

# Jinmeng Rao

Artificial Intelligence · Geographic Information System

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## Education

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### University of Wisconsin-Madison

Ph.D. in Geographic Information System

*Madison, United States*

*September 2019 - Present*

- **Advisor:** Prof. Song Gao
- **Key Coursework:** Spatial Analysis, Algorithm Design, Big Data System, Advanced Geocomputing, etc.

### Wuhan University

M.S. in Geographic Information System

*Wuhan, China*

*September 2016 - June 2019*

- **Advisor:** Prof. Qingyun Du
- **Key Coursework:** Machine Learning, Spatial Information Services, Geographic Information System, etc.

### Wuhan University

B.S. in Geographic Information System

*Wuhan, China*

*September 2012 - June 2016*

- **Advisor:** Prof. Shiliang Su
- **Key Coursework:** Advanced Mathematics, Linear Algebra, Probability Theory and Statistics, Discrete Mathematics, Object-Oriented Programming, Geographic Information System, Economic Geography, Urban Planning, Urban Environment Analysis, etc.

## Research Experience

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### University of Wisconsin-Madison

Research Assistant

*Madison, United States*

*September 2019 - Present*

- **Time-Series Data Analysis:** Used anonymous location data from over 45 million mobile phones to analyze the association between stay-at-home social distancing mandates and the spread of COVID-19.
- **Neighborhood Visual Appearance:** Applied street view images to quantify the multi-scale visual appearance of neighborhoods in Shenzhen, China. Used Geographically Weighted Principal Component Analysis to explore the varying multivariate structures of visual appearance.
- **Privacy-Preserving Data Publication:** Applied Long Short-Term Memory networks (LSTM) and Generative Adversarial Networks (GANs) to model spatiotemporal social media trajectory data and to generate privacy-preserving synthetic data for data publication.
- **Privacy Protection Techniques:** Worked with data privacy protection methods such as de-identification, K-anonymity, differential privacy; explored the effectiveness of location privacy protection techniques on massive spatiotemporal social media data.
- **Pedestrian Navigation:** Proposed an augmented reality pedestrian navigation method that uses landmarks as beacons to guide users in urban areas. Landmarks are detected using deep-learning-based models and then augmented by virtual signs.

### Wuhan University

Research Assistant

*Wuhan, China*

*September 2016 - June 2019*

- **Geospatial Data Processing:** Geospatial data processing and analysis using Qt, Python and open-source libraries such as Numpy, GDAL/OGR, and Shapely. Algorithms are parallelized and accelerated using multiprocessing and Cython.
- **Land Use Expansion Modeling:** Implemented an ensemble learning algorithm by stacking several machine learning algorithms such as Support Vector Machine and Random Forest to predict land use expansion. The model is implemented using Scikit-learn in Python.
- **Deep Learning Object Detection:** Designed a lightweight deep-learning-based object detection model for mobile devices. We integrated a convolutional neural network SqueezeNet into the Single-Shot MultiBox Detector.
- **Outdoor Augmented Reality:** Proposed an outdoor augmented reality method combining inertial/magnetic sensors, GPS, and spatial relationships. Developed an Android prototype.

## Professional Experience

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### Sturfee Inc.

Research Intern

*California, United States*

*June 2020 - August 2020*

- Camera pose estimation based on ground view image and satellite image.
- Ground feature filter using semantic segmentation on ground view images.
- Designed an algorithm for projecting image from ground view to satellite view.
- Designed an algorithm for automatic feature matching between ground view image and satellite image.

### Wuhan University

Network Center Assistant

*Wuhan, China*

*October 2017 - June 2019*

- Daily management and maintenance of the school's network and public servers.
- Design, development, and maintenance of the school's website and meeting room reservation system.

## Services & Honors

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Service	<b>Reviewer</b> , for Habitat International	2020
Service	<b>Reviewer</b> , for Land Use Policy	2020
Service	<b>Curriculum Committee Member</b> , Department of Geography, University of Wisconsin-Madison	2020
Service	<b>Student Assistant</b> , International Research Symposium on cartography and GIScience	2020
Service	<b>Volunteer</b> , the 2020 Wisconsin Land Information Association (WLIA)	2020
Service	<b>Volunteer</b> , ERASMUS+ GeoServices-4-Sustainability Project	2018
Honor	<b>Welcome Award</b> , Graduate School, University of Wisconsin-Madison	2019
Honor	<b>Outstanding Graduate Student</b> , Wuhan University	2018
Honor	<b>Silver Award</b> , China "Internet+" Innovation and Entrepreneurship Competition Hubei Final	2018
Honor	<b>The 1<sup>st</sup> Prize</b> , Wuhan University "Internet+" Innovation and Entrepreneurship Competition	2017
Honor	<b>National Scholarship</b> , Ministry of Education, China	2017
Honor	<b>National Scholarship</b> , Ministry of Education, China	2015
Honor	<b>The 1<sup>st</sup> Prize Scholarship</b> , Wuhan University	2015
Honor	<b>Merit Student</b> , Wuhan University	2015
Honor	<b>The 2<sup>nd</sup> Prize</b> , Foreign Language Translation Competition Hubei Final	2015
Honor	<b>The 3<sup>rd</sup> Prize</b> , SuperMap Cup National University GIS Contest	2014
Honor	<b>The 2<sup>nd</sup> Prize Scholarship</b> , Wuhan University	2013
Honor	<b>Merit Student</b> , Wuhan University	2013

## Publications

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- **Rao, J.\***, Gao, S., Kang, Y. and Huang, Q. (2020). LSTM-TrajGAN: A Deep Learning Approach to Trajectory Privacy Protection. In the Proceedings of the 11th International Conference on Geographic Information Science (GIScience 2021), pp. 1-16. (Accepted)
- **Rao, J.\***, Gao, S., Kang, Y. and Du, Q. (2020). Landmarks as Beacons: Pedestrian Navigation Based on Landmark Detection and Mobile Augmented Reality. AutoCarto 2020. (Accepted)
- **Rao, J.\***, Yu, J., Zhu, X., Du, T. and Ren, F. (2020). An Algorithm For Removing Invalid Pixels In Remote Sensing Images Based On Vector Boundary Extraction. Journal of Geomatics. (Accepted)
- Wu, C., Peng, N., Ma, X., Li, S., and **Rao, J.\***. (2020). Assessing multiscale visual appearance characteristics of neighbourhoods using geographically weighted principal component analysis in Shenzhen, China. Computers, Environment and Urban Systems. (Accepted)
- Kang, Y., Zhang, F.\*, Peng, W., Gao, S., **Rao, J.**, Duarte, F. and Ratti, C. (2020). Understanding house price appreciation using multi-source big geo-data and machine learning. Land Use Policy, 10 (4), 9-19.
- Kang, Y., Gao, S.\*, Liang, Y., Li, M., **Rao, J.**, and Kruse, J. (2020). Multiscale Dynamic Human Mobility Flow Dataset in the US during the COVID-19 Epidemic. Scientific Data (Under Review).
- Gao, S.\*, **Rao, J.**, Kang, Y., Liang, Y., Kruse, J., Dopfer, D., Sethi, A., Reyes, F., Yandell, B. and Patz J. (2020). Association of Mobile Phone Location Data Indications of Travel and Stay-at-Home Mandates With COVID-19 Infection Rates in the US. JAMA Network Open. 2020;3(9):e2020485.
- Gao, S.\*, **Rao, J.**, Kang, Y., Liang, Y. and Kruse, J. (2020). Mapping county-level mobility pattern changes in the United States in response to COVID-19. ACM SIGSPATIAL Special 12 (1), 16-26.
- Kang, Y.\*, **Rao, J.**, Peng, B., Gao, S., Roth, R. and Zhang F. (2020). Towards Cartographic Knowledge Encoding with Deep Learning: A Case Study of Building Generalization. AutoCarto 2020. (Accepted)
- Liang, Y., Gao, S.\*, Li, M., Kang, Y. and **Rao, J.** 2019, November. Analyzing the Gap Between Ride-hailing Location and Pick-up Location with Geographical Contexts. The 1st ACM SIGSPATIAL International Workshop on RAAS. ACM. (**Best Poster Paper**)
- Gao, S.\*, **Rao, J.**, Liu, X., Kang, Y., Huang, Q. and App, J. (2019). Exploring the effectiveness of geomasking techniques for protecting the geoprivacy of Twitter users. Journal of Spatial Information Science, 2019(19), 105-129.
- Gao, S.\*, Li, M., **Rao, J.**, Mai, G., Prestby, T. and Marks, J. (2019). Automatic Urban Road Map Generation from Massive GPS Trajectories of Taxis. BGD19.
- Qiao, Y.\*, **Rao, J.**, Wang, J., Du, Q. and Ren, F. (2017). Geographic Object Detection for Outdoor Augmented Reality. Geomatics World, 5, 011.
- **Rao, J.**, Qiao, Y., Ren, F., Wang, J. and Du, Q.\* (2017). A Mobile Outdoor Augmented Reality Method Combining Deep Learning Object Detection and Spatial Relationships for Geovisualization. Sensors, 17(9), 1951.

## Skills

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<b>Platform &amp; Software</b>	Windows, Linux, Android; Colab, Unity 3D, ArcGIS, QGIS, Microsoft Office, $\LaTeX$ , etc.
<b>Libraries</b>	Tensorflow, PyTorch, Jupyter, Scikit-learn, Numpy, Scipy, Pandas, Matplotlib, MySQL, PostgreSQL, etc.
<b>Programming</b>	Python, Java, C/C++, Qt, C#, Javascript+HTML+CSS, R, etc.
<b>Languages</b>	English (Fluent, 105/120 in TOEFL test), Chinese (Native)