Deepak Nag Ayyala

Experience

2017–Present **Assistant Professor**, *Augusta University*, Department of Population Health Sciences, Augusta, GA.

2015–2017 **Postdoctoral Associate**, *The Jackson Laboratory for Genomic Medicine*, Zhengqing Ouyang Lab, Farmington, CT.

2013–2015 **Postdoctoral Researcher**, *The Ohio State University*, Department of Statistics, Columbus, OH.

2007–2013 **Graduate Teaching Assistant**, *University of Maryland, Baltimore County*, Department of Mathematics and Statistics, Baltimore, MD.

2009–2013 **Instructor**, *University of Maryland, Baltimore County*, Department of Mathematics and Statistics, Baltimore, MD.

Education

2009–2013 **Doctorate of Philosophy in Statistics**, *University of Maryland, Baltimore County*, Baltimore, MD.

2007–2009 **Master of Science in Statistics**, *University of Maryland, Baltimore County*, , Baltimore, MD.

2004–2007 **Bachelor of Mathematics (Honors)**, *Indian Statistical Institute*, Bangalore, India.

Research Interests

High dimensional statistics: Study asymptotic properties of estimators to construct better small sample procedures. Investigate new methods to incorporate dependence structure in high dimensional models.

Transcriptomics: Study transcriptomic data obtained from various experiments such as bulk and single cell RNA-seq, RNA secondary structure and post-transcriptional modifications.

Metagenomics: Understand the dynamics of human microbiome over time and determine its direct and mediatory role in disease progression.

Epigenetics: Develop novel statistical models to integrate different sequencing techniques and data arising from different experiments.

Funding support

2019–2023 NIH/NIDDK (1R01DK121003-01)
Translumbosacral Neuromodulation Therapy for Fecal Incontinence: Randomized Trial (PI – Satish Rao).
Role: Biostatistician (12% FTE)

2019–2020 National Security Agency
AU-Fort Gordon Teaching Contract (Theoretical foundations for Machine Learning)
Role: Co-Investigator (10% FTE)

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2019–2020 National Security Agency
AU-Fort Gordon Teaching Contract (Machine Learning for Data Science)
Role: Co-Investigator (10% FTE)

2018–2020 Georgia School of Orthodontics
Statistical support for Orthodontics Resident Program
Role: Biostatistician (10% FTE)

Scientific and professional memberships

Member, American Statistical Association; (Georgia Chapter)

Member, Institute of Mathematical Statistics

Member, International Indian Statistical Association

Teaching

At Augusta University

Statistical Models and Methods, Advanced Computational Methods, Advanced Statistical Inference, Modern Methods of Multivariate Analysis

At University of Maryland, Baltimore County

Introduction to Probability for Scientists and Engineers, Probability for Actuarial Science, Environmental Statistics, Applied Statistics for Business and Economics.

Others

September 2015 Omics Data Analysis workshop (Webpage link)
Introductory workshop on R language and basic analysis tools for clinical research faculty in the College of Medicine, The Ohio State University.

Scholastic Activities (Include Offices Held)

Reviewer

Publons profile: Please click here

2020–Present Associate Editor
Emerging Themes in Epidemiology

2017–Present Reviewer
Bioinformatics; Communications in Statistics – Simulation and Computation;
MDPI - Mathematics; Communications in Statistics - Theory and Methods;
BMJ Open; Technology in Cancer Research & Treatment

University committees

2019–Present Information Technology & University Resources Committee Augusta University

2018–Present Member, Institutional Review Board (IRB), Augusta University

2019 Organizing Committee Member
Workshop on Emerging Data Science Methods for Complex Biomedical and Cyber Data, Augusta University

Student dissertation committees

Rafael Hellebuyck (Member) *M.S. – 2018*

Oluseyi Odubote (Member) *Ph.D. – 2020*

	James Dow (Member)	*Ph.D. – 2022 (expected)*
	Bich Na Choi (Co-chair)	*Ph.D. – 2022 (expected)*
	Rongrong Wang (Co-chair)	*Ph.D. – 2023 (expected)*
	Vy Ong (Co-chair)	*Ph.D. – 2024 (expected)*

Awards and Honors

2009, 2013 Outstanding graduate teaching assistant in the field of statistics
College of Natural and Mathematical Sciences, UMBC

2010 First prize - Student poster competition
Probability and Statistics Day

2004 – 2007 Grant for Bachelor of Mathematics,
Ministry of Statistics and Programme Implementation, Government of India

Computer skills

Proficient in
R, MATLAB and C.

Fluent in Julia, SAS and Python.

Operating Systems: Linux, Windows
Knowledgeable in building and maintaining linux-based high-performance computation (HPC) servers

Packages

CRAMP Covariance matrix testing using RAndom Matrix Projection
https://github.com/dnayyala/cramp

prepr Pre-pivoting root based test statistic for comparing mean vectors of two populations in high dimensional data sets
https://github.com/dnayyala/prepr

DIMER Differential methylation of RNA transcripts
https://github.com/jiananlin/DIMER

MethylCapSig Detection of Differentially Methylated Regions using MethylCap-Seq Data
https://cran.r-project.org/web/packages/MethylCapSig/index.html

GrammR Graphical Representation and Modeling of Metagenomic Reads
http://cran.r-project.org/web/packages/GrammR/index.html

Conference presentations

2021 Workshop: Advanced Statistical Methods and
Dynamic Data Visualizations for Mental Health Sciences — Invited Talk
National Institute of Mental Health (https://www.didvizandstats.org/)
Title: Adjusting for confounders in cross-correlation analysis of resting state networks

2018 Georgia Statistics Day — Invited Talk
University of Georgia, Athens GA
Title: Penalized multivariate count models for genomic data

2018 University of Maryland, Baltimore County — Invited Talk
Title: Penalized multivariate count models for genomic data

2017 International Conference on Statistics for 21st Century — Invited talk
University of Kerala, India
Title: Discrete multivariate models for genomic count data

2015 SAMSI Beyond Bioinformatics - Transition workshop — Invited Talk
Research Triangle Park, NC
Title: 3D Chromatin Reconstruction using TAD-Penalized Models.

2015 University of Nebraska, Lincoln, NE — Invited Talk
Title: Graphical representation and feature selection in metagenomic count data

2015 University of Massachusetts, Lowell. — Invited talk
Title: Mean vector testing for high dimensional dependent observations.

2015 SAMSI Beyond Bioinformatics - Epigenetics workshop — Invited talk
Research Triangle Park, NC
Title: Statistical methods for detecting differentially methylated regions based on MethylCap-seq data.

2014 Probability and Statistics Day, UMBC — Invited talk
Title: Graphical representation of microbial community subpopulations using penalized Kendall's distance.

2014 Algorithms for Threat Detection Program Review — Poster presentation
Boulder, CO
Title: Graphical representation of microbial community subpopulations using penalized Kendall's distance.

2012 Maryland Neuroimaging Retreat, Baltimore, MD — Poster Presentation
Title: Investigation of experimental factors in resting state networks.

2011 IISA Conference on Probability, Statistics and Data Analysis — Invited Talk
Raleigh, NC
Title: Testing for mean vector in high dimensional Gaussian time series.

2011 Joint Statistical Meetings, Miami, FL — Contributed Talk
Title: Testing equality of correlation matrices at lag zero for time-dependent observations.

2010 Probability and Statistics Day, UMBC, Baltimore, MD — Contributed Talk
Title: A new test for the mean vector for *l*arge p, small n problem.
First prize for Best Student Presentation

2010 International Conference on Statistics, Probability, Operations Research, Computer Science and Allied Areas — Contributed Talk
Visakhapatnam, India
Title: Estimation of the proportion of exponential signals.

2009 Joint Statistical Meetings, Washington D.C. — Contributed Talk
Title: Estimation of the proportion of exponential signals.

Publications

Book Chapters

[1] **D. N. Ayyala**. *Chapter 6 - High-dimensional statistical inference: Theoretical development to data analytics*, volume 43 of *Handbook of Statistics*. Elsevier, 2020.

Articles

[2] **D. N. Ayyala**, S. Ghosh, and D. F. Linder. Covariance matrix testing in high dimension using random projections. *to appear in Computational Statistics*, 2021.

[3] **D. N. Ayyala**, J. Lin, and Z. Ouyang. Differential RNA methylation using multivariate statistical methods. *to appear in Briefings in Bioinformatics*, 2021.

[4] S. C. Coughlin and **D. N. Ayyala**. Symptoms associated with comorbid diabetes among breast cancer survivors. *Breast Cancer Research and Treatment*, 2021.

[5] S. C. Coughlin, **D. N. Ayyala**, and J. E. Cortes. Problems in Living among Breast Cancer Survivors. *Current Cancer Reports*, 3(1), 2021.

[6] S. C. Coughlin, **D. N. Ayyala**, J. Luque, and J. X. Moore. Predictors of Prostate Cancer Screening among African American Men Seen at an Academic Medical Center in the Southern United States. *Current Cancer Reports*, 3(1), 2021.

[7] S. S. Coughlin, **D. N. Ayyala**, and et al. A Health Survey of African American Men Seen at an Academic Medical Center in the Southern United States. *Journal of Community Medicine*, 4(1), 2021.

[8] S. Ghosh, **D. N. Ayyala**, and R. Hellebuyck. Two-Sample High Dimensional Mean Test Based On Prepivots. *Computational Statistics and Data Analysis*, 163, 2021.

[9] B. Majeed, **D. N. Ayyala**, and S. S. Coughlin. Cigarette Smoking after Surviving Breast Cancer: A Pilot Study. *Current Cancer Reports*, 3(1):124–127, 2021.

[10] S. S. C. Rao, E. Coss-Adame, Y. Yan, A. Erdogan, J. Valestin, and **D. N. Ayyala**. Sensory Adaptation Training or Escitalopram for IBS with Constipation and Rectal Hypersensitivity: Randomized Controlled Trial. *Clinical and Translational Gastroenterology*, 12(7), 2021.

[11] S. S. C. Rao, X. Xiang, A. Sharma, T. Patcharatrakul, Y. Yan, R. Parr, **D. N. Ayyala**, and S. Hamdy. Translumbosacral Neuromodulation Therapy for Fecal Incontinence: A Randomized Frequency Response Trial. *The American Journal of Gastroenterology*, 116(1):162–170, 2021.

[12] S. S. C. Rao, Y. Yan, E. Erdogan, E. Coss-Adame, T. Patcharatrakul, J. Valestin, and **D. N. Ayyala**. Barostat or syringe-assisted sensory biofeedback training for constipation with rectal hyposensitivity: A randomized controlled trial. *Neurogastroenterology and Motility*, 2021.

[13] S. S. C. Rao, Y. Yun, X. Xiang, A. Sharma, **D. N. Ayyala**, and S. Hamdy. Effects of Translumbosacral Neuromodulation Therapy on Gut and Brain Interactions and Anorectal Neuropathy in Fecal Incontinence: A Randomized Study. *Neuromodulation: Technology at the Neural Interface*, accepted, 2021.

[14] X. Xiang, A. Sharma, T. Patcharatrakul, Y. Yan, R. Parr, **D. N. Ayyala**, and S. S. C. Rao. Randomized Controlled Trial of Home Biofeedback Therapy versus Office Biofeedback Therapy for Fecal Incontinence. *Neurogastroenterology and Motility*, 2021.

[15] S. C. Coughlin, **D. N. Ayyala**, B. Majeed, L. Cortes, and G. Kapuku. Cardiovascular Disease among Breast Cancer Survivors. *Cardiovascular Disorder and Medicine*, 2(1), 2020.

[16] S. C. Coughlin, **D. N. Ayyala**, M. Tingen, and J. E. Cortes. Financial distress among breast cancer survivors. *Current Cancer Reports*, 2020(1):48–53, 2020.

[17] S. S. C. Rao, X. Xiang, Y. Yan, K. Rattanakovit, T. Patcharatrakul, R. Parr, **D. N. Ayyala**, and A. Sharma. Randomised clinical trial: linaclotide vs placebo—a study of bi-directional gut and brain axis. *Alimentary Pharmacology & Therapeutics*, 51(12):1332–1341, 2020.

[18] H. Whiteside, A. Nagabandi, K. Brown, **D. N. Ayyala**, and G. Sharma. Prevalence and clinical characteristics associated with left atrial thrombus detection: Apixaban. *Journal of the American College of Cardiology*, 11(2):84–93, 2019.

[19] **D. N. Ayyala**, A. Roy, J. Park, and R. P. Gullapalli. Adjusting for Confounders in Cross-correlation Analysis: an Application to Resting State Networks. *Sankhya B*, 80(1):123–150, 2018.

[20] **D. N. Ayyala**, J. Park, and A. Roy. Mean vector testing for high-dimensional dependent observations. *Journal of Multivariate Analysis*, 153:136–155, 2017.

[21] Z. Qin, B. Li, K. N. Conneely, H. Wu, M. Hu, **D. N. Ayyala**, Y. Park, V. X. Jin, F. Zhang, H. Zhang, L. Li, and S. Lin. Statistical Challenges in Analyzing Methylation and Long-Range Chromosomal Interaction Data. *Statistics in Biosciences*, 8(2):284–309, 2016.

[22] **D. N. Ayyala**, D. E. Frankhouser, J. Ganbat, G. Marcucci, R. Bundschuh, P. Yan, and S. Lin. Statistical methods for detecting differentially methylated regions based on MethylCap-seq data. *Briefings in Bioinformatics*, 17(6):926–937, 2015.

[23] **D. N. Ayyala** and S. Lin. GrammR: graphical representation and modeling of count data with application in metagenomics. *Bioinformatics*, 31(10):1648–1654, 2015.

[24] J. Park and **D. N. Ayyala**. A test for the mean vector in large dimension and small samples. *Journal of Statistical Planning and Inference*, 143(5):929–943, 2013.

Conference Abstracts

[25] C. A. Hamilton, **D. N. Ayyala**, D. Walsh, C. Bramwell, C. Walker, R. W. Dib, J. Gosse, A. Ladak, P. Morrissette, A. S. R. S. Rao, A. Chao, and J. Vazquez. Small Towns, Big Cities: Rural and Urban Disparities among Hospitalized Patients with COVID-19 in the Central Savannah River Area. In *Infectious Diseases Week*, 2021.

[26] B. Majeed, D. Walsh, **D. N. Ayyala**, and C. Hatzigeorgiou. Trends in hospitalization rates of lab-confirmed COVID-19 adults at a large academic health center in the U.S. March-August 2020. In *Virtual Poster Session at Canadian Society for Epidemiology and Biostatistics Annual Meeting*, 2021.

[27] S. S.. C. Rao, Y. Yan, E. Coss-Adame, A. Erdogan, T. Patcharatrakul, J. Valestin, and **D. N. Ayyala**. 406 - Barostat Assisted Sensory Adaptation Training For IBS And Rectal Hypersensitivity: Randomized Controlled Trial. *Gastroenterology*, 158(6, Supplement 1):S–76, 2020.

[28] A. E. Berman, G. H. Horde, A. Gopal, P. T. Maddux, and **D. N. Ayyala**. Abstract 11492: Recurrence of Atrial Fibrillation Following Pulmonary Vein Isolation: Development of a Multivariate Predictive Model Using Real-world Data. *Circulation*, 140(Suppl_1), 2019.

[29] A. Sharma, X. Xiang, Y. Yan, Tanisa Patcharatrakul, Rachael Parr, A. Herekar, **D. N. Ayyala**, and S. S. C. Rao. 786 – Home Biofeedback Therapy with Novel Device Versus Office Biofeedback Therapy for Fecal Incontinence: Randomized Controlled Study. *Gastroenterology*, 156, 2019.

[30] Q. Wan, Y. Yan, X. Xiang, A. Sharma, T. Patcharatrakul, K. Rattanakovit, **D. N. Ayyala**, and S. S. C. Rao. Sa1652 – Towards an Optimal Tool for Assessment of Fecal Incontinence (FI) Severity and Therapeutic Responsiveness. *Gastroenterology*, 156(6, Supplement 1):S–354, 2019.

Under review

[31] J. C. Gibbs, C. J. Boatman, B. D. Sookhoo, **D. N. Ayyala**, S. A. Parada, and J. A. Blair. Orthopaedic Trauma Trends During Covid-19 Epidemic. *submitted*, 2021.

[32] D. Nelwan, K. Fratino, **D. N. Ayyala**, and B. A. Morganstern. How Race and Prior Medical Interactions Impact Time to Presentation for Genital Pain in Pediatric Males. *submitted*, 2021.

[33] A. S. Newsome, **D. N. Ayyala**, S. Blackwell, and et al. Meaningful metrics: medication regimen complexity for critical care pharmacist workload. *submitted*, 2021.

[34] B. Siddiqui, R. W. Gibson, **D. N. Ayyala**, C. Hamilton, M. Farrough, A. Osborn, V. Burkhalter, A. Chao, and J. Vazquez. Estimated Community Seroprevalence of COVID-19 in the Central Savannah River Area (CSRA), May 26 – June 12, 2020. *submitted*, 2021.

[35] S. Cho, J. Lim, **D. N. Ayyala**, J. Park, and A. Roy. Note on Mean Vector Testing for High-Dimensional Dependent Observations, 2019.

Manuscripts in preparation

[36] **D. N. Ayyala** and S. Lin. Penalized Dirichlet-multinomial models for feature selection in metagenomic data, 2022.

[37] **D. N. Ayyala** and Z. Ouyang. Penalized models for simultaneous cell-type detection and feature selection in single-cell RNA-Seq data, 2022.

[38] **D. N. Ayyala**, V. Ong, and D. F. Linder. High dimensional MANOVA using random projections, 2021.

[39] B. N. Choi and **D. N. Ayyala**. Inference for high-dimensional Dirichlet distributions using random projections, 2021.