

ABSTRACT

The phenomenon of crime in Central Java exhibits spatial variation influenced by social, economic, educational, and demographic factors. This study aims to model the number of crime cases in Central Java in 2024 using Geographically Weighted Regression (GWR) and Geographically Weighted Artificial Neural Network (GWANN), and to compare their performance. The independent variables include the Human Development Index (IPM), the percentage of poor population (PPM), the poverty depth index (P1), the expected years of schooling (HLS), and population density (KP), based on official data from Badan Pusat Statistik. The GWR model results indicate the presence of spatial heterogeneity, where each variable has varying effects across districts/cities. GWR produced an R^2 value of 0.3700 with an RMSE of 140.6663. Meanwhile, GWANN was able to capture non-linear relationships while simultaneously accounting for spatial variations between regions. GWANN achieved much better performance with an R^2 value of 0.9970 and an RMSE of 9.5579. Based on the performance comparison, GWANN outperformed GWR in modeling crime cases in Central Java. These findings confirm that, in addition to spatial heterogeneity, the relationship between socio-economic factors and crime rates is also non-linear. Therefore, GWANN is considered more suitable for crime analysis, particularly when dealing with highly complex data. This study further implies the importance of modern spatial methodologies that are more adaptive to various applied fields.

Keywords: Criminality, Geographically Weighted Regression, Geographically Weighted Artificial Neural Network, Spatial Heterogeneity, Non-Linearity