

Site Suitability for Essential Services and Digital Connectivity in India using Machine Learning

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ABSTRACT

In India's impoverished regions, limited access to essential services and digital connectivity hinders socioeconomic development and escalates inequality. This study addresses these challenges by focusing on the placement of Aadhaar centers and Network towers to enhance service accessibility and connectivity. Aadhaar centers are crucial for providing residents with unique identification. Concurrently, improving network coverage is vital for economic activities, and communication. Site suitability for Aadhaar Centres leverages the use of nighttime lights, population, built-up areas and distance from roads to identify optimal locations. The dataset consisting of these factors for existing and non-aadhaar center locations are given to machine learning models like Support Vector Classifier, Logistic Regression and XGBoost to estimate the suitability. Support Vector Classifier was the best model with a testing accuracy of 0.890. Using these predicted suitability rates, suitability maps are visualized with zone wise most suitable points. The network towers placement suitability module uses various factors like slope, population, elevation, Land Use Land Cover, distance to roads, and distance to recreational centers are processed for existing and non-tower locations to train and test various machine learning models. Support Vector Classifier, Random Forest Classifier and XGBoost models are used out of which XGBoost was identified as the best model with a testing accuracy of 0.940. The subsequent task involves identifying dead zones where signal coverage is nil. The existing network towers and few locations with most suitability to place new network towers are analyzed and the remaining area which is not covered by both are tagged as dead zones. The Aadhaar center placement is done for all zones in Nawada, Bihar and Network Tower Placement Suitability along with dead zones is done for Coimbatore, Tamil Nadu. This study helps policymakers and service providers to enhance infrastructure and service delivery in impoverished regions of India.

Keywords: Aadhaar Center Site Suitability, Digital Connectivity, Machine Learning, Network Tower Site Suitability, Socioeconomic Development