Implementation of K-Means Clustering in Mapping Areas Prone to Motor Vehicle Theft and Violent Theft Based on Geographic Information Systems (Case Study in Probolinggo Regency)

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ABSTRACT

The increasing crime rate in Probolinggo Regency, particularly robbery with violence (curas) and motor vehicle theft (curanmor), necessitates spatial data-based prevention strategies. This study aims to implement the K-Means Clustering algorithm using a one-dimensional Manhattan distance formula to map high-risk areas of curas and curanmor, determine the optimal value of k using the elbow method, and visualize the clustering results through a web-based GIS. The results show that the K-Means algorithm was successfully applied automatically through a web-based system, enabling seamless data integration with regional maps. Based on the analysis of the Sum of Squared Errors (SSE), the optimal number of clusters for both types of data is k = 3, as indicated by a significant SSE decrease between k = 2 and k = 3. The interactive map visualization effectively displays safe, moderate, and high-risk clusters for each sub-district. The clustering results reveal that the curas cases are distributed into 1 high-risk, 4 moderate, and 19 safe sub-districts, while the curanmor cases are grouped into 1 high-risk, 6 moderate, and 17 safe sub-districts. These differences indicate that each type of crime has distinct vulnerability patterns, making specific mapping and handling approaches necessary. This system is expected to serve as a decision support tool for authorities in more effective crime prevention efforts.

Keywords*: K-Means, Manhattan Distance, Elbow Method, Aggravated Robbery (Curas), Vehicle Theft (Curanmor).*