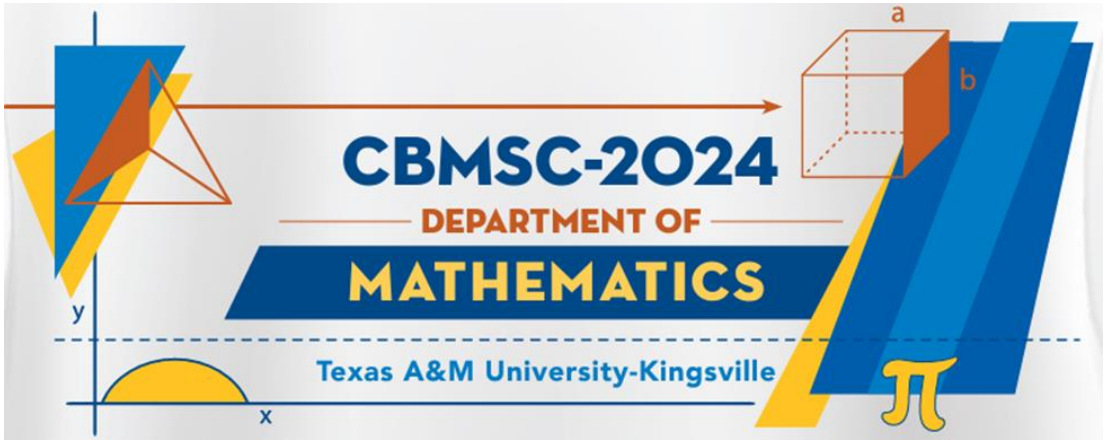
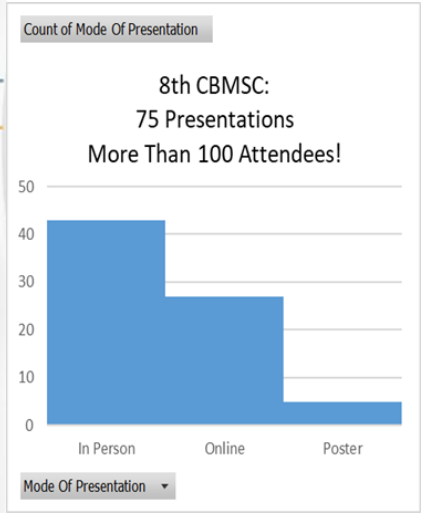
The 8th Coastal Bend Mathematics and Statistics Conference

ABSTRACT BOOK

Saturday, April 6th, 2024

Texas A&M University-Kingsville





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53. *Exploring the impact of latent and obscure factors on left-censored data: Bayesian approaches and case study*
54. *Advanced SAS Programming*
55. *Estimation from nonprobability samples: a review of methods and evidence.*
56. *Probabilistic Modeling of Interactive Species*

Schedule Overview

7:45am – 8:45am: Breakfast and Registration, Kleberg Hall 149

8:45am – 9:00am: Welcoming Words - Organizing Committee and Dean Dr. Dolores Guerrero, Kleberg Hall 149

9:10am – 9:45am: Plenary Speaker – Devanayagam Palaniappan, Kleberg Hall 149

10:00am – 11:55 am: Morning Sessions, Rhode Hall 3rd floor

12:00pm – 1:00pm: Lunch, Javelina Dinning Hall

1:15 pm – 1:50 pm: Plenary Speaker – Tamer Oraby, Kleberg Hall 149

2:00pm – 5:30pm: Afternoon Sessions, Rhode Hall 3rd Floor

5:30pm – 6:00pm: Concluding Remarks

Notes:

1. The conference schedule is based on the US Central Time Zone (UTC – 6:00).
2. Each regular talk is scheduled for 25 minutes: 20-minute presentation time and 5-minute question and transition time.

Poster Presentations will be available in the Hallways of the third floor of Rhode Hall all day.

Plenary Speaker

Dr Devanayagam Palaniappan, Texas A&M University – Corpus Christi

Biography: D. Palaniappan is a Professor of Applied Mathematics in the Department of Mathematics & Statistics at Texas A&M University, Corpus Christi, where he has been since 2010. He is a recipient of Alexander von Humboldt fellowship, a German research grant. He is also affiliated with the Center of Applied Mathematics and Statistics at the New Jersey Institute of Technology as an external faculty member. His areas of interest in research include mathematical biology, physics, engineering, applied mathematics, and mathematics. His current work focuses on the mathematical modeling and comprehension of the hydrodynamic interactions and swimming of microbes in complex fluid settings. Professor Palaniappan will deliver the presentation:

Mathematical Modeling of Squirming Micro-organisms at Low-Reynolds Numbers

Abstract: Artificial and/or biological micro-swimmers that can move and interact with each other at the microscopic scale show great promise in biomedical applications such as drug delivery and microsurgery. Successful application of these interacting swimmers to biomedical tasks relies on their ability to traverse biological fluids with challenging background flow fields. The seminal work by Lighthill Commun. Pure Appl. Math., 109, (1952)] on the propulsion of ciliated microorganisms serves as a reference for many modern studies on swimming of micro-organisms at low Reynolds numbers. In this talk, we discuss mathematical models capturing the swimming characteristics of microbes in various fluid environments.

Email: devanayagam.palaniappan@tamucc.edu
Time: 9:10 AM – 9:45 AM, Kleberg Hall 149

Plenary Speaker

Dr Tamer Oraby, University of Texas Rio Grande Valley

Biography: Dr. Tamer Oraby, an associate professor in the School of Mathematical and Statistical Sciences at The University of Texas Rio Grande Valley, has a wide array of research interests spanning statistical and mathematical modeling. His multi-disciplinary projects extend across biology, data science, ecology, engineering, infectious diseases, mathematics, probability and stochastic processes, social and behavioral sciences, statistics, and other fields. Since joining UTRGV in 2014, Dr. Oraby has taught 23 different courses and published 30 papers in peer-reviewed journals, 2 peer-reviewed book chapters, and 2 proceedings. Before joining UTRGV, Dr. Oraby published 13 papers in peer-reviewed journals, and 2 peer-reviewed book chapters. Dr. Oraby served as a Principal Investigator for two MAA REUs and currently is a co-PI for an NSF REU at UTRGV. Dr. Oraby is a co-PI in other grants, including those funded by AIM-AHEAD-NIH and Welcome Trust from the UK. At the 8th Coastal Bend Dr. Oraby will deliver the presentation:

Berkson Error Adjustment in some Retrospective Cohort Studies

Abstract: In this presentation, I will be sharing my research on adjusting for Berkson errors in certain exposure models when using different statistical methods. The work also offers valuable insights for refining assessments of occupational exposure and understanding the relationship between EMF exposure and brain cancer risk. The analysis of various surrogates and Berkson error adjustments highlights the challenges in selecting the most suitable surrogate. Interestingly, the findings suggest no clear connection between lifetime exposure to extremely low-frequency magnetic fields and increased risk of brain cancer, in line with recent epidemiological findings

Email: tamer.oraby@utrgv.edu
Time: 1:15 PM – 1:50 PM, Kleberg Hall 149

Morning Session #1, 10 AM - 12:00 Noon

Room: Rhode Hall 309, Chair: CHRISTOPHER TROMBLEY

1. *How Does Education Impact a Family's Overall Well-being and Quality of Life? An application of Ordinal Logistic Regression*
Author(s): Hongwei Wang, Cody Perry, Saul Cardenas
Affiliation: Texas A&M International University
Email: hongwei.wang@tamiu.edu
Time: 10 AM – 10:25 AM

2. *Mitigating Emissions from Carbon-Intensive Hydropower Systems Through Floating Solar Power Deployment*
Author(s): Areefin Ul Hassan Chowdhury, Hansapani Rodrigo, Mingxu Li, Rafael Schmitt, Rafael M. Almeida
Affiliation: University of Texas Rio Grande Valley
Email: areefinulhassan.chowdhury01@utrgv.edu, hansapani.rodrigo@utrgv.edu
Time: 10:30 AM – 10:55 AM

3. *On Finite Element Solution of Stress-Strain State in a Strain-Limiting Elastic Body Containing a V-Notch*
Author(s): Maria P. Fernando and S. M. Mallikarjunaiah
Affiliation: Texas A&M University-Corpus Christi
Email: fpieo@islander.tamucc.edu
Time: 11:00 AM – 11:25 AM

4. *Trajectories of Charged Particles Pairs Settling in A Viscous Fluid*
Author(s): Chris Trombley
Affiliation: Texas A&M University-Kingsville
Email: Christopher.Trombley@tamuk.edu
Time: 11:30 AM – 11:55 AM

Morning Session #2, 10 AM - 12:00 Noon

Room: Rhode Hall 310, Chair: SIMONA HODIS

1. *Effect of Slip on the Oscillatory Stokes Flow Around a Circular Cylinder*
Author(s): Subarna Biswas & D. Palaniappan
Affiliation: Texas A&M University-Corpus Christi
Email: sbiswas@islander.tamucc.edu
Time: 10:00 AM – 10:25 AM

2. *Mathematics Behind Music*
Author(s): Simona Hodis
Affiliation: Texas A&M University-Kingsville
Email: simona.hodis@tamuk.edu
Time: 10:30 AM – 10:55 AM

3. *Hilbert-Kunz Theories and Applications*
Author(s): Jesus A. Mendiola Herrera
Affiliation: Texas A&M International University
Email: harag@tamiu.edu
Time: 11:00 AM – 11:25 AM

4. *Oscillations in neuronal activity: a neuron-centered spatiotemporal model of the Unfolded Protein Response in prion diseases*
Author(s): Mike Lindstrom
Affiliation: University of Texas Rio Grande Valley
Email: mike.lindstrom@utrgv.edu
Time: 11:30 AM – 11:55 AM

Morning Session #3, 10 AM - 12:00 Noon

Room: Rhode Hall 332, Chair: MICHAEL MUZHEVE

1. *Variable Selection in High-Dimensional Ordinal Quantile Regression*
Author(s): Mai Dao, Md Sakhawat Hossain and Zhuanzhuan Ma
Affiliation: Wichita State University, Clemson University and University of Texas Rio Grande Valley
Email: mai.dao@wichita.edu
Time: 10:00 AM – 10:25 AM

2. *Constrained Quantization and the Conditional Quantization for Probability Distributions*
Author(s): Mrinal Kanti Roychowdhury
Affiliation: University of Texas Rio Grande Valley
Email: mrinal.roychowdhury@utrgv.edu
Time: 10:30 AM – 10:55 AM

3. *A Sufficient Condition for the Hamiltonicity of Vertex Envelopes of Plane Graphs*
Author(s): Michael T. Muzheve
Affiliation: Texas A &M University – Kingsville
Email: michael.muzheve@tamuk.edu
Time: 11:00 AM – 11:25 AM

4. *Modelling and Simulation Methods in Analysis*
Author(s): Daniel Tovar, Jr.
Affiliation: Texas A&M International University
Email: harag@tamiu.edu
Time: 11:30 AM – 11:55 AM

Morning Session #4, 10 AM - 12:00 Noon

Room: Rhode Hall 333, ONLINE, Chair: ADEN AHMED

1. *Exploring the Impact of Latent and Obscure Factors on Left-Censored Data: Bayesian Approaches and Case Study*
Author(s): Pragya Gupta, Arvind Pandey, David D. Hanagal, Shikhar Tyagi
Affiliation: Central University of Rajasthan, Central University of Rajasthan, Savitri Bai Phule Pune University, Christ Deemed to be University
Email: shikhar1093tyagi@gmail.com
Time: 10:00 AM – 10:25 AM

2. *Exponential Type Estimators Based on Robust Measures of Location*
Author(s): Muhammad Abid
Affiliation: Government College University Faisalabad
Email: mabid@gcuf.edu.pk
Time: 10:30 AM – 10:55 AM

3. *A Cost-Effective Computational Approach with Non-Response on Two Occasions*
Author(s): Shashi Bhushan
Affiliation: University of Lucknow
Email: bhushan_s@lkouniv.ac.in
Time: 11:00 AM – 11:25 AM

4. *Effect of Measurement Uncertainty on Optimal CUSUM Mean Control Charts*
Author(s): Tahir Munir, David Paul Suda, Abdu R Rahman, Hefin Rowlands
Affiliation: The Aga Khan University, University of Malta, The Aga Khan University, University of South Wales
Email: tahirmunir677@yahoo.com
Time: 11:30 AM – 11:55 AM

Morning Session #5, 10 AM - 12:00 Noon

Room: Rhode Hall 342, ONLINE, Chair: SARJINDER SINGH

1. *Cheating Detection and Prevalence Estimates in the Indirect Question Techniques*
Author: Pier Francesco Perri
Affiliation: University of Calabria
Email: pierfrancesco.perri@unical.it
Time: 10:00 AM – 10:25 AM

2. *Estimation from Nonprobability Samples: a Review of Methods and Evidence*
Author(s): Ramón Ferri-García, Jorge Rueda, Beatriz Cobo, María del Mar Rueda
Affiliation: University of Granada
Email: rferri@ugr.es
Time: 10:30 AM – 10:55 AM

3. *Combining Techniques to Reduce Social Desirability Bias with those to Reduce Selection Bias*
Author(s): Beatriz Cobo, María del Mar Rueda
Affiliation: University of Granada
Email: beacr@ugr.es
Time: 11:00 AM – 11:25 AM

4. *Methods for integrating probability and non-probability survey data.*
Author(s): Jorge Luis Rueda-Sánchez, Beatriz Cobo, Ramón Ferri-García, María del Mar Rueda
Affiliation: University of Granada
Email: jorgerueda@ugr.es
Time: 11:30 AM – 11:55 AM

Morning Session #6, 10 AM - 12:00 Noon

Room: Rhode Hall 343, ONLINE, Chair: FARANAK RABIEI

1. *Ratio and Product Type Estimators in Post-stratified Sampling with Measurement Errors*
Author(s): Amita Yadav, Sarla Pareek, Narendra Singh Thakur
Affiliation: Banasthali University
Email: amitayadav73@yahoo.in
Time: 10:00 AM – 10:25 AM

2. *Resilient Regression: Strategies for Handling Outliers and Multicollinearity in Data Analysis*
Author(s): Manish Sharma, Banti Kumar and Sunali Mahajan
Affiliation: Sher-e-Kashmir University of Agrilcultural Sciences and Technology
Email: Manish.sharma@zu.ac.ae
Time: 10:30 AM – 10:55 AM

3. *Transmission Based association Test for Multivariate Phenotype Using Quasi Likelihood*
Author: Hemant Kulkarni, Vishwnath Karad
Affiliation: MIT World Peace University
Email: hemant.statistics@gmail.com
Time: 11:00 AM – 11:25 AM

4. *Instability of elastic filaments in a shear flow*
Author(s): Agnieszka M. Slowicka, Nan Xue, Pawel Sznajder, Janine Nunes, Howard A. Stone and Maria L. Ekiel-Jezewska
Affiliation: IPPT PAN, Princeton University, IPPT PAN, Princeton University, Princeton University, IPPT PAN
Email: mekiel@ippt.pan.pl
Time: 11:30 AM – 11:55 AM

Afternoon Session #1, 2:00 PM - 4:30 PM

Room: Rhode Hall 309, Chair: REZA AHANGAR

1. *Mathematical Models and the Fitzhugh-Nagumo Equation in Neuroscience*
Author(s): Jose A. Herrera
Affiliation: Texas A&M International University
Email: harag@tamiu.edu
Time: 2:00 PM – 2:25 PM

2. *Exploring Potential Applications of the Monster Group and Other Simple Sporadic Groups*
Author(s): Juan Carlos Nava
Affiliation: Texas A&M International University
Email: harag@tamiu.edu
Time: 2:30 PM – 2:55 PM

3. *Weakly Nonlinear Solutions for a Thermo-Solutal Convective Flow in a Porous Medium*
Author(s): Dambaru Bhatta
Affiliation: University of Texas Rio Grande Valley
Email: dambaru.bhatta@utrgv.edu
Time: 3:00 PM – 3:25 PM

4. *Power Series Method for Nonlinear Fluid Dynamics Equations*
Author(s): Vesselin Vatchev
Affiliation: University of Texas Rio Grande Valley
Email: vesselin.vatchev@utrgv.edu
Time: 3:30 PM – 3:55 PM

5. *Probabilistic Modeling of Interactive Species*
Author(s): Reza Ahangar
Affiliation: Texas A & M University- Kingsville
Email: reza.ahangar@tamuk.edu
Time: 4:00 PM – 4:30 PM

Afternoon Session #2, 2:00 PM - 4:30 PM

Room: Rhode Hall 310, HYBRID, Chair: YI-FAN HSU

1. *A Robust Bootstrap Control Chart for the Log-Logistic Percentiles*
Author(s): Zhuanzhuan Ma, Chanseok Park, Min Wang
Email: University of Texas Rio Grande Valley, Pusan National University, University of Texas at San Antonio
Email: zhuanzhuan.ma@utrgv.edu
Time: 2:00 PM – 2:25 PM

2. *New Methods for Imbalanced Data Classification*
Author(s): Yi-fan Hsu
Affiliation: Texas A&M University-Kingsville
Email: Yi-fan.hsu@tamuk.edu
Time: 2:30 PM – 2:55 PM

3. *Analyzing the Nerves System Using the Fitz-Hugh–Nagumo Model*
Author(s): Arianna E. Ortiz
Affiliation: Texas A&M International University
Email: harag@tamiu.edu
Time: 3:00 PM – 3:25 PM

4. *Generating Heat Maps for Turbulence - Imputing Turbulence Readings Through Spatio-Temporal weighting*
Author(s): Joel Williams
Affiliation: University of Texas Rio Grande Valley
Email: joel.williams01@utrgv.edu
Time: 3:30 PM – 3:55 PM

5. *The UN Genocide Convention and the USBP Immigration Checkpoints in South Texas: A Knowledge-Based Application*
Author(s): Colin Wark
Affiliation: Texas A&M University-Kingsville
Email: colin.wark@tamuk.edu
Time: 4:00 PM – 4:25 PM

6. *Accelerated Destructive Degradation Tests with Interaction Effects*
Author(s): Ankush Sharma, Sanjeev K. Tomer, M S Panwar
Affiliation: Banaras Hindu University
Email: ankushsharma.statistics@gmail.com
Time: 4:30 PM – 4:55 PM
Note: Online Session

Afternoon Session #3, 2:00 PM - 5:00 PM

Room: Rhode Hall 332, Chair: LIHUA ZUO

1. *Analysis and Comparison of Equilibrium Height Growth Models for Fracture Propagation in Formations with Multiple Layers*
Author(s): Lihua Zuo, Kan Wu
Affiliation: Texas A&M University-Kingsville, Texas A&M University
Email: lihua.zuo@tamuk.edu
Time: 2:00 PM – 2:25 PM

2. *On the Mathematical and Computational Issues of Modeling Fracture in Porous Elastic Solids Whose Material Moduli Depend Upon the Density*
Author(s): S. M. Mallikarjunaiah
Affiliation: Texas A&M University - Corpus Christi
Email: m.muddamallappa@tamucc.edu
Time: 2:30 PM – 2:55 PM

3. *Critical Appraisal of Multidrug Therapy in the Ambulatory Management of Patients with COVID-19 and Hypoxemia*
Author(s): Eleftherios Gkioulekas, Peter A. McCullough and Colleen Aldous
Affiliations: University of Texas Rio Grande Valley, McCullough Foundation and Chief Medical Officer of Truth for Health Foundation, University of KwaZulu-Natal
Email: eleftherios.gkioulekas@utrgv.edu
Time: 3:00 PM – 3:25 PM

4. *A New Randomized Response Two Deck Card Model*
Author: Oluwatosin Lawal
Affiliation: Texas A&M University – Kingsville
Email: oluwatosin.lawal@students.atmuk.edu
Time: 3:30 PM – 3:55 PM

5. *Impact of Imbalanced and Balanced Data for AI/Machine Learning in Cyberattack Detection Problem*
Author(s): Dipok Deb, Hansapani Rodrigo, SJ Kumar
Affiliation: University of Texas Rio Grande Valley
Email: dipok.deb01@utrgv.edu
Time: 4:00 PM – 4:25 PM

6. *Optimization of SOX2 Expression for Enhanced Glioblastoma Stem Cell Virotherapy*
Author(s): Abraham Puig and Dongwook Kim
Affiliation: Texas A&M University – Kingsville
Email: dongwook.kim@tamuk.edu
Time: 4:30 PM – 5:00 PM

Afternoon Session #4, 2:00 PM - 4:30 PM

Room: Rhode Hall 333, Chair: BETTY FOWLER

1. *A Glimpse of Hopf Bifurcation with Respect to the Fitz-Hugh-Nagumo Equations*
Author(s): Mauricio Loera
Affiliation: Texas A&M International University
Email: harag@tamiu.edu
Time: 2:00 PM – 2:25 PM

2. *Describing the Lifecycle Dynamics of Lithium-Ion Batteries (LIBs)*
Author(s): Kristen Hallas, Tamer Oraby
Affiliation: University of Texas Rio Grande Valley
Email: kristen.hallas01@utrgv.edu
Time: 2:30 PM – 2:55 PM

3. *Analytical Considerations for Longitudinal Analysis of eGFR in Patients after Lung Transplantation*
Author(s): Kristina Vatcheva, Dina Abdelwahab
Affiliation: University of Texas Rio Grande Valley, Cairo University
Email: kristina.vatcheva@utrgv.edu
Time: 3:00 PM – 3:25 PM

4. *An Extent of Children's Health Coverage: Medicaid, CHIP, and Beyond*
Author(s): Alberto Gonzalez
Affiliation: Texas A&M International University
Email: harag@tamiu.edu
Time: 3:30 PM – 3:55 PM

5. *Advanced SAS Programming*
Author(s): Purnachandrasekhar Rao Bellamkonda
Affiliation: Texas A&M University – Kingsville
Email: purnab6581@gmail.com
Time: 4:00 PM – 4:25 PM

Afternoon Session #5, 2:00 PM - 5:30 PM

Room: Rhode Hall 342, ONLINE, Chair: SARJINDER SINGH

1. *Monitoring Small Variation of a Non-Normal Process with an application on Wind Speed Data.*
Author(s): Mizanur Rahman Mukta, Pear Hossain
Affiliation: Bangabandhu Sheikh Mujibur Rahman Science & Technology University, The University of Hong Kong
Email: mizanurrahmanmukta@gmail.com
Time: 2:00 PM – 2:25 PM

2. *Nonlinear Stability Analysis of Double-Diffusive Convection in a Kelvin-Voigt Fluid*
Author(s): Mahanthesh Basavarajappa, Dambaru Bhatta
Affiliation: University of Texas Rio Grande Valley
Email: mahanthesh.b@utrgv.edu
Time: 2:30 PM – 2:55 PM

3. *What Most Affects the Probability of Receiving Public Assistance? Examining the Effect of Family Background and Educational Attainment on Receiving Public Assistance with Multivariate Regression Analysis*
Author(s): Patricia I. Vargas
Affiliation: Oregon State University
Email: vargasp@lifetime.oregonstate.edu
Time: 3:00 PM – 3:25 PM

4. *An Evaluation of Feature Selection Methods in Machine Learning in the Presence of Class Imbalance*
Author(s): Martha Asare, Rodrigo Hansapani
Affiliation: University of Texas Rio Grande Valley
Email: martha.asare01@utrgv.edu
Time: 3:30 PM – 3:55 PM

5. *A Brief Study on Higher Order Moments of the Estimator of Proportion Using Warner's Model*
Author(s): Srikar Govardhana
Affiliation: Texas A&M University – Kingsville
Email: govardhanasrikee@gmail.com
Time: 4:00 PM – 4:25 PM

6. *Study of Growth Complexity in Large Cervix Deformations*
Author(s): Kun Gou
Affiliation: Texas A&M University-San Antonio
Email: kgou@tamusa.edu
Time: 4:30 PM – 4:55 PM

7. *Bias of Propensity Score Matching due to Effect Modification with Confounding*
Author(s): Xuan Wang, Tamer Oraby, Helmut Schneider
Affiliation: University of Texas Rio Grande Valley
Email: xuan.wang@utrgv.edu
Time: 5:00 PM – 5:25 PM

Afternoon Session #6, 2:00 PM - 5:30 PM

Room: Rhode Hall 343, ONLINE, Chair: CHRIS TROMBLEY

1. *Comparative Analysis of Rice Genotype Classification Using Statistical and Artificial Neural Network Models*
Author(s): Manish Sharma and Shavi Gupta
Affiliation: Sher-E- Kashmir University of Agricultural Sciences & Technology Jammu
Email: manshstat@gmail.com
Time: 2:00 PM – 2:25 PM

2. *Emerging Trends in Digital Health Technologies: Revolutionizing Data Collection and Analysis in Clinical Trials*
Author(s): Shivashankar Thati
Affiliation: Techdata Services Company LLC
Email: ssthati@outlook.com
Time: 2:30 Pm – 2:55 PM

3. *Features Selection in Regression Models Using Variance-based Sensitivity Analysis*
Author(s): Jakob Spiller, Nahid Hasan
Affiliation: Texas A&M University – Commerce
Email: nahid.hasan@tamuc.edu
Time: 3:00 PM – 3:25 PM

4. *Detecting Change Points in Non-linear Curves of Longitudinal Data with Irregularly Spaced Intervals: Leveraging Smoothing Techniques*
Author(s): Jobayer Hossain
Affiliation: Nemours Children's Hospital
Email: jhossain@nemours.org
Time: 3:30 PM – 3:55 PM

5. *Third Wave, Decoding Egyptian Fractions*
Author(s): Milo Gardner
Author(s): California State University, Fullerton
Email: milogardner@yahoo.com
Time: 4:00 PM – 4:25 PM

6. *Modify the LASSO Regression Model via its Bayesian Interpretation*
Author(s): Gayan Warahena-Liyanage
Affiliation: University of Dayton
Email: gwarahenaliyanage1@udayton.edu
Time: 4:30 PM – 4:55 PM

7. *Detecting Change Points in Non-linear Curves of Longitudinal Data with Irregularly Spaced Intervals: Leveraging Smoothing Techniques*
Author(s): Jobayer Hossain
Affiliation: Nemours Children's Hospital
Email: jhossain@nemours.org
Time: 5:00 PM – 5:25 PM

Poster Session

Rhode Hall, 3rd Floor Hallways

1. *B-CNN for Early Alzheimer Disease Detection in MRI Scans*
Author(s): Mohammad Rafsan
Affiliation: University of Texas Rio Grande Valley
Email: mohammad.rafsan01@utrgv.edu

2. *Oscillations in neuronal activity: a Neuron-Centered Spatiotemporal Model of the Unfolded Protein Response in Prion Diseases*
Author(s): Omar Sharif
Affiliation: University of Texas Rio Grande Valley
Email: omar.sharif01@utrgv.edu

3. *Estimation of Treatment Effects with Missing Observations in Crossover Clinical Trials*
Author(s): Gajendra K. Vishwakarma
Affiliation: Indian Institute of Technology Dhanbad
Email: vishwagk@iitism.ac.in

4. *Numerical Analysis of Fractional Differential Equations*
Author(s): Faranak Rabiei
Affiliation: Texas A&M University – Kingsville
Email: faranak.rabiei@tamuk.edu

5. Taking Chances: The Analysis of Simplified Parcheesi
Author(s): Aden Ahmed
Affiliation: Texas A&M University – Kingsville
Email: aden.ahmed@tamuk.edu

6. *Comparison Between Multiple Sensitive Characteristics (CBMSC)*
Author(s): Daniel Arias and Sarjinder Singh
Affiliation: Texas A&M University-Kingsville
Email: darias@students.tamuk.edu

Abstracts

Optimization of SOX2 Expression For Enhanced Glioblastoma Stem Cell Virotherapy

Abraham Puig and Dongwook Kim
Texas A&M University - Kingsville
dongwook.kim@tamuk.edu

Glioblastoma is one of the most lethal adult cancers, characterized by extremely low survival rates and classified as a grade IV glioma. The poor prognosis can be attributed to cancer stem-like cells, which contribute to therapy resistance and cancer recurrence. Therapies specifically targeting the glioblastoma stem cells could have great clinical impacts. Oncolytic virotherapy is a relatively a new therapeutic tool that can target cancer cells for lysis using engineered lytic viruses. The Zika virus has been shown to infect glioblastoma stem cells via the membrane receptor avb5, which is activated by the stem-specific transcription factor SOX2. Since the expression level of SOX2 is an important predictive marker for successful virotherapy, we developed a mathematical model and investigated the optimal conditions for viral infection, replication and host cell lysis. Our studies determined critical threshold levels of both SOX2 and viral replication to achieve strong therapeutic efficacy of the Zika virotherapy against glioblastoma stem cells.

Taking Chances: The Analysis of Simplified Parcheesi

Aden Ahmed
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Parcheesi is an example of a two-player, strictly competitive game of perfect information with chance moves. This game has only two possible outcomes that we will denote by W (a win for Player I and a loss for Player II) or L (a loss for Player I and a win for Player II). In such games, the motivation of a rational player is to maximize the probability of winning. Parcheesi is played between Player I (White) and Player II (Black) on a (2m+1) by n board. The central cell in the first column of the board is shaded. The winner is the first to reach the shaded square following some prescribed routes and rules. We will restrict our attention to the 3x2, 3x3, and 5x2 board games. For the first two cases, we will briefly share the solutions. A complete analysis of the third case will be presented. A conjecture on the (2m+1) by 2 will conclude the presentation.

Instability of Elastic Filaments in a Shear Flow

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Based on numerical simulations and experiments, we investigate short-time dynamics of elastic fibers in a shear flow [1]. We demonstrate the buckling instability and show how it differs from another pattern of bending, typical also for large times. Also, we show how the buckling depends on the filament Young's modulus and its initial orientation.

[1] Agnieszka M. Slowicka, Nan Xue, Pawel Sznajder, Janine Nunes, Howard A. Stone and Maria L. Ekiel-Jezewska, New J. Phys., vol. 24, 013013, 2022.

An Extent of Children's Health Coverage: Medicaid, CHIP, And Beyond

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This article examines children's health coverage today and studies the ways and means to ensure its financial sustainability and the factors associated with it in doing so.

As it is argued extensively reductions in children's coverage would lead to reduced access to care and other long-term effects for children and increase financial weight on the states and providers. It also suggests that reductions in children's coverage could have broader implications and long-term negative effects on their health, education, and eventually on their financial success as adults. However, the decades of progress, mostly bolstered by the Affordable Care Act (ACA), a new funding mechanism needs to be sought to safeguard the coverage to overcome the children's uninsured rate that is rapidly growing. This article further analyses the pros and cons of these efforts using a comprehensive statistical analysis.

Ratio and Product Type Estimators in Post-Stratified Sampling wth Measurement Errors

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In this paper, an extension of ratio and product type estimator be studied to estimate population mean in the context of poststratification design while the data is affected by measurement errors. The derivations of extended estimators to calculate bias and MSE up to first order of approximation has been done. By using some real data sets, an empirical study has been done to check the performance of estimators under measurement error.

Accelerated Destructive Degradation Tests with Interaction Effects

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Accelerated destructive degradation tests (ADDT) help to get reliability information in a very short time. An ADDT plan specifies factor-level combinations of accelerating variables (for example, temperature, voltage, etc.), inspection points at each factor-level combination, and the allocation of test units to these inspection points. This article deals with the problem of designing multi-factor constant-stress ADDT plans with a generalized log-linear stress-life model. The optimal plan consists of finding optimal allocations at inspection points under D-optimality and V-optimality criteria. A simulation study is carried out to test the adequacy of the model, which shows that the simulated values of ML estimates are quite close to the asymptotic values when the number of units is large enough at each test condition. The test is applied to real data, and it shows that the main stress factors and their interactions have a significant effect on the product's life.

Mitigating Emissions from Carbon-Intensive Hydropower Systems Through Floating Solar Power Deployment

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Despite being typically cleaner than fossil fuels, certain hydropower facilities have greenhouse gas emissions per unit electricity generated ('emission intensity') that exceed those of fossil-fueled power plants. The emerging practice of deploying floating solar arrays ('floatovoltaics') on reservoirs may offer an opportunity to make high-emitting hydropower systems more climate-friendly. Here we leverage emissions data from >2000 hydropower dams worldwide to calculate the required floatovoltaic installed capacity and areal coverage to reach emission intensities compatible with low-carbon development goals. Assuming standard values for the emission intensity and power density of floating solar power, we determine the solar energy generation and floatovoltaic system capacity for achieving the targeted emission reductions. Our findings suggest that implementing floatovoltaics can meaningfully lower emissions in many carbon-intensive hydropower systems. Conversely, in many hydropower systems, the required floatovoltaic capacity for a substantial reduction in carbon emissions is technically unfeasible. Our study contributes valuable insights to the ongoing discussion of leveraging floatovoltaics as a viable solution for maximizing land-use efficiency and curtailing carbon emissions from future energy systems.

Analyzing the Nerves System Using the Fitzhugh–Nagumo Model

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The FitzHugh–Nagumo model (FHN) describes a prototype of an excitable system (e.g., a neuron). It is an example of a relaxation oscillator because if the external stimulus $I_{{{\text{ext}}}}$ exceeds a certain threshold value, the system will exhibit a characteristic excursion in phase space before the variables v and w relax back to their rest values. The phase plane analysis technique is used to model the action potentials generated by neurons with the Fitzhugh-Nagumo Model. The dynamics of the two-state variable system (membrane potential v and recovery variable w) can be explored. The variables kept in the reduction of the model are the excitable variable and the recovery variable which are characterized as being the fast and slow variables respectively. The FitzHugh-Nagumo model was called, by FitzHugh, the Bonhoeffer-van der Pol model (BVP). FitzHugh explains that the BVP was devised in the same way as the van der Pol equation if its solution does not, to be sure, give an accurate fit to curves obtained from many physical oscillators. The purpose of this project is to present how the FitzHugh–Nagumo model is analyzed to study the nervous system. The relevancy of the model and the extent of analysis conducted based on the model are presented.

Combining Techniques to Reduce Social Desirability Bias with Those To Reduce Selection Bias

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On most occasions when a survey is carried out we are interested in information that can be considered sensitive or confidential, which is why a problem known as social desirability bias arises, which is the tendency to respond based on what is socially acceptable to do, this results in the participants refuse to participate in the survey or provide false or conditioned answers, thus altering the precision and reliability of the estimates. Since the 1960s different questioning methods have been designed to ensure respondent anonymity and cutting down false reporting and these techniques are known as Indirect Questioning Techniques. Among them you can find randomized response technique, item count technique and non-randomized response technique.

In recent years, there has been concern on the part of researchers about the lack of coverage and the lack of response when carrying out a survey and given that costs are increasing, they have considered whether non-probability sampling could be a good option. Online surveys carried out by volunteers have had great growth since they are carried out quickly and cheaply but they also have problems such as the lack of an adequate sampling frame which causes selection bias if the population covered differs from the target population. Some techniques have arisen in the last years regarding this issue. Therefore, in our study, we are going to consider not only the social desirability bias, but we are also going to take into account the selection bias to get our estimates.

Trajectories of Charged Particles Pairs Settling in a Viscous Fluid

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The dynamics of charged point particles pairs settling in a Stokes flow are determined. Stationary states exist with particle centers in line with and inclined with gravity. Stability properties of these stationary states are given. Stable stationary states need not be unique. The basin of attraction for a stable stationary state is unbounded. The qualitative behavior just described is qualitatively different from the uncharged case where there only exists a bounded set of neutrally stable periodic relative trajectories. The system is parameterized by the ratio of radii, ratio of masses and the ratio of characteristic electrostatic to gravitational force. The dependence of stability properties on these parameters is shown via graph.

The UN Genocide Convention and The USBP Immigration Checkpoints in South Texas: A Knowledge-Based Application

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Following Goldsmith (2010) I present a knowledge-based application of the UN Genocide Convention to the United States Border Patrol's (USBP's) operation of the immigration checkpoints in and near Brooks County Texas between 2009 and 2019. A knowledge-based application of the convention obviates the need for specific intent (dolus specialis) instead relying on the actor's knowledge that their activities are destroying a protected group. The victims in this case are the roughly 650 mostly Hispanic migrants from Latin America who died in rural Brooks County, Texas during the aforementioned time period while trying to circumvent the nearby checkpoints (Leutert 2019). USBP agents staffing the checkpoints may racially profile motorists and Hispanics are targeted by these investigatory stops (See Osete 2016; Anthony 2020; U.S. v. Martinez-Fuerte, 428 U.S. 543). Thus, the goal of these checkpoints may be to force undocumented Hispanic migrants to hike through the deadly South Texas brush country in order to avoid them. This objective has been characterized as "deterrence." Thus, by operating these checkpoints, the USBP may be "Deliberately inflicting on the [ethnic] group [Hispanics] conditions of life calculated to bring about its physical destruction in…part". Accordingly, these activities should be assessed under Article II (c) of the Genocide Convention.

Weakly Nonlinear Solutions for A Thermo-Solutal Convective Flow in a Porous Medium

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Here we consider a thermo-solutal convective flow in a horizontal porous layer. The continuity equation, Darcy momentum equation, heat equation and solute transport equation describe the flow. The density variation due to temperature and solute concentration gives rise to a buoyancy force for this convective flow. Assuming no-flow basic state solutions to be steady, we derive the various order systems by employing perturbation method. Using the normal mode approach, we obtain vertically varying systems up to second order. We also derive the amplitude equation. Numerical results for the dependent variables are presented for various Lewis numbers.

Comparison Between Multiple Sensitive Characteristics (CBMSC)

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In this talk, we will discuss an idea of making comparison between multiple sensitive characteristics (CBMSC) using randomized response technique. Among seniors, social stigma of embarrassment, being ashamed, worries about family members, thinking about burdening others makes them to hide problems related to health, finance, addiction, mental, shame, loss of independence, legal matters, and other social issues etc. It seems as people grow, some sensitive issues may have increasing or decreasing trend while grouping people on an ordinal scale by age. Simulation study results will be demonstrated to show the effect of use of randomized response techniques on the increasing or decreasing trend of sensitive proportions with groups based on age. The CBMSC based on nominal groups such as gender, ethnicity etc. will also be discussed if time permitted.

Modelling and Simulation Methods in Analysis

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Simulation plays a prominent role in a wide range of statistical and computational analyses. In modern times the frequency interpretation of probability becomes the tool for Monte Carlo and simulation methods. This indeed ease computational difficulties. Simulation methods can play a significant role. Simulations are carried out in a classroom or laboratory and the results, then interpreted into real situations. The use of modern economical, efficient, and easily available computational power, potentially more accurate, simulation approach became a tool for analysts.

As widely known, simulation methods offer a flexible option to estimate statistical power for standard and non-traditional study designs and parameters of interest. The approaches yet to be described are universally relevant for evaluating study designs used in epidemiologic and social science areas.

Impact of Imbalanced and Balanced Data For AI/Machine Learning in Cyberattack Detection Problem

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An imbalanced dataset means that most samples belong to a majority class and few examples belong to a minority class. Mainly, machine learning algorithms emphasize classifying the majority class while neglecting or incorrectly classifying the minority class. Consequently, the lack of training data stemming from data imbalances leads to an abundance of false detections. In cybersecurity, AI/machine learning-based IDS is used to detect and mitigate attacks. In this research, we aim to examine how the data imbalance issue affects the detection and prevention of binary and multiclass DDoS attacks using an ML-based IDS. We will deal with the data imbalance by employing four different sampling methods and evaluating the effectiveness of five distinct machine-learning algorithms. We intend to train our model using the CIC-DDoS 2019 dataset and evaluate its performance on both the same dataset and the CIC-IoT 2023 dataset. We will then compare the outcomes, focusing on metrics such as accuracy, precision, recall, and f-1 score for both binary and multiclass classification scenarios.

Critical Appraisal of Multidrug Therapy in the Ambulatory Management of Patients with COVID-19 And Hypoxemia

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This critical appraisal is focused on three published case series of 119 COVID-19 patients with hypoxemia who were successfully treated in the United States, Zimbabwe, and Nigeria with similar off-label multidrug treatments that may include ivermectin, nebulized nanosilver, doxycycline, zinc, and vitamins C and D, resulting in rapid recovery of oxygen levels. We investigate whether these treatment protocols were successful in preventing hospitalizations and deaths. We use a simplified self-controlled case series method to investigate the association between treatment and the existence of a hospitalization rate reduction effect. To show the association between treatment and the existence of a mortality rate reduction effect, we performed conservative comparisons of the treatment case series with several external control groups using the exact Fisher test. A novel statistical technique, based on the Sterne interval and the Bayesian factor, was used to assess the resilience of these results with respect to selection bias. A statistically significant reduction in hospitalization rate is supported by our statistical analysis for two of the three case series with the most aggressive treatments, and it is found to be resilient against both random and systemic selection bias. Combining all three case series or the two case series with the most aggressive protocols allows us to show the existence of statistically significant mortality rate reduction, and it is more likely than not that random selection bias does not overturn this finding. These results, combined with an extensive literature review, show that the efficacy of these multidrug treatments is supported by the Bradford Hill criteria for strength of association, temporality, biological gradient, consistency, and biological plausibility.

Numerical Analysis of Fractional Differential Equations

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In this research we will analysis the numerical solutions of fracatal-fractional order differential equations using the developed numerical technique.

Estimation of Treatment Effects with Missing Observations in Crossover Clinical Trials

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Background: The statistical analysis in presence of missing data in any study is challenging. It gets more attention since last few years for clinical trials. There are several reasons for the occurrence of missing data in the crossover trial. However, attempts toward crossover trial data are negligible.

Objective: Development of missing data handling technique to handle crossover trial data where missing data occur during the follow-up measurements.

Methodology: Data obtained from a crossover trial having microarray gene expression values are considered. The gene expression values are considered as outcomes with therapeutic effects. The statistical methodology are explained through Multiple Imputation and Bayesian approach separately. Further, their performance with same data is documented. In Bayesian context, it becomes feasible to perform the causal effect relation jointly with imputation.

Results: Multiple Imputation procedures to overcome the missing values in the dataset and thereafter performed with the mixed effect model to explore the causal effect relation between therapeutic arm on gene expression values.

Modify the Lasso Regression Model Via Its Bayesian Interpretation

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The purpose of this study is to modify the ordinary LASSO regression model by using a generalized Laplace distribution (GL). A family of GL distributions is derived using the T-R{Y} framework. The Bayesian interpretation of LASSO is used to introduce additional constraints to the ordinary LASSO model approach. The modified LASSO regression model is examined for geometric effects induced by the parameters of the GL distribution. Finally, a real-world dataset is shown to show that the modified LASSO regression model is flexible and useful in selecting variables that have better prediction capabilities.

Transmission Based Association Test for Multivariate Phenotype Using Quasi Likelihood

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The Transmission Disequilibrium Test (TDT) is a family-based alternative to the population-based case-control test for genetic association and is protected against inflated rates of false positives arising due to possible population substructure. Most complex genetic traits are governed by quantitative precursors and it may be a more prudent strategy to analyze these quantitative traits instead of the binary end-point clinical trait. However, a single quantitative trait may not be a sufficiently good surrogate for the clinical end-point and a test based on a multivariate phenotype vector comprising the precursor variables may yield higher power to detect association. While the classical TDT design utilizes information on transmission only from heterozygous parents in a family, Kulkarni and Ghosh (2017) showed that the inclusion of transmission information from both parents results in a substantial increase in the power of the association test. In this article, we extend the above mentioned quasi-likelihood-based procedure proposed by Kulkarni and Ghosh to incorporate multivariate phenotypes possibly comprising both quantitative and qualitative phenotypes. We carry out extensive simulations under a wide spectrum of genetic models and compare the performance of the proposed procedure with some existing association tests for multivariate phenotypes.

How Does Education Impact A Family's Overall Well-Being and Quality Of Life? An Application of Ordinal Logistic Regression

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Collecting data from 292 students, we analyzed the impact of education on Hispanic families' well-being and quality of life. We found that those whose parents were involved more in their education and who encountered more barriers or challenges were likelier to feel that their quality of life would improve as their educational attainment increased. This study highlights the importance of parent involvement and indicates that the college-age population is adept at overcoming obstacles and barriers.

Features Selection in Regression Models Using Variance-Based Sensitivity Analysis

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Variance-based sensitivity analysis serves as a crucial tool for assessing the variability of inputs on the output of complex mathematical models. In this thesis, we study Sobol indices, a class of variance-based sensitivity analysis, to quantify the importance of each input variable on the overall variability of the model output.

Initially, we discuss Sobol's first and total order indices. This includes brief demonstration through two examples: the Sobol G-function and a polynomial function, each with six input variables. These examples serve to highlight the theoretical foundations and practical applications of Sobol's indices in analyzing model sensitivities.

Primarily, we apply Sobol's method within the framework of a regression model to assess the importance of various features, also known as predictors, in predicting total medical expenses. Our findings reveal that 'smoking status' emerged as the most important feature impacting health insurance charges, followed by 'age' and 'bmi' as the second and third most important features, respectively. This application not only demonstrates the effectiveness of Sobol's indices in real-world actuarial scenarios but also provides a clear hierarchy of factors affecting health insurance premiums.

In summary, this study aims to implement a variance-based sensitivity method to select the most influential features, suggesting possible model simplifications and providing insights that could improve decision-making processes in health insurance modeling.

Hilbert-Kunz Theories and Applications

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The Hilbert-Hunz theory is related to other impotent notions and studies in commutative algebra. These discussions include reviews of some of the techniques applied to the Hilber-Kunz functions. Among other things, these revolve around representation rings, and p-fractals, divisor class groups, the cohomology of vector bundles, intersection theory, and cellular decomposition on the fundamental domain.

At the end, this presentation concludes with the discussion of a theory of multiplicities using the work of Kunz and the theories further developed extensively by Monsky.

Detecting Change Points in Non-Linear Curves of Longitudinal Data With Irregularly Spaced Intervals: Leveraging Smoothing Techniques

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A more effective approach for modeling non-linear trends in longitudinal data with irregularly spaced measurements involves fitting linear trends in separate segments, joined at fixed times known as change points (CPs). However, methods for determining the location and number of CPs for fitting piecewise linear mixed effects models are limited, lacking reasonable computational algorithms in standard software packages. To address this, generalized additive mixed effect models (GAMMs) and LOESS smooth curves have often been employed to discern the salient features of the non-linear trend in unbalanced longitudinal data. In this study, we utilized the R function segmented, which offers an effective algorithm for detecting CPs in general non-linear curves, on the LOESS and GAMMs smooth curves to identify change points. Determining the optimal smoothness and the number of CPs involved careful methodological considerations. The obtained locations exhibit variability within a certain width in the piecewise linear mixed effects model, which is crucial for determining the optimal location of CPs. To evaluate and compare the effectiveness of these two smoothing functions in detecting change points, we applied them to a very large dataset of early childhood growth patterns.

Optimal Determination of Change-Points on Piecewise Linear Mixed Effects Models: A Comparative Study Using RE-EM Tree and Segmented

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Longitudinal data, characterized by irregularly spaced measurements, can often be effectively modeled using parametric or semi-parametric curves. However, when dealing with non-linear trends, polynomial approximations of any order may fall short. Instead, a more effective approach involves fitting linear trends within distinct segments, which are then linked together at fixed times known as change points (CPs). Unfortunately, methods for determining the optimal location and number of CPs in fitting piecewise linear mixed effects models are limited. Presently, no widely accessible computational algorithm exists within standard software packages, except for the random effects expectation-maximization (RE-EM) tree available in R. Nonetheless, R packages such as 'segmented' and 'strucchange' offer promising avenues for detecting CPs in regression or time series analyses. These methods not only hold the potential to estimate the number of CPs but also provide initial approximations of their locations. These approximations can be further refined by considering within-subject correlation in the model. This study investigates the application of the RE-EM tree, and segmented methods in accurately determining CPs in fitting piecewise linear mixed effects models, utilizing both real-world and simulated datasets.

Generating Heat Maps for Turbulence - Imputing Turbulence Readings Through Spatio-Temporal Weighting

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This presentation introduces a novel method for addressing the challenge of predicting accurate clear-air turbulence. While planes can directly measure the Eddy Dissipation Rate (EDR), a crucial indicator of turbulence, our approach makes the data accessible over a large scale by processing observations from multiple flights. We generate EDR heat maps by applying spatio-temporal weighting to impute turbulence readings. The validation of our model using K-Fold cross-validation yields promising results. This innovative approach can potentially advance aviation safety by providing pilots with precise mappings of the invisible danger around them.

Methods for Integrating Probability and Non-Probability Survey Data

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Online surveys are revolutionising the way information is collected because they are quick, easy and inexpensive to administer. For this reason, even official institutions are investigating online surveys and the possibility of using them to replace traditional methods of administering questionnaires, such as face-to-face interviews or computer-assisted telephone interviewing (CATI). However, online surveys have one major drawback, which is their non-probability nature, which avoid us from properly constructing and studying their estimators. Therefore, probability surveys remain the most accurate and reliable alternative. However, in certain cases it may be useful to use a non-probability sample, even if it is complementary to a classical probability survey. Especially in cases where such a survey cannot achieve a recommended sample size or under-represents a part of the population.

In this paper, we will develop a new methodology to combine probability and non-probability survey samples, with the complementary use of machine learning techniques, in order to obtain more accurate estimates of the population of interest. To test the performance of this method, we will conduct a simulation study with many other techniques that have been widely studied, trying to keep the bias as low as possible. Finally, we will check how this new method, which integrates both types of samples, achieves the best results in terms of reducing the bias of the estimates.

Mathematical Models and The Fitzhugh-Nagumo Equation in Neuroscience

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The Fitzhugh-Nagumo model is often used as a generic model for excitable media because it is analytically tractable. You will use it as a simple model to generate traveling waves by the addition of a diffusion term: a second derivative in spatial coordinates. As with ordinary differential equations, whenever you attempt to compute partial differential equations, you must be careful that the various errors that can be introduced, such as truncation errors and roundoff errors, are not significant and that the necessary conditions for stability are met. In this presentation, numerical methods including the finite difference method, the finite element method, and the least-squares finite element method are applied to approximate its traveling wave solutions. Since the FitzHugh-Nagumo model with strong reaction has a significant role in the application, appropriate numerical scheme is designed to study it. The consistency and stability of the methods will be investigated as needed. Numerical results are provided to illustrate the performances of the methods on the FitzHugh-Nagumo model under different cases. The Fitzhugh-Nagumo neuron model has been essentially utilized to analyze the impact and its effects as it plays a significant role in Neuroscience.

Exploring Potential Applications of The Monster Group and Other Simple Sporadic Groups

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One of the most common applications of groups is the description and characterization of the structure of a given object, symmetry being the most typical one. However, groups have interesting properties that constitute the additional distinctive structure of the group itself. In particular, there is a special type of group that is considered fundamental in some sense. In the case of finite groups, the latter can be broken down into some sort of composition of smaller groups. The so-called simple groups are those groups whose only normal subgroups are the identity subgroup and the group itself. One such simple group that has sparked the interest of many mathematicians over the past decades is the Monster group. The Monster is the largest of the sporadic simple groups. Its order is approximately 8x10^53. The Monster is a group of rotations in 196,883 dimensions. With the help of modern computational resources, it is possible to handle groups such as this one without much difficulty. Although there are no known current applications of this group, we believe that exploring its properties and its structure we may find ideas that may eventually be translated into specific, and hopefully, concrete applications to this impressive group.

Describing the Lifecycle Dynamics of Lithium-Ion Batteries (Libs)

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A nation of electric vehicles, powered by lithium-ion batteries (LIBs), plays a big part in the vision of a net-zero emission economy. However, using new lithium material for LIBs also contributes significantly to emissions. Though recycling rates of lithium-ion batteries (LIBs) vary based on the reporting source, many articles claim that merely 5% of all LIBs are recycled worldwide. To reach true net-zero emissions, recycling rates for existing LIBs must raised significantly. Yet it is challenging to determine an exact recycling rate, due to the variety in LIB device life-cycle and the popularity of second-purpose LIB use. These factors pose difficulties in building a circular economy for LIBs which considers recycling in the production model. One outstanding barrier to making recycling economical throughout the LIB supply chain relates to the uncertainty surrounding remaining useful life (RUL) of an LIB - at what level of degradation is there optimal salvage-ability?

To address this question, we explore the application of sparse identification of nonlinear dynamics methods (SINDy) to a dataset of 124 commercial lithium iron phosphate/graphite (LFP) defining a model capable of predicting battery state-of-health (SOH) over time. If a precise remaining useful life (RUL) and percent yield from recycling can be guaranteed within a certain level of confidence, then private industry will have incentives to emphasize LIB recycling in their production models.

Analytical Considerations For Longitudinal Analysis Of Egfr In Patients After Lung Transplantation

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Glomerular filtration rate (GFR) is measure of how well the kidneys filter the blood by removing waste and extra water to make urine. GFR is used to help diagnose kidney disease at an early stage, to monitor people with chronic kidney disease (CKD), to monitor people with other conditions that cause kidney damage, such as diabetes and high blood pressure. Often treatment interventions may result in an initial acute effect on eGFR shortly after the treatment that differs from the long-term treatment effect. When this occurs, the rate of decline in eGFR over time may be characterized by two slopes: an acute slope and chronic slope. In this study, we present longitudinal data modeling strategies characterizing the rate of decline in eGFR among individuals with AKI and CKD in a large cohort of lung transplant recipients

Study of Growth Complexity in Large Cervix Deformations

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In this talk, the human cervix during pregnancy is studied to show how cervical thinning and dilation are generated by complex growth. The morphoelasticity theory is employed to model the deformations. A growth tensor is used to represent growth in three principal directions of the cervical tissue. The computational results demonstrate that both negative radial growth and positive circumferential growth facilitate thinning and dilation. Modeling such mixed growth represents an advancement beyond commonly used uniform growth inside tissues to study tubular deformations. The results, employing the cervix as an example, reveal that complex growth may occur inside tissues to achieve certain tubular deformations.

Analysis and Comparison of Equilibrium Height Growth Models for Fracture Propagation in Formations with Multiple Layers

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Because of the development of hydraulic fracturing in unconventional reservoirs and the singularity issues existing in the computation problems, accurately modeling the propagation of the hydraulic fractures has been both a necessity and big challenge for the researchers. Among all the techniques for fracture propagation modeling, equilibrium height growth model is the most efficient method due to the balance of accuracy and computation efficiency. In this study, the development history will be discussed, and their connections and differences will be analyzed. Especially, three different equilibrium height growth models (Analytical Method, Reference Pressure Method and Direct Minimum Method) are analyzed and compared for a three-layer reservoir zone. Their advantages and disadvantages are summarized and illustrated.

Nonlinear Stability Analysis Of Double-Diffusive Convection In A Kelvin-Voigt Fluid

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Fluid motion driven by thermal gradients (Rayleigh-Bénard convection) is a common and important phenomenon in nature. Convection is a major feature of the dynamics in the oceans, the atmosphere, and the interior of stars and Earth. Rayleigh-Bénard convection problems also find numerous industrial applications. In this talk, I will present a mathematical model of the Rayleigh-Bénard convection configuration for a viscoelastic class of fluid, wherein a dissolved salt field exists. Nonlinear stability analysis of the problem will be discussed. Additionally, I will present some numerical results. This is a joint work carried out with Dr. Dambaru Bhatta, UTRGV.

Variable Selection in High-Dimensional Ordinal Quantile Regression

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Since the pioneering work of Koenker and Bassett (1978), quantile regression has been a popular regression technique that helps researchers investigate a whole distribution of the response variable. In practice, ordinal outcomes appear frequently and have significant importance in many applications. In this discussion, we develop a Bayesian hierarchical model to conduct parameter estimation and variable selection for quantile regression with ordinal responses. We use the latent response variable generated by the ordinal outcomes and the mixture representation of the asymmetric Laplace distribution to set up the quantile regression model. Then, we employ the horseshoe prior and group sampling of the latent dependent variable and cutpoints to reduce autocorrelation in generated posterior samples in high-dimensional settings. Finally, we utilize the sequential two-means clustering to select important predictors for the model comparison. We conduct both simulation studies and real data applications to illustrate the feasibility and computational advantages of the proposed model.

Resilient Regression: Strategies for Handling Outliers and Multicollinearity in Data Analysis

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Ensuring the accurate representation of response functions is essential for effective modeling and analysis. This paper explores various regression methods, recognizing the detrimental impact of outliers and multicollinearity on classical regression models, leading to misleading results. Multicollinearity diminishes coefficient precision, thereby weakening the statistical power of the regression model. To address these issues, robust regression techniques are recommended as they remain unaffected by outliers and errors in distribution specification, offering resilient and comprehensive estimates compared to mean regression. Robust methods such as ridge regression and M estimates present formal procedures to mitigate the influence of outliers and multicollinearity on regression estimates. Consequently, employing robust regressions helps minimize differences between functional forms, enhancing the reliability of the modeling process.

Comparative Analysis of Rice Genotype Classification Using Statistical and Artificial Neural Network Models

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Classification is that arena of science which deals with grouping of objects on the basis of information available about those objects. It plays a significant role for planning purposes in agriculture system. The aim of this study is to study the classification techniques through statistical as well as artificial neural network models for the primary data related to 140 rice genotypes of the trial laid in SKUAST, Jammu for yield and yield attributing characters. The statistical model used for classification technique was ordinal logistic regression model whereas in case of artificial neural network, multilayered perceptron neural network was used. The class variable number of days for 50 % flowering was categorized into 3 classes and was considered as dependent variable and all other characters as independent variables. The ability measures of classification such as Accuracy Rate, Kappa Statistics, Average precision and

Average Recall were used for testing samples. Number of days for full flowering was found to be important attributing character for classification. Multilayered Perceptron Neural Network performed better than Ordinal Logistic Regression for classification of genotypes for different classes of maturity of rice genotypes.

On Finite Element Solution of Stress-Strain State in a Strain-Limiting Elastic Body Containing a V-Notch

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In this talk, first I will describe a novel constitutive relation to characterize the response of elastic solids. The class of models considered allows a nonlinear relationship to describe the response of a geometrically linear body. The proposed theory leads to a quasi-linear partial differential equation that presents several challenges. A conforming finite element discretization of the boundary value problem will be presented. Finally, I will present some interesting results from the direct numerical simulation of static v-notch problem.

An Evaluation of Feature Selection Methods in Machine Learning in The Presence of Class Imbalance

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Class imbalance is a problem that often arises in real-world machine learning applications, such as medical diagnosis and fraud detection, where one class significantly outperforms the other(s). Traditional approaches can lead to models that are biased towards the majority class, which can negatively affect the performance of the minority class. To address this issue, techniques such as the synthetic minority oversampling technique (SMOTE), Adaptive Synthetic Sampling (ADASYN), and NearMiss have been used to adjust the class distribution; however, they may not work well when the feature space is noisy, irrelevant, or high-dimensional. This thesis proposes a novel approach that integrates class rebalancing techniques with feature elimination strategies, and then passes each feature through a random forest (RF) and Deep Neural Network (DNN) for a comprehensive analysis. We focused on feature elimination methods, such as chi-square, information gain, logistic regression, Recursive Feature Elimination (RFE), LASSO, and Decision Tree-based importance, to identify and discard non-informative features, thereby streamlining the models and potentially mitigating overfitting. This technique combines the strengths of both random forests (RF) and deep neural networks (DNNs) to provide deeper insights into the feature behavior and model performance on imbalanced datasets. We also conducted a comprehensive benchmarking analysis to demonstrate the effectiveness of our method in various class imbalance scenarios and evaluate the impact of each class rebalancing technique when combined with advanced predictive modeling. Our study presents an integrated solution that addresses class imbalance through established resampling techniques and enhances predictive modeling using a unique feature elimination and dual-modelling approach. The findings of this study offer significant insights and practical guidance for practitioners dealing with imbalanced datasets to improve model accuracy, interpretability, and generalization in real-world applications.

A Glimpse of Hopf Bifurcation with Respect to the Fitzhugh-Nagumo Equations

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The two-dimensional FitzHugh–Nagumo model describes the process of activation and deactivation dynamics of a spiking neuron. We model the neuron as a resting potential. Since it is a stable equilibrium, small perturbation always leads to trajectory that converge on it. Since big perturbation starts spiking, this equilibrium cannot be unique. In its basic form, the model consists of two coupled, nonlinear ordinary differential equations, one of which describes the fast evolution of the neuronal membrane voltage, the other representing the slower recovery action of sodium channel deinactivation and potassium channel deactivation. Phase plane analysis of the FHN model provides qualitative explanations of several aspects of the excitability exhibited by the Hodgkin–Huxley (HH) model, including all-or-none spiking, excitation block, and the apparent absence of a firing threshold. In this presentation, we take a deeper look at a FitzHugh–Nagumo model in a network with time delay. More importantly, we studied the linear stability of the equilibrium, then the existence of Hopf bifurcation is given, and finally, the stability of the Hopf bifurcation is introduced with Respect to the FitzHugh-Nagumo Equations.

A Sufficient Condition for the Hamiltonicity of Vertex Envelopes of Plane Graphs

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We explore a sufficient condition for the Hamiltonicity of vertex envelopes of plane graphs. In particular we show that if a plane graph G contains an independent set of vertices I such that G - I is a tree, then its vertex envelope G_V^* is Hamiltonian. Based on this criteria, we identify classes of plane graphs whose vertex envelopes are Hamiltonian. We also describe constructions that produce plane graphs whose vertex envelopes are Hamiltonian, and investigate the Hamiltonicity of graphs obtained through edge subdivisions.

Oscillations in Neuronal Activity: A Neuron-Centered Spatiotemporal Model of the Unfolded Protein Response in Prion Diseases

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Many neurodegenerative diseases (NDs) are characterized by the slow spatial spread of toxic protein species in the brain. The toxic proteins can induce neuronal stress, triggering the Unfolded Protein Response (UPR), which slows or stops protein translation and can indirectly reduce the toxic load. However, the UPR may also trigger processes leading to apoptotic cell death and the UPR is implicated in the progression of several NDs. In this talk, we develop a novel mathematical model to describe the spatiotemporal dynamics of the UPR mechanism for prion diseases. Our model is centered around a single neuron, with representative proteins P (healthy) and S (toxic) interacting with heterodimer dynamics. The model takes the form of a coupled system of nonlinear reaction-diffusion equations with a delayed, nonlinear flux for P. Through the delay, we find parameter regimes that exhibit oscillations in the P- and S-protein levels. We also consider quasi-realistic clinical parameters to understand how possible drug therapies can alter the course of a prion disease.

Third Wave, Decoding Egyptian Fractions

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By 1864, after base 10 decimals had erased memories of Egyptian math styles and conventions, German scholars led a first wave to read Egyptian fraction math for 60 years. A second wave , headed by Chace , et al (1927), read the RMP, with a 2/n table , skipped over many LCM details . Second wave scholars labeled Egyptian fraction arithmetic as only additive in scope , containing no abstract elements, a sterile paradigm followed for almost 100 years by Egyptologists.

How can scribal 2/n table applications be added-back to directly discuss Egyptian fractions in an impartial third wave by Egyptologists and math historians?

Oystein Ore, "Number Theory and its History" , 1948 stated:

" The origin of the study of number properties go back probably almost as far as counting and the arithmetic operations . It does not take long before it is discovered that some numbers behave differently than others ; for instance , some numbers can be divided into smaller equal parts and others not. The operation with fractions lead immediately to the study of divisibility of numbers , the least common multiple and the greatest common divisor ."

Monitoring Small Variation of a Non-Normal Process with an Application on Wind Speed Data.

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We studied a non-normal situation is to monitor the process variability where we propose the use of a VREWMA control chart which is developed under Rayleigh distribution. We modified the EWMA control chart under Rayleigh distribution. We introduce a pivotal quantity for the scale parameter of the Rayleigh distribution which follows a gamma distribution. Probability limits and L-sigma limits are contemplated alongside with the performance measure based on different RL (run length) attributes like, ARL, SDRL, MDRL Power curve, RL curve and percentiles. We also compared our proposed VREWMA control chart with classical EWMA to illustrate the superiority our proposed chart. To avoid the complexity of future calculations for practitioners, factors for constructing control chart for monitoring the Rayleigh parameter are given for different sample sizes and different false alarm rate. We also provide simulated data to illustrate and judge the behavior of VREWMA control chart for monitoring small variations of non-normal process. We show that the proposed VREWMA control chart can detect the small variations for the non-normal process for different smoothing constants. Finally, a real life example of latest wind speed data of Bangladesh has been provided to show the significance of such a control chart.

B-CNN For Early Alzheimer Disease Detection in MRI Scans

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Alzheimer's Disease (AD) is a neurodegenerative condition characterized by dementia and impaired neurological function, impacting memory, behavior, and cognitive processes. This incurable condition predominantly targets individuals aged 40 and above. The diagnosis of Alzheimer's involves a detailed assessment of the patient's MRI scans and neuropsychological tests. Deep Learning (DL), a subset of Artificial Intelligence (AI), has introduced innovative methods for automating the diagnosis of medical (MRI) images. In the pursuit of enhancing the accuracy and efficiency of AD diagnosis, this project embarks on a comprehensive comparison of existing DL models, specifically focusing on the Convolutional Neural Network (CNN). Bayesian Convolutional Neural Network (BayesianCNN) and the U-net model. Utilizing the Alzheimer's Disease Neuroimaging Initiative's OASIS dataset, we delve into the intricacies of these models to determine their efficacy in automating the analysis of MRI scans for the early detection and monitoring of AD. Through rigorous evaluation, we aim to identify the strengths and limitations of each model, considering factors such as sensitivity, specificity, and computational efficiency. This comparative analysis not only sheds light on the potential of AI in revolutionizing AD diagnostics but also paves the way for future innovations in the field of medical imaging and neurodegenerative disease management. By leveraging the power of advanced DL techniques, our project seeks to contribute to the ongoing efforts in improving the quality of life for individuals afflicted with Alzheimer's Disease, offering hope for more accurate, timely, and accessible diagnoses.

Constrained Quantization and the Conditional Quantization for Probability Distributions

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Constrained quantization for a Borel probability measure refers to the idea of estimating a given probability by a discrete probability with a finite number of supporting points lying on a specific set. The specific set is known as the constraint of the constrained quantization. A quantization without a constraint is known as an unconstrained quantization, which traditionally in the literature is known as quantization. Constrained quantization has recently been introduced by Pandey and Roychowdhury. With the introduction of constrained quantization, quantization now has two classifications: constrained quantization and unconstrained quantization. Constrained quantization is greatly useful in radiation therapy of cancer treatment. In radiation therapy, to make sure that the radiation does not directly hit the region of good cells one can use the constrained quantization technique. Constrained quantization is extensively useful in national security, for example, to install missile stations targeting another country in an efficient way the technique of constrained quantization can be used. Constrained quantization is also useful in sending and getting signals from a certain region with minimum distortion using a fixed number of towers installed in a different region. Further, we have introduced another new idea in quantization which is known as conditional quantization in both constrained and unconstrained cases. Conditional quantization has also significant interdisciplinary applications: for example, in radiation therapy of cancer treatment to find the optimal locations of n centers of radiation, where k centers for some k<n of radiation are preselected, the conditional quantization technique can be used. After the introduction of constrained quantization, and then conditional quantization, the quantization theory is now much more enriched with huge applications in our real world. For more details one can consult my preprints and publications. I will talk about it.

Exponential Type Estimators Based on Robust Measures of Location

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This study presents some exponential type estimators based on robust measures of location such as Tri-mean, Hodges Lehman estimators, and mid-range. The main purposes of utilizing these estimators is to asses the performance of proposed estimators in case of outliers values in the data set. The MSE is used as the efficiency criteria. Numerical illustration is also presented by using real life data set.

A New Randomized Response Two Deck Card Model

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In this paper, we propose a new two deck randomized response model where the respondents are instructed to draw cards from two decks in such a way that the final estimator is more efficient than the competitors considered in the present investigation. The new expressions for the probabilities of (Yes, Yes), (Yes, No), (No, Yes) and (No, No) responses are used to construct a new estimator. A simulation study has been conducted to determine the magnitude of gained relative efficiency.

Oscillations in Neuronal Activity: A Neuron-Centered Spatiotemporal Model of the Unfolded Protein Response in Prion Diseases

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Many neurodegenerative diseases (NDs) are characterized by the slow spatial spread of toxic protein species in the brain. The toxic proteins can induce neuronal stress, triggering the Unfolded Protein Response (UPR), which slows or stops protein translation and can indirectly reduce the toxic load. However, the UPR may also trigger processes leading to apoptotic cell death and the UPR is implicated in the progression of several NDs. In this paper, we develop a novel mathematical model to describe the spatiotemporal dynamics of the UPR mechanism for prion diseases. Our model is centered around a single neuron, with representative proteins P (healthy) and S (toxic) interacting with heterodimer dynamics (S interacts with P to form two S's). The model takes the form of a coupled system of nonlinear reaction-diffusion equations with a delayed, nonlinear flux for P. Through the delay, we find parameter regimes that exhibit oscillations in the P- and S-protein levels. We find that oscillations are more pronounced when the S-clearance rate and S-diffusivity are small in comparison to the P-clearance rate and P-diffusivity, respectively. The oscillations become more pronounced as delays in initiating the UPR increase. We also consider quasi-realistic clinical parameters to understand how possible drug therapies can alter the course of a prion disease. We find that decreasing the production of P, increasing the clearance of S, reducing the recruitment rate, and increasing the clearance of P appear to be the most powerful modifications to reduce the mean UPR intensity and potentially moderate the disease progression.

What Most Affects the Probability of Receiving Public Assistance? Examining the Effect of Family Background and Educational Attainment on Receiving Public Assistance with Multivariate Regression Analysis

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Understanding poverty as being unable to meet basic needs such as water, food, clothes, shelter, and essential services (e.g., sanitation, health, and education), its concerted study in the United States not only stands tandem with constitutionally upheld values such as equality but is crucial for soundly informing and assessing law, policy, and programs that ensure a robust society. Especially amidst global challenges (e.g., COVID-19), it becomes all the more important to understand what factors may most impact movement into and out of poverty. For this project, I examine how family background and educational attainment interact to jointly affect poverty in the United States using data from a nationally representative panel study sponsored by the National Center for Education Statistics (NCES). After proxying poverty with receiving public assistance, I tested 18 independent variables consistent with demographic and family background by conducting a multivariate regression. Ten variables were found to have a statistically significant effect on the probability of receiving public assistance with dependents (under the age of 18), recent unemployment (within the past three years), and being female being among the strongest predictors of receiving public assistance ($p<0.001$). Roughly 36% of the variation in receiving public assistance is explained by the 18 independent variables tested, helping paint poverty with more color. More importantly, these results signal a need to buttress public programs through at least 2023 given the skyrocketing unemployment rate of the 2020 year. Leaders in education, non-profit, and government may ask how, while further research can expand the list of independent variables and/or focus on a single ascribed or achieved status to test varying hypotheses in response to the “causes” of poverty.

Cheating Detection and Prevalence Estimates in the Indirect Question Techniques

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In the survey research methodology, the indirect questioning techniques (IQTs) denote a nonstandard data-collection approach used to reduce nonresponse and untruthful answers in surveys conducted with traditional direct questioning (DQ) methods and concerning highly personal, sensitive, stigmatizing, and perhaps incriminating issues such as drug addiction, domestic violence, racial prejudice, illegal income, noncompliance with laws and regulations. The validity of the IQ approach relies on two assumptions: (1) survey participants are completely honest in reporting their responses; (2) instructions prescribed by the adopted tecnique are well understood and correctly executed by the respondents. Nonetheless, the IQTs are not immune to the presence of the cheaters, i.e. respondents that fail to understand and correctly follow the rules prescribed by the adopted technique and/or deliberately conceal their true status through self-protective responding. The presence of cheaters in a "sensitive survey" may affect the accuracy of prevalence estimates by introducing a bias that needs to be controlled. To this aim, different models have been proposed in the literature. In this talk we show how the Cheating Detection Triangular Model (CDTRM) has been used in a real survey concerning COVID-19-related health behaviors to control for nonresponse and social desirability bias, and to estimate the presence of cheaters. We describe the survey design, comment the CDTRM prevalence estimates for three COVID-19 behaviors and compare them with the estimates obtained with the DQ approach. We show that the CDTRM estimates are substantially higher, thus presumably less distorted, and more valid, than those obtained in the DQ setting.

Exploring the Impact of Latent and Obscure Factors on Left-Censored Data: Bayesian Approaches and Case Study

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In the realm of scientific investigation, traditional survival studies have historically focused on mitigating failures over time. However, when both observed and unobserved variables remain enigmatic, adverse consequences can arise. Frailty models offer a promising approach to understanding the effects of these latent factors. In this scholarly work, we hypothesize that frailty has a lasting impact on the reversed hazard rate. Notably, our research highlights the reliability of generalized Lindley frailty models, rooted in the generalized log-logistic type II distribution, as a robust framework for capturing the widespread influence of inherent variability. To estimate the associated parameters, we employ diverse loss functions such as SELF, MQSELF, and PLF within a Bayesian framework, forming the foundation for Markov Chain Monte Carlo methodology. We subsequently utilize Bayesian assessment strategies to assess the effectiveness of our proposed models. To illustrate their superiority, we employ data from renowned Australian twins as a demonstrative case study, establishing the innovative models' advantages over those relying on inverse Gaussian and gamma frailty distributions. This study delves into the impact of hidden and obscure factors on left-censored data, utilizing Bayesian methodologies, with a specific emphasis on the application of generalized Lindley frailty models. Our findings contribute to a deeper understanding of survival analysis, particularly when dealing with complex and unobservable covariates.

Advanced SAS Programming

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In this talk, we will present a few advanced SAS procedures for producing descriptive statistics. Advanced SAS programming techniques have become pivotal in extracting insights from complex datasets, facilitating informed decision-making across various industries. This abstract provides an overview of the key advancements in SAS programming methodologies and their implications.

Estimation from Nonprobability Samples: A Review of Methods and Evidence.

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The introduction of new technologies in survey sampling and the development of Big Data have contributed to the rise of nonprobability samples. They are often quicker and cheaper to obtain in comparison to probability samples, but also commonly suffer selection bias from multiple sources, such as self-selection or coverage errors. Several adjustments to tackle this bias have been developed throughout the years, which can be applied depending on the available information. For instance, calibration in any of its forms can be used when only population totals of auxiliary variables are available. If a reference probability sample is available, it can be used to estimate the missing inclusion probabilities for individuals in the nonprobability sample. This can be done with several approaches: Propensity Score Adjustment, quasi-randomization, Kernel Weighting, Statistical Matching, and doubly robust estimators. If the full population data is available for some auxiliary variables, estimators based on superpopulation models can be used. Comparisons available in literature show several interesting patterns, such as the positive effect of combining some of this techniques (normally PSA and calibration but other combinations have been studied), the benefits of using Machine Learning algorithms for the prediction tasks these methods involve, but also for variable selection, and the greater consistency of estimators based on weighted predictive models. Studies also suggest that methods based on superpopulation modeling usually provide the best results, followed by Statistical Matching and doubly robust estimators, but their performance depends on the data and the auxiliary variables considered.

Probabilistic Modeling of Interactive Species

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The probabilistic population model with interactions between species will be developed. We use predator-prey interaction to come up with a system of probabilistic differential equations. By accepting a series of assumptions (Postulate) that may govern the environment, one can reach a variety of different models. In a special case we develop a system with predator's rate of change instead of the natural birth and death processes. The mean probability of the population as a mathematical expectation is computed as a solution of the system using random parameters.

On the Mathematical and Computational Issues of Modeling Fracture in Porous Elastic Solids Whose Material Moduli Depend Upon the Density

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In this talk, I will discuss mathematical and computational issues related to modeling fracture in porous elastic solids whose material moduli depend upon density. The response of the material is characterized by a special class of nonlinear implicit constitutive relations. I will propose a sub-class of nonlinear relations wherein the stress and the linearized strain appear linearly. Then, a mixed variational formulation for the three field variables such as displacement, deviatoric stress, and spherical stress will be presented for a static and quasi-static crack problem. The existence theorem for the well-posedness of the regularized problem will be discussed. I will also discuss some interesting finite element simulation results that can be directly correlated with the response of real-world engineering materials.

Median-Adapted Estimation for Population Mean: A Robust Method in the Presence of Outliers in Data

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Within the existing literature, numerous approaches for estimating the population mean rely on utilizing the mean or median of an auxiliary variable. This paper introduces a novel and efficient unbiased estimator for the population mean by using the known median of an auxiliary variable under simple random sampling. Further, the theoretical expression of the estimator's variance up to the first-order approximation has been obtained. Additionally, it conducts a comparative analysis and establishes the conditions under which the proposed estimator outperforms existing methods in terms of efficiency. A simulation study using R software is presented to illustrate and validate the theoretical findings. The results underscore the robustness and efficacy of the proposed median-adapted estimator, particularly in the presence of outliers in the data.

A Cost-Effective Computational Approach with Non Response on Two Occasions

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The present study is an attempt to equip a strategy with a cost-effective computational approach when non response is present under two occasion sampling. We have applied our computational cost strategy over Choudhary et al. (2004)’s non response setup for fixed precision and evaluated cost. In addition, we have also computed variance for some fixed cost. We have discussed the aforementioned procedure for three cases as when there is non response present on both occasions, first occasion and second occasion. A numerical illustration is demonstrated for validation of improved cost methodology where we also work out with optimum unmatched or matched fraction while Choudhary et al. (2004) do not provide the direct optimal result.

Emerging Trends in Digital Health Technologies: Revolutionizing Data Collection and Analysis in Clinical Trials

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Digital health technologies play a pivotal role in revolutionizing decentralized trials by facilitating continuous data collection and generating real-world evidence to assess the risk-benefit profiles and endpoint analysis of investigational products. This presentation explores the significance of validated and regulatory-approved digital health technologies in decentralized trials, focusing on their ability to remotely collect medical-grade data from participants' homes [1]. Examples include ambulatory blood pressure measurements, which aid in distinguishing white coat hypertension, and actigraphy data collection, which provides insights into sleep and physical activity patterns as well as symptoms of several nervous system disorders. By harnessing these technologies, researchers can streamline data collection processes, enhance data accuracy, and ultimately improve the efficiency and validity of clinical research, thereby advancing the field and benefiting patient care. The integration of digital health technologies into endpoint analysis further solidifies their role in transforming the clinical trial landscape and driving improvements in patient outcomes.

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Mathematics Behind Music

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Music, until the 17th century was one of the four mathematical disciplines of the quadrivium beside arithmetic, geometry, and astronomy. One of the earliest discoveries that interval ratios are directly related to the length of the instrument's string is attributed to Pythagoras (c. 500 BC). However, it took two millenniums to fix the music interval length by using the irrational number, the twelfth root of two.

Wherever there is beauty, it should be a pattern, a fractal structure hidden. Most classical musical pieces are beautiful to our ears, therefore it should be fractal in the musical notes arrangement. Many musicologists said that Bach's music is mathematical but it is not possible to prove whether or not Bach consciously used mathematical structures in his compositions.
Music being three-dimensional: frequency, amplitude, time interval, fractal geometry is not appropriate to use, but detrended fluctuation analysis (DFA) applied to short time series makes more sense.

In this presentation, I will give a short history of how the irrational number solved a long-time problem in music and, I will apply DFA to some music pieces and obtain their fractal dimensions.

A Brief Study on Higher Order Moments of the Estimator of Proportion Using Warner's Model

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In this topic, we have developed expressions for the population skewness and population kurtosis of the estimator of population proportion of a sensitive characteristic obtained using the Warner (1965) model. It is well known that the variance of the estimator of proportion for Warner's (1965) estimator is higher than the direct question method. It is shown that the value of the coefficient of skewness decreases for the estimator of proportion and the value of the coefficient of kurtosis also decreases. The changes in the values of these coefficients are computed for various choices of device parameters. Then simulated values of the coefficient of skewness and coefficient of kurtosis are compared to the true values of the coefficients of skewness and kurtosis.

Effect of Slip on the Oscillatory Stokes Flow Around a Circular Cylinder

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Two-dimensional oscillatory slow viscous flow problem in the neighborhood of an infinitely long circular cylinder is investigated in the low-Reynolds number regime. Exact analytical solutions for the mathematical boundary value problem are determined by the use of Fourier expansion method with stick-slip (Navier-slip) boundary conditions at the surface of the cylinder. It is found that the slip parameter ξ changes the flow structure significantly in various time domains. The flow domains are chosen according to distinct values of the frequency parameter σ. The streamlines are sketched and they display interesting flow patterns. The frequency and slip parameters, σ and ξ, strongly influence the flow fields in all cases. For some values of σ eddy structures start to appear when there is no slip at the surface and eventually disappears when ξ is gradually increased. Our numerical results indicate that delaying the occurrence of closed eddies is possible with the Navier-slip parameter. The results are of some interest in modeling the movement of microorganisms due to surface distortions.

Effect of Measurement Uncertainty on Optimal CUSUM Mean Control Charts

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The precision of measuring systems of observations is paramount for ensuring the reliability of statistical process control charts in monitoring processes. The efficacy of these charts hinges on the accuracy of the measurement system employed. Measurement errors can lead to erroneous decisions, such as unnecessary halts or failure to intervene when necessary. In this study, we explore the impact of measurement inaccuracies on the performance of two optimal CUSUM charts used for monitoring the mean of normally distributed processes: the traditional CUSUM chart and Crosier's CUSUM chart. To address measurement errors, we adopt the additive measurement error model. Through comprehensive Monte Carlo simulations across varying magnitudes of measurement errors, we analyze detailed run length profiles of these charts in terms of average run length (ARL), extra quadratic loss, relative ARL, and performance comparison index. Our findings reveal a significant reduction in the effectiveness of combined charts due to measurement errors, prompting the incorporation of a multiple measurements scheme as a countermeasure. Among the two charts studied, Crosier's CUSUM demonstrates superior performance. Furthermore, to underscore the impact of measurement uncertainty and its implications, we present results from a simulated dataset featuring a shift in the process mean.

Power Series Method for Nonlinear Fluid Dynamics Equations

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In the talk we discuss a Frobenius method for studying partial differential equations with a polynomial type of nonlinearity. Equations of this type are regularly used to model the dynamics of fluids and are often related to the Euler equations. We show that we can obtain a wide range of traveling wave solutions to well-known equations, KdV, Boussinesq, Camassa-Holm, and more, by using the proposed method.

For the classical Euler equations (EE) with a slightly modified kinematic equation we obtain an exact solution for the boundary conditions and the solution is a uniform approximation to the exact solution of the complete system. Furthermore, we show that in the context of asymptotic approximations the proposed method provides approximate solutions to the EE of exponential order. We also discuss properties, convergence, and extensions of the method.

Bias of Propensity Score Matching Due to Effect Modification with Confounding

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Propensity score matching (PSM) and inverse probability weighting (IPW) have both been applied to obtain causal estimates of treatment affect. This paper explores situations where a confounder is also an effect modifier, and it compares both methods used for bias reduction. A simulation study demonstrates that propensity score matching fails to provide an adequate bias reduction for the ATE when a confounder is also an effect modifier in contrast to inverse probability weighting. In these situations, the IPW provides less biased estimates for the ATE with a smaller mean squared error (MSE).

New Methods for Imbalanced Data Classification

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The fundamental problems behind modeling imbalanced data are that the data do not have enough information in the minority group and the data noise is compounded by a large number of cases and inputs. Existing techniques for handling imbalanced data classification include (a) pre-modeling methods that generate better training data by reducing the imbalance ratio between classes and/or selecting more relevant subset of features and (b) modeling methods by modifying existing modeling techniques to adjust the excessively high false negative rate. Among the existing techniques, the Synthetic Minority Oversampling Techniques (SMOTE) have been shown among the best. Literature also shown SMOTE suffers some drawbacks for dealing with unexpected noise in the generated data that reduces the benefit of the SMOTE sample. A new method by integrating the propensity score method with SMOTE to remove the noise data at the pre-modeling stage was proposed to deal with these problems.

A Robust Bootstrap Control Chart for the Log-Logistic Percentiles

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In this paper, we develop a robust bootstrap control chart for the problems of detecting a shift in the percentile of the log-logistic population in a process monitoring scenario, in which the quality characteristic of interest is product lifetime. The construction of a quality control chart usually depends on an accurate estimation of the unknown process parameters, which is often obtained based on conventional methods such as the maximum likelihood and methods-of-moments estimators. However, these estimators are sensitive to outliers and could result in severe bias for obtaining the control limits and thus misleading false alarm signals. To overcome this potential issue, we advocate a robust repeated median estimator as an alternative for the process parameters. Simulation studies and a real-data application are provided to illustrate the effectiveness of the proposed bootstrap control charts in terms of the average run length and the standard deviation of run length.

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