospatial Artificial Intelligence (GeoAI), PlanetScope, Random Forest, Gradient Boosting, Extreme Gradient Boosting.

ABSTRACT

INTEGRATION OF MULTISPECTRAL IMAGERY AND URBAN MORPHOMETRICS FOR BUILDING FOOTPRINTS CLASSIFICATION IN PARTS OF YOGYAKARTA CITY AND SLEMAN REGENCY USING GEOAI MODELS

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Indonesia's population growth drives increasing demand for housing across urban, peri-urban, and rural areas, each with distinct spatial characteristics. Geospatial Artificial Intelligence (GeoAI) offers capabilities for managing residential areas through pattern extractions from large and complex geospatial datasets such as building footprints. This study aims to evaluate the performance of three GeoAI algorithms Random Forest (RF), Gradient Boosting (GB), and Extreme Gradient Boosting (XGBoost) in classifying residential and non-residential buildings. The dataset used comprises building footprints from the Global Google-Microsoft Open Buildings Dataset, from which 43 morphometric features were extracted. In addition, land use information derived from multispectral classification using PlanetScope imagery was used to provide contextual labels for the building footprints. The study area covers several subdistricts in parts of Sleman Regency and Yogyakarta City, namely Depok, Gamping, Gondokusuman, Jetis, Mlati, Ngaglik, Ngemplak, Sleman, and Tegalrejo. The results show that XGBoost achieved the most representative performance, with an overall accuracy of 79.47% and better capability in identifying both residential and non-residential building classes. In contrast, the GB model produced only a single class in its predictions, indicating its failure to capture morphometric patterns. Meanwhile, the RF model tended to overpredict the no class due to its high sensitivity to impurity in imbalanced data. A key advantage of XGBoost lies in its sparsity-aware capability, which allows it to handle missing values effectively, making it more adaptive, especially when dealing with spatial data uncertainty in large-volume building footprint datasets.

Keywords: Residential, Geospatial Artificial Intelligence (GeoAI), PlanetScope, Random Forest, Gradient Boosting, Extreme Gradient Boosting.