

# Interdisciplinary Research

Computational Engineering in CEE



Xinyu Chen

Postdoc, MIT (now)

PhD, University of Montreal ('23)  
Civil Engineering (Transportation)

## Interests

- Advanced computing for engineering
- Urban system & mobility & demand
- Data-driven traffic flow modeling
- Climate system monitoring
- Machine learning & data science
- Optimization & math programming

### PhD (ML for Transportation)

- **Traffic imputation** w/ tensor decomposition  
[Chen et al.'19](#); [Chen et al.'21](#) in TR-C (cited 300+)  
[Chen et al.'22](#) in IEEE TITS (cited 100+)
- **Time series imputation** w/ Laplacian convolution  
[Chen et al.'24](#) in IEEE TKDE
- **Mobility prediction** w/ Bayesian optimization  
[Chen & Sun'22](#) in IEEE TPAMI (cited 250+)
- **Traffic prediction** w/ Hankel factorization  
[Chen et al.'24](#) in IJOC
- **Dynamic climate pattern discovery**  
[Chen et al.'24](#) in IEEE TKDE

### Postdoc (ML + Optimization for Spatiotemporal Data)

- **Tensor decomposition for ML**  
[Chen et al.'24](#), major revision in IEEE TPAMI
- **Causal inference from climate systems**  
[Chen et al.'24](#), 2nd-round review in IEEE TKDE
- **Mobility periodicity quantification w/ MIP**

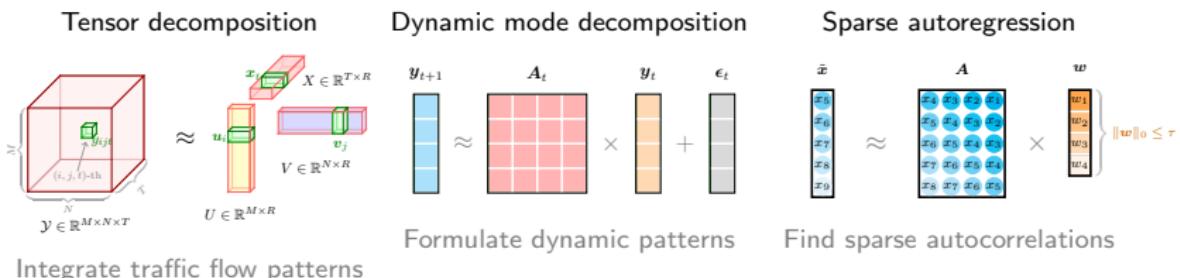


# Research Contributions

- Formulating engineering problems



- Advancing ML development



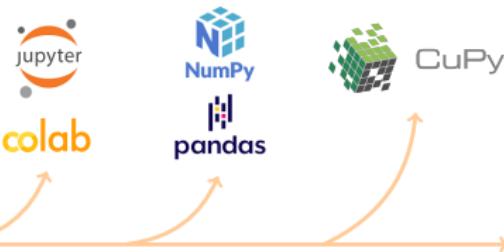
# Reproducible Research for Engineering

- The last mile of AI for computational engineering

Human mobility & smart cities  
Data-driven transport analytics  
Spatiotemporal data modeling  
Interpretable ML for causal inference  
Tensor decomposition for ML

...

Directions & Topics



Reproducible Research

- Open-source projects



**transdim**

(1,200+ GitHub stars)

ML for Transport Data Imputation

<https://github.com/xinychen/transdim>



**Tensor Decomposition for ML**

(ML initiative)

Math & ML Tutorials

<https://sites.mit.edu/tensor4ml>



**Spatiotemporal data modeling**

(Data science initiative)

Model Development of ML & Data Science

<https://spatiotemporal-data.github.io>

# **Building Research Impact at Vanderbilt**

CEE Collaboration

Synergistic with Vanderbilt's College of Connected Computing

## **Teaching & Grant**