



# Convergence of CyberGIS and Geospatial AI

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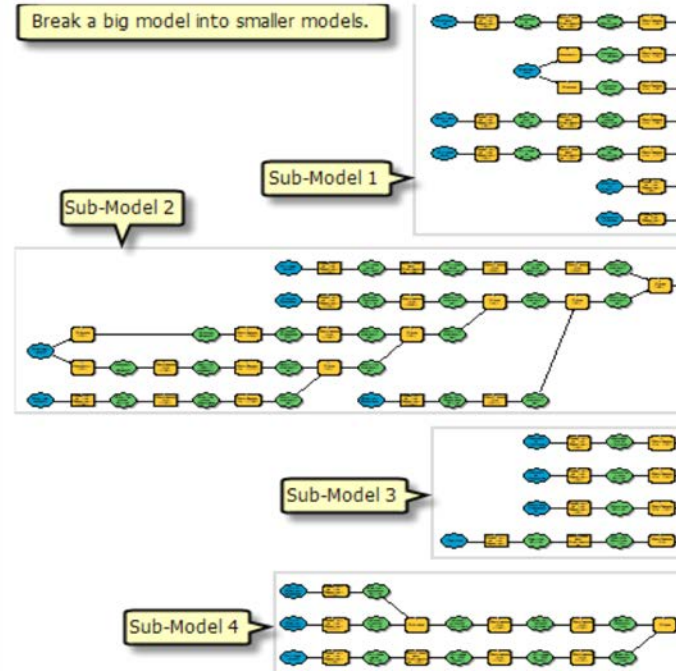


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**ICICLE**  
DEMOCRATIZING AI

# GeoAI-Enabled GIS Assistant



SO

Tell me the percentage of water bodies within 10km buffer distance of the State Capital of Wisconsin



I'm sorry, but I don't have access to the most up-to-date geospatial data to answer your question. However, I can guide you on how to obtain this information.



You can use Geographic Information System (GIS) software, such as ArcGIS or QGIS, to analyze the proximity of water bodies to the State Capital of Wisconsin. You will need to obtain a shapefile or dataset of water bodies within Wisconsin and another shapefile or dataset of the State Capital of Wisconsin.

Once you have both datasets, you can use the buffer tool to create a 10km buffer around the State Capital of Wisconsin. Then, you can use a spatial join or intersect tool to calculate the percentage of water bodies within the 10km buffer distance.

Alternatively, you can search for existing studies or reports that have already calculated this information. The Wisconsin Department of Natural Resources or the Wisconsin Geological and Natural History Survey may have information that could be helpful.

# GeoAI events in the past five years

- IJGIS, GeoInformatica, TGIS GeoAI Special Issues
- ACM SIGSPATIAL GeoAI Workshops (GeoAI'2017, 2018, 2019, 2021, 2022)
- AAG GeoAI and Deep Learning Symposium (AAG 2018, 2019, 2020, 2022, 2023)
- GIScience GeoKG & GeoAI Workshop (2021 & 2023)
- CPGIS & UCGIS GeoAI Webinar Series
- Trillion Pixel Challenge for GeoAI (ORNL)

**Topics:** spatially explicit AI models, geographical object detection, spatial scene classification, spatial interpolation and predictions, geospatial semantics, geospatial knowledge graphs, intelligent cartography etc.



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GeoAI: spatially explicit artificial intelligence techniques for geographic knowledge discovery and beyond

Krzysztof Janowicz, Song Gao, Grant McKenzie, Yingjie Hu & Budhendra Bhaduri

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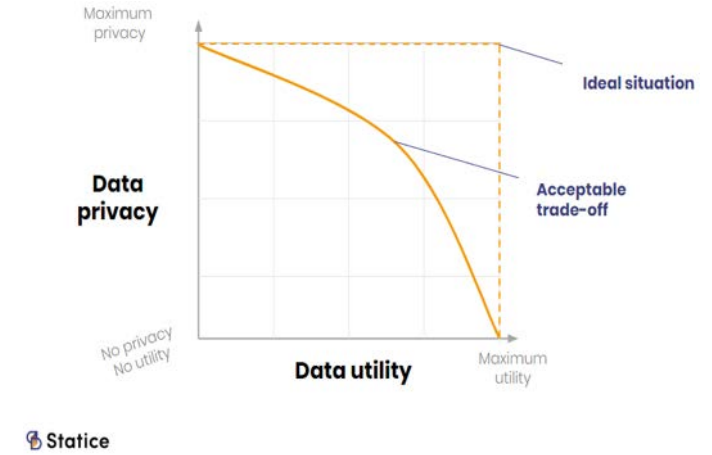
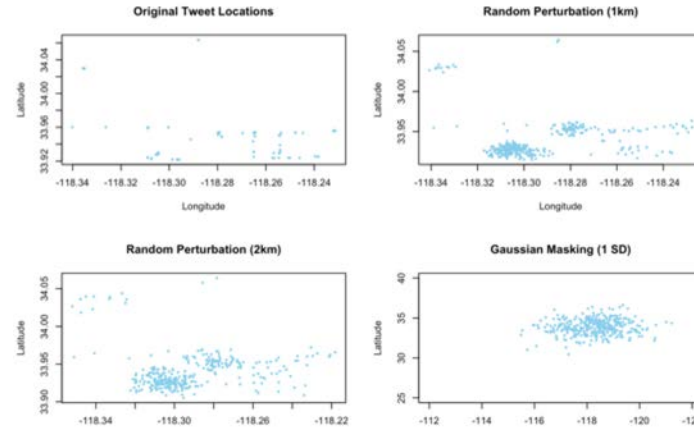
AMERICAN ASSOCIATION  
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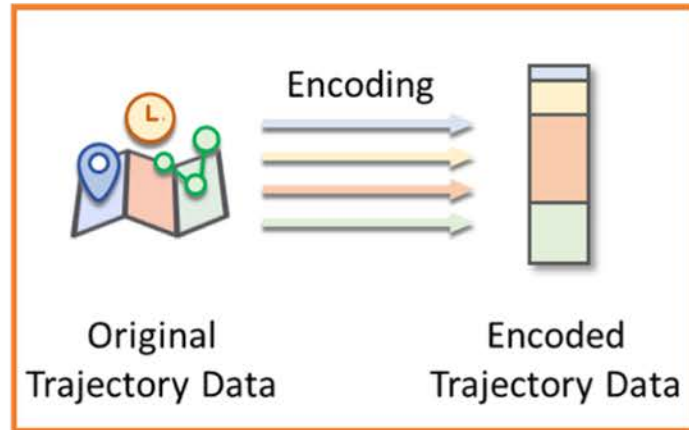
# Spatially Explicit AI Models

- **Invariance test:** The results of spatially explicit models are not invariant under relocation of the studied phenomena.
- **Representation test:** spatially explicit models contain spatial representations of the studied phenomena in their implementations (e.g., location encoding)
- **Formulation test:** spatially explicit models make use of spatial concepts in their formulations, e.g. the notion of a neighborhood.
- **Outcome test:** spatial structures/forms of inputs and outcomes are different.

# GeoAI for Location Privacy Protection

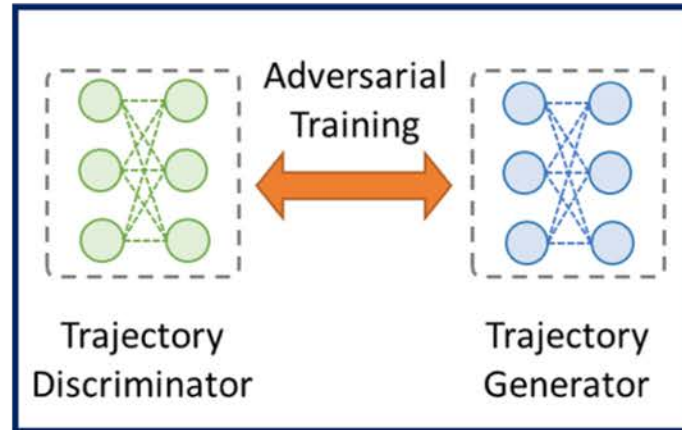


## Real Trajectory Data



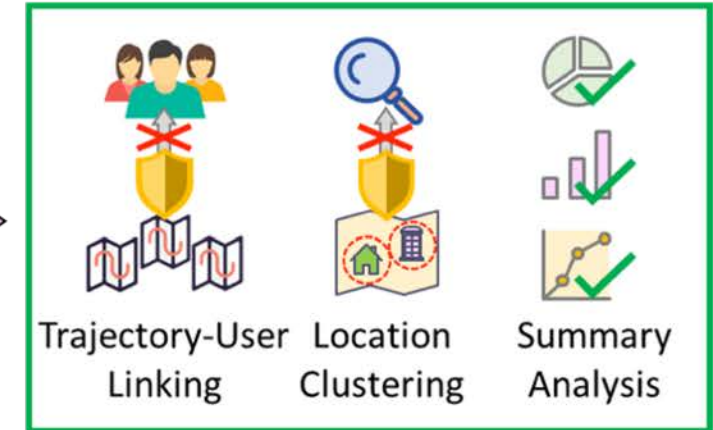
Trajectory Encoding Model

## Trajectory Privacy Protection



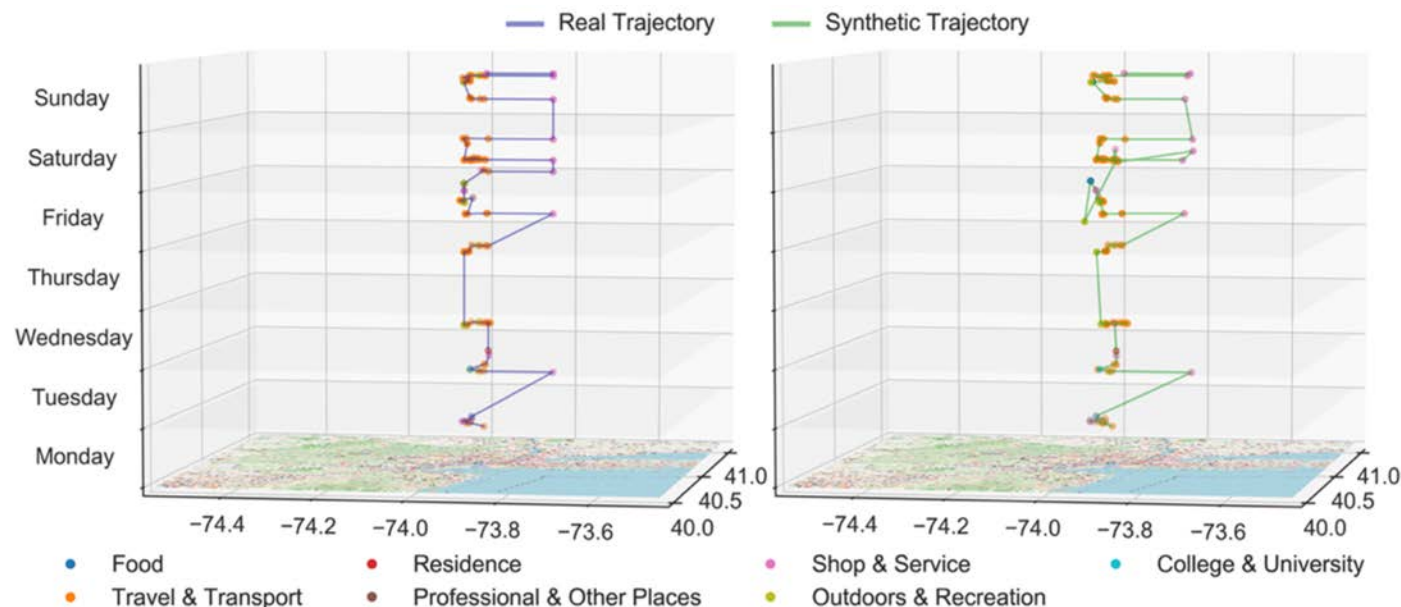
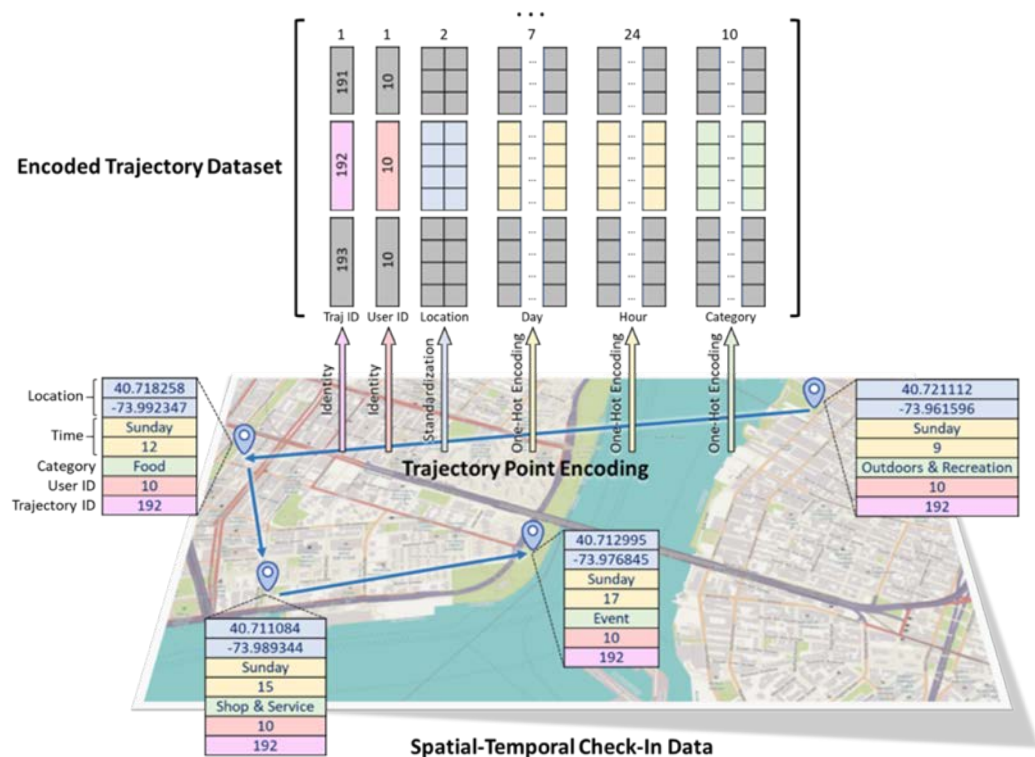
LSTM-TrajGAN Model

## Synthetic Trajectory Data



Application Scenarios

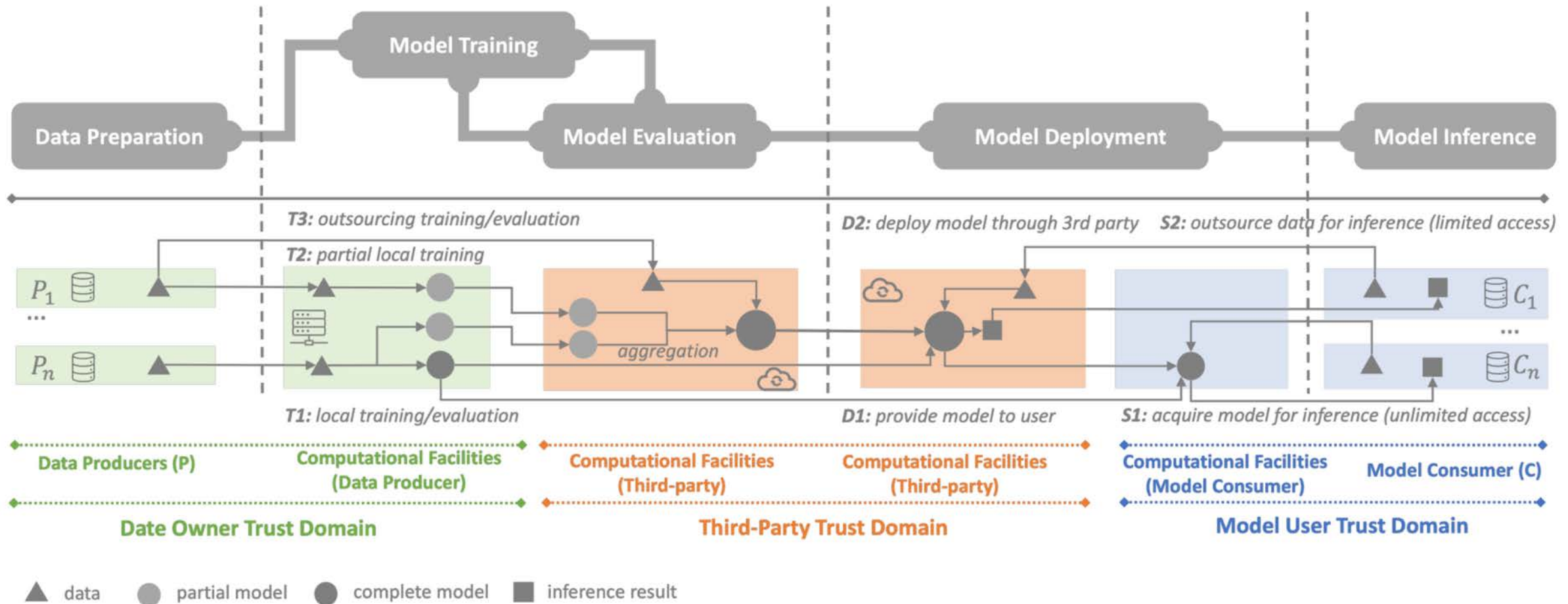
# Trajectory Loss Function Design



$$TrajLoss(y^r, y^p, t^r, t^s) = \alpha L_{BCE}(y^r, y^p) + \beta L_s(t^r, t^s) + \gamma L_t(t^r, t^s) + c L_c(t^r, t^s)$$

# Privacy-Preserving Machine Learning

Build trust in model training and inference on Cyberinfrastructure



# Federated Learning-Based Framework

