Jayakrishnan Ajayakumar | **Curriculum Vitae**

Senior Research Associate, 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 Technology, Kochi Kerala India 2005 — 2009

Research Experience

Senior Research Associate - GIS | Health & Hazards Lab, Case Western Reserve University (2022 – Current)

- Designed and developed multiple geospatial analytic systems for various research endeavors such as exploratory analysis of **Environmental and Epidemiological data**, assessing **environmental changes** using spatially embedded videos by building **AI models**, and understanding the **spatial privacy vulnerabilities** associated with spatial data sources such as Zip+4 codes.
- Designed and taught a full semester course **Geospatial Analytics for Bio-Health Informatics** (PQHS-427) as well as co-taught **An Introduction to GIS in Health and Social Sciences** (MPHP-426).
- Designed and Developed two modules "Big Data" and "Geospatial Data" for the **National Science Foundation (NSF)** funded Hour of CI project with a focus on Cyber Literacy and GIScience (invited).
- Involved in grant writing for **multiple NIH funded R21 projects** such as medical transport services and fine-scale environment risk analysis in Goma, DRC.
- **Reviewer for multiple reputed journals** such as Nature Scientific Reports and Nature Scientific Data.

Research Associate - GIS | Health & Hazards Lab, Case Western Reserve University (2019 – 2022)

- Designed and developed multiple software systems to **improve health-related research** that spans **AI, spatially encoded video, cluster detection, and geo-masking** for privacy preservation.
- Providing programming, database, and spatial support for **multiple funded projects** in collaboration with University Hospitals (UH), Cleveland Clinic (CCF), Ohio Hospital Association (OHA), and Cleveland Department of Public Health (CDPH).
- **Co-investigator** in multiple funded projects from **Ohio Department of Education (ODE)**
- 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.
- Designed and Developed and co-taught multiple courses such as **Geospatial Data in Health** (MPHP-499), **Python Programming in Computing in Bio-Health Informatics** (PQHS-416), and **An Introduction to GIS in Health and Social Sciences** (MPHP-426).
- Provided **peer review support** for multiple **flagship journals** such as American Association of Geographers (AAG) and International Journal of Geographic Information Science (IJGIS)

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

- Designed and developed computational techniques to analyze Spatially Embedded Videos, Spatial Video Geonarratives, and developed new spatial methods for capturing statistically significant clusters from spatial grids (funded through University Fellowship at Kent State University).
- Multiple invited lectures in **Introduction to GIS, and Spatial Programming and Databases.**
- Provided **peer review support** for GIS journals such as **Transactions in GIS and Cartographic and Geographic Information Science.**

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

Refereed Publications

Lovell, R. E., Lorincz-Comi, N., Curtis, J., Curtis, A., **Ajayakumar, J.**, & Caparole, L. (2025). Neighborhood level predictors of rape: A novel spatial regression approach. *Journal of Criminal Justice*, *98*, 102419. https://doi.org/10.1016/j.jcrimjus.2025.102419

Maisha, F. M., Curtis, A. J., **Ajayakumar, J.**, Kakongo, R. K., Siku, E., Ali, A., & Morris, J. G. (2025). Cholera risk in Goma, DR Congo, after forced clearing of relief camps. *The Lancet*, *405*(10490), 1658–1659. https://doi.org/10.1016/S0140-6736(25)00658-0

Lorincz-Comi, N., Yang, Y., **Ajayakumar, J.**, Mews, M., Bermudez, V., Bush, W., & Zhu, X. (2025). HORNET: Tools to find genes with causal evidence and their regulatory networks using eQTLs. *Bioinformatics Advances*, *5*(1), vbaf068. https://doi.org/10.1093/bioadv/vbaf068

Ajayakumar, J., Curtis, A. J., Maisha, F. M., Bempah, S., Ali, A., Kannan, N., Armstrong, G., & Morris, J. G. (2024). Using spatial video and deep learning for automated mapping of ground-level context in relief camps. *International Journal of Health Geographics*, *23*(1), 23. https://doi.org/10.1186/s12942-024-00382-7

Jackson, J., Ewanyshyn, A., Perry, S., Ens, T., Ginn, C., Keanna, C., Armstrong, G., **Ajayakumar, J.**, Curtis, J., & Curtis, A. (2024). Using spatial video geonarratives to improve nursing care for people who use drugs and experience homelessness: A methodology for nurses. *Journal of Advanced Nursing*, *80*(8), 3432–3441. https://doi.org/10.1111/jan.16004

Mavian, C. N., Tagliamonte, M. S., Alam, M. T., Sakib, S. N., Cash, M. N., Moir, M., Jimenez, J. P., Riva, A., Nelson, E. J., Cato, E. T., **Ajayakumar, J.**, Louis, R., Curtis, A., De Rochars, V. M. B., Rouzier, V., Pape, J. W., de Oliveira, T., Morris, J. G., Salemi, M., & Ali, A. (2023). Ancestral Origin and Dissemination Dynamics of Reemerging Toxigenic Vibrio cholerae, Haiti. *Emerging Infectious Diseases*, *29*(10), 2073–2082. https://doi.org/10.3201/eid2910.230554

Culbert, A. A., Ren, B. O., Maheshwer, B., Curtis, A., **Ajayakumar, J.**, Gilmore, A., Hardesty, C., Mistovich, R. J., Son-Hing, J., Liu, R. W., & Glotzbecker, M. P. (2023). Disparities in Pediatric Orthopedic Surgery Care During the COVID-19 Pandemic Pre-vaccine and Post-Vaccine Availability. Journal of Pediatric Orthopedics, 43(8), 529–535. https://doi.org/10.1097/BPO.0000000000002469

Ajayakumar, J., Curtis, A., & Curtis, J. (2023). The utility of Zip4 codes in spatial epidemiological analysis. PLOS ONE, 18(5). https://doi.org/10.1371/journal.pone.0285552

McCloskey, C., Zeller, J., Berk, A., Patil, N., **Ajayakumar, J.,** Curtis, A., & Curtis, J. (2023). Prevalence and geographic features of patients eligible for extracorporeal cardiopulmonary resuscitation. Resuscitation, 188, 109837. https://doi.org/10.1016/j.resuscitation.2023.109837

Curtis, A. J., Maisha, F., **Ajayakumar, J.**, Bempah, S., Ali, A., & Morris, J. G. (2022). The Use of Spatial Video to Map Dynamic and Challenging Environments: A Case Study of Cholera Risk in the Mujoga Relief Camp, D.R.C. Tropical Medicine and Infectious Disease, 7(10), Article 10. https://doi.org/10.3390/tropicalmed7100257

Miller, A. K., Gordon, J. C., Curtis, J. W., **Ajayakumar, J.**, Schumacher, F. R., & Avril, S. (2022). The Geographic Context of Racial Disparities in Aggressive Endometrial Cancer Subtypes: Integrating Social and Environmental Aspects to Discern Biological Outcomes. International Journal of Environmental Research and Public Health, 19(14), 8613. https://doi.org/10.3390/ijerph19148613

Curtis, A. J., **Ajayakumar, J.**, Curtis, J., & Brown, S. (2022). Spatial Syndromic Surveillance and COVID-19 in the U.S.: Local Cluster Mapping for Pandemic Preparedness. International Journal of Environmental Research and Public Health, 19(15), 8931. https://doi.org/10.3390/ijerph19158931

Ajayakumar, J., Curtis, A. J., Rouzier, V., Pape, J. W., Bempah, S., Alam, M. T., Alam, Md. M., Rashid, M. H., Ali, A., & Morris, J. G. (2022). Spatial Video and EpiExplorer: A Field Strategy to Contextualize Enteric Disease Risk in Slum Environments. International Journal of Environmental Research and Public Health, 19(15), 8902. https://doi.org/10.3390/ijerph 19158902

Bempah, S., Curtis, A., Awandare, G., **Ajayakumar, J.**, & Nyakoe, N. (2022). The health-trash nexus in challenging environments: A spatial mixed methods analysis of Accra, Ghana. Applied Geography, 143, 102701. https://doi.org/10.1016/j.apgeog.2022.102701

MacMurdo, M. G., Mulloy, K. B., Culver, D. A., Felix, C. W., Curtis, A. J., **Ajayakumar, J.**, & Curtis, J. (2022). Mapping Mobility: Utilizing Local-Knowledge-Derived Activity Space to Estimate Exposure to Ambient Air Pollution among Individuals Experiencing Unsheltered Homelessness. International Journal of Environmental Research and Public Health, 19(10), Article 10. https://doi.org/10.3390/ijerph19105842

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. https://doi.org/10.1289/EHP10414

Ajayakumar, J., Curtis, A., & Curtis, J. (2021). A clustering environment for real-time tracking and analysis of Covid-19 case clusters. Proceedings of the 2nd ACM SIGSPATIAL International Workshop on Spatial Computing for Epidemiology (SpatialEpi 2021), 1–9.

Lorincz-Comi, N., **Ajayakumar, J.**, Curtis, J., Zhang, J., Curtis, A., & Lovell, R. (2021). Addressing uncertainty in census estimates. Spatial Statistics, 45, 100523. https://doi.org/10.1016/j.spasta.2021.100523

Ajayakumar, J., Curtis, A. J., Rouzier, V., Pape, J. W., Bempah, S., Alam, M. T., Alam, Md. M., Rashid, M. H., Ali, A., & 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), 5. https://doi.org/10.1186/s12942-021-00259-z

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. https://doi.org/10.1061/(ASCE)NH.1527-6996.0000425

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. https://doi.org/10.1353/hpu.2021.0028

Curtis, A., **Ajayakumar, J.**, Curtis, J., Mihalik, S., Purohit, M., Scott, Z., Muisyo, J., Labadorf, J., Vijitakula, S., Yax, J., & Goldberg, D. W. (2020). Geographic monitoring for early disease detection (GeoMEDD). Scientific Reports, 10, 21753. https://doi.org/10.1038/s41598-020-78704-5

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.1527-6996.0000408

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. https://doi.org/10.1016/j.healthplace.2020.102382

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, 34(9), 1683–1707. https://doi.org/10.1080/13658816.2020.1732393

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. https://doi.org/10.1186/s12942-019-0194-8

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. https://doi.org/10.1080/2373566X.2019.1624186

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.

Curtis, A., Squires, R., Rouzier, V., Pape, J. W., **Ajayakumar, J.**, Bempah, S., Taifur Alam, M., Alam,

M. M., Rashid, M. H., Ali, A., & Morris, 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. https://doi.org/10.3390/ijerph16050807

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. https://doi.org/10.3390/ijerph16030515

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), Article 1. https://doi.org/10.3390/ijerph16010033

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 Knowledge of the Marginalized as a Resource. Annals of the American Association of Geographers, 108(6), 1521–1536. https://doi.org/10.1080/24694452.2018.1471386

Krystosik, A. R., Curtis, A., Buritica, P., **Ajayakumar, J.**, Squires, R., Dávalos, D., Pacheco, R., Bhatta, M. P., & 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. https://doi.org/10.1371/journal.pone.0181208

Ajayakumar, J., & Ghazinour, K. (2017). I am at home: Spatial Privacy Concerns with Social Media Check-ins. Procedia Computer Science, 113, 551–558. https://doi.org/10.1016/j.procs.2017.08.278

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 the Photogrammetry, Remote Sensing and Spatial Information Sciences, IV -4-W2, 139–146. https://doi.org/10.5194/isprs-annals-IV-4-W2-139-2017

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, 30(12), 2355–2376. https://doi.org/10.1080/13658816.2016.1172714

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. (2015). Assessing American Red Cross First Aid mobile app user trends: Implications for resilience. American Journal of Disaster Medicine, 10(4), 273–283. https://doi.org/10.5055/ajdm.2015.0209

Refereed Book Chapters

Curtis, A., Curtis, J., **Ajayakumar, J.**, & Jefferis, E. (2025). Using Spatial Mixed Methods to Reveal the Geographic Nuances of Opioid Overdose Patterns in Small and Rural Towns. In M. Leitner (Ed.), *New Research in Crime Modeling and Mapping Using Geospatial Technologies* (pp. 211–230). Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-81580-5_10

Curtis, A., Tyner, J., **Ajayakumar, J.**, Kimsroy, S., & Ly, K.-C. (2022). Adding Spatial Context to the 17 April 1975 Evacuation of Phnom Penh: How Spatial Video Geonarratives Can Geographically Enrich Genocide Testimony. In Routledge Handbook of the Digital Environmental Humanities. Routledge.

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. In Uncertainty and Context in GIScience and Geography: Challenges in the Era of Geospatial Big Data. Routledge. https://doi.org/10.4324/9781003123842

Curtis, A., Curtis, J., **Ajayakumar, J.**, & Jefferis, E. (2025). Using Spatial Mixed Methods to Reveal the Geographic Nuances of Opioid Overdose Patterns in Small and Rural Towns. In *New Research in Crime Modeling and Mapping Using Geospatial Technologies* (pp. 211-230). Cham: Springer Nature Switzerland.

Research and Funding Support

Co-PI, National Institutes of Health R21 Using the Reportable Disease Mapping (REDMAP) platform and Geospatial Information Systems (GIS) to discover novel barriers to HIV screening in Cuyahoga County", Justin Yax, DO (UH) PI ($442,750) 15% Effort — 2025-2027

Senior Personnel, National Institutes of Health R21 MD018435-01 Using spatial analytics and social determinants of health to redefine critical access to medical transport services for rural populations. — 2023-2028

Developing a national level spatial database for medical transport services.

Senior Personnel, Cleveland Department of Public Health Spatial Epidemiology collaboration with Case Western Reserve University. — 2023

Provided consultation services for designing various spatial intervention strategies

Senior Personnel, National Institutes of Health (**University of Florida Subaward) RO1 Al138554** Cholera in Goma, DRC Curtis PI for CWRU. — 2023-2024

Designed and developed various spatial analytics for understanding the environmental impact on Cholera outbreaks in Goma, DRC.

Co-PI, Ohio Department of Higher Education Geographic Monitoring for Early Disease Detection (GeoMEDD): An Actionable Warning System for Opiate Overdoses in Ohio ($221,573) — 2022

Modified the GeoMEDD clustering algorithm for identifying clusters of overdoses in Ohio

Co-PI, Ohio Hospital Association Case GIS Health & Hazards Lab (Curtis Lab) Building GeoMEDD ($156,975) Covid-19 Surveillance Infrastructure for Ohio Hospital Association — 2021

Implemented a state-wide syndromic surveillance system with a spatial database at its core.

Senior Personnel, University Hospitals of Cleveland UH Venture – Curtis GIS Lab ($535,799) Curtis PI — 2020-2022

Provided spatial support for university hospitals by designing various spatial analytic systems including a syndromic surveillance system and the GeoMEDD clustering algorithm.

Senior Personnel, Cleveland Department of Public Health Cleveland Department of Public Health collaboration with Case Western Reserve University. 2020-2022

Implemented syndromic surveillance system and GeoMEDD clustering algorithms to track Covid-19 spread in Cleveland.

Senior Personnel, University Hospitals of Cleveland UH Venture – Curtis GIS Lab ($179,550) Curtis PI 2020

Member of the spatial response team to Covid-19 outbreak in Northeast Ohio. Developed various analytics to identify hotspots and strategize intervention.

Co-PI,Ohio Department of Higher Education Third Frontier Research Incentive Mapping Expert Knowledge to Identify the Geographic Context of Opiate Use. (Total Direct $115,713, Indirect $7,173) Curtis PI. 2020

Provided mapping and geospatial support.

Senior Personnel, National Institute of Allergy & Infectious Diseases (University of Florida Subaward) RO1 Al126357 Cholera Transmission and Evolution in Port-au-Prince, Haiti (Direct costs $107,959.33 Total $161,399.17) Curtis PI for CWRU 2016-2021

Designed and developed various geospatial analytic tools to mine spatial embedded video data from micro environments to understand the pattern of cholera spread.

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

Teaching & Education Support

Courses Taught

2023 MPHP-426, **An Introduction to GIS in Health and Social Sciences** (Team thought, Jayakrishnan Ajayakumar is one of the teachers). Developed **spatial analysis and spatial programming module**.

2023 Designed and Developed two modules "**Big Data**" and "**Geospatial Data**" for the **National Science Foundation (NSF)** funded **Hour of CI project** with a focus on **Cyber Literacy and GIScience**.

2023 PQHS-427, **Geospatial Analytics for Bio-Health Informatics** (Designed and Developed **full-course for Spring 2023**). The entire course can be downloaded from https://github.com/JayakrishnanAjayakumar/geospatialanalytics2023

2022 MPHP-499, Independent Study (Team thought, Jayakrishnan Ajayakumar is one of the teachers). Developed a complete module for **Geospatial Data in Health.** Introduced students to QGIS as well as spatial programming using Python. The entire course details can be found in https://github.com/JayakrishnanAjayakumar/GeospatialData

2022 PQHS-416, Computing in Biomedical Health Informatics (Team thought, Jayakrishnan Ajayakumar is one of the teachers). Developed **Python Programming in Computing in Bio-Health Informatics.** Taught Python programming concepts using Jupyter Notebooks with a combination of JupyterHub and GitHub. The notebook details can be found in https://github.com/JayakrishnanAjayakumar/Python_Programming_2022/

2022 MPHP-426, An Introduction to GIS in Health and Social Sciences (Team thought, Jayakrishnan Ajayakumar is one of the teachers). Developed **a spatial analysis module**. The notebook details can be found in https://github.com/JayakrishnanAjayakumar/Intro_to_GIS_2021

Invited Lectures

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.

Presentation and Talks

Curtis, A. and **Ajayakumar, J**. Adventures in Spatial Data Analytics: Working at the Scale of Intervention / Operations. 2023 Big Data Neuroscience Workshop, The Ohio State University, Columbus Ohio September 14,2023 2023

Curtis, A. **Ajayakumar, J.**, and J. Curtis. Introducing a Spatial Syndromic Surveillance Approach to Identify Emergent Clusters of Covid-19. International Symposium on Geospatial Approaches to Combating Covid-19, Florence Italy December 13, 2021 2021

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 Epidemiolo gy, Beijing, China, Nov. 2, 2021 2021

Curtis, A., **Ajayakumar, J.,** Curtis, J., Mihalik, S., Proctor, A., Hixson, E., Muisyo, J., Sullivan, T., Scott, Z., Labadorf, J., Andres, A., Mannix, H., and James, E. "Spatial Syndromic Surveillance of Emerging Covid Outbreaks", American Public Health Association, Denver 27th October 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 (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. 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

Hospital/Health Department Affiliate

2021-Present **Cleveland Department of Public Health,** part of the CWRU Covid-19 joint response

2021-2022 **Ohio Hospital Association,** part of the state-wide Covid-19 response.

2020-Present **University Hospitals Ventures,** part of the Covid-19 response collaborative

2020-2022 **Cleveland Clinic Foundation Enterprise Analytics, Cleveland Clinic,** part of the Covid-19 response collaborative

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 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

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
- Journal of Health Care for the Poor and Underserved 2019-Present
- Transactions in GIS 2019-Present
- Cartographic and Geographic Information Science 2021-Present
- American Association of Geographers 2021-Present
- ISPRS Journal of Photogrammetry and Remote Sensing 2021-Present
- Healthcare 2021-Present
- PLOS One 2022-Present
- Cancer Epidemiology, Biomarkers & Prevention 2023-Present
- Nature Scientific Reports 2023-Present
- Nature Scientific Data 2023-Present
- Communications Medicine 2023-Present
- Geocarto International 2023-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, Ray

Deep Learning Frameworks

Tensorflow, Keras, PyTorch

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, ArcPro

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

Bio : https://ghhlab.epbi.cwru.edu/JayakrishnanAjayakumar