

Hospital site suitability assessment using three machine learning approaches: evidence from the Gaza strip in Palestine

ABSTRACT

Palestinian healthcare institutions face difficulties in providing effective service delivery, particularly in times of crisis. Problems arising from inadequate healthcare service delivery are traceable to issues such as spatial coverage, emergency response time, infrastructure, and manpower. In the Gaza Strip, specifically, there is inadequate spatial distribution and accessibility to healthcare facilities due to decades of conflicts. This study focuses on identifying hospital site suitability areas within the Gaza Strip in Palestine. The study aims to find an optimal solution for a suitable hospital location through suitability mapping using relevant environmental, topographic, and geodemographic parameters and their variable criteria. To find the most significant parameters that reduce the error rate and increase the efficiency for the suitability analysis, this study utilized machine learning methods. Identification of the most significant parameters (conditioning factors) that influence a suitable hospital location was achieved by employing correlation-based feature selection (CFS) with the search algorithm (greedy stepwise). Thus, the suitability map of potential hospital sites was modeled using a support vector machine (SVM), multilayer perceptron (MLP), and linear regression (LR) models. The results of the predicted sites were validated using CFS cross-validation and the receiver operating characteristic (ROC) curve metrics. The CFS analysis shows very high correlations with R² values of 0.94, 0.93, and 0.75 for the SVM, MLP, and LR models, respectively. Moreover, based on areas under the ROC curve, the MLP model produced a prediction accuracy of 84.90%, SVM of 75.60%, and LR of 64.40%. The findings demonstrate that the machine learning techniques used in this study are reliable, and therefore are a promising approach for assessing a suitable location for hospital sites for effective health delivery planning and implementation.

Keyword: GIS; Site suitability; Machine learning; Healthcare; Palestine