Ran Tao, Ph.D.

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CONCENTRATION

Geographic Information Science, spatial interactions (OD flows), spatial statistics, spatial data mining, geovisualization, transportation and movement analysis

CURRENT APPOINTMENT

Aug 2017– **Lecturer**. Spatial Sciences Institute, Dornsife College of Letters, Arts and Sciences, University of Southern California, USA

EDUCATION

Ph.D. 2017 Geography and Urban Regional Analysis
University of North Carolina at Charlotte, USA
Dissertation: No Boundary for Spatial Interactions — Exploratory Spatial Flow Data Analysis. Advisor: Prof. Jean-Claude Thill

B.S. 2012 Remote Sensing Science and Technology
Wuhan University, China
Thesis: Impacts of High Speed Rail on Railroad Network Accessibility in China. Advisor: Prof. Zhixiang Fang

PUBLICATIONS

Peer-reviewed

1. **Ran Tao**, Jean-Claude Thill, Mona Kashiha, Craig Depken. (Submitted). Flow HDBSCAN: A Hierarchical and Density-Based Spatial Flow Cluster Analysis Method. *ACM SIGSPATIAL'17*
2. **Ran Tao**, Weixin Zhai, Ying Long. (Submitted). Explore Travel Behavior During China's Chunyun with Mobile Phone Location Data. *Computers, Environment and Urban Systems*.
3. Gang Chen, Jean-Claude Thill, **Ran Tao**. (Submitted). A Novel Integrated Pixel- and Object-based Algorithm to Map the Fine-scale (30m) Spatiotemporal Patterns of Rubber Plantations in Southeast Asia. *ISPRS Journal of Photogrammetry and Remote Sensing*.
4. **Ran Tao**, Jean-Claude Thill. (2016). A Density-Based Spatial Flow Cluster Detection Method. In *the Ninth International Conference on Geographic*

Information Science (GIScience2016) Short Paper Proceedings. Montreal, Canada: 288–291.

5. **Ran Tao**, Daniel Strandow, Michael Findley, Jean-Claude Thill, James Walsh. (2016). A Hybrid Approach to Modeling Territorial Control in Violent Armed Conflicts. *Transactions in GIS*, 20(3): 413–425.
6. **Ran Tao**, Jean-Claude Thill. (2016). Spatial Cluster Detection in Spatial Flow Data. *Geographical Analysis* 48(4): 355–372.
7. **Ran Tao**, Jean-Claude Thill, and Ikuho Yamada. (2015). Detecting Clustering Scales with the Incremental K-Function: Comparison Tests on Actual and Simulated Geospatial Datasets. In V. Popovich, M. Schrenk, K. Korolenko, and C. Claramunt (editors), *Information Fusion and Geographic Information Systems (IF&GIS'2015)*. Springer, Heidelberg, Germany: 93–107.
8. Shih-Lung Shaw, Zhixiang Fang, Shiwei Lu, **Ran Tao**. (2014). Impacts of High Speed Rail on Railroad Network Accessibility in China. *Journal of Transport Geography* 40: 112–122.
9. **Ran Tao**, Manzhu Yu. (2011). Comparative Study on Methods of Quantitative Identification of Sand and Dust Storm Based on MODIS Data, *Geomatics World* 09: 51–54 (in Chinese).

Manuscripts in preparation

1. **Ran Tao**, Jean-Claude Thill. FlowAMOEBA: Identify Regions of Anomalous Spatial Interactions and Create a Spatial Flow Weights Matrix. Plan to submit to *Geographical Analysis*.
2. **Ran Tao**, Jean-Claude Thill. Reveal Gang Crime Activities with Spatiotemporal Patterns of Motor Vehicle Theft and Recovery Locations. Plan to submit to *Applied Geography*.
3. Daniel Yonto, **Ran Tao**, Jean-Claude Thill. Where Does Gentrification Happen? Examine Distribution of Gentrification with Local Spatial Heteroscedasticity (LOSH). Plan to submit to *Environment and Planning A*.
4. **Ran Tao**, Anjun Hu, Jean-Claude Thill. The Spatial Pattern of Economic Impact by High-Speed Rail in China. Plan to submit to *The Annals of Regional Science*.

RESEARCH EXPERIENCE

2012–2017 **Research Assistant. Geography Department at UNC-Charlotte**

Dissertation research is focused on developing **three** exploratory spatial data analysis **methods for massive spatial flow data** in movement, migration, and crime events.

1. Developed a hot-flow detection method called **Flow K-function** for detecting both global and local patterns of flow's spatiotemporal distribution. Combined knowledge of spatial statistics and geovisualization. Implemented with **C++** program, boosted computation by **OpenMP** parallel computing technique, visualized with **ArcMap**, **D3.js**, **jflowmap**
2. Developed a flow clustering method called **Flow HDBSCAN** which integrates density-based clustering and hierarchical clustering methods.

Combined knowledge in spatial data mining, machine learning. Implemented with **Python** (scikit learn), visualized with **R** and **QGIS**
3. Developed a bottom-up approach called **FlowAMOEBA** to delineate regions of anomalous spatial interactions and create a spatial flow weights matrix. Combined knowledge of spatial statistics, geospatial modeling, and geovisualization. Implemented with **Python** (clusterPy), visualized with **ArcMap** and **QGIS**

2015–2017 **Research Assistant**. **Resources and Conflict Research Project**
Developed GIS approach to modeling territorial control in violent armed conflicts in Sub-Saharan Africa through network analysis on a hybrid transportation network. The initial version was implemented with **ArcGIS ModelBuilder**. Currently developing a **python-based QGIS plugin** to share the approach as handy tool to scholars at large
PI: Prof. James Walsh & Prof. Jean-Claude Thill (UNC Charlotte)

2016 **Research Assistant. Remote Sensing Research Project**
Applied remote sensing classification techniques to identify the spatial extent and age of rubber plantations in Myanmar. Implemented with **ENVI**, using **Landsat 8** satellite imagery
PI: Prof. Jean-Claude Thill & Prof. Gang Chen (UNC Charlotte)

2013–2014 **Research Assistant. Mecklenburg County Air Quality Project**
Applied GIS spatial analysis techniques to investigate environmental justice aspects of air quality in Mecklenburg County. More specifically, using **buffer analysis** and **spatial regression modeling** to evaluate how air pollution affect residents of different ethnicities
PI: Prof. Jean-Claude Thill (UNC Charlotte)

Summer 2013 **Research Assistant. North Carolina Forest Service Project**
Applied **cloud computing** (built a private "cloud" using **OpenStack**, also tested with **AWS EC2**) and **parallel computing** (**OpenMP** and **MPI** techniques using computing clusters of UNC-Charlotte) to enhancing the process of watershed delineation and land cover change modeling in North Carolina
PI: Prof. Wenwu Tang (UNC Charlotte)

2011–2012 **Research Associate. China's High-Speed Rail Research Project**
Quantify the influence of high-speed rails on the traditional railroad system in China. Calculated **network accessibility** (**C++**), modeled the socio-economic impacts with **spatial econometrics models** (**Stata**)
PI: Prof. Shih-Lung Shaw (University of Tennessee, Knoxville)

2010–2011 **Principal Investigator and Team Leader**. **Nationally Funded Undergraduate Key Research Project**

Analyzed the relationships between sand storms and vegetation, temperature, sand soil moisture using **MODIS** satellite imagery. Implemented with **ENVI**, **ERDAS**, and **ArcGIS**

TEACHING EXPERIENCE

Summer 2015 **Instructor. GEOG 1103 Spatial Thinking**
Provided students with an overview of spatial thinking fundamentals and introduced the latest geospatial technologies including online mapping, GIS, GPS, and remote sensing. Tailored syllabus and course structure for summer schedule, taught both lectures and labs, and administered all grades, guided students to design and finish their own final projects. (Student evaluation 4.7/5)

2013–2015 **Instructor. Workshop series of Project Mosaic**
Designed and instructed **10+ workshop**s for both faculties and graduate students in social sciences at UNC Charlotte. Each workshop is a 2-hour session including lecture and hands-on exercises. Covering topics of ArcGIS, cartography, spatial regression, spatial statistics, R, GeoDa, and high-performance computing

Spring 2014 **Teaching Assistant. GEOG 4105 Spatial Database**
Assisted Prof. Elizabeth Delmelle with leading labs, tutoring and grading students' coursework

Fall 2013 **Teaching Assistant. GEOG 6131 Research Design Fundamentals**
Assisted Prof. Jean-Claude Thill with leading discussion, tutoring and grading students' coursework

CONFERENCE PRESENTATIONS

1. **Ran Tao**, Jean-Claude Thill. A Density-Based Spatial Flow Cluster Detection Method. GIScience 2016. Montreal, Canada. September, 2016.
2. **Ran Tao**, Daniel Strandow, Michael Findley, Jean-Claude Thill, James Walsh. Calculating Drive-time Buffers and Territories with Sparse Road Network. Esri User Conference. San Diego, CA. June, 2016.
3. **Ran Tao**, Daniel Strandow, Michael Findley, Jean-Claude Thill, James Walsh. A Hybrid Model of Territorial Control in Violent Armed Conflicts. American Association of Geographers 2016 Annual Meeting. San Francisco, CA. April, 2016.
4. Jean-Claude Thill, **Ran Tao**, Ikuho Yamada. Detecting Clustering Scales with the Incremental K-function: Comparison Tests on Actual and Simulated Geospatial Datasets. 7th International Workshop on Information Fusion and Geographic Information Systems: Deep Virtualization for Mobile GIS, Grenoble, France. May, 2015.

5. **Ran Tao**, Jean-Claude Thill. Explore Vehicle Theft & Recovery Data in City of Charlotte. American Association of Geographers 2015 Annual Meeting. Chicago, IL. April, 2015.
6. **Ran Tao**, Anjun Hu, Jean-Claude Thill. The Spatial Pattern of Economic Impact by High-Speed Rail in China. American Association of Geographers 2014 Annual Meeting. Tampa, FL. April, 2014.
7. **Ran Tao**, Jean-Claude Thill. Detecting Spatial Clustering Pattern of Flow Data. 2013 Annual North American Meetings of the Regional Science Association International. Atlanta, GA. November, 2013.
8. **Ran Tao**, Jean-Claude Thill. A New Method to Detect Spatial Clustering of Flow Data. American Association of Geographers 2013 Annual Meeting. Los Angeles, CA. April, 2013.

HONORS AND AWARDS

Summer 2015	AWS in Education Grant award ($1,000 in AWS credit)
Summer 2015	UNC Charlotte TPDS teaching award ($4,500)
2012–2017	Tuition Award, Graduate Assistant Support Plan (GASP), UNC Charlotte
Sept 2013	Championship of North Carolina World Geography Bowl
June 2013	Travel Award of Open Science Grid (OSG) 2013 Summer School
July 2013	Travel Award of XSEDE (Extreme Science and Engineering Discovery Environment)

AFFILIATIONS AND SERVICES

2017–Present	Reviewer, *Cartography and Geographic Information Science* (1)
2017–Present	Reviewer, *Scientia Iranica* (1)
2017–Present	Reviewer, *Transactions in GIS* (1)
2014–Present	Reviewer, *Computers, Environment and Urban Systems* (5)
2015–2016	Member, Faculty search committee, Dept. of Geography and Earth Sciences, UNC Charlotte
2013–Present	Research Fellow, Center for Applied Geographic Information Science (CAGIS), UNC Charlotte
2013–Present	Member, Association of American Geographers (AAG)
2013–Present	Member, Regional Science Association International (RSAI)
2013–2014	Student Senator, GESGO (Geography and Earth Science Graduate Organization), UNC Charlotte

TECHNICAL SKILLS

C/C++, Python, R, ArcGIS, QGIS, GrassGIS, GeoDa, HTML, JavaScript, SQL, D3.js, OpenMP, MPI, ENVI, ERDAS, AWS, OpenStack, GeoServer