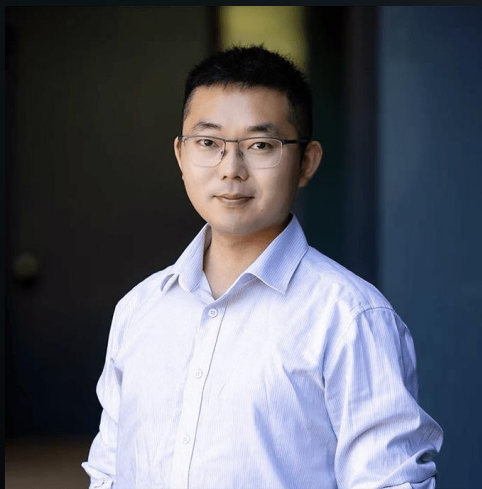


Geospatial Data Analysis, Prediction, and GeoAI: New Theories, Methods, and Software

Topic 7. Spatial decision-making and applications

Lecture website: <https://yongzesong.com/lecture-20260104>



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Associate Editor: *GIScience & Remote Sensing* (IF 6.9, Q1)

Topic Editor: *Geoscientific Model Development* (IF 4.9, Q1)

Lecture outline

Lecture website: <https://yongzesong.com/lecture-20260104>

Password: 20260104

Contents

Part 1. Lecture (1st class)

1. Concepts of spatial decision-making
2. Model-based decision making
3. Spatial urban index development

Part 2. Practice (2nd to 4th classes)

1. Practice (40 min)
2. Assignment (40 min)
3. Submit your assignment (10 min)

Tips:

1. Working in a group of 3 or 4
2. Collecting feedback at each day
3. Individual assignments and working in a group
4. Complete assignments in the class
5. Assignment feedback sections after day 2
6. Install R and Rstudio
7. Sign Up for Google Earth Engine

Concepts of spatial decision making

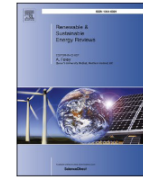
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Developing sustainable road infrastructure performance indicators using a model-driven fuzzy spatial multi-criteria decision making method

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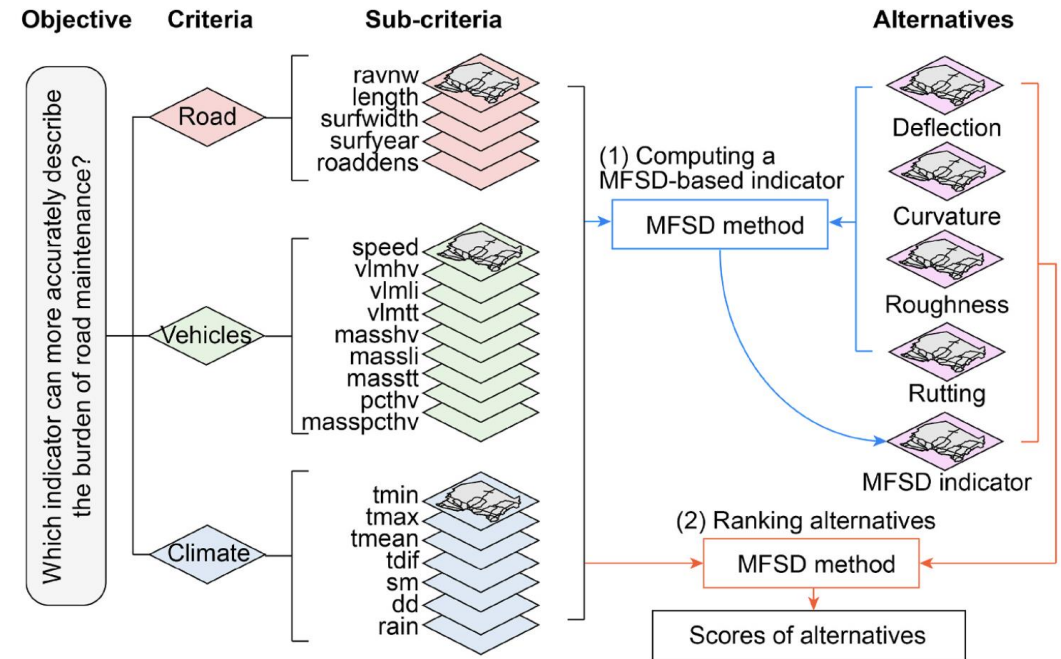
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ARTICLE INFO

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 Model-driven decision making
 Fuzzy spatial MCDM
 Spatial analysis
 GIS
 Machine learning

ABSTRACT

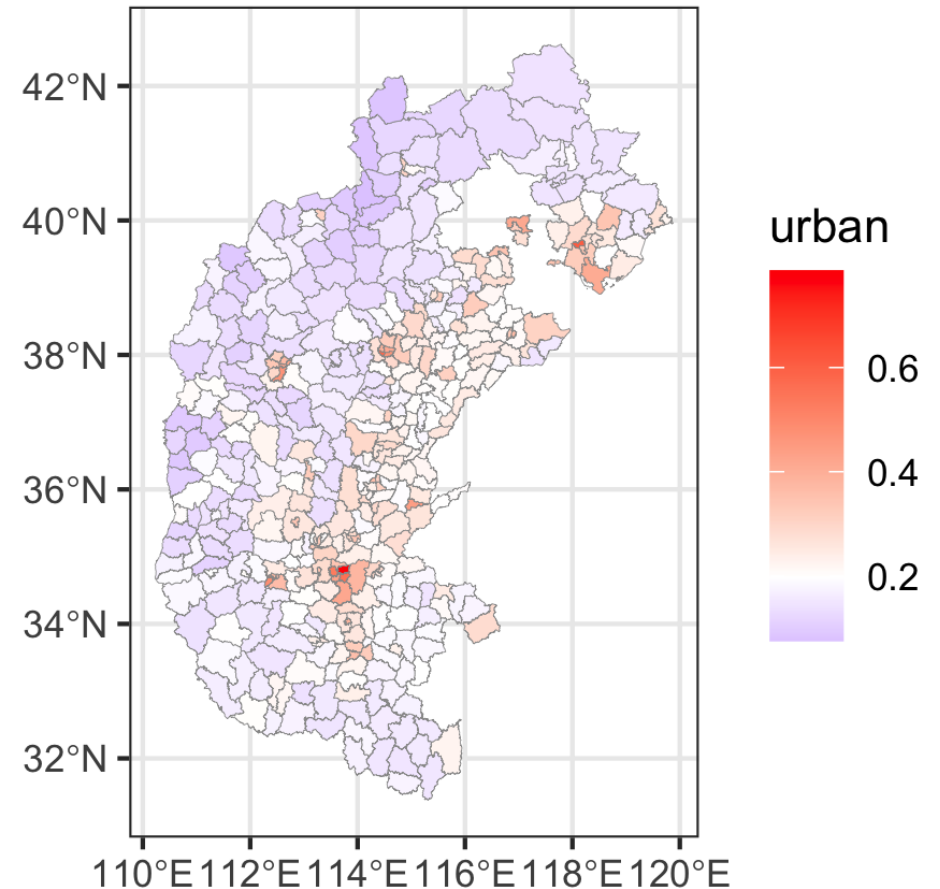
Road infrastructure performance is closely associated with passengers and freight transportation systems and socio-economic development. The performance of road infrastructure is commonly measured by sensor-monitored indicators, and the ability of monitored indicators in revealing actual performance is generally determined by decision makers and road users. However, it is usually unreliable to directly apply monitored indicators in road performance evaluation, due to the limited aspects of individual sensor-monitored indicators, and potential biases and uncertainties of human experience. To address the issues, this study proposes a model-driven fuzzy spatial multi-criteria decision making (MFSD) approach to derive a comprehensive and accurate indicator of sustainable road performance. In this study, the MFSD approach is applied in exploring the road network in the Wheatbelt region in Western Australia, Australia. Spatial variables of road properties, traffic vehicles and climate conditions are used as criteria in the decision making. Four sensor monitored indicators are collected for estimating contributions of criteria. Results show that the MFSD-based indicator can more comprehensively and accurately characterize sustainable road infrastructure performance. In the study area, the MFSD-based indicator can improve 30.46% of the correlation with road maintenance cost compared with roughness, which is the optimal sensor monitored indicator. At the local government areas, the MFSD-based indicator can explain 45.8% of practical road maintenance cost. Sensitivity analysis from multiple aspects indicates that MFSD is a reliable and accurate method in decision making. The proposed method and analysis have broad potentials in the network-level sustainable infrastructure management.



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Practice

- Please construct a composite urbanisation index from multiple socioeconomic indicators using an objective entropy-weighting approach.
- Students are required to normalise the indicators, calculate entropy-based weights, and aggregate the variables into a single index representing overall urbanisation level.
- The resulting index must then be linked to spatial units and visualised on a map to examine its spatial distribution and relative differences across regions.
- generate urban index.zip file



Assignment

You will have 40 min for working on Assignment

Write a 200 word essay on the analysis of spatial decision making for mapping urbanization.

Any questions?