

Comparison of natural breaks method and frequency ratio dividing attribute intervals for landslide susceptibility mapping

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Abstract: Producing reliable landslide susceptibility maps is crucial for effective landslide prevention. However, previous studies have placed less emphasis on the technique for dividing attribute intervals of evaluation factors when assessing landslide susceptibility. This study aims to compare the influences of the natural breaks method and the frequency ratio method (FR) as techniques for dividing attribute intervals of continuous evaluation factors. Additionally, different susceptibility assessment models, including frequency ratio (FR), frequency ratio coupled with analytic hierarchy process (FR-AHP), frequency ratio coupled with BP neural network (FR-BP), and frequency ratio coupled with mean impact value and BP neural network (FR-MIV-BP) were utilized to explore landslide susceptibility in Huichang County and its surrounding areas. Based on field investigations and correlation analysis, ten evaluation factors were selected, comprising land use, lithology, plan curvature, profile curvature, slope, aspect, elevation, distance to fault, distance to road, and normalized vegetation index (NDVI). Finally, the uncertainties were tested using receiver operating characteristic curves (ROC) and the distribution law of susceptibility index. The results indicated that the FR method yielded higher accuracy than the natural breaks method in dividing attribute intervals. The MIV algorithm optimized BP neural network demonstrated a 0.7% to 0.8% improvement compared to the traditional BP neural network. The FR-MIV-BP models exhibited smaller mean values and larger standard deviations for the landslide susceptibility index, suggesting better alignment with the actual landslide distribution features. This study has important implications for selecting evaluation factor division methods and appropriate models, providing valuable landslide susceptibility mapping for disaster prevention in Huichang County and its surrounding areas.

Keywords: Frequency ratio; Natural breaks; BP neural network; MIV algorithm; AHP; Distribution law of susceptibility index