



# Intelligent Spatial Prediction and Interpolation Methods

--- In Handbook of Geospatial Artificial Intelligence

Dr. Di Zhu

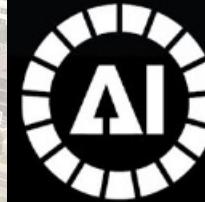
Assistant Professor

Geospatial Data Intelligence (GeoDI) Lab

Department of Geography, Environment and Society

University of Minnesota, Twin Cities

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GeoAI Discovery



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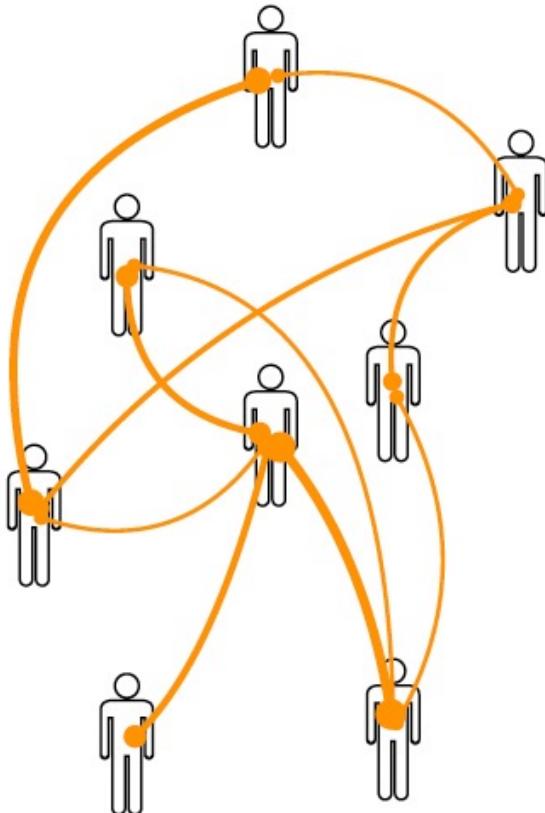
Twin Cities Campus

*Department of Geography, Environment and Society  
College of Liberal Arts*

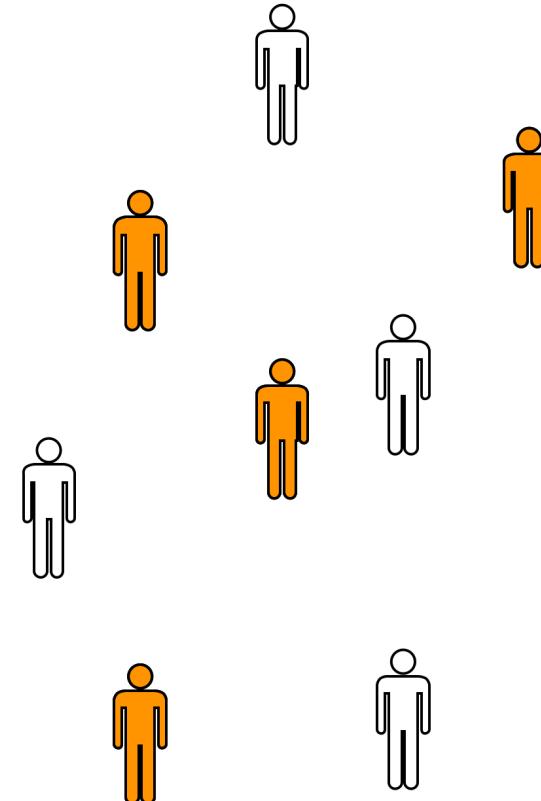
Di Zhu, Ph.D.  
Assistant Professor  
473 Social Sciences Building  
267 19th Avenue South  
Minneapolis, MN 55455

# Prediction?

- ◆ Consider the society...



The **relationships** between people



The **characteristics** for certain people

# Spatial Prediction?

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◆ Consider locations ...



# Incomplete spatial data & AI

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- ◆ “geo-tagged data collected from remote sensing & social sensing offers us the opportunity to understand the complex geographic process from a data-driven perspective ...”
- ◆ Fairy tale if not for novel analytical models & methods
  - limited observations, incomplete features, mismatch of scales, missing snapshots, etc.



# Spatial Prediction

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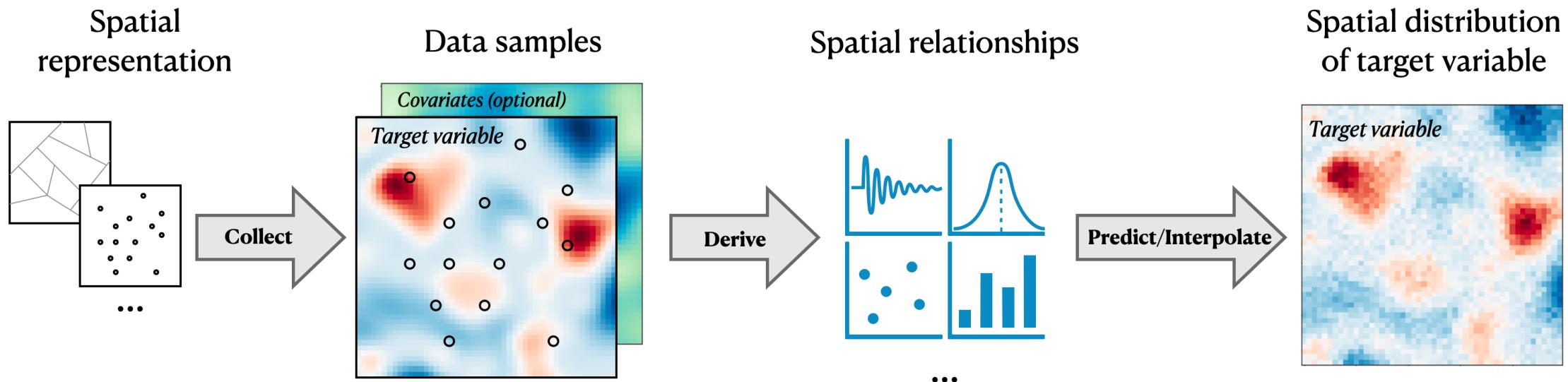


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## ◆ A typical workflow



## ◆ Spatial interpolation, spatial regression, etc.

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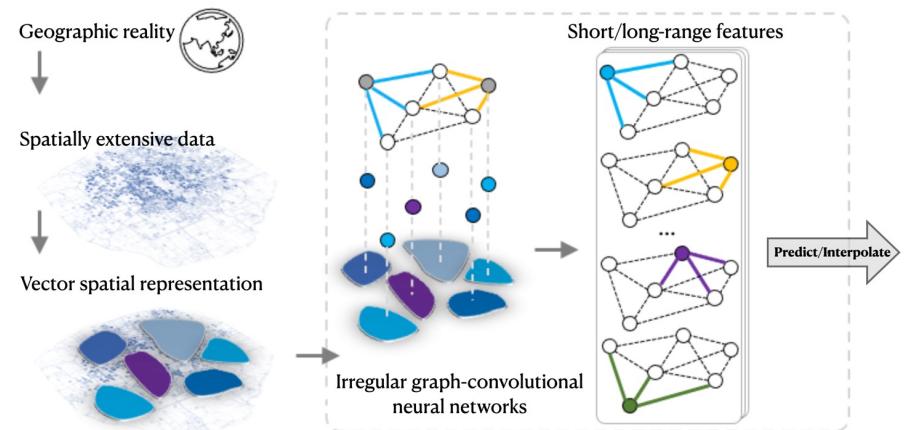
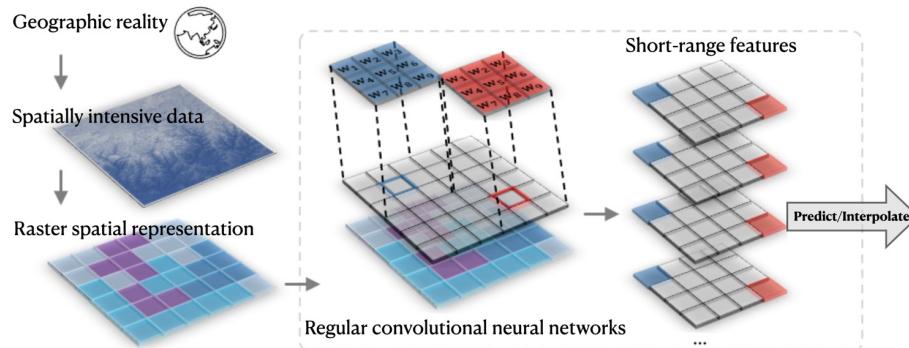
# Motivation for “special” prediction

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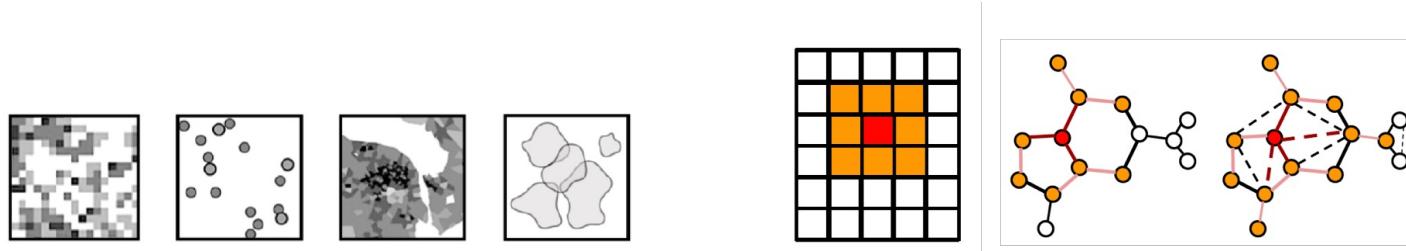


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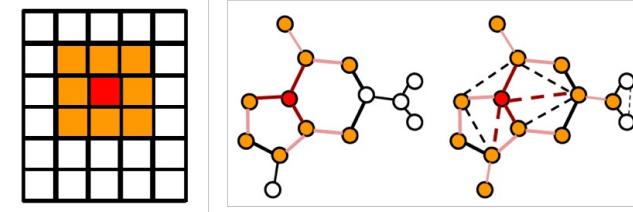
## ◆ Spatial is special (gaps)



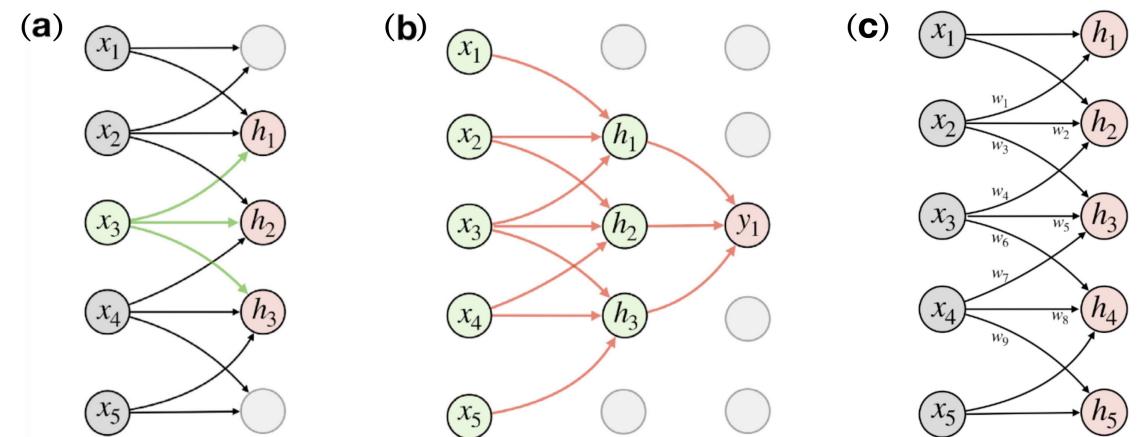
## AI & Geospatial Modeling



## Multimodal features



## Notion of Neighborhood



## Dependence & Heterogeneity

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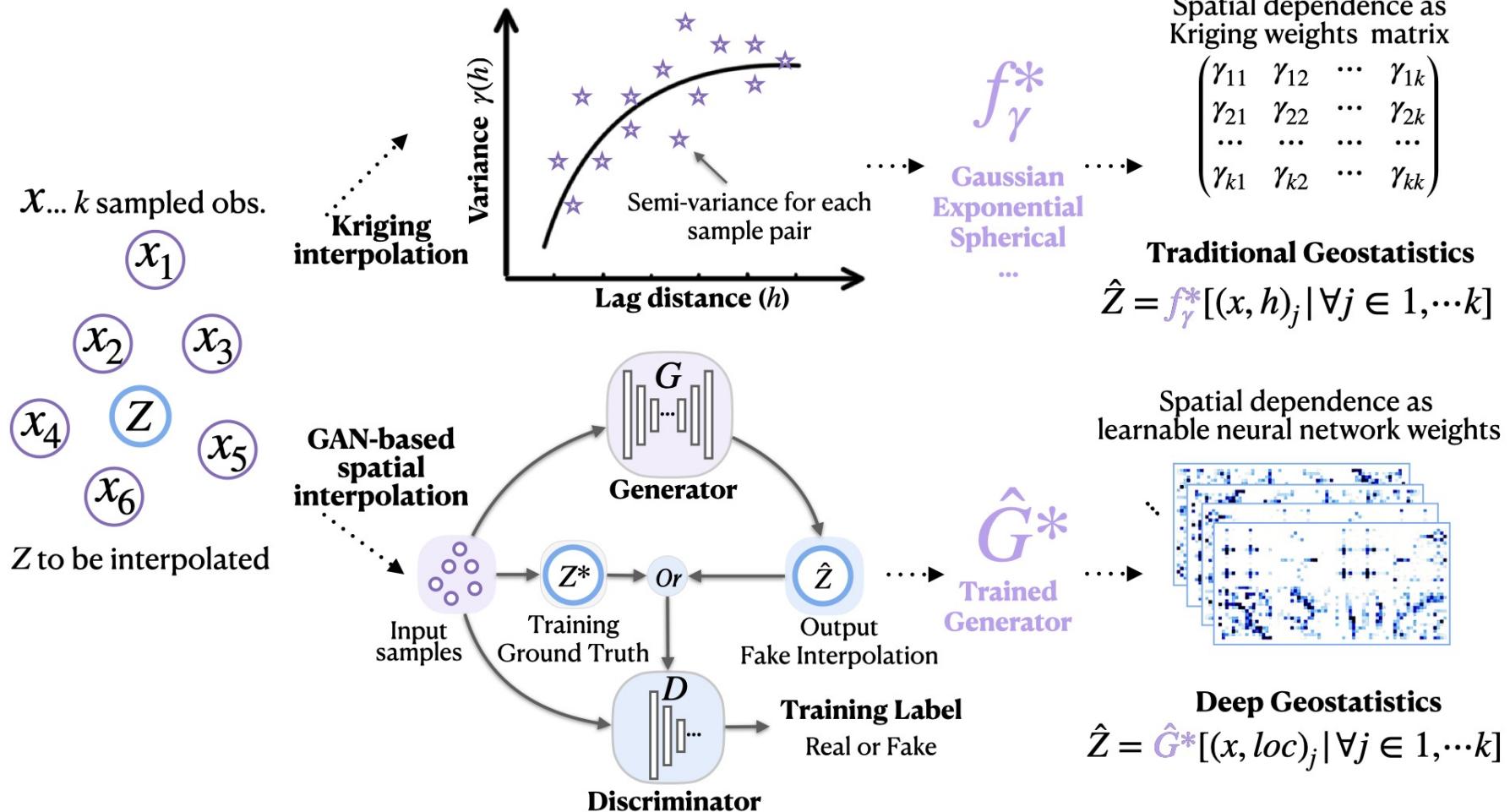
# GeoAI for spatial interpolation

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## ◆ Generative AI vs. Geostatistics



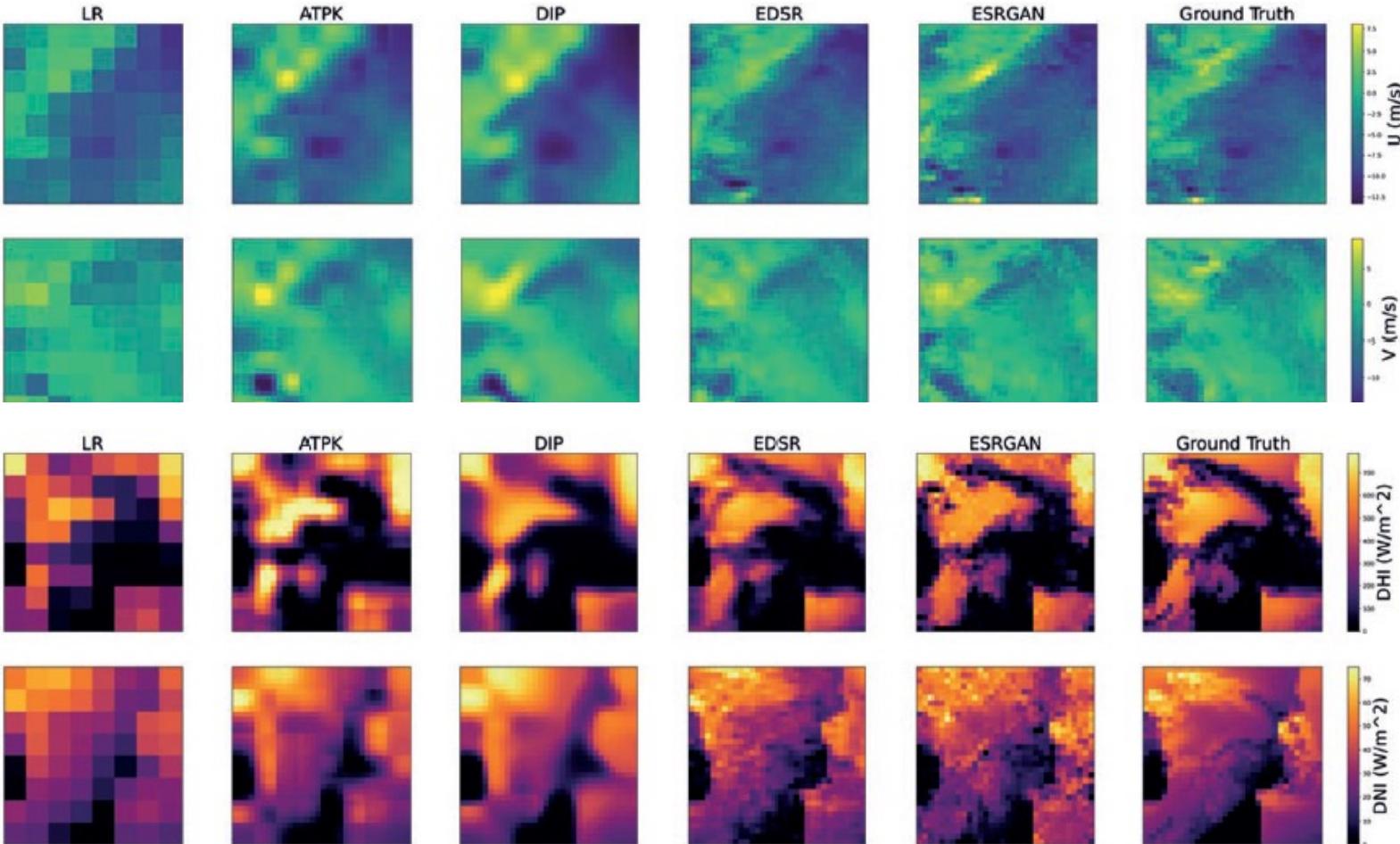
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# GeoAI for spatial interpolation

## ◆ Case for wind and solar radiation super-resolution

Wind relative MSE ( $\downarrow$ ) / SWD ( $\downarrow$ )

Wind	ATPK	DIP	EDSR	ESRGAN
4x	0.505/0.167	0.900/0.158	0.261/0.124	0.391/0.145



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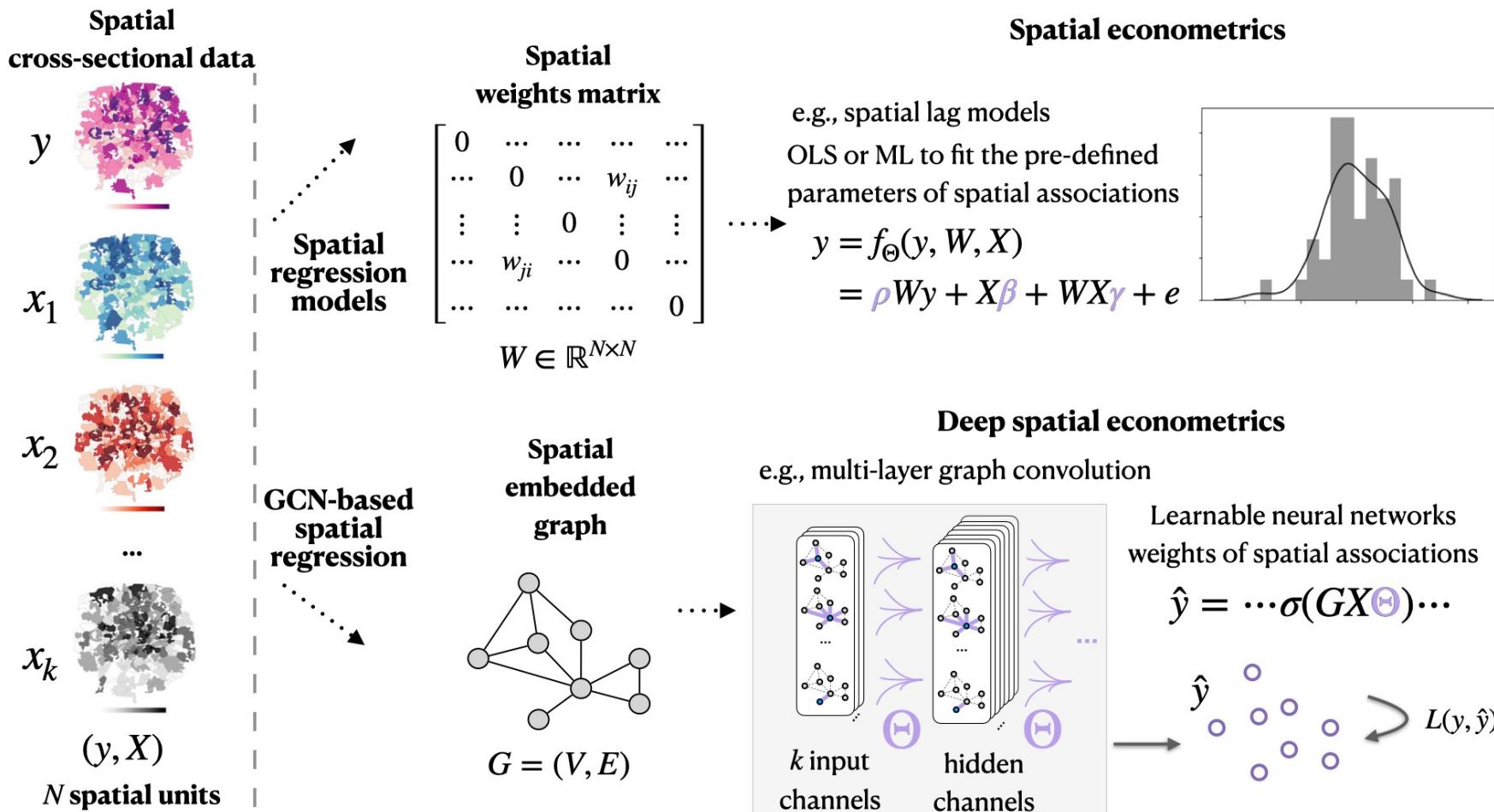
# GeoAI for spatial regression

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## ◆ Graph-based AI vs. spatial econometric models



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# GeoAI for spatial regression

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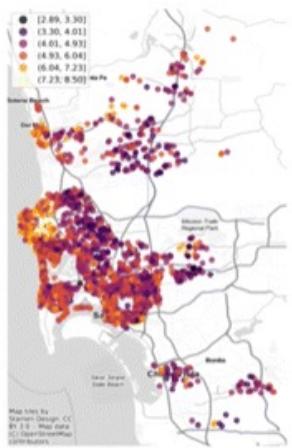


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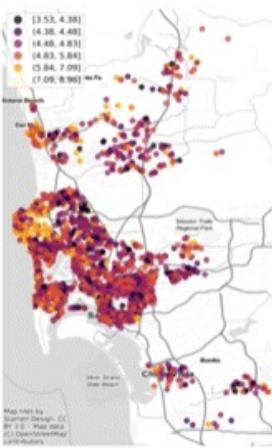
## ◆ Case for housing rental price prediction

- 6110 listings & 11 covariates at San Diego, C.A., U.S. on Jul. 07, 2016

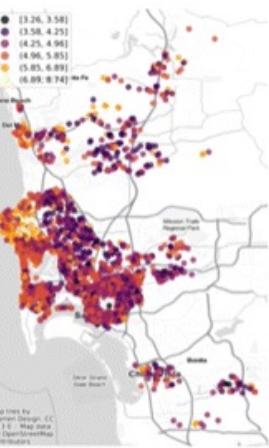
Data



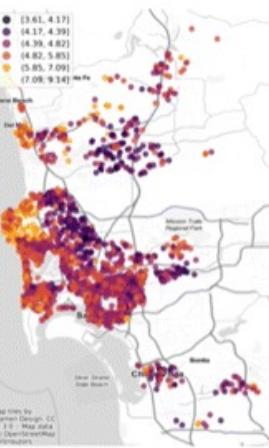
LR



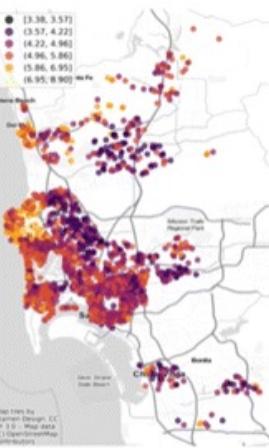
LR+



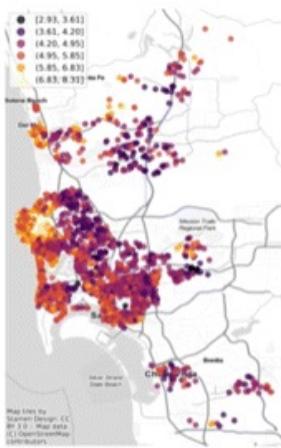
SAR



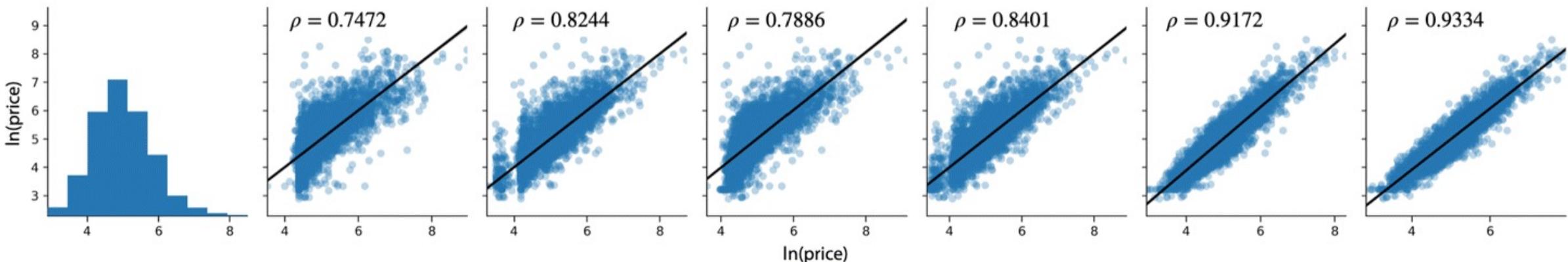
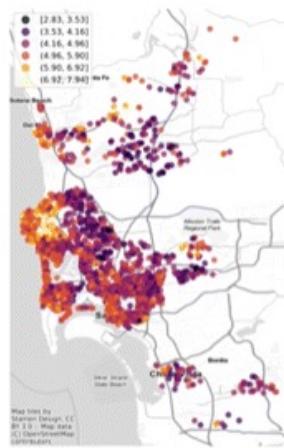
SAR+



SRGCNN-GW



SRGCNN-GW+



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## ◆ Transferability & Generalization

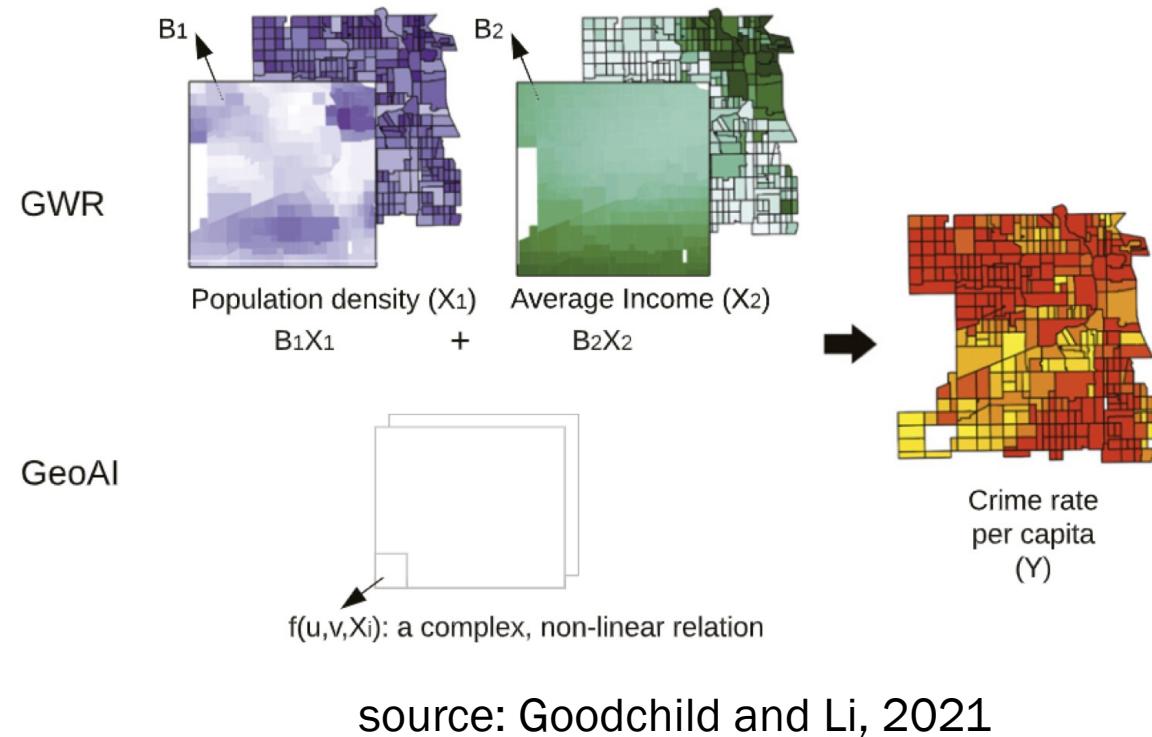
- Cross-State and Cross-Region spatial prediction

## ◆ Interpretability & Explainability

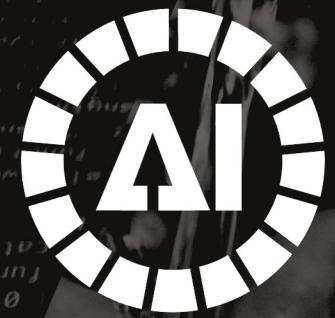
- Cross-Feature and Cross-Scale spatial reasoning

## ◆ Geospatial Uncertainty

- Weak-replicability of process
- Data, model and inductive biases
- ...



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# Thanks!



dizhu@umn.edu



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