

TOWARD SMART RESILIENCE: SMART SYSTEMS FOR SITUATIONAL AWARENESS OF FLOOD IMPACTS AND TRANSPORTATION ACCESS (SSSAFT) IN COMMUNITIES

Jamie Padgett (Rice University), Philip Bedient (Rice University), Danielle King (Rice University), Devika Subramanian (Rice University)

PG, FY2020

1. Problem Definition

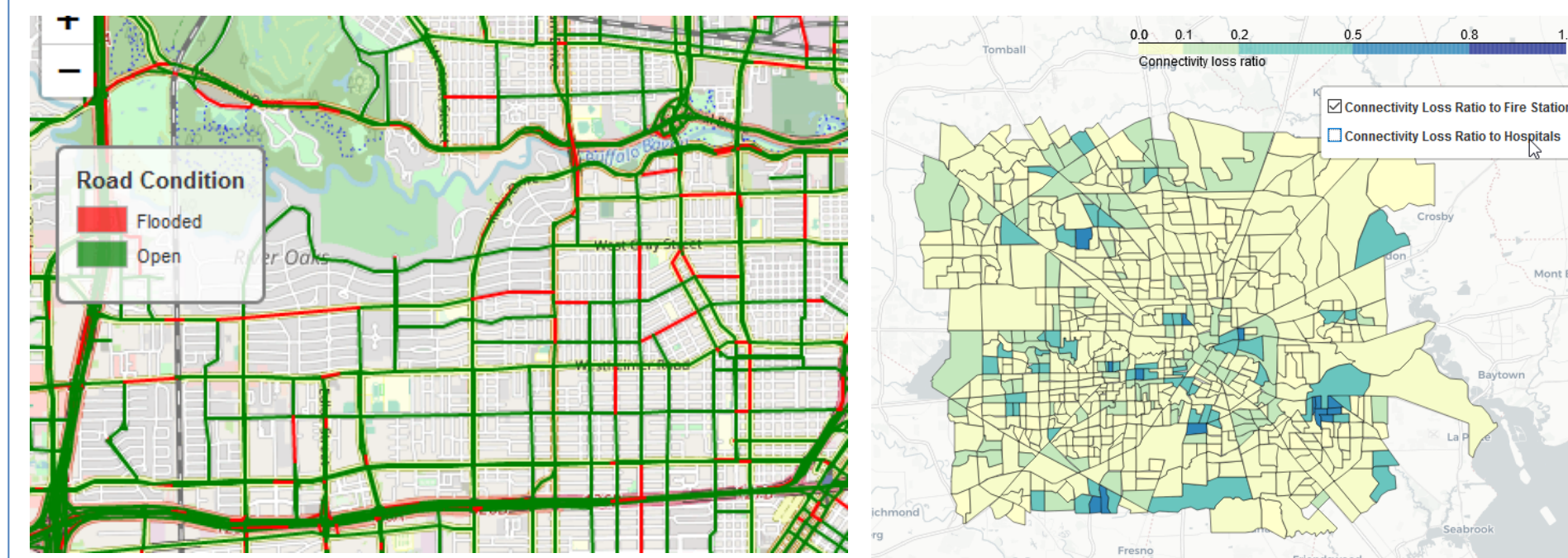
Problem



In the US, a majority (63%) of flood-related deaths happened on roads. Lack of real-time road condition data results in delays and detours which puts both responders and evacuees at risk.

SSSAFT Framework

Proposed Solution



Real-time information on flooded roads.

Flood impact on access to communities.

3. Intellectual Merit

Transforming situational awareness

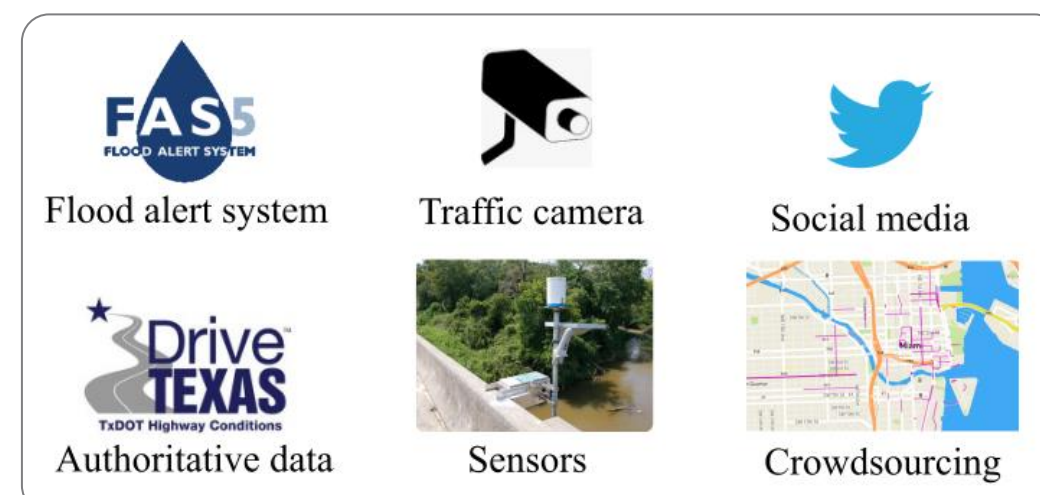
- Harness the power of big data, machine learning, network analysis, data fusion, and physics-based models.
- Custom **mobility-centric** data extraction for higher-resolution data.

Community need driven

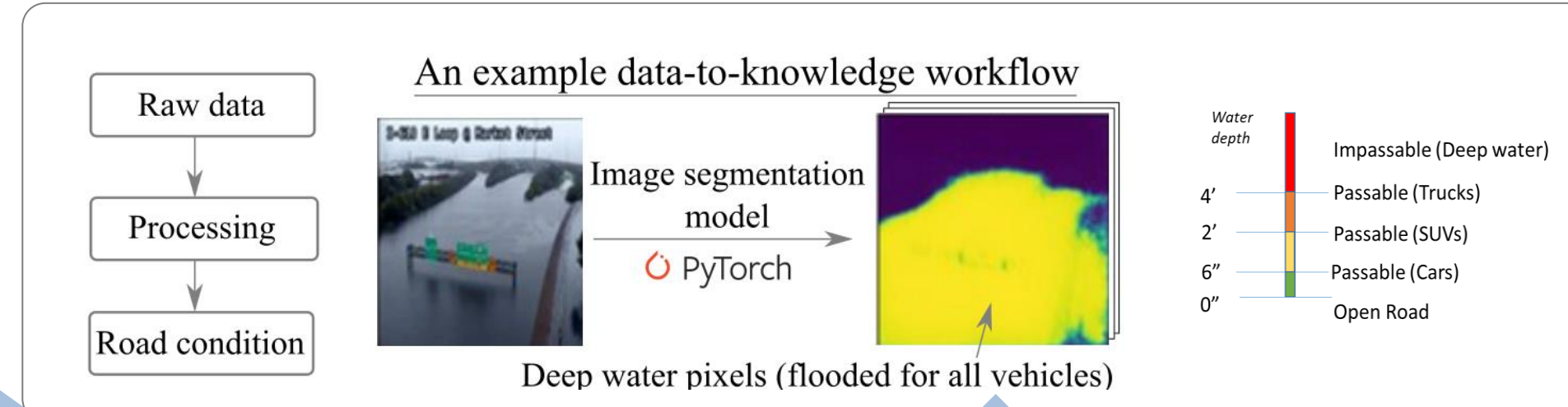
- **Emergency responder** and decision-maker input.
- Pilot studies in two Houston watersheds.
- **Community stakeholders** from govt. and private agencies.
- Organizational functioning & emergency personnel psychological resilience insight.

2. Project Structure and Update

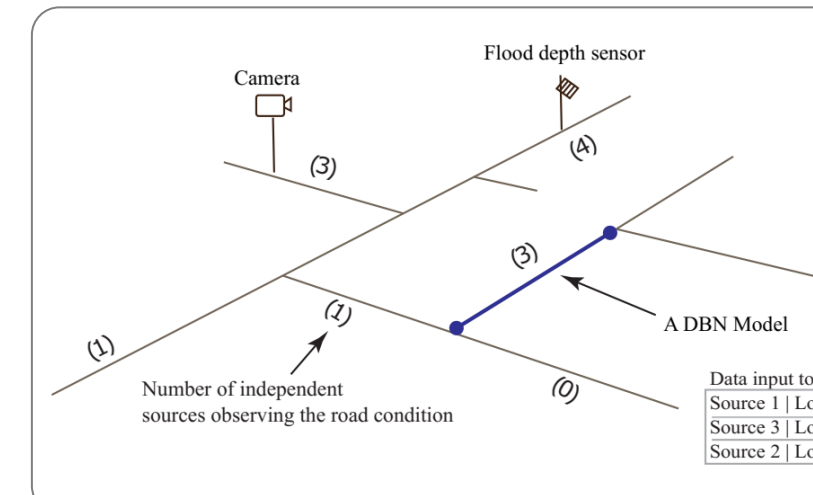
1. Real-time flood data sources



2. Mobility-centric data-to-knowledge (D2K) pipelines



3. Road link-level data fusion

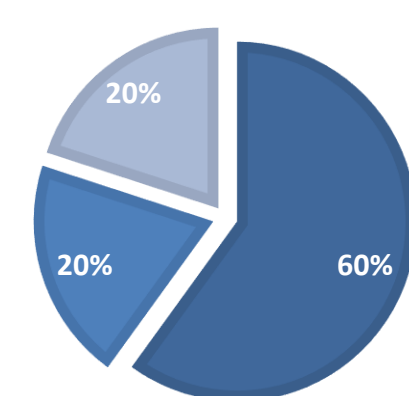


Emergency personnel psychological resilience



SOURCES OF STRESS

■ Safety of Others ■ Information Accuracy ■ Flooded roads



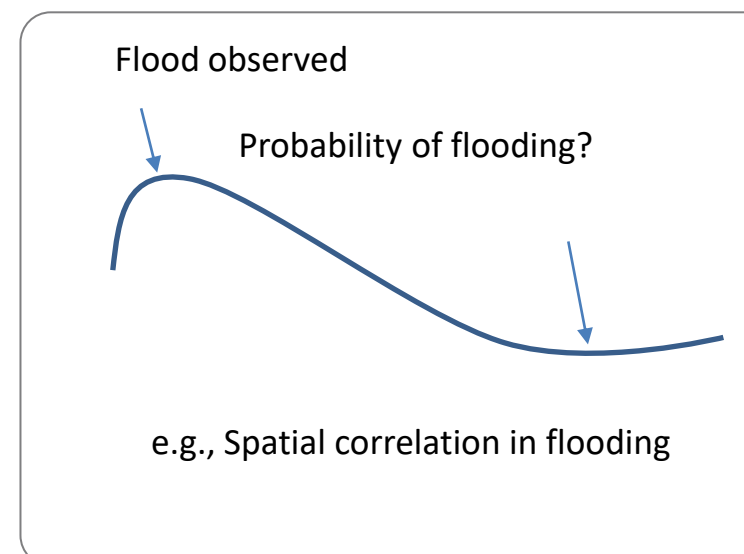
Most Valued Information

- Road Closures
- Visuals (e.g., camera views)
- Flood depth
- Topographic information
- Rainfall predictions

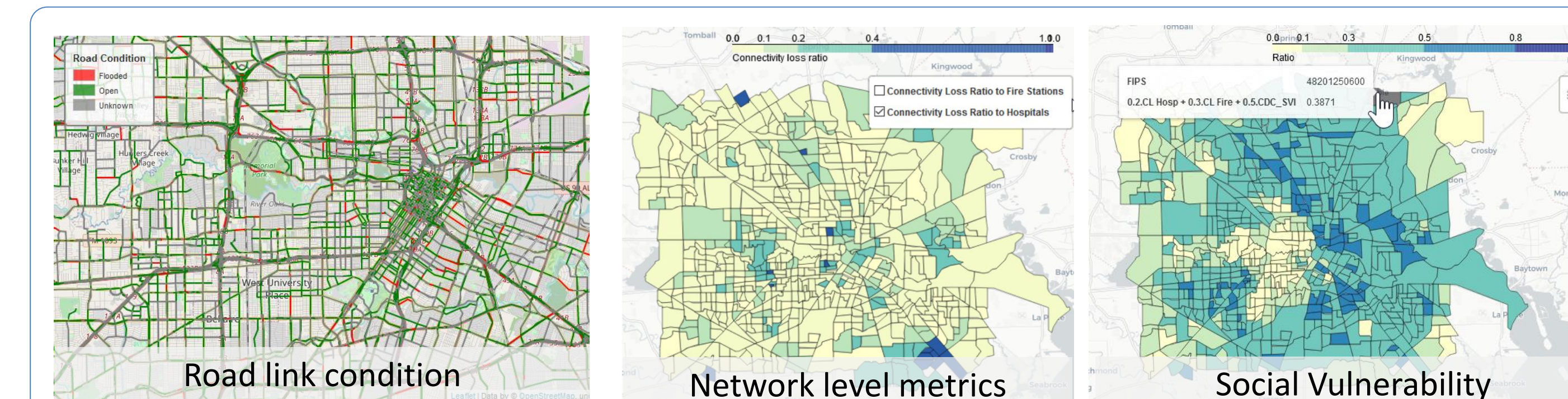
Mock-up of SSSAFT



4. Data Augmentation



5. Visualization and Communication



4. Broader Impact

Community

- Enhanced situational awareness.
- Potential work-related stress reduction.
- Safer, more efficient emergency response.
- Enhanced community resilience.

Technical contributions

- Social-vulnerability and infrastructure performance considerations.
- Enhanced mobility-centric D2K pipelines.
- New, integrated physics-based, data-driven models; Spatial correlation in flooding.
- Insights on work-related stress tied to flooding.

Data sharing

- Opensource data.
- Opensource mobility-centric D2K pipelines.

Scalability

- Modular SSSAFT structure enables easy sharing.
- SSSAFT easily tailorable to needs of other communities.

5. Next Steps

- Pilot testing framework during next hurricane season in two Houston watersheds.
- User-testing and validation studies.
- Extend to other potential data sources, data extraction pipelines.
- Gain new insights on the data generation process and data equity.