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REVIEWER'S REPORT

Manuscript No.: IJAR-59636

Title: GIS-Based Road Accident Analysis and Kernel Density Estimation A Review of Hotspot Identification Methods, Applications, and Research Gaps

Recommendation:
Accept as it is .....
Accept after minor revision.....
Accept after major revision ...✓.....
Do not accept (*Reasons below*) .....

Reviewer's ID: JPR- **098**

Rating	Excel.	Good	Fair	Poor
Originality		✓		
Techn. Quality		✓		
Clarity			✓	
Significance		✓		

Detailed Reviewer's Report

Decision: Accept after Major Revision

Major Revisions

1. Limited literature coverage: The review includes only a small number of key references. The authors should expand the literature review with more recent studies on GIS-based accident analysis, network KDE, spatial statistics, and road-safety hotspot identification.

2. Review methodology requires improvement: The paper describes itself as a narrative review but does not explain how the selected studies were identified. The authors should specify the databases searched, search terms, publication period, and criteria used to select relevant studies.

3. Insufficient critical analysis: Several sections primarily describe individual studies. The authors should provide a deeper critical synthesis highlighting methodological differences, strengths, weaknesses, and the circumstances under which each hotspot identification method is appropriate.

4. Comparison of hotspot identification methods: The comparison table includes planar KDE, Network KDE, Moran's I, Getis–Ord Gi*, crash-rate analysis, kriging, and Empirical Bayes methods. However, the comparison is brief. The authors should provide a more detailed assessment of the data

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requirements, assumptions, advantages, limitations, and applications of these methods.

5. Bandwidth selection needs greater attention: Bandwidth is one of the most influential parameters in KDE. The authors should discuss objective bandwidth selection approaches and explain how sensitivity analysis can be used to assess the stability of identified hotspots.

6. Conventional KDE versus Network KDE: The distinction between planar KDE and Network KDE is explained, but the practical implications require further discussion. The authors should provide a clearer comparison of their suitability for urban roads, highways, intersections, and disconnected road networks.

7. Statistical validation of hotspots: The manuscript correctly states that high KDE density does not automatically establish statistical significance. However, the discussion of validation methods is limited. The authors should explain how Local Moran's I, Getis–Ord Gi*, crash-rate screening, and other appropriate statistical approaches can complement KDE.

8. Traffic exposure and accident risk: The paper discusses traffic exposure but does not sufficiently explain how exposure measures can be incorporated into hotspot assessment. The authors should provide examples of appropriate measures, such as vehicle-kilometres travelled, traffic volume, or other suitable exposure denominators.

9. Integration of GIS, AHP, and machine learning: Sections 7.3 and 7.4 introduce AHP and machine learning, but the relationship between these methods and KDE is not developed sufficiently. The authors should explain their respective roles and discuss appropriate validation procedures, including the prevention of spatial data leakage.

10. Proposed framework lacks practical demonstration: The proposed ten-stage framework is a useful conceptual contribution, but it is not evaluated using an actual accident dataset. The authors should consider demonstrating the framework with a case study or provide a more detailed step-by-step methodological illustration, including expected inputs, outputs, and validation measures.

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Minor comments

1. Title: The title is relevant and descriptive. However, the authors may consider shortening it slightly while retaining the focus on GIS, KDE, and road accident hotspot identification.

2. Abstract: The abstract provides a reasonable overview, but it should more clearly state the review's scope, approach, principal findings, and original contribution.

3. Keywords: The keywords are appropriate. The authors may consider adding terms such as spatial autocorrelation, crash-rate analysis, and road-network analysis.

4. Introduction: The introduction should more clearly establish the motivation for reviewing multiple hotspot identification methods and explain the practical significance of the review.

5. Section organization: Some discussions in the introduction, KDE applications, and limitations sections overlap. The authors should reduce repetition and improve the flow between sections.

6. Mathematical formulation: The KDE equation on page 4 should be checked for proper formatting, notation, and mathematical completeness. All variables and parameters should be consistently defined.

7. Figures and visual presentation: The manuscript would benefit from illustrative GIS maps showing planar KDE and Network KDE results. A conceptual diagram comparing the two methods would also improve understanding.

8. Comparison table: The table in Section 6 should be improved for readability. The authors should ensure consistent terminology, column alignment, and adequate explanation of abbreviations such as NKDE and Gi*.

9. AHP and machine-learning discussion: The discussion should include suitable examples of how these techniques have been applied in road-safety research, supported by relevant references.

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10. References and formatting: The reference list contains inconsistent spacing, punctuation, and formatting. The authors should follow the journal's prescribed referencing style and verify the bibliographic details and DOI information.