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Architectural Strategies for Flood Mitigation in Urban Environments: A Study of Traditional Elements and Contemporary Resilience

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Unveiling the Interplay: Flood Impacts on Transportation, Vulnerable Communities - Data, and Methods

Seyedeh Negar Naghedi, Farzad Piadeh, Kouros Behzadian, Moein Hemmati

Introduction

- Human mobility is highly vulnerable against natural hazards
- Floods affect more people worldwide than any other hazards



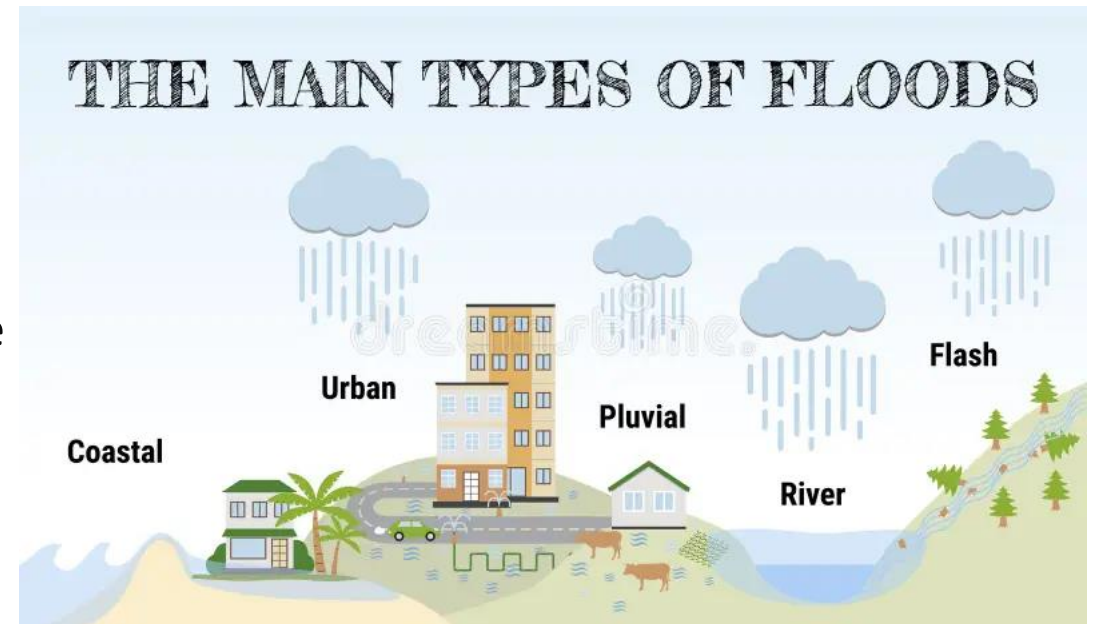
Overview of the study

- An extensive review: more than 4600 papers at the first step
- First round of review: decreasing the number to 413
- Final references: 139
- Considering both flooding and transportation together, data types and methods

| | |
|----------------------------------------------------|--------------------------------------------------------------|
| Search within Article title | Search documents * transport OR road OR traffic |
| AND | |
| Search within Article title, Abstract, Keywords | Search documents flood OR extreme OR disaster OR rainfall |
| AND | |
| Search within Article title, Abstract, Keywords | Search documents impact |
| AND | |
| Search within Article title, Abstract, Keywords | Search documents pluvial OR runoff |
| AND NOT | |
| Search within Article title, Abstract, Keywords | Search documents sediment |

Flooding sources

- Pluvial
- Riverine
- Flash flood/Storm surge
- Coastal
- Snow melt



Flooding Impacts on the transportation

1. Accessibility

- a. Road accessibility
- b. Infrastructure accessibility
- c. Emergency response access



2. Disruptions

- a. Traffic flow disruptions
- b. Public transit disruptions



Flooding Impacts on the transportation

3. Infrastructure damage

- a. Transportation infrastructure damage
- b. Road safety



4. Indirect / Sequential

- a. Economic costs and productivity losses
- b. Impacts on vulnerable populations
- c. Long-term resilience and adaptation



Methods Used in the literature

1. Spatial analysis
 - a. Static network analysis
 - b. Dynamic network analysis
 - c. GIS-based analysis
2. Decision Support System (DSS)
 - a. MCDM/MADM
 - b. Discussion
 - c. Decision tree framework
3. AI based
 - a. Machine learning (ML)
 - b. Deep learning (DL)
 - c. Datamining (DM)

Types of the data used

1. Traffic data
 - a. Traffic volume
 - b. Traffic flow data
 - c. Travel behavior data
2. Infrastructure
 - a. Road network
 - b. Transportation infrastructure
3. Point of interest data



Types of the data used

4. Location characteristics

- a. Demography
- b. Buildings
- c. Land use/ Land cover

5. Mobile based

- a. Mobile phone signals
- b. Smartphone apps

6. Text / Video content

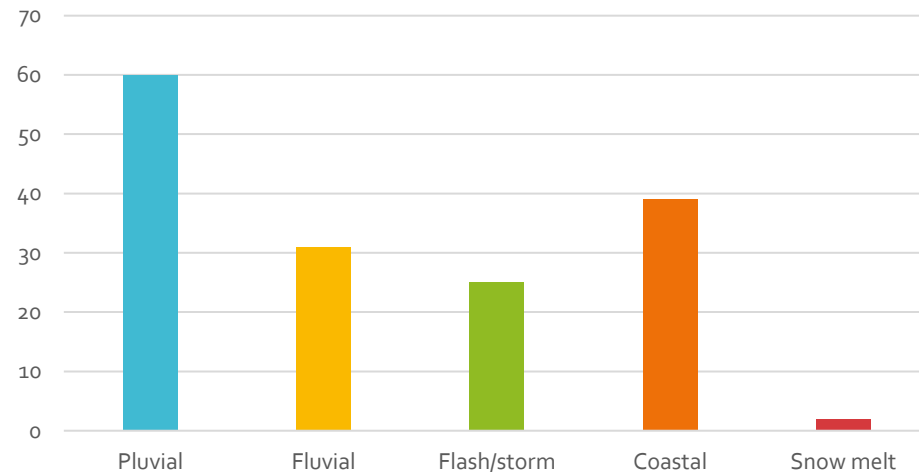


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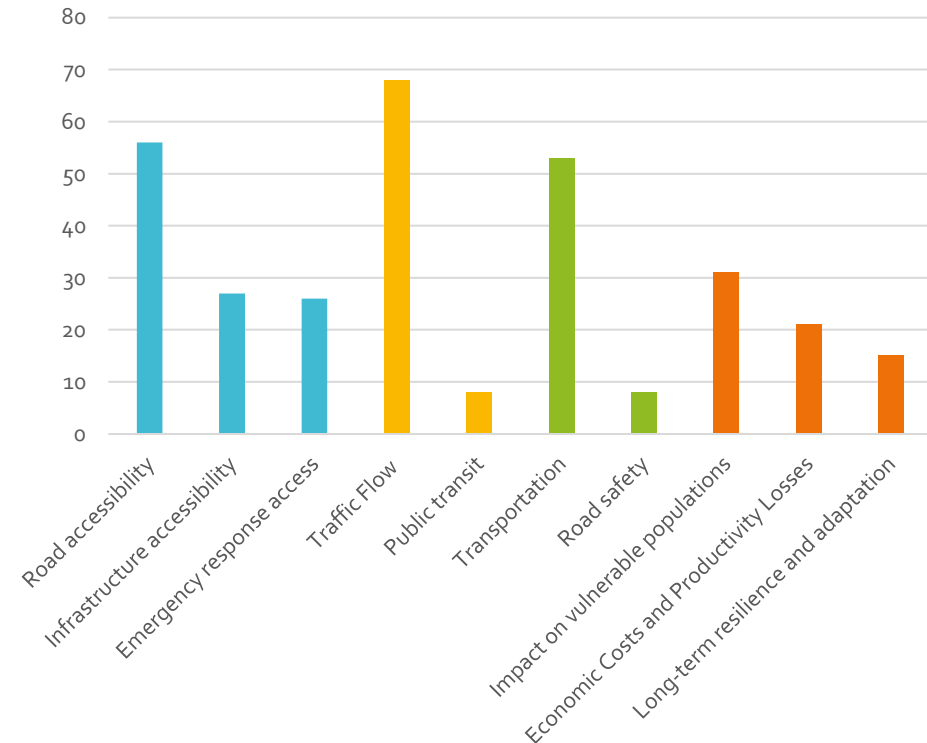


Results: Flood types and the impacts

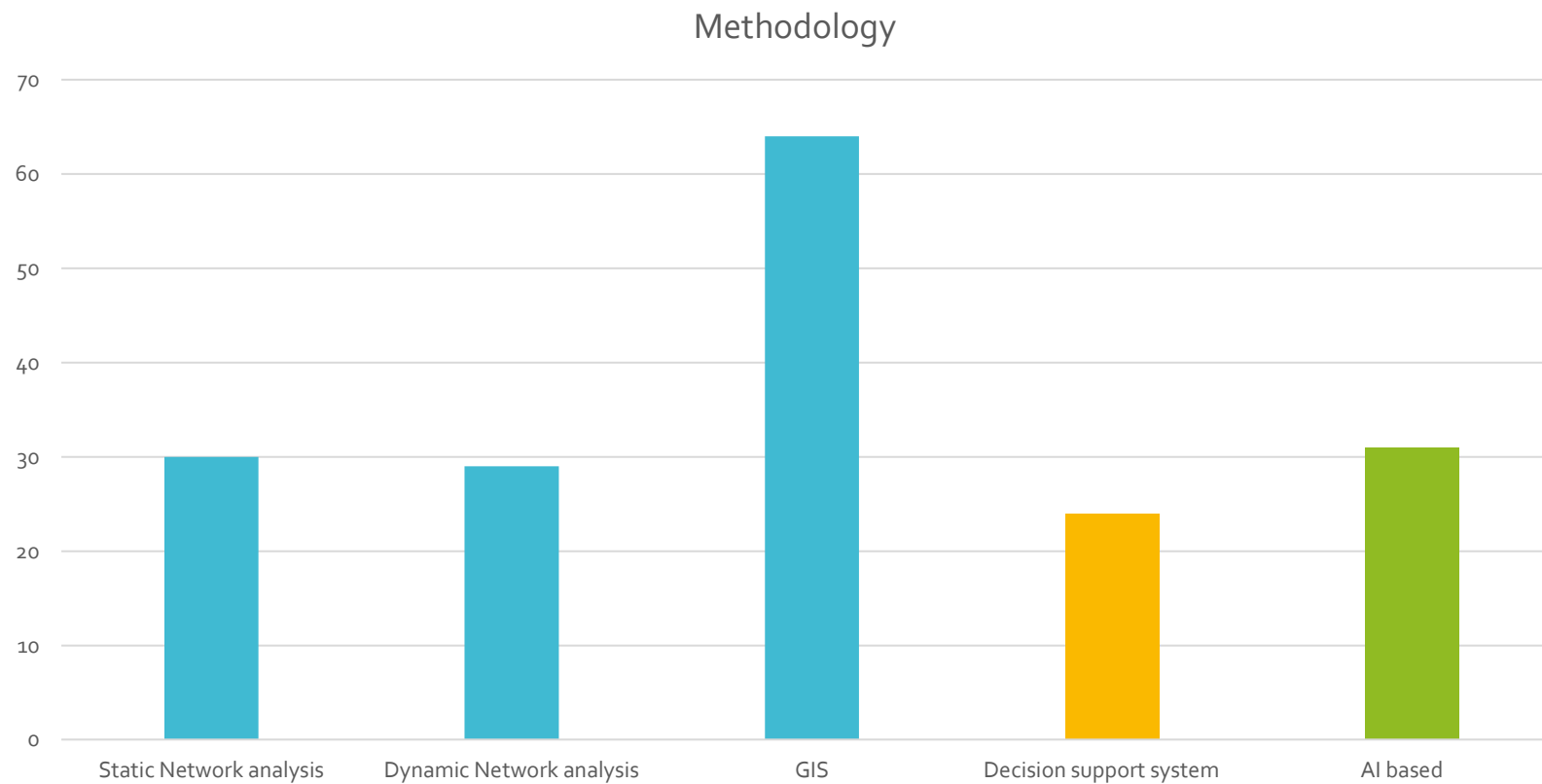
Types of flooding



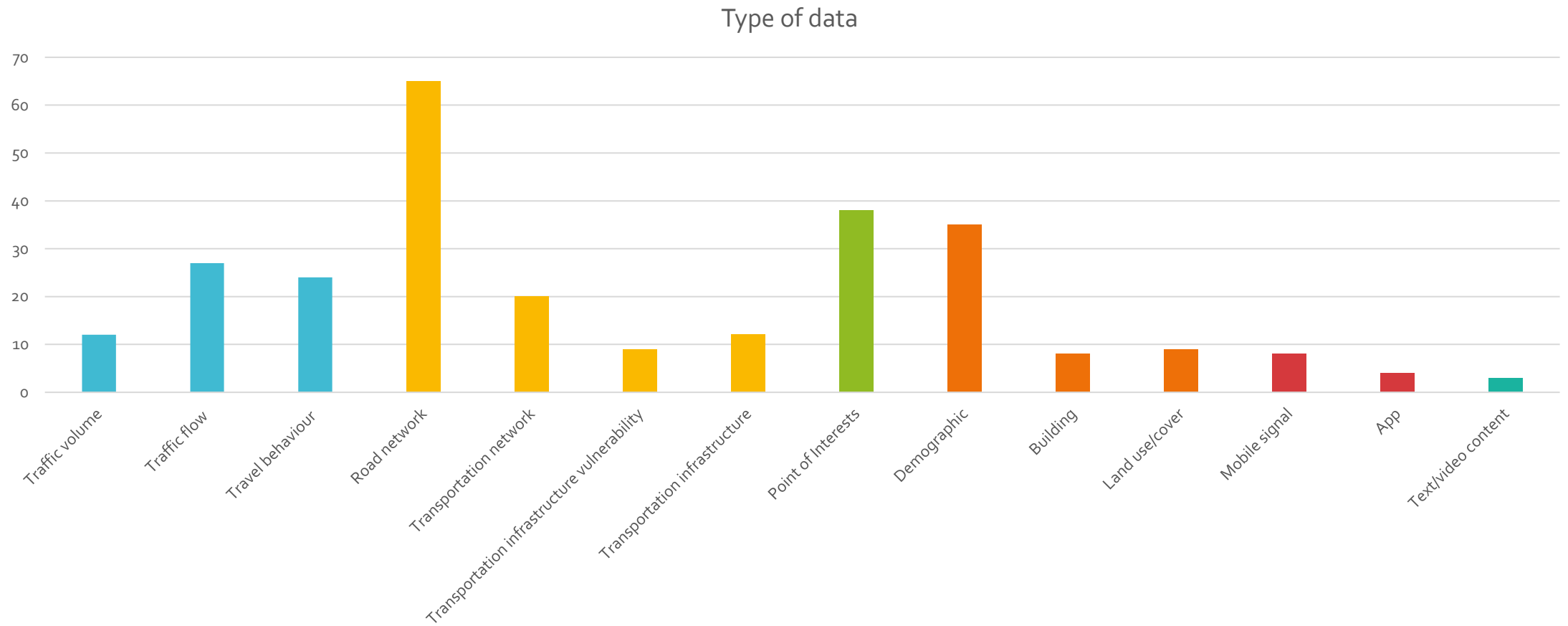
Type of the flood effect on the transportation



Results: Methods used



Results: Data type



Conclusion

- Most of the researches (%80) are in local scale
- AI based methods are used in fewer papers, however, it has a growing rate in the recent years
- Most of the flood types are Pluvial flooding, showing the impact of more probable floods on the transportation (less devastating)
- Mobile based data has a small share of the data types, though there is a high capacity for these type of data in AI based analysis



Thank you!