

# Hyperlocal Risk Monitoring and Pandemic Preparedness through Privacy-Enhanced Mobility and Social Interactions Analysis

Li Xiong, Weihua An, Shivani Patel, Emory University; Cyrus Shahabi, USC  
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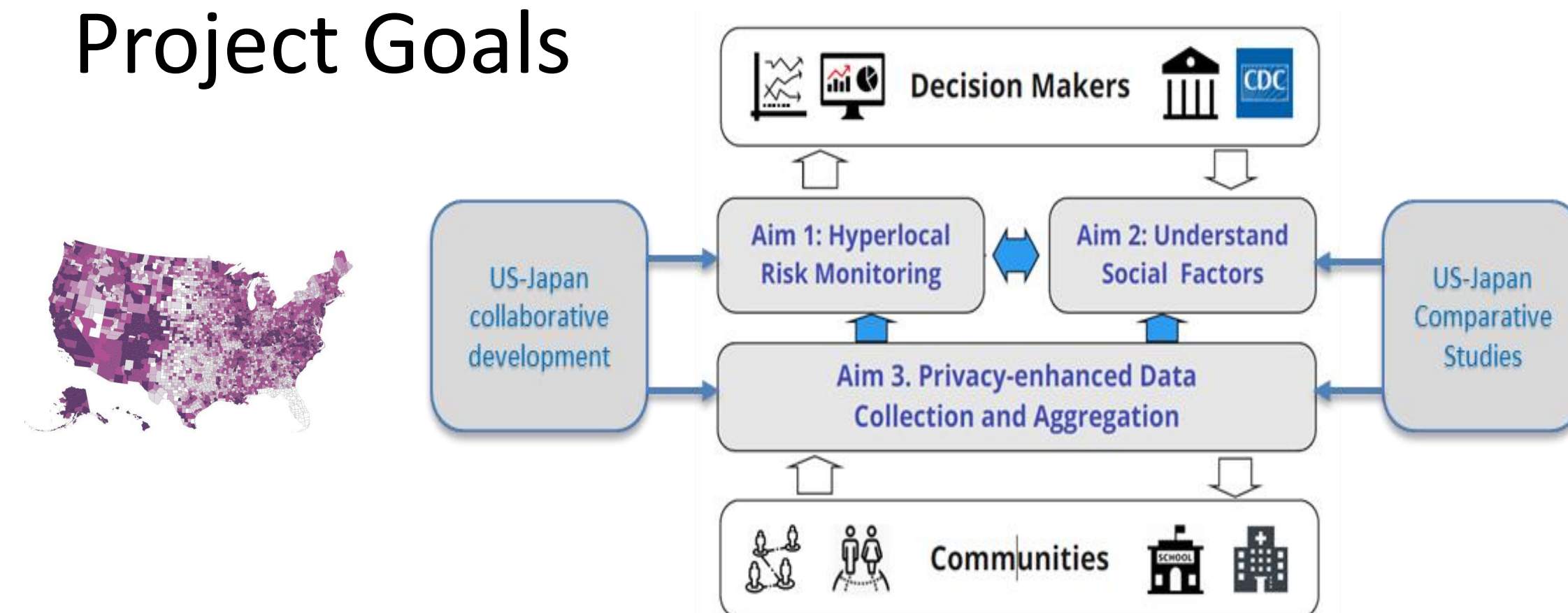
## Collaborating Institutions in Japan



## Community Partners



## Project Goals



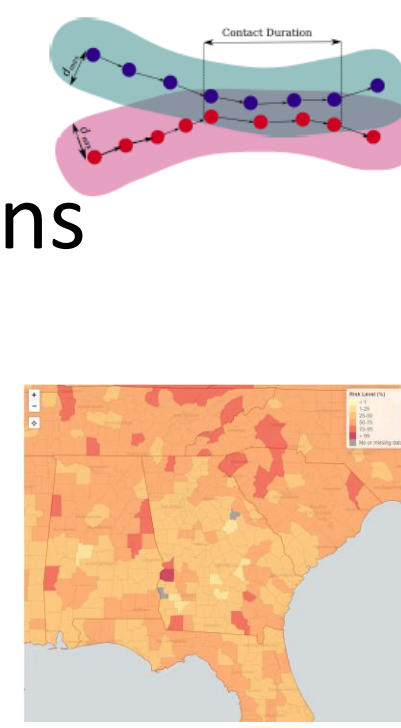
## Intellectual Merit

- Aim 1. Develop computational models utilizing mobility and social interactions data for real-time fine-grained hyperlocal infection risk estimation
- Aim 2. Study social risk factors, health equity in COVID-19, psychological reactions
- Aim 3. Develop privacy enhancing methods for data collection and aggregation, understand social/legal questions on privacy enhancing technology

## Project Activities

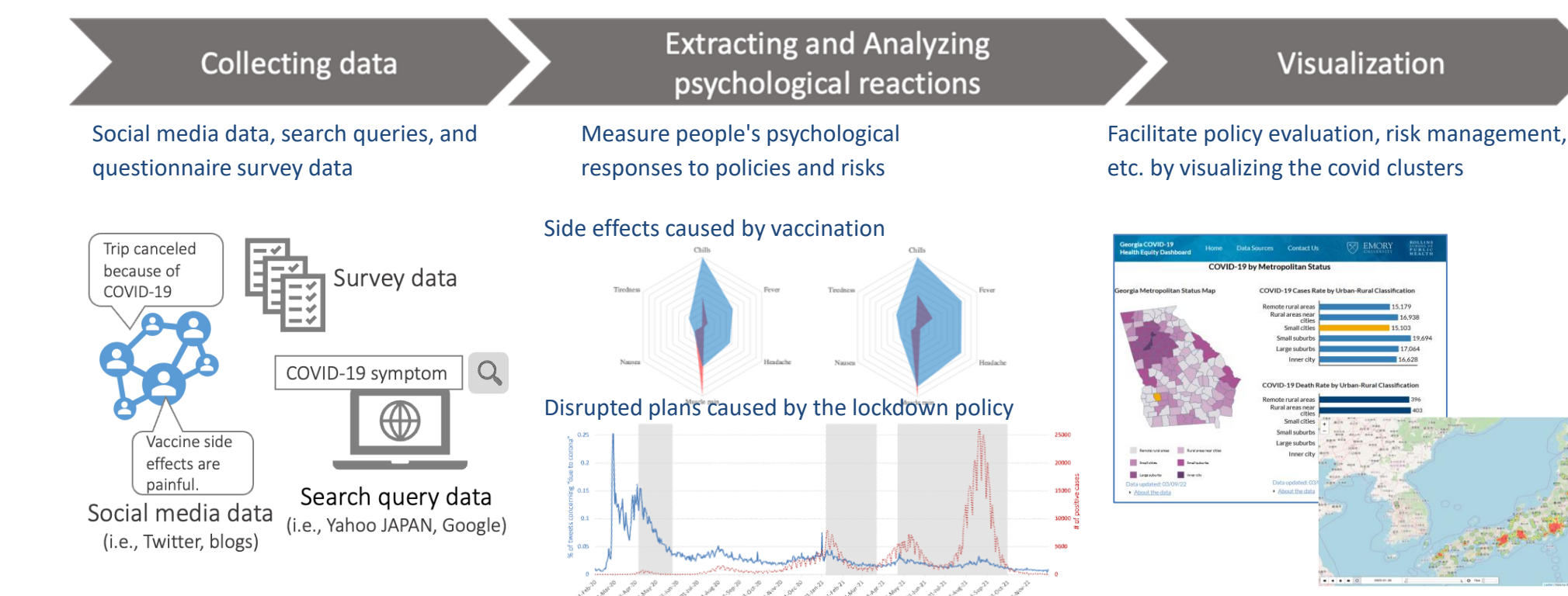
### Mobility based hyperlocal (fine-grained) risk estimation

- Hawks models and deep learning models
- Using sample mobility data
- Evaluation with simulated infection patterns



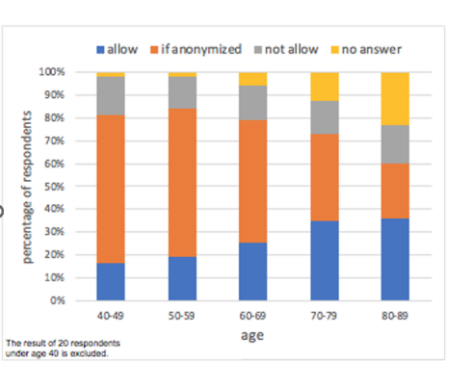
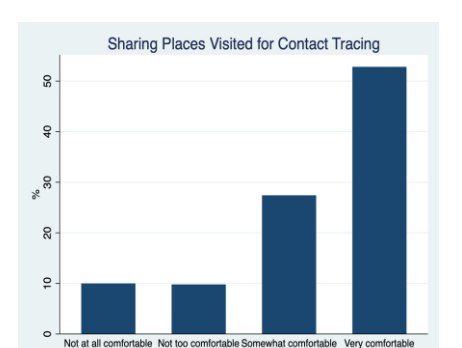
Toward Accurate Spatiotemporal COVID-19 Risk Scores Using High-Resolution Real-World Mobility Data. ACM Trans. Spatial Algorithms Syst. 8(2): 1-30 (2022)  
Estimating Spread of Contact-Based Contagions in a Population Through Sub-Sampling. Proc. VLDB Endow. 14(9): 1557-1569 (2021)

### Measuring Psychological Reactions and Sentiments using Search Queries and Social Media Data



### Privacy enhanced data collection and aggregation

- Understanding data sharing and privacy attitudes for COVID-19
- Customizable privacy and enhancing privacy-utility tradeoff
- Legal issues of data collection apps



PrivLBS: Local Differential Privacy for Location-Based Services with Staircase Randomized Response. 29th ACM Conference on Computer and Communications Security (CCS), 2022  
Projected Federated Averaging with Heterogeneous Differential Privacy. 48th International Conference on Very Large Data Bases (VLDB), 2022

## Broader Impact (Immediate)

- Fine-grained risk estimation models and software toolkits for epidemiologists and decision makers
- Understandings of social factors for decision makers
- Privacy-enhanced data collection and analysis methods and toolkits for data collectors/providers, social scientists and epidemiologists

## Broader Impact (Sustainability)

- Enables data-driven policy and decision making for local public health agencies, local government decision makers (e.g., partial lockdowns, business closures)
- Enables data-driven decision making for community members (e.g., avoid high risk areas)

## Next Steps

- Incorporating additional data sources: Behavior, Search data, Social determinants, Social interactions
- Additional data collection from social media and surveys and data analysis
- Privacy survey analysis and algorithm design
- Community engagement and joint US-Japan workshops