

# Mengling Qiao

Associate Research Scientist, Columbia University

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## CORE COMPETENCIES

- Time-Series Analysis & Forecasting • Applied ML/DL • Spatial-Temporal Modeling & Analysis • Data Science • NLP • Applied Generative AI • Data-Driven Research

## EDUCATION

**Wuhan University** | Direct-Entry Ph.D. in *Geographic Information Science* | CN Sept. 2015 - Dec. 2020

- **Awards:** Recipient of 4 graduate studies scholarships×4 (10%), The Scholarship for Outstanding Freshmen (5%)

**Nanjing Normal University** | B.Sc. in *Geographic Information Science* | CN Sept. 2011 - Jun. 2015

- **Awards:** Recipient of Talent Scholarship (1%), Outstanding Student Scholarship (2%), National Encouragement Scholarship (1%)

## APPOINTMENTS

**Columbia University in the City of New York** New York, U.S.

**Associate & Postdoctoral Research Scientist** | *Earth and Environmental Engineering* Jan. 2023 - present

**Guest Lecturer** | *Civil Engineering & Engineering Mechanics* | *Data Science Institute* Jan. 2023 - Dec. 2024

- **Secured & Executed Two Multi-Institutional Projects:** Co-led \$600K projects on data-driven disaster response. Defined technical strategy and coordinated execution in multivariate time-series modeling, forecasting, and data engineering, driving project direction and ensuring all major milestones were met.
- **Comprehensive Knowledge Integration:** Synthesized 900+ academic papers and 400+ reports using AI tools to guide decisions.
- **Proposal Development & Technical Leadership:** Coordinated 3+ teams to prepare an NSF \$500K proposal on spatiotemporal ML/DL, graph modeling, and transfer learning for smart drainage simulation. (ongoing).

**The Hong Kong University of Science and Technology** Hong Kong, SAR

**Postdoctoral Fellowship** | *Computer Science & Engineering* Jul. 2022 - Jan. 2023

- **Rapid Proposal Development:** Led a team of 5 PhD students to develop an AR/VR research proposal, completed successfully within one week
- **Visual Analytics and Pipeline Optimization:** Supported decision-support systems and visualization projects; accelerated delivery by 4 months through improved pipeline design.
- **Awards:** Recipient of the [Research Talent Hub](#) of Hong Kong (HKD 431,264)

**The Chinese University of Hong Kong** Hong Kong, SAR

**Postdoctoral Fellowship** | *Geography and Resource Management* Jun. 2021 - Jul. 2022

- **Executed Project on Risk Modeling:** Led a \$450K project; developed indices and extended models for spatial-temporal risk quantification and prediction; delivered actionable insights for agencies using predictive analytics.
- **Outreach:** Delivered invited talks at multiple universities to disseminate findings.

## PROJECTS

**Resilience Metrics for High-Frequency Travel Behavior**  National Science Foundation (2023–2024)

- Developed time-series anomaly detection, cross-correlation models, and network-based resilience metrics by integrating multimodal, high-frequency transportation data (3+ million time-series records spanning subway, taxi, rideshare, bike); Built automated Python workflows, reducing manual processing by 40%.
- Quantified impacts: Ida accounted for 40% of anomalies, the subway most affected (23%); Citi Bike fastest to respond, FHV/taxi fastest to recover.

**Time-Series Modeling of Indicators for Public Safety** United States-Japan Foundation (2023–2024)

- Modeled 15-year city-level time series of climate, mobility, and census indicators using Bayesian models and multiple ML/DL to quantify city safety. Achieved  $R^2 = 0.85$  citywide, improving prediction accuracy by  $\approx 3\text{--}5\times$  over weaker baselines.
- Employed advanced feature analysis (Python Pipeline with SHAP model) to rank predictors and improve accuracy.

**Spatial-Temporal Risk Quantification and Prediction** The Chinese University of Hong Kong (2021–2022)

- Designed PCA-weighted time-series indices integrating mobility and demographic features to assess public health risk across multiple spatial scales. Achieved  $\approx 60\text{--}65\%$  stronger correlation with ground truth compared to traditional index (correlation improved from 0.48 to 0.79).
- Improved prediction accuracy by extending GTWR methods to capture dynamic time-series patterns in disease spread and community response; Outperformed baseline methods:  $R^2$  improved from 0.23 (OLS) to 0.93 (GTWR) in temporal models ( $\approx 300\%$  gain) and from 0.36 to 0.8 in spatial models ( $\approx 120\%$  gain).

### Social Media Posts and Street View Images Analytics

Multiple Studies (2018–2025)

- **Risk and Sentiment Modeling:** Built NLP (Chinese-BERT-wwm) and geospatial models to analyze 10+ million social media posts; identified public responses to heatwaves (F1-score = 0.97); geospatial models achieved enhanced model explanatory power with  $R^2 = 0.87$ , 1.5x higher than standard regression.
- **Street View–Driven Insights:** Developed computational frameworks integrating semantic and geometric features from 166K+ street view imagery and 125K+ building footprints, and human emotions from 1.6+million social media posts; applied Generalized Additive Mixed Model to capture nonlinear relationships of built environment and human well-being; Identified key thresholds, such as green view optimal at 45%.
- **Economic Segregation Analysis:** Built multilevel measures of economic segregation using large-scale human activity data from 15+ million social media, 121K+ customer review comments, and 39K+ property transaction records. The segregation index developed with TF-IDF weighting reveals finer-grained and more realistic economic segregation patterns than traditional methods.

## HIGHLIGHTS

- **Team Leadership:** Led applications for 3 grant attempts (1 funded, 1 under review); As PI for 1 research project; Led a capstone project ranked 1<sup>st</sup> of 6 teams; Supervised 3 graduate-level training projects on NLP, ML/DL, and Graph Theory (delivered 32+ invited classes for 30+ graduates); mentoring 2 graduate students at the [Data Science Institute](#).
- **Cross-Functional Engagement:** Led a 4-hour hands-on workshop on “ML/DL for socio-environmental data analytics” at I-GUIDE Forum 2025.
- **Project Delivery:** Acted as lead representative in a multi-PI research collaboration team, regularly presenting and coordinating across faculty and researchers; Managed multiple concurrent research timelines across universities and international collaborators, consistently delivering output on time.
- **Multi-Source Data Perspective:** Leveraged human activity data, spatial big data, and emerging technology-generated streams (sensors, imagery, IoT, social platforms) to uncover hidden dynamics beyond traditional sources, enabling improved forecasting, resilience assessment, and decision-making.
- **Research Impact**
  - Specialized in long-term and high-frequency time-series modeling across domains
  - Published 15+ peer-reviewed papers in top outlets and 2 book chapters, advancing methods in data-driven time-series analytics and resilient human-environment systems. *Full list:* [Google Scholar](#)
  - Delivered 10+ presentations at top-tier international conferences.
  - Served as Guest Editor for Applied Science Special Issue “Geospatial Data Processing, Mining and Application”.
  - Reviewer of 12+ international journals, delivering 40+ review reports

## SKILLS

- **Core Data Science & AI**
  - *ML & DL:* PyTorch, TensorFlow, Hugging Face Transformers, Scikit-Learn, NumPy, Pandas, CUDA, AWS
  - *Time-Series Analysis & Forecasting:* ARIMA/SARIMA, Prophet, LSTM/GRU, Bayesian, Anomaly Detection
  - *Spatial-Temporal Modeling:* Spatio-Temporal Regression, Spatial Panel Data Models.
  - *NLP:* Sentiment Analysis, Topic Modeling, LLMs (BERT, Hugging Face).
  - *Math & Stats:* Probability, Linear Algebra, Statistical Inference
  - *Graph & Network Science:* Graph-Based Modeling, Centrality Analysis, Modularity Detection, Random Walks.
- **Programming & Tools**
  - *Languages:* Python (10+ yrs), R, SQL, C#, Java
  - *Databases & Platforms:* Jupyter, MongoDB, Oracle
  - *GIS & Visualization:* ArcGIS, QGIS, Gephi, Origin.