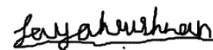# Jayakrishnan Ajayakumar | Curriculum Vitae

Population and Quantitative Health Sciences, School of Medicine, Case Western Reserve University, Cleveland, OH
Telephone: 234-281-5565 Email: jxa421@case.edu

Education

PhD in Geography — Kent State University, Kent, Ohio   2015 — 2019
Dissertation: Context in geographic data: How to explore, extract and analyze data from
spatial video and spatial video geonarratives Advisor: Dr. Andrew Curtis

MS in Digital Sciences — Kent State University, Kent, Ohio   2013 — 2015

B. Tech in Electrical and Electronics Engineering — Cochin University of Science and   2005 — 2009
Technology, Kochi Kerala India

Research Experience

Research Associate – GIS | Health & Hazards Lab, Case Western Reserve University   2019 – Now

- Developed software for the Identification of health risks in spatially encoded videos using Neural Networks.
- Continued development of multiple software to compress, collect, analyze and visualize spatially encoded video data and geonarratives
- Developed Parallel Computing based Spatio-temporal Cluster detector for Crime Analysis.
- Developed software to geo-mask with a reverse process option for collaborators sharing sensitive spatial health data.
- Providing programming, database, and spatial support for multiple projects in collaboration with University Hospitals (UH), Cleveland Clinic (CCF) and Ohio Hospital Association (OHA), and Cleveland Department of Public Health (CDPH)
- Co-developed GeoMEDD (which has a Contractor Invention Disclosure 2020-3825 (IP)), which is an early disease detection tool, currently used by OHA, CCF, UH and CDPH for Covid-19 case monitoring.

Graduate Research Assistant — GIS | Health & Hazards Lab, Kent State University   2016 — 2019

- Lab manager for GIS | Health & Hazards Lab, Kent State University

Duties include managing lab projects, providing technical support (computing, programming and GIS) for all GHH projects. Developing new spatial software solutions for processing Spatial Video Geonarratives (SVG) including

1. Wordmapper – A stand-alone software for conducting exploratory analysis with geonarratives
2. Spatial Video Explorer – A set of tools to collect, repair, synchronize, and visualize Spatial Videos
3. Spatial Video Geonarrative Filter – A spatial filter developed to assess the significance of spatial word clustering in narratives.

Graduate Research Assistant — High Performance Computing and GIS Laboratory, Kent State University   2014 — 2016

- Key contributor to Parallel Cartographic Modelling Language (PCML) (https://github.com/HPCGISLab/pcml)
- Key developer for Socio-Environmental Data Explorer (SEDE), a web-based system for spatial social media analysis (https://github.com/HPCGISLab/SEDE)
- Developed WebGIS systems to visualize and process Geonarratives through the web.

Summer Intern — Department of Physical Education, Kent State University   2014

- Developed Android based application that could help instructors to create surveys on sport injuries

Professional Experience

Senior Systems Engineer — Infosys Limited, Trivandrum Kerala India   2012 − 2013
- Worked for Point of Sales System (POS) with Apple Inc. as client
- Provided technical support for Apple Online Payment System
- Key developer in Apple Geo-based rollouts.

Systems Engineer — Tata Consultancy Services, Chennai Tamilnadu India   2009 − 2012
- Key developer and technical support person for Internet and Intranet Applications
- Key developer for a J2EE based Intranet Application that generates airline deals

Research

Refereed Publications

MacMurdo, M. G., Mulloy, K. B., Felix, C. W., Curtis, A. **J., Ajayakumar**, J., & Curtis, J. (2022). Ambient Air Pollution Exposure among Individuals Experiencing Unsheltered Homelessness. *Environmental Health Perspectives*, *130*(2), 027701.   2022

Jayakrishnan Ajayakumar, Andrew Curtis and Jacqueline Curtis. 2021. A clustering environment for real-time tracking and analysis of Covid-19 case clusters. In Proceedings of 2nd ACM SIGSPATIAL International Workshop on Spatial Computing for Epidemiology (SpatialEpi'21), November 2, 2021, Beijing, China. ACM, New York, NY, USA, 9 pages.   2021

Lorincz-Comi, N., **Ajayakumar, J.,** Curtis, J., Zhang, J., Curtis, A., & Lovell, R. (2021). Addressing uncertainty in census estimates. *Spatial Statistics*, 100523.   2021

Ajayakumar, J., Curtis, A. J., Rouzier, V., Pape, J. W., Bempah, S., Alam, M. T., & Morris, J. G. (2021). Exploring convolutional neural networks and spatial video for on-the-ground mapping in informal settlements. *International Journal of Health Geographics*, *20*(1), 1-17.   2021

Pilkington, S. F., Curtis, A., Mahmoud, H., van de Lindt, J., Smith, S., & **Ajayakumar, J.** (2021). Preliminary Documented Recovery Patterns and Observations from Video Cataloged Data of the 2011 Joplin, Missouri, Tornado. *Natural Hazards Review*, *22*(1), 05020015.   2021

Bempah, S., Odhiambo, L., Curtis, A., Pandit, A., Mofleh, D., **Ajayakumar, J.**, & Odhiambo, L. A. (2021). Fine Scale Replicable Risk Mapping in an Informal Settlement: A Case Study of Mathare, Nairobi. *Journal of Health Care for the Poor and Underserved*, *32*(1), 354-372.   2021

Curtis, A., **Ajayakumar, J.,** Curtis, J., Mihalik, S., Purohit, M., Scott, Z., & Goldberg, D. W. (2020). Geographic monitoring for early disease detection (GeoMEDD). *Scientific reports*, *10*(1), 1-11.   2020

Aghababaei, M., Koliou, M., Pilkington, S., Mahmoud, H., van de Lindt, J. W., Curtis, A., Smith, S., **Ajayakumar, J.**, & Watson, M. (2020). Validation of Time-Dependent Repair Recovery of the Building Stock Following the 2011 Joplin Tornado. *Natural Hazards Review*, *21*(4), 04020038. https://doi.org/10.1061/(ASCE)NH.1527-6996.000040.   2020

Bempah, S., Curtis, A., Awandare, G., & **Ajayakumar, J.** (2020). Appreciating the complexity of localized malaria risk in Ghana: Spatial data challenges and solutions. *Health & Place*, *64*, 102382.   2020

Ajayakumar, J., & Shook, E. (2020). Leveraging parallel spatio-temporal computing for crime analysis in large datasets: Analyzing trends in near-repeat phenomenon of crime in cities. *International Journal of Geographical Information Science*, *0*(0), 1–25.   2020

Ajayakumar, J., Curtis, A. J., & Curtis, J. (2019). Addressing the data guardian and geospatial scientist collaborator dilemma: How to share health records for spatial analysis while maintaining patient confidentiality. *International Journal of Health Geographics*, *18*(1), 30.   2019

Curtis, J., Curtis, A., Felix, C., **Ajayakumar, J.**, & Sponaugle-Schrock, T. (2019, November 5). *Using Novel Geospatial Approaches to Improve Health Service Delivery to the Homeless Population in a Rural County*. APHA's 2019 Annual Meeting and Expo (Nov. 2 - Nov. 6).   2019

Curtis, A., Tyner, J., **Ajayakumar, J.,** Kimsroy, S., & Ly, K.-C. (2019). Adding Spatial Context to the April 17, 1975 Evacuation of Phnom Penh: How Spatial Video Geonarratives Can Geographically Enrich Genocide Testimony. *GeoHumanities*, *5*(2), 386–404.   2019

Curtis, A., Curtis, J. W., **Ajayakumar, J.**, Jefferis, E., & Mitchell, S. (2019). Same space – different perspectives: Comparative analysis of geographic context through sketch maps and spatial video geonarratives. *International Journal of Geographical Information Science*, *33*(6), 1224–1250.   2019

Krystosik, A. R., Curtis, A., Mutuku, P., Bempah, S., **Ajayakumar, J.,** Odhiambo, L., Bisanzio, D., Forsyth, J., Mwashee, L., Adamz, B., & others. (2019). The Use of Spatial Video to Describe Localized Environmental Risk Patterns for Arboviral Transmission in Urban Kenya. *American Journal of Tropical Medicine and Hygiene*, *101*, 243–243.   2019

Curtis, A., Squires, R., Rouzier, V., Pape, J. W., **Ajayakumar, J.**, Bempah, S., & Morris Jr, J. G. (2019). Micro-Space Complexity and Context in the Space-Time Variation in Enteric Disease Risk for Three Informal Settlements of Port au Prince, Haiti. *International journal of environmental research and public health*, *16*(5), 807.   2019

Ajayakumar, J., Curtis, A., Smith, S., & Curtis, J. (2019). The Use of Geonarratives to Add Context to Fine Scale Geospatial Research. *International journal of environmental research and public health*, *16*(3), 515.   2019

Curtis, A., Bempah, S., **Ajayakumar, J.**, Mofleh, D., & Odhiambo, L. (2019). Spatial Video Health Risk Mapping in Informal Settlements: Correcting GPS Error. *International journal of environmental research and public health*, *16*(1), 33.   2019

Curtis, A., Curtis, J. W., **Ajayakumar, J.,** Jefferis, E., & Mitchell, S. (2018). Same space– different perspectives: comparative analysis of geographic context through sketch maps and spatial video geonarratives. *International Journal of Geographical Information Science*, 1-27.   2018

Curtis, A., Felix, C., Mitchell, S., **Ajayakumar, J.**, & Kerndt, P. R. (2018). Contextualizing Overdoses in Los Angeles's Skid Row between 2014 and 2016 by Leveraging the Spatial   2018

Knowledge of the Marginalized as a Resource. *Annals of the American Association of Geographers*, 1-16.

Krystosik, A. R., Curtis, A., Buritica, P., **Ajayakumar, J.,** Squires, R., Dávalos, D., & James, M. A. (2017). Community context and sub-neighborhood scale detail to explain dengue, chikungunya and Zika patterns in Cali, Colombia. *PloS one*, *12*(8), e0181208.

2017

Ajayakumar, J., & Ghazinour, K. (2017). I am at home: Spatial Privacy Concerns with Social Media Check-ins. *Procedia Computer Science*, *113*, 551-558.

2017

Ajayakumar, J., Shook, E., & Turner, V. K. (2017). Normalization Strategies for Enhancing Spatio-Temporal Analysis of Social Media Responses during Extreme Events: A Case Study based on Analysis of Four Extreme Events using Socio-Environmental Data Explorer (SEDE). *ISPRS Annals of Photogrammetry, Remote Sensing & Spatial Information Sciences*, *4*.

2017

Shook, E., Hodgson, M. E., Wang, S., Behzad, B., Soltani, K., Hiscox, A., & **Ajayakumar, J.** (2016). Parallel cartographic modeling: a methodology for parallelizing spatial data processing. *International Journal of Geographical Information Science*, 1-22.

2016

Musigdilok, V.V., Demeter, N.E., Burke, R.V., Shook, E., **Ajayakumar, J.,** Berg, B.M., Hawkins, M.D., Ferree, J., MacAloney, B.W., Chung, S., Pellegrino, J.L., Tolli, D., Hansen, G., Upperman, J.S. (2016). Assessing American Red Cross First Aid Mobile App User Trends: Implications for Resilience. American Journal of Disaster Medicine 10(4):273-283. DOI:10.5055/ajdm.2015.0209

2016

Presentation and Talks

J. Ajayakumar, A. Curtis, J. Curtis "A clustering environment for real-time tracking and analysis of Covid-19 case clusters". The 2nd ACM SIGSPATIAL International Workshop on Spatial Computing for Epidemiology, Beijing, China, Nov. 2, 2021

2021

Curtis, J., A. Curtis, C. Felix., **J. Ajayakumar** and T. Sponaugle-Schrock "Using Novel Geospatial Approaches to Improve Health Service Delivery to the Homeless Population in a Rural County". American Public Health Association, Philadelphia 2019.

2019

Curtis. A., Rouzier, V., **Ajayakumar, J.,** Bempah, S., Alam, M.T., Ali, A., Pape, J.W., and John Glenn Morris "Temporal and Spatial Variation in Cholera Risk in Three Informal Settlements of Port Au Prince, Haiti". International Health Conference, Oxford, UK. 2019

2019

Turner, V.K., Shook, E., and **Ajayakumar, J.** "Sarf 2.0: Transformations to the Social Amplification of Risk and Enabling New Social-Ecological Discovery Through Social Media" The Association of American Geographers 114th Annual Meeting, New Orleans, LA, Apr. 13, 2018.

2018

Ajayakumar, J., Shook, E. "Socio-environmental Data Explorer (SEDE): Leveraging Cyberinfrastructure for Quantitative and Qualitative Analysis of Big Social Media Data during Extreme Events". Robert-Raskin Student Competition, The Association of American Geographers 114th Annual Meeting, New Orleans, LA, April 10 - April 14, 2018.

2018

Ajayakumar, J., Shook, E., and Turner, VK. "Extracting Contextual Information from Spatio Temporal Social Media Data during Extreme Events using Socio-Environmental Data Explorer

2018

(SEDE): A Case Study based on Social Media Response to Tornadoes in the United States". The Association of American Geographers 114th Annual Meeting, New Orleans, LA, April 10 - April 14, 2018.

Ajayakumar, J., Shook, E. "Normalization Strategies for Enhancing Spatio-Temporal Analysis of Social Media Responses during Extreme Events: A Case Study based on Analysis of Four Extreme Events using Socio Environmental Data Explorer (SEDE).", 2nd International Symposium on Spatiotemporal Computing (ISSC), Harvard University, Cambridge, MA, August 7 – August 9, 2017. — 2017

Ajayakumar, J., Shook, E. "Spatio-temporal analysis of public response through Social media during extreme events", International symposium on Location-Based Social Media Data and Tracking Data, Washington DC, July 1 – July 2, 2017. — 2017

Ajayakumar, J., Shook, E. "Spatio-Temporal Social Media Analysis using Socio-Environmental data explorer (SEDE)". The Association of American Geographers 113th Annual Meeting, Boston, MA, April 5 - April 9, 2017. — 2017

Hill, A., Ajayakumar, J., Turner, V., and Shook, E. (2016). "Twitter and Media Response to Lead in Water After the Flint Water Crisis". 4th Annual Water and Land Symposium, Kent State University, Kent, OH, October 5-6, 2016. — 2016

Ajayakumar, J., Shook, E., and Turner, VK. "Socio-Environmental Data Explorer (SEDE)". The Association of American Geographers 112th Annual Meeting, San Francisco, CA, March 29 - April 2, 2016. — 2016

Ajayakumar, J., Shook, E., Curtis, A., and Curtis, J. "Web-based Framework for Geonarrative Mapping". East Lakes Division Of The AAG Annual Meeting, Kent, OH, October 9–10, 2015 — 2015

Musigdilok, V., Shook, E., **Ajayakumar, J.**, Burke, R.V., Berg, B., Demeter, N., Hawkins, M., Ferree, J., Pellegrino, J., Tolli, D., Hansen, G., Chung, S., and Upperman, J.S. "American Red Cross Scientific Advisory Committee Mobile Apps Study" American Red Cross Scientific Advisory Meeting, Washington, DC, June 2015. — 2015

Shook, E. and **Ajayakumar, J.** "Processing Points in the Parallel Cartographic Modeling Language" CyberGIS All Hands Meeting 2015, Reston, VA, September 14-16, 2015. — 2015

Shook, E., Turner, V.K, and **Ajayakumar, J.** "Socio-Environmental Data Explorer Computational Workflow" National Socio-Environmental Synthesis Center (SESYNC) Workshop: Kickoff Workshop: Socio-Environmental Data Explorer Workshop Series, Annapolis, MD, June 22-24, 2015. — 2015

Turner, V.K., Shook, E., and **Ajayakumar, J.** "Socio-Environmental Data Explorer (SEDE): Part I and II" National Socio-Environmental Synthesis Center (SESYNC) Workshop: Data-Intensive Analysis and Modeling Theme Meeting, Annapolis, MD, June 1-2, 2015. — 2015

Shook, E., and **Ajayakumar, J.** "Experiences using ROGER with the Parallel Cartographic Modeling Language" ROGER Supercomputer Meeting (Telecast presentation), June 2015. — 2015

Shook, E., **Ajayakumar, J.**, Vutla, S., and Kukkadapu, G. "Lowering Barriers for CyberGIS" The Association of American Geographers 111th Annual Meeting, Chicago, IL, April 21-25, 2015.

2015

Awards and Scholarship

University Fellowship for 2018-2019 academic year from the Division of Graduate Studies at Kent State University, Kent, Ohio

2018-2019

Top Five Finalist in Robert-Raskin Student Competition: "Socio-environmental Data Explorer (SEDE): Leveraging Cyberinfrastructure for Quantitative and Qualitative Analysis of Big Social Media Data during Extreme Events", The Association of American Geographers 114th Annual Meeting, New Orleans, LA, April 10 - April 14, 2018.

2018

Best Paper Award "Normalization strategies for enhancing spatio-temporal analysis of social media responses during extreme events: a case study based on analysis of four extreme events using socio-environmental data explorer (SEDE).", 2nd International Symposium on Spatiotemporal Computing (ISSC), Harvard University, Cambridge, MA, August 7 – August 9, 2017. (http://sites.cloud.gmu.edu/issc2017/bestpaper.php)

2017

Winner, Best Reflection of Symposium Theme: "Social Media and Diffusion: Understanding the impact of geography on the diffusion of information via social media". University Consortium for Geographic Information Science (UCGIS) Symposium, Arlington, VA, May 23 – May 25, 2017. (http://www.ucgis.org/student-posters-2017)

2017

Acceptance to University Consortium for Geographic Information Science (UCGIS) summer school themed Collaborative Problem Solving with CyberGIS and Geospatial Data Science with scholarship of $2000 for workshop and symposium, Champaign, IL and Arlington, VA, May 15 – May 25, 2017

2017

Reviewer

ISPRS International Journal of Geo-Information	2018-Present
International Journal of Health Geographics	2018-Present
International Journal of Geographical Information Science	2020-Present
International Journal of Environmental Research and Public Health	2019-Present
Healthcare	2019-Present
Transactions in GIS	2019-Present

Selected Research Projects

2021   **Covid-19 Syndromic Surveillance for University Hospitals,** Case Western Reserve University
As a member of the Covid-19 Syndromic Surveillance Team, I have developed multiple software's which has been be used for geographical monitoring of Covid-19 cases. Apart from Covid-19 case monitoring, I have designed and developed a completely automated spatial database system, which was used for analyzing spatial

data from various hospital data sources such as Emergency Department Admissions (ED) and Emergency Management System (EMS). Such level of detailed fine-grained spatial insights proved to be particularly useful for the hospital system to develop intervention strategies as well as prepare for disease flare-ups and surges.

2021   **GeoMEDD (Geographic monitoring for early disease detection)**, Case Western Reserve University
GeoMEDD is a syndromic surveillance system, which utilizes a combination clustering methodology and spatial database for identifying emerging disease patterns. GeoMEDD was first employed for the Covid-19 (Coronavirus-2019) syndromic surveillance for University Hospitals (UH) which was later taken up by Cleveland Clinic Foundation (CCF), and Ohio Hospital Association (OHA). The entire pipeline is completely automated and has been extensively used by hospital systems for identifying disease outbreaks and for devising intervention strategies. The current GeoMEDD system that is deployed in UH hospital environment handles real-time disease data and other contextual data sources. The main technology stack include PostgreSQL (database), PostGIS (spatial package for database), and Python.

2021   **Automatic Environmental Health Risk Detection from Spatial Videos using Convolutional Neural Networks**, Case Western Reserve University
As a part of a collaborative project with University of Florida on understanding the nexus between environmental risks and Cholera in Haiti, I have developed a machine-learning model to identify environmental risk factors such as trash, open drain, and standing water from spatial videos. The completely automated system can effectively reduce the labor of manually classifying and mapping environmental risk. The main technology stack include Tensorflow (for convolution neural networks), and Python.

2020   **Parallel Near Repeat Calculator,** Case Western Reserve University
A scalable software for identifying and statistically assessing the significance of space-time clusters in very large (Big) datasets. The software was initially tested on a crime dataset from the City of Chicago containing 2 million crime events. The entire test was conducted on a cluster environment provided by Pittsburg Super Computing Center. The experiment results shows that the near repeat calculator is scalable with large datasets in a high performance-computing environment (HPCE). The main technology stack include Python and multiprocessing.

2020   **Privy**, Case Western Reserve University
Privy is a standalone software developed for geomasking spatial confidential data and enable health practitioners to share health data. The standalone nature of the software helps researchers to run the software in secure environments without any external connections. Mathematically, privy utilizes a combination of affine and rotational transformation for masking spatial data. The technological stack used for the software include PyQT and Python.

2019   **Wordmapper,** Kent State University
Wordmapper is a standalone software developed to extract, synthesize, and analyze geonarratives obtained from transcriptions and associated Global Positioning System (GPS) coordinates. The narratives that have been combined with the GPS coordinates can further be spatialized and used for mapping as well as for spatial analysis. The software has an interactive visualization user interface, a query module, and a categorical coding module to perform qualitative coding and analysis. The technological stack used for the software include PyQT, GoogleMaps API, Natural Language Toolkit and Python. Currently, the software is used by different research groups for performing spatial narrative-based analysis.

2019   **Spatial Video Player Explorer**, Kent State University
Spatial Video Player Explorer is a suite of exploratory tools for analyzing spatial videos. The spatial video library, which is a module in spatial video explorer, is used to efficiently perform spatial queries using spatial video as the source. The GPS correction module in the spatial video explorer is used to correct or completely create a new GPS path for an existing spatial video source. The spatial video explorer module helps to view multiple spatial videos simultaneously along with an interactive map for visualizing the path traversed. Further, the end user can create new spatial layers from scratch through the software.

2014   **Socio-Environmental Data Explorer (SEDE),** Kent State University
SEDE is designed as a tool to capture public response through social media during natural disasters and other environmental catastrophes. SEDE is designed as a social-media enhanced decision support system that gathers real-time streaming social media and environmental data, synthesize the data and supports real-time

interactive querying and qualitative coding analysis. Currently SEDE hosts around 5 billion spatial tagged tweets from all over the world. Technology stack for SEDE includes Java, J2EE, Servlets, JSP, and PostgreSQL database.

2013   **Parallel Cartographic Modelling Language (PCML),** Kent State University
PCML is a computing language developed for GIScientists with a vision to improve (1) usability, (2) programmability, and (3) scalability. It supports declarative parallelism and helps researchers with no parallel programming skills to completely leverage computing resources available at HPCE environments. The main technological stack include Python Multiprocessing, MPI, Numba, and Numpy.

Technical Skills

SOFTWARE DEVELOPMENT

Programming Languages

Python, Java, C++, C

Parallel Programming Frameworks

Python Multiprocessing, MPI, OpenMP, CUDA, Dask

Deep Learning Frameworks

Tensorflow, Keras

WEB PROGRAMMING

J2EE, JavaScript, JQuery, HTML5, Data Driven Documents (D3.js), CSS, AJAX, Google Maps API, Flask

DATABASE

PostgreSQL (with PostGIS), MySQL, Oracle

SOFTWARE

ArcGIS, Quantum GIS (QGIS), GDAL

Tool Development and Contributions

- **GeoMEDD** - Developer for the clustering software
  (https://github.com/JayakrishnanAjayakumar/SyndromicSurveillance)
- **Privy –** Sole developer for a standalone software developed to mask geospatial health
  data.(https://github.com/ghhlab/confidentiality)
- **Wordmapper –** Sole developer for a standalone software that can process, analyze and visualize geonarratives.
  (https://github.com/JayakrishnanAjayakumar/Wordmapper)
- **PCML –** Major contribution for developing libraries for parallel raster processing
  (https://github.com/HPCGISLab/pcml)
- **Socio Environmental Data Explorer (SEDE) –** Sole developer for a web-GIS software for exploratory analysis of Large Scale Social Media Data. (https://github.com/HPCGISLab/SEDE)
- **Spatial Video Explorer –** Sole developer for a software suite, which contains functionalities for collecting, editing and visualizing spatial videos.

- **Spatial Video Filter** – Sole developer for a standalone software which can be used to perform statistical analysis with spatially-cued words extracted from geonarratives.
- **Parallel Near-repeat Calculator** – Sole developer for a standalone software designed on the principals of parallel spatial computing to perform near-repeat analysis on large scale crime data. (https://github.com/JayakrishnanAjayakumar/Near-Repeat-Calculator)

GitHub: https://github.com/JayakrishnanAjayakumar

Scholar : https://scholar.google.com/citations?user=rpVPNa8AAAAJ&hl=en&oi=ao

Teaching & Education Support

2021	Multiple Invited Guest Lecture for **An Introduction to GIS in Health & Social Sciences**. Taught various spatial concepts involving Spatial analysis, Point Pattern Analysis and Spatial Clustering. Provided technical support for students. (Case Western Reserve University)
2021	Invited Guest Lecture for **Introduction to GIS**. Taught various GIS concepts and modifiable area unit problem (MAUP). (Case Western Reserve University)
2020	Invited Guest Lecture for **An Introduction to GIS in Health & Social Sciences**. Taught concepts related to spatial big data sources. (Case Western Reserve University)
2019	Invited Guest Lecture for **Introduction to GIS**. Taught concepts related to Geo-computation, parallel spatial computing and spatial social-media analysis. (Case Western Reserve University)
2017	Invited Guest Lecture for **Spatial Programming and Database**. Taught concepts related to spatial social media streaming data analysis and concepts related to spatial databases. Introduced students to use Anaconda (Environment for Python programming), Jupyter Notebooks (web interface for Python programming), and techniques to extract geo-tagged tweets using Twitter API. Introduced students to spatial computing and the challenges associated with big geospatial data. (Kent State University)
2016	Provided in-class software demonstrations and technical support for the students in **Medical Geography** class. Provided technical assistance for students with their final projects. (Kent State University)
2015	Provided technical support for students in **Web-and-Mobile GIS** class. Helped students with developing interactive web pages using Html5, Javascript, and Google Maps API.