

1. Traffic congestion evaluation of urban streets based on fuzzy inference system and GIS application (2024)

- **Abstract:** This paper satisfies the requirements for reliable and inexpensive congestion detection in urban road networks. The objective of this research is to use fuzzy logic to detect traffic condition states based on sets of rules that compare the field traffic states. An alternative approach is introduced that enables knowledge-based effective methods of detecting traffic congestion. The main strategies include detecting congestion based on index measures of traffic speed, speed reduction, and speed ratio, combined with spatial analysis of traffic data using ArcGIS to produce digitized street maps of congestion. Utilizing a Fuzzy Inference System (FIS) provides an analytical solution for ambiguous and uncertain problems. Categories of traffic input parameters distinguish congestion levels by determining congestion index va

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duction index highlights hot spots within the study network (e.g. Bab Al-Moathum zone and areas near Mustansiriyah University and Al-Kindi hospital) that induce heavy congestion with index ranges of 0.651–0.717. A precise threshold is defined to categorize congestion levels (Free-flow, Normal, Moderate, Heavy, Blocked) using the FIS. A two-parameter input contributes to one output that combines different congestion field measures. Over 15 links in the case study (e.g. Bab Al-Moathum zone, Palestine Street near Mustansiriyah University, Al-Kindi hospital) showed worst traffic conditions (blocked) in some segments, while others range from heavily congested to normal. This FIS-based approach provides a more realistic and detailed view of traffic congestion for selected street networks compared to traditional single-parameter methods 【24†L81-L90】 【24†L91-L99】 .

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ring algorithm was applied to classify the spatiotemporal distribution of congested roads. Then, a Geographical Detector (Geo-detector) was used to identify potential factors for each spatiotemporal congestion pattern. The results revealed six congestion patterns for intra-regional and inter-regional roads on weekdays. On both intra- and inter-regional roads, congestion density reflected by building height was the strongest indicator during the morning peak period. Public facilities such as hospitals, tourist sites, and green spaces located near employment or residential areas contributed to congestion during peak and off-peak hours. On intra-regional roads, a sparse road network and greater distance from the city center contributed to congestion during peak hours. On inter-regional roads, the number of bus stops contributed most to early evening peak congestion, while the design of entrances to large buildings in mixed business and public service areas increased congestion levels. These findings suggest that land use should be more mixed in high-density areas to reduce trips to the city center. However, such mixed land-use planning should be combined with detailed microenvironment design to improve accessibility for different travel modes, thereby increasing traffic efficiency and reducing congestion 【26†L43-L52】 【26†L53-L63】 . The innovative multi-source data approach demonstrated in this study can potentially be applied to traffic congestion and land use planning elsewhere 【26†L64-L65】 .

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Furthermore, a spatial distribution in the form of heat maps is proposed to describe traffic behavior in specific areas of Mexico City via a Web-GIS application. This work demonstrates that social media are a valuable alternative for collaboratively gathering Volunteered Geographic Information, effectively “sensing” city dynamics through citizens acting as sensors 【123†L530-L538】 【123†L539-L541】 .

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12. A Prediction Model of Traffic Congestion Using Weather Data (2015)

- **Abstract:** Weather factors such as temperature and rainfall in residential areas and tourist destinations affect traffic flow on the surrounding roads. In this study, we attempt to find new insights into the relationship between traffic congestion and weather by leveraging big data processing technology 【110†L2-L4】 【112†L1-L4】 . (Additional details: The authors propose a traffic congestion prediction model for specific roads and regions, and experimental results demonstrate its effectiveness in predicting congestion using day, time, and weather inputs.)
- **APA Citation:** Lee, J., Hong, B., Lee, K., & Jang, Y.-J. (2015). *A prediction model of traffic congestion using weather data*. In **2015 IEEE International Conference on Data Science and Data Intensive Systems (DSDIS)** (pp. 81–88). IEEE.

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- **Abstract:** In this paper, we present a detailed investigation on the impact of weather data on different traffic flow prediction models. Multiple forecasting models were evaluated with and without incorporating weather features. The study found that including weather data can improve the performance of traffic flow prediction models, highlighting the importance of weather factors in traffic forecasting 【118†L1-L4】 .
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11. Traffic Flow Prediction under Multiple Adverse Weather Conditions Based on Self-Attention Mechanism and Deep Learning Models (2023)

- **Abstract:** To improve the accuracy of traffic flow prediction under adverse weather, a deep hybrid attention (DHA) model is proposed, consisting of a traffic block and a weather block. The traffic block uses a Convolutional Neural Network (CNN) and Gated Recurrent Unit (GRU) to capture spatiotemporal patterns in traffic flow data, while the weather block uses a Convolutional LSTM to extract relationships between weather and traffic flow. A self-attention mechanism is embedded in both blocks. Four cases of adverse weather (rainy, foggy, and windy scenarios) were used to validate the DHA model. Experiments show that the DHA model exhibits excellent performance under multiple adverse weather conditions; different adverse weather types have varying impacts on traffic volume and speed patterns; and the prediction accuracy of all models decreases as weather severity increases [106†L15-L24] [106†L25-L28] .
- **APA Citation:** Zhang, W., Yao, R., Du, X., Liu, Y., Wang, R., & Wang, L. (2023). *Traffic flow prediction under multiple adverse weather conditions based on self-attention mechanism and deep learning models*. Physica A: Statistical Mechanics and its Applications, 625, 128988. <https://doi.org/10.1016/j.physa.2023.128988>

12. A Prediction Model of Traffic Congestion Using Weather Data (2015)

- **Abstract:** Weather factors such as temperature and rainfall in residential areas and tourist destinations affect traffic flow on the surrounding roads. In this study, we attempt to find new insights into the relationship between traffic congestion and weather by leveraging big data processing technology [110†L2-L4] [112†L1-L4] .
(Additional details: The authors propose a traffic congestion prediction model for

specific roads and regions, and experimental results demonstrate its effectiveness in predicting congestion using day, time, and weather inputs.)

- **APA Citation:** Lee, J., Hong, B., Lee, K., & Jang, Y.-J. (2015). *A prediction model of traffic congestion using weather data*. In **2015 IEEE International Conference on Data Science and Data Intensive Systems (DSDIS)** (pp. 81–88). IEEE.

13. The Impact of Weather Data on Traffic Flow Prediction Models (2022)

- **Abstract:** In this paper, we present a detailed investigation on the impact of weather data on different traffic flow prediction models. Multiple forecasting models were evaluated with and without incorporating weather features. The study found that including weather data can improve the performance of traffic flow prediction models, highlighting the importance of weather factors in traffic forecasting 【 118†L1-L4】 .
- **APA Citation:** Al-Selwi, H. F., Abd Aziz, A. B., Abas, F. S., Hamzah, N. A. A., & Mahmud, A. B. (2022). *The impact of weather data on traffic flow prediction models*. IAES International Journal of Artificial Intelligence, 11(4), 1223–1231. <https://doi.org/10.11591/ijai.v11i4.336>