Real-Time Tracking Data and Machine Learning Approach for Assessing Pedestrian Walking Patterns – Impact of Spatial Dynamics at the University of Moratuwa

Harini Sawandi[1] and Amila Jayasinghe[2]

Abstract

Understanding the key elements that affect pedestrian walking patterns is vital for enhancing transportation systems in urban environments. This experimental study tackles important gaps in current literature, especially the insufficient examination of walking behavior concerning land use characteristics and spatiotemporal factors. By focusing on walking patterns in connection to these aspects, this study intends to provide insights that can help improve urban transportation planning and policy. This study employs real-time tracking data and machine learning to evaluate the intricate dynamics of walking behavior using GPS-enabled location-based services and mobile accelerometer data. The investigation utilizes k-means clustering to identify walking patterns and the eXtreme Gradient Boosting (XGBoost) machine learning algorithm to evaluate the influence of spatial factors on pedestrian movement. The primary objective is to assess the influence of land use attributes on walking patterns,

offering quantifiable information regarding how spatial design could promote or impede walking behavior. The study is predicated on a case analysis performed at the University of Moratuwa, providing a concentrated examination within a campus setting that embodies educational and mixed-use attributes. Identified key components encompass tree views, mean depth, and choice—elements demonstrated to influence land use planning in a manner that improves walkability. Tree views enhance visual appeal and offer shade, promoting walking by fostering a more pleasant pedestrian experience. Mean depth, denoting the spatial connection and accessibility of various areas, defines the navigability and simplicity of a space for pedestrians. Furthermore, the presence of "choice," or the availability of alternative routes, enhances navigational flexibility, motivating individuals to traverse the area on foot. These findings underscore the necessity of integrating these spatial dynamics into urban transportation strategy. By comprehending the influence of land use features on pedestrian behavior, transportation planners and urban designers can formulate specific methods to enhance walkability. These solutions may include incorporating shaded walkways, optimizing spatial layouts to minimize walking effort, and providing several route options to cater to pedestrian preferences. Moreover, these elements facilitate the alleviation of automotive congestion, encourage active transportation, and enhance sustainable urban mobility objectives. This study employs machine

learning and real-time data collecting to analyze pedestrian movement patterns, offering insights that surpass conventional survey-based methodologies. The findings highlight the necessity for evidence-based, data-driven urban design and planning methodologies to develop pedestrian-friendly environments that enhance health, accessibility, and sustainable mobility. Policymakers and urban planners are urged to utilize these findings to develop strategies that emphasize pedestrian requirements in transportation systems, guaranteeing that metropolitan areas are both walkable and supportive of efficient and resilient urban transport networks.

Keywords: *Pedestrian behavior, Land use characteristics, Walkability, Machine learning, Urban transportation planning*

1. Department of Town & Country Planning, University of Moratuwa. sawandiwsh.19@uom.lk

2. Department of Town & Country Planning, University of Moratuwa.