Efficiency and Reliability of Probabilistic Based Frequency Ratio Model (FR) in Urban Growth Modelling

Abubakr A. A. Alsharif, Biswajeet Pradhan*
Department of Civil Engineering, Faculty of Engineering
University Putra Malaysia, 43400, UPM, Serdang
Email. biswajeet24@gmail.com or biswajeet@lycos.com (Corresponding author)

Abstract

Urban expansion is a dynamic and continuous spatial phenomenon which associates population growth and economic development. Analysing and understanding urbanization process require models that capable to simulate, monitor and predict both urban growth and urban sprawl. In this paper, a probabilistic based frequency ratio model (FR) that has not applied before in urban growth modelling of cities was employed to simulate and predict the urban expansion of Tripoli metropolis city, Libya. Three temporal remote sensing data (RS) of years (1996, 2002 and 2010) and geographic information system (GIS) were used to extract various urban deriving factors for the study area. The considered urban factors are: slope, distance to active economic centre, distance to central business district (CBD), distance to roads, distance to built up areas, distance to educational area, restricted areas and urbanized area extent. Subsequently, for model calibration FR model was applied to simulate urban growth for time period 1996 to 2002. For model validation, temporal data between 2002 to 2010 were used and subsequently future urban growth suitability map was produced. The relative operating characteristic method (ROC) was used to validate the FR model. The validation results indicated 85% prediction accuracy. Finally, the results demonstrated that FR model can be used in urban growth modelling of cities. On the other hand, FR model has temporal and dynamic limitations that should be considered in urbanization analysis. This research recommended that to improve FR model performance further, it is necessary to correlate urban expansion rates within the classes and their frequency ratios in particular urban deriving factor with time change.

Keywords: Urban growth; Frequency ratio; GIS; Remote sensing; Tripoli