

# **Ensemble of Data–Driven EBF Model with Knowledge Based AHP Model for Slope Failure Assessment in GIS Using Cluster Pattern Inventory**

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**Key words:** Geoinformation/GI; Remote sensing; Risk management; Landslide; GIS; Spatial Pattern Analysis; Nearest Neighbor Index; Ensemble method; Malaysia.

## **SUMMARY**

In this study, an ensemble model was developed using a data-driven evidential belief function (EBF) and knowledge-based Analytic Hierarchy Process (AHP) model. The ensemble model was developed to overcome the subjectivity of the expert opinion in AHP model, as a semi-quantitative model and also to find the inter-relationship importance between landslide causative factors. Firstly, two different inventory patterns were used to compare its prediction accuracy, i.e. 1st random pattern, 2nd cluster pattern. For inventory mapping, a total of 220 landslide locations were collected using historical landslide location data, and classified into training and testing data. The training data were tested for randomness in previous study using nearest neighbour index (NNI) technique. The test results show a large percentage of cluster patterns in training data (88%). The cluster locations were used to train 14 landslide conditioning factors derived from various sources: topographic derived parameters, lithology, normalized difference vegetation index (NDVI) and landuse/landcover map. For model validation, an area under the curve (AUC) of ensemble prediction map, showed 83.5% with cluster locations, and 82% with random pattern locations. The proposed methodology enhanced the previous research's results to predict rainfall-induced susceptibility map in Kuala Lumpur city and surrounding areas using geographic information system (GIS). Based on the findings, one can infer that the clustered data can be effectively used as training data with ensemble model instead of random selection technique. As a conclusion, the final result can provide a valuable scientific basis for spatial decision making in planning and urban management studies.