
SCHOOL OF MATHEMATICAL AND STATISTICAL SCIENCES
4th Coastal Bend
MATHEMATICS AND STATISTICS
CONFERENCE
The School of Mathematical and Statistical Sciences is pleased to announce the 4th Coastal Bend Mathematics and Statistics Conference.
The Conference provides a leading forum for disseminating the latest research and brings together students, teachers, and industry professionals from the Coastal Bend community, South Texas region, Texas, and the nation. The Conference solicits contributions from both theoretical and applied research in the field of mathematics, statistics, and related areas.
SATURDAY, MARCH 23, 2019
8:30 AM to 5:30 PM
The University of Texas Rio Grande Valley
Edinburg Campus.
HTTPS://FACULTY.UTRGV.EDU/ELEFTHERIOS.GKIOULEKAS/2019-COASTAL-BEND-CONF/
DEADLINE FOR TITLE/ABSTRACT SUBMISSION: MARCH 15, 2019
FOR MORE INFORMATION, CONTACT:
DR. ZHIJUN QIAO - ZHIJUN.QIAO@UTRGV.EDU
DR. GEORGE YANEV - GEORGE.YANEV@UTRGV.EDU
UTRGV

4th Coastal Bend Mathematics & Statistics Conference
Saturday, March 23 - The University of Texas Rio Grande Valley

Organizers:

Chairs: Dr. Zhijun Qiao (zhijun.qiao@utrgv.edu) and Dr. George Yanev (george.yanev@utrgv.edu)

Organizing Committee Members:

Dr. Dambaru Bhatta (dambaru.bhatta@utrgv.edu)

Dr. Alexey Glazyrin (alexey.glazyrin@utrgv.edu)

Dr. Sergey Grigorian (sergey.grigorian@utrgv.edu)

Dr. Tamer Oraby (tamer.oraby@utrgv.edu)

Dr. Erwin Suazo (erwin.suazo@utrgv.edu)

Dr. Kristina Vatcheva (kristina.vatcheva@utrgv.edu)

4th Coastal Bend Mathematics & Statistics Conference
Saturday, March 23 - The University of Texas Rio Grande Valley

8:30 a.m. – 9:00 a.m.	Breakfast and Conference Registration *(EMAGC lobby)*		
9:00 a.m. – 9:30 a.m.	Opening Remarks (*EMAGC 1.302*) Dr. Mohammed Farooqui, Interim Dean, COS Dr. Timothy Huber, SMSS Director		
9:30 a.m. – 10:20 a.m.	**Plenary talk (*EMAGC 1.302*)** Asymptotic Model Equations Arising in Shallow Water Theory *Yue (David) Liu, Department of Mathematics* *University of Texas at Arlington*		
10:20 a.m. – 10:35 a.m.	*Coffee break*		
10:35 a.m.-12:05 p.m.	**Parallel sessions**		
PS1: Statistics I *EMAGC 1.318*	PS2: Math I *EMAGC 1.302*	PS3: Students I (ends 11:55am) *EMAGC 1.410*	
12:05 a.m.-1:15 p.m.	**Lunch / Poster Presentations**		
1:15 p.m. – 2:05 p.m.	**Plenary talk (*EMAGC 1.302*)** Gamma Degradation Model and Related Applications: From Light Intensity to Drug Dissolution *Hon Keung Tony Ng, Department of Statistical Science* *Southern Methodist University*		
2:10 p.m.- 3:40 p.m.	**Parallel sessions**		
PS4: Math II *EMAGC 1.302*	PS5: Statistics II *EMAGC 1.318*	PS6: Students II (ends 3:50pm) *EMAGC 1.410*	
3:40 p.m. – 4:00 p.m.	*Coffee Break*		
4:00 p.m.- 6:00 p.m.	**Parallel sessions**		
PS7: Math III *EMAGC 1.318*	PS8: Math IV *EMAGC 1.302*	PS9: Students III (ends 6:20pm) *EMAGC 1.410*	

Parallel sessions schedule

PS1: Statistics I EMAGC 1.318	**10:35am-12:05pm. Chair Dr. Gkioulekas**
10:35 a.m.- 11:05 a.m.	Permutation tests for general dependent truncation Sy Han (Steven) Chiou, University of Texas at Dallas
11:05 a.m. – 11:35 a.m.	Higher Order Calibration Estimators in Two Stage sampling Veronica I. Salinas, Texas A & M Kingsville
11:35 a.m. – 12:05 p.m.	Randomized Response Techniques: Theory and Applications Sarjinder Singh, Department of Mathematics, Texas A&M University-Kingsville

PS2: Math I EMAGC 1.302	**10:35am-12:05pm. Chair Dr. Grigorian**
10:35 a.m.- 11:05 a.m.	On a Fully Implicit Energy Conserving Finite Element Discretization for the Wave Propagation in New Class of Strain-Limiting Elastic Bodies Mallikarjunaiah S. Muddamallappa, Texas A&M University-Corpus Christi
11:05 a.m. – 11:35 a.m.	Quantization for Probability Distributions Mrinal Roychowdhury, School of Mathematical and Statistical Sciences, University of Texas Rio Grande Valley, Edinburg, TX
11:35 a.m. – 12:05 p.m.	Let the Quantum Games Begin! Aden Ahmed, Department of Mathematics, Texas A&M University-Kingsville

PS3: Students I EMAGC 1.410	**10:35am-11:55am. Chair Dr. Suazo**

10:35 a.m.- 10:55 a.m.	A Time Series Graph Cut Image Segmentation Scheme for Liver Tumors Yufeng Cao, Washington State University
10:55 a.m. – 11:15 a.m.	Neural Network Solutions to Irregularly Observed Continuous - Time Stochastic Processes Jacinto De La Cruz Hernandez, Department of Mathematics and Physics, Texas A&M International University, Laredo
11:15 a.m. – 11:35 a.m.	Sparse Recovery Methods for Error Correction with Applications in Bad Data Detection for Power Systems Mengqi Hu, University of Texas at Dallas
11:35 a.m. – 11:55 a.m.	Population Dynamics for One and Multiple Species Tiffany Tooke, Texas A&M University-San Antonio

PS4: Math II EMAGC 1.302	**2:10pm-3:40pm. Chair Dr. Grigorian**
2:10 p.m. – 2:40 p.m.	Constant scalar curvature metrics Dimiter Vassilev, University of New Mexico
2:40 p.m. – 3:10 p.m.	The reduced order method for solving the linear complementarity problem with an M-matrix Ximing Fang, Zhaoqing University, China; UTRGV visiting scholar, School of Mathematical and Statistical Sciences, UTRGV, Edinburg, TX
3:10 p.m. – 3:40 p.m.	On differential independence of ζ and Γ Qi Han, Texas A&M University at San Antonio

PS5: Statistics II - EMAGC 1.318	**2:10pm-3:40pm. Chair Dr. Vatcheva**
2:10 p.m. – 2:40 p.m.	A Curious Variation on the Warner Device for Use in Randomized Response

	Zakry Zapata, Sarjinder Singh, *Stephen Sedory, Department of Mathematics, Texas A&M University-Kingsville
2:40 p.m. – 3:10 p.m.	Optimal Dividend Policy When Risk Reserves Follow a Jump-Diffusion Process with a Completely Monotone Jump Density Under Markov-Regime Switching Zhengjun Jiang, School of Mathematical and Statistical Sciences, University of Texas Rio Grande Valley, Edinburg, TX
3:10 p.m. – 3:40 p.m.	Random Forest Classification and Biomarker Discovering Model to Detect HIV-Associated Neurocognitive Impairment Hansapani Rodrigo, School of Mathematical and Statistical Sciences, University of Texas Rio Grande Valley, Edinburg, TX

PS6: Student II EMAGC 1.410	**2:10pm-3:50pm. Chair Dr. Bhatta**
2:10 p.m. – 2:30 p.m.	Estimation of Coefficient of Dispersion Using Auxiliary Information Christin Variathu Eappen, Stephen A. Sedory and *Sarjinder Singh, Department of Mathematics, Texas A&M University-Kingsville
2:30 p.m. – 2:50 p.m.	Forced Quantitative Randomized Response Model Using Ranked Set Sampling *Vaishnavi Bollaboina, Stephen Sedory and Sarjinder Singh, Department of Mathematics, Texas A&M University-Kingsville
2:50 p.m. – 3:10 p.m.	Calibration Estimation of Mean by using Double Use of Auxiliary Information Shameem Alam, Quaid-i-Azam University Islamabad Pakistan/Department of Mathematics, Texas A&M University-Kingsville
3:10 p.m. – 3:30 p.m.	Influence of Beacon Tracking on Usages and Performance in College Algebra Courses with Learning Support *Miguel A. Contreras & Pablo D. Morales, Department of Mathematics and Physics, Texas A&M International University, Laredo, TX

3:30 p.m. – 3:50 p.m.	Correlation between Higher Education and Financial Literacy Lorna P. Espinoza, Department of Mathematics and Physics, Texas A&M International University, Laredo

PS7: Math III EMAGC 1.302	**4:00pm-6:00pm. Chair Dr. Oraby**
4:00 p.m. – 4:30 p.m.	Accelerated Gradient Methods for Large-Scale Linear Inverse Problems Xianqi Li, Harvard University
4:30 p.m. – 5:00 p.m.	Analysis of Out-of-Sample Extensions of Diffusion Maps Jianzhong Wang, Sam Houston State University, Huntsville, TX
5:00 p.m. – 5:30 p.m.	On the reconstruction of viscous damping from spectral data Roger Knobel, School of Mathematical and Statistical Sciences, University of Texas Rio Grande Valley, Edinburg, TX
5:30 p.m. – 6:00 p.m.	Hydrodynamic loads on a submerged offshore structure due to wave scattering Dambaru Bhatta, School of Mathematical and Statistical Sciences, University of Texas Rio Grande Valley, Edinburg, TX

PS8: Math IV EMAGC 1.302	**4:00pm-6:00pm. Chair Dr. Suazo**
4:00 p.m. – 4:30 p.m.	Inverse spectral transform for the Ragnisco-Tu equation with Heaviside initial condition Junyi Zhu, Zhengzhou University, UTRGV visiting scholar, School of Mathematical and Statistical Sciences, UTRGV, Edinburg, TX
4:30 p.m. – 5:00 p.m.	Human cervix deformation analysis during pregnancy Kun Guo, Texas A&M University – San Antonio

5:00 p.m. – 5:30 p.m.	Multi-locality and fusion rules on the generalized structure functions in two-dimensional and three-dimensional Navier-Stokes turbulence Eleftherios Gkioulekas, School of Mathematical and Statistical Sciences, University of Texas Rio Grande Valley, Edinburg, TX
5:30 p.m. – 6:00 p.m.	Spectral Singularities with Directional Sensitivity Hamidreza Ramezani, Department of Physics & Astronomy, University of Texas Rio Grande Valley, Brownsville, TX

PS9: Students III EMAGC 1.410	**4:00pm-6:20pm. Chair Dr. Balogh**
4:00 p.m. – 4:20 p.m.	Robust explicit relaxation technique for solving the Green - Naghdi equations Eric J. Tovar, Texas A&M University, College Station, TX
4:20 p.m. – 4:40 p.m.	The Unified Transform Method for the semi-discrete heat equation on the half-line Jorge Cisneros, University of Washington
4:40 p.m. – 5:00 p.m.	The Period of the Quasipolynomial for Coefficients of Gaussian Polynomials Arturo Martinez, School of Mathematical and Statistical Sciences, University of Texas Rio Grande Valley, Edinburg, TX
5:00 p.m. – 5:20 p.m.	Primes and Composites: From Old to New and Beyond Rafael Colunga Vasquez, Department of Mathematics and Physics, Texas A&M International University, Laredo, Texas
5:20 p.m. – 5:40 p.m.	Random Network Models of Parental Vaccine Acceptance and Disease Spread Courtney Stuart, School of Mathematical and Statistical Sciences, University of Texas Rio Grande Valley, Edinburg, TX
5:40 p.m. – 6:00 p.m.	Analysis of the CNN Algorithm in target recognition using SAR images

	Ligang Zou, School of Mathematical and Statistical Sciences, University of Texas Rio Grande Valley, Edinburg, TX
6:00 p.m.-6:20 p.m.	On persistence of superoscillations for the Schrödinger equation with time-dependent quadratic Hamiltonians Elijah Hight & *Jose Palacio, School of Mathematical and Statistical Sciences, University of Texas Rio Grande Valley, Edinburg, TX

Abstracts

Let the Quantum Games Begin!

Aden Ahmed
Texas A&M University - Kingsville
aden.ahmed@tamuk.edu

We present an effect on classical games that is obtained by replacing the notion of probability distribution with the notions of “quantum superposition” and “measurement.” Our particular focus will be on two player games where each player has precisely two pure strategic choices.

Games in normal form are represented as “payoff” functions. Game quantization requires the extension of these functions to much larger domains. The main result of this work is the co-ordinatization of these extended functions by the quaternions in order to obtain computationally friendly versions of these functions. This computational capability is then exploited to analyze and potentially classify the Nash equilibria in the new extended games with occasionally counter intuitive results.

Calibration Estimation of Mean by using Double use of Auxiliary Information

Shameem Alam
Quaid-i-Azam University Islamabad Pakistan/University of Texas A & M Kingsville
shamimalamqau@gmail.com

Calibration is a technique which generates the weights which are close to the specified design weights by making use of a set of calibration constraints. It improves the precision of the estimates of population parameters by using auxiliary information. When a sufficient correlation exists between the study and auxiliary variable, the ranks of the auxiliary variable also correlated with the study variable and thus, these ranks can be used as an effective tool in increasing the precision of an estimator. In the current investigation, we propose an improved estimator of the finite population mean that uses the supplementary information in form of the ranks of the auxiliary variable in stratified sampling design. The estimated variance of the proposed estimator of mean is developed by using a lower level calibration and simulations as well as real data based results are obtained.

Hydrodynamic Loads on a Submerged Offshore Structure due to Wave Scattering

Dambaru Bhatta
School of Mathematical and Statistical Sciences, University of Texas Rio Grande Valley, Edinburg, TX
Dambaru.bhatta@utrgv.edu

We derive the governing system with proper boundary conditions in terms of a velocity potential function due to wave scattering by a submerged cylindrical structure in water of finite depth. The solution to the boundary value problem is obtained by considering two regions, and then matching the interior and exterior solutions at the interface. The analytical expressions for the hydrodynamic forces are derived using the pressure obtained from Bernoulli's equation. For different depth to radius and draft to radius ratios, computational results for the forces are presented.

Forced Quantitative Randomized Response Model using Ranked Set Sampling

Vaishnavi Bollaboina, Stephen Sedory and Sarjinder Singh*
Department of Mathematics, Texas A&M University-Kingsville
vaishnavi.bollaboina@students.tamuk.edu

In this talk, we will consider the problem of estimating the mean of a sensitive variable by combining the ideas of Bouza (2009) on the use of Ranked Set Sampling and of Gjestvang and Singh (2007) on the use of a Forced Quantitative Response. The proposed estimator is compared to the estimator of Bouza (2009), and situations are investigated where the new proposed estimator could be useful.

A Time Series Graph Cut Image Segmentation Scheme for Liver Tumors

Yufeng Cao
Washington State University
yufeng.cao@wsu.edu

Tumor detection in biomedical imaging is a time-consuming process for medical professionals and is not without errors. Thus in recent decades, researchers have developed algorithmic techniques for image processing using a wide variety of mathematical methods, such as statistical modeling, variational techniques, and machine learning. In this paper, we propose a semi-automatic method for

liver segmentation of 2D CT scans into three labels denoting healthy, vessel, or tumor tissue based on graph cuts. First, we create a feature vector for each pixel in a novel way that consists of the 59 intensity values in the time series data and propose a simplified perimeter cost term in the energy functional. We normalize the data and perimeter terms in the functional to expedite the graph cut without having to optimize the scaling parameter λ. In place of a training process, predetermined tissue means are computed based on sample regions identified by expert radiologists. The proposed method also has the advantage of being relatively simple to implement computationally. It was evaluated against the ground truth on a clinical CT data set of 10 tumors and yielded segmentation with a mean Dice similarity coefficient (DSC) of .77 and mean volume overlap error (VOE) of 36.7%. The average processing time was 1.25 minutes per slice.

Permutation Tests for General Dependent Truncation

Sy Han (Steven) Chiou
Department of Mathematical Sciences, University of Texas at Dallas
schiou@utdallas.edu

Truncated survival data arise when the event time is observed only if it falls within a subject-specific region, known as the truncation set. Left-truncated data arise when there is delayed entry into a study, such that subjects are included only if their event time exceeds some other time. *Quasi-independence* of truncation and failure refers to factorization of their joint density in the observable region. Under quasi-independence, standard methods for survival data such as the Kaplan–Meier estimator and Cox regression can be applied after simple adjustments to the risk sets. Unlike the requisite assumption of independent censoring, quasi-independence can be tested, e.g., using a conditional Kendall's tau test. Current methods for testing for quasi-independence are powerful for monotone alternatives. Nonetheless, it is essential to detect any kind of deviation from quasi-independence so as not to report a biased Kaplan–Meier estimator or regression effect, which would arise from applying the simple risk set adjustment when dependence holds. Nonparametric, minimum p-value tests that are powerful against non-monotone alternatives are developed to offer protection against erroneous assumptions of quasi-independence. The use of conditional and unconditional methods of permutation for evaluation of the proposed tests is investigated in simulation studies. The proposed tests are applied to a study on the cognitive and functional decline in aging.

The Unified Transform Method for the Semi-discrete Heat Equation on the Half-line

Jorge Cisneros
University of Washington
jorgec5@uw.edu

In this work, we present a semi-discrete analogue of the transform method proposed by A. S. Fokas to solve initial-boundary-value problems for evolution linear partial differential equations. The semi-discrete method is presented via an application to the second-order centered spatial discretization of the heat equation $q_t = q_{xx}$ on the half line. We conclude with the continuum limit of the integral solution and discuss current work in progress.

Influence of Beacon Tracking on Usages and Performance in College Algebra Courses with Learning Support

Miguel A. Contreras and Pablo D. Morales*
Department of Mathematics and Physics, Texas A&M International University, Laredo, TX

The presentation will examine the relationships and differences between student responses on the Campus Labs (Beacon Student Tracking Software) Student Strengths Inventory (Academic Self Efficacy, Educational Commitment, and Resiliency) administered during a pre-freshman orientation, usage of academic resources provided by the University Leaning Center and final grades of college freshman enrolled in an introductory mathematics course at Texas A&M International University. Data analysis includes independent sample t-tests, ANOVAS and correlations. Results from data analyses will be disseminated to the University Advising and Mentoring Center and the Office of Student Orientation, Leadership and Engagement for further discussion.

Estimation of Coefficient of Dispersion using Auxiliary Information

Christin Variathu Eappen, Stephen A. Sedory and Sarjinder Singh*
Department of Mathematics, Texas A&M University-Kingsville
christin.variathu_eappen@students.tamuk.edu

In this talk, we first discuss a few properties along with limitations of traditional measures of coefficient of dispersion in comparison to the well-known standard measure of variation called the coefficient of variation. To overcome the limitations of in the traditional coefficient of dispersion, a new measure of coefficient of dispersion is introduced which is more informative than the conventional one. A new naïve estimator of the newly developed measure of coefficient of dispersion is proposed. The bias and variance expressions for the naïve estimator are derived to the first order of approximation. In the presence of an auxiliary variable, ratio and regression type estimators for estimating the new measure of coefficient of dispersion are proposed. The bias and the variance expressions to the first order of approximation are derived. A simulation study, using R language, to judge the performance of the proposed ratio and regression type estimators with respect to the naïve estimator is considered. At the end, applications of the proposed ratio and regression type estimator based on real data sets are discussed.

Correlation between Higher Education and Financial Literacy

Lorna P. Espinoza
Department of Mathematics and Physics, Texas A&M International University, Laredo
lorna.espinoza@tamiu.edu

Having a college degree is necessary to be able to find a decent job, and while employers are looking for high-qualified individuals with experience, higher education is becoming more difficult to obtain. While employment rate for recent graduates are dropping, the amount of student debt in the United States keeps increasing. According to the National Center for Education Statistics, 19,841,000 students attended a private or public college or university. Out of those 19.84 million of students, it is approximated that almost 12 million have borrowed a loan. This shows that approximately 60% of attendees in higher education need the financial assistance of a loan to support educational expenses. It is estimated that the average cost of University per student for the 2016–17 academic year is $17,237 at public institutions, $44,551 at private nonprofit institutions, and $25,431 at private for-profit institutions. With these statistics, the like hood of students needing to request loans, credit cards or obtain any type of debt is highly common. Most students face big debts during and after college. After graduation, they face the stress of their personal finances. Students are encouraged to invest in

education at the expenses of borrowing loans with high interest rate. While they enter counseling sessions held for those students interested in applying for a loan, this is the only type of "financial literacy" required for students. Most Individuals invest a long time trying to get an education to find an appropriate job but still are not able to be financially stable. Almost two-thirds of Americans are not able to pass a basic financial literacy test, and while each higher education institutions must follow the federal standards for financial regulation, only five states require some type of financial literacy during secondary education. Fewer higher education institutions have optional financial literacy programs for students. This arises from the fact that the number of students trying to develop a financial plan and, in the urge, make ends meet and after graduation. It is estimated that they will spend around $350 each month only in student loan repayment. Evaluating the implementation of financial literacy will allow students to learn how to better utilize financial resources available without building a lifetime debt.

The Reduced Order Method for Solving the Linear Complementarity Problem with an M-matrix

Ximing Fang, UTRGV scholar
School of Mathematical and Statistical Sciences, University of Texas Rio Grande Valley, Edinburg, TX
fangxm504@163.com

In this paper, by seeking the zero and the positive entry positions of the solution, we provide a direct method, called the reduced order method, for solving the linear complementarity problem with an M-matrix. In order to show the accuracy and the effectiveness of the method, the corresponding numerical experiments are performed.

Multi-locality and Fusion Rules on the Generalized Structure Functions in Two-dimensional and Three-dimensional Navier-Stokes Turbulence

Eleftherios Gkioulekas
School of Mathematical and Statistical Sciences, University of Texas Rio Grande Valley, Edinburg, TX
eleftherios.gkioulekas@utrgv.edu

Using the fusion rules hypothesis for three-dimensional and two-dimensional Navier-Stokes turbulence, we generalize a previous non-perturbative locality

proof to multiple applications of the nonlinear interactions operator on generalized structure functions of velocity differences. We shall call this generalization of non-perturbative locality to multiple applications of the nonlinear interactions operator ``multilocality.'' The resulting cross-terms pose a new challenge requiring a new argument and the introduction of a new fusion rule that takes advantage of rotational symmetry. Our main result is that the fusion rules hypothesis implies both locality and multilocality in both the IR and UV limits for the downscale energy cascade of three-dimensional Navier-Stokes turbulence and the downscale enstrophy cascade and inverse energy cascade of two-dimensional Navier-Stokes turbulence. We stress that these claims relate to non-perturbative locality of generalized structure functions on all orders, and not the term by term perturbative locality of diagrammatic theories or closure models that involve only two-point correlation and response functions.

Human Cervix Deformation Analysis during Pregnancy

Kun Gou
Texas A&M University-San Antonio
kgou@tamusa.edu

Human cervix is an important mechanical organ located immediately below the uterus for keeping the fetus inside the uterus before baby due date. During the whole pregnancy period, the fibers inside the cervix are constantly evolving to suite the mechanical need of the cervix. The water amount inside the cervical tissue also increases to make the cervix become soft enough for smooth baby birth. The cervix is considered as a hyperelastic body surrounded by ligaments to fix the cervix on the pelvic skeleton. The top boundary of the cervix is subjected to both the intrauterine pressure from the uterus contraction and hydrostatic pressure from the fluid and fetus weight inside the uterus. We study the stress distribution of the loaded swelling cervix, and how its length and lumen area change during the second trimester period of pregnancy. The computational result helps treat a disease called cervical inefficiency, under which the cervix becomes soft and effaced ahead of the time for a normal due date causing miscarriage or immature baby birth. The stress distribution allows us to know where the cervix is under tension and vulnerable. The lumen area also facilitates us to know where the cervix is narrow so that we can use cerclage to tighten the cervix for more secure pregnancy.

Spectral Singularities with Directional Sensitivity

Ramezani Hamidreza
University of Texas Rio Grande Valley, Edinburg, TX
hamidreza.ramezani@utrgv.edu

In this talk we introduce a new class of spectral singularities that are sensitive to the direction of excitation (the so-called spectral singularity with directional sensitivity (SSDS)) and are arising in nonlinear systems with broken parity symmetry. These spectral singularities are sensitive to the direction of the incident beam and result in diverging transmission and reflection for left (right) incident while the transmission and reflection of the right (left) side of the system remain finite. Our proposed SSDS might have application in designing nonlinear sensors and it might provide a solution for hole burning problem in pumped laser cavities.

On Differential Independence of ζ and Γ

Qi Han
Texas A&M University at San Antonio
qhan@tamusa.edu

ABSTRACT: It is a profound result of Otto Hölder in 1887 saying that the Euler gamma-function Γ can not satisfy any nontrivial algebraic differential equation having polynomial coefficients in $\mathbf{C}$. David Hilbert, in his lecture addressed to the International Congress of Mathematicians at Paris in 1900 for his famous 23 problems, stated in Problem 18 that the Riemann zeta-function ζ can not satisfy any nontrivial algebraic differential equation having polynomial coefficients in $\mathbf{C}$, either; this problem was solved by Mordukhai-Boltovskoi and Ostrowski independently, and further extended by Voronin.

In 2007, Lawrence Markus, using essentially the main idea of Hölder, showed that $\zeta(\sin(2\pi z))$ and $\Gamma(z)$ are algebraically differential independence. He further conjectured that $\zeta(z)$ and $\Gamma(z)$ are algebraically differential independence as well; that is, when

$$P\left(\zeta, \zeta', \cdots, \zeta^{(m)}; \Gamma, \Gamma', \cdots, \Gamma^{(n)}\right)(z) \equiv 0$$

for a polynomial P of $m + n + 2$ independent variables, then necessarily $P \equiv 0$.

In this talk, we investigate this question and show a positive answer to it for some differential equations generated through a special family of functions $F(u_0, u_1, \cdots, u_m; v_0, v_1, \cdots, v_n)$, which are continuous in $(u_0, u_1, \cdots, u_m)$ but have polynomial coefficients in $(v_0, v_1, \cdots, v_n)$.

This is a joint work with Dr. Jingbo Liu.

Neural Network Solutions to Irregularly Observed Continuous - Time Stochastic Processes

Jacinto De La Cruz Hernandez
Department of Mathematics and Physics, Texas A&M International University, Laredo
Jacinto.DelaCruz@tamiu.edu

In this paper, we consider the problem of sparse recovery from a linear system which has bad data in observation. An iterative l_1- l_1 minimization algorithm is used to detect bad data (outliers in the error) in the observation and state estimation of the system, which has applications in state estimation of electrical power networks. We will compare our method and the conventional l_1 minimization method for the same problem with both simulations and real data.

Sparse Recovery Methods for Error Correction with Applications in Bad Data Detection for Power Systems

Mengqi Hu
University of Texas at Dallas
Mengqi.Hu@utdallas.edu

In this paper, we consider the problem of sparse recovery from a linear system which has bad data in observation. An iterative l_1- l_1 minimization algorithm is used to detect bad data (outliers in the error) in the observation and state estimation of the system, which has applications in state estimation of electrical power networks. We will compare our method and the conventional l_1 minimization method for the same problem with both simulations and real data.

Optimal Dividend Policy When Risk Reserves Follow a Jump-Diffusion Process with a Completely Monotone Jump Density under Markov-Regime Switching

Zhengjun Jiang
School of Mathematical and Statistical Sciences, University of Texas Rio Grande Valley, Edinburg, TX
zhengjun.jiang@utrgv.edu

The paper studies optimal dividend distribution for an insurance company whose risk reserves in the absence of dividends follow a Markov-modulated jump-

diffusion process with a completely monotone jump density where jump densities and parameters including discount rate are modulated by a finite-state irreducible Markov chain. The major goal is to maximize the expected cumulative discounted dividend payments until ruin time when risk reserve is less than or equal to zero for the first time. I extend the results of Jiang [Journal of Applied Probability, 52(2015), 209-223] for a Markov-modulated jump-diffusion process from exponential jump densities to completely monotone jump densities by proving that it is also optimal to take a modulated barrier strategy at some positive regime-dependent levels and that value function as the fixed point of a contraction is explicitly characterized.

On the Reconstruction of Viscous Damping from Spectral Data

Roger Knobel
School of Mathematical and Statistical Sciences, University of Texas Rio Grande Valley, Edinburg, TX
roger.knobel@utrgv.edu

Suppose a vibrating string is surrounded by a non-uniform medium which imparts a damping force on its transverse motion. Assuming the motion of the string is governed by the linear one-dimensional wave equation with an unknown variable damping coefficient, we show how the observed motion of the string at one point can be used to determine the unknown damping coefficient throughout the length of the string. Data from a simple sonometer experiment is used illustrate the method.

Accelerated Gradient Methods for Large-Scale Linear Inverse Problems

Xianqi Li
Harvard University
xli71@mgh.harvard.edu

Large-scale linear inverse problems arise in a wide range of applications such as image processing and statistical inference. However, the large (possibly dense and ill-conditioned) matrix in data fidelity term often brings significantly computational challenges when solving the formulated optimization problems and hence hindered the applicability of the sophisticated interior point method and second-order optimization methods. To tackle those challenges, first-order gradient method turns into a good choice. In this talk, we first review some

classical first-order methods, then we will introduce the proposed backtracking based accelerated gradient methods, which are capable of hunting for more aggressive step size via conducting fewer number of line searches. A brief convergence analysis will be presented. In the final part, we will discuss some applications of the proposed algorithms on structured (low rank and/or sparsity and/or group sparsity) network learning, total-variation based image reconstruction and image super-resolution problems.

Asymptotic Model Equations Arising in Shallow Water Theory

Yue (David) Liu
Department of Mathematics, University of Texas at Arlington
yliu@uta.edu

The study of water waves has a long history starting from Euler in 1752, and continues to be a very active area to the present day. Mathematically, the water wave equations describe the motion of water bounded above by a free surface. This free surface is subject to a constant (atmospheric) pressure, while gravity acts as an external force. In this talk, I will start by demonstrating the underlying complexity of the physical system, and then I will discuss possible simplifications in the “shallow water” regime along with the relevant physical phenomena. In particular, I will focus on the singularity formation of the Cauchy problem for the simplified nonlocal shallow-water models, such as Camassa-Holm-type equations in 1D and 2D cases.

The Period of the Quasipolynomial for Coefficients of Gaussian Polynomials

Arturo Martinez
School of Mathematical and Statistical Sciences, University of Texas Rio Grande Valley, Edinburg, TX
arturo.j.martinez01@utrgv.edu

Preliminary report. The goal of this presentation is to show that for a fixed m, all Gaussian polynomials $\begin{bmatrix} N+m \\ m \end{bmatrix}$ come in exactly $\frac{2\ lcm(m)}{m}$ varieties, where $lcm(m)$ represents the least common multiple of the numbers 1 through m. The set of partitions of n into at most m parts, $p(n,m)$, can be decomposed into the sum of

two collections; partitions with parts not larger than N, denoted $p(n,m,N)$, and partitions with parts larger than N, denoted $P(n,m,N)$.

It is well known that the quasipolynomial for $p(n,m)$ is periodic with period $lcm(m)$. The period of $P(n,m,N)$ is shorter, and strangely the quasipolynomial for $p(n,m,N)$ appears to not be periodic at all. We will discuss these observations and other behavior of these functions.

On a Fully Implicit Energy Conserving Finite Element Discretization for the Wave Propagation in New Class of Strain-Limiting Elastic Bodies

Mallikarjunaiah S. Muddamallappa
Texas A&M University-Corpus Christi
m.muddamallappa@tamucc.edu

The main purpose of this talk is to describe a finite element discretization of the problem of unsteady stress wave propagation and interaction with the re-entrant notch in a nonlinear elastic media. Within the realm of strain-limiting response relations, one can have a nonlinear relationship between linearized strain and the Cauchy stress, which is impossible in the classical linearized elasticity. For the problem on hand, one needs to solve a quasi-linear hyperbolic partial differential equation that is obtained through balance of linear momentum. In this talk, we present a fully discrete finite element algorithm coupled with damped Newton's method to solve the wave equation. Our numerical experiments demonstrate a quite distinctive stress wave interaction with notch tip and more importantly an energy conserving property.

Gamma Degradation Model and Related Applications: From Light Intensity to Drug Dissolution

Hon Keung Tony Ng
Department of Statistical Science, Southern Methodist University, Dallas, TX
ngh@mail.smu.edu

In engineering and sciences, the process that a system reduces in performance, reliability or life span of assets gradually and irreversibly is known as a degradation process. Degradation measurements are recorded over time for prognostics and health management purposes. The gamma degradation model has been used to characterize the evolution of degradation measurements. In this talk, I will first provide an introduction to the gamma degradation model. Then, I will introduce a

two-phase degradation model and discuss the likelihood and Bayesian inference for this model. The gamma model and the inferential methods are applied to analyze a real data set of light emitting diodes (LEDs). In addition to engineering applications, I will also discuss an application of the gamma degradation model in biopharmaceutical statistics. The gamma degradation model is used for assessing the similarity of two drug dissolution profiles and its merits are discussed.

On persistence of superoscillations for the Schrödinger equation with time-dependent quadratic Hamiltonians

*Elijah Hight and Jose Palacio**
School of Mathematical and Statistical Sciences, University of Texas Rio Grande Valley, Edinburg, TX
jose.palacio01@utrgv.edu

In this work we study the persistence on time of superoscillations for the Schrödinger equation with quadratic time-dependent Hamiltonians. We have solved explicitly the Cauchy initial value problem with oscillatory initial data. In order to prove the persistence of superoscillations we have defined explicitly a convolution operator in terms of solutions of a Riccati system associated with the variable coefficients of the Hamiltonian. The convolution operator is defined on a space of entire functions. Particular examples include Caldirola-Kanai and degenerate parametric harmonic oscillator Hamiltonians.

Random Forest Classification and Biomarker Discovering Model to Detect HIV-Associated Neurocognitive Impairment

Hansapani Rodrigo
School of Mathematical and Statistical Sciences, University of Texas Rio Grande Valley, Edinburg, TX
hansapani.rodrigo@utrgv.edu

HIV- associated neurocognitive disorders (HAND) occur frequently among people with end-stage Acquired Immunodeficiency Syndrome (AIDS). Early intervention and detection enhance the possibility of reducing the risk of suffering from severe consequences due to HAND. Genome-wide screening of transcription regulation in brain tissue help in identifying substantial abnormalities present in patients' gene transcripts and to discover possible biomarkers. This

study explores the possibility of developing a classification model using a random forest to identify the risk of diagnosing with different forms of HAND (HIV associated Dementia and HIV-encephalitis). Random forest is a popular tree-based ensemble machine learning tool that is highly data adaptive which account for correlation as well as interactions among features. Gene expression levels of three different brain sectors; white matter, neocortex and neostriatum from each patient have been utilized in developing our model. The developed model has a 65% accuracy, 69% precision and 67% recall rates. The heat map reveals significant expression level differences in certain genes of the patients relative to controls, unfolding favorable candidates for potential biomarkers to detect HAND, early on.

Quantization for Probability Distributions

Mrinal Roychowdhury
School of Mathematical and Statistical Sciences, University of Texas Rio Grande Valley, Edinburg, TX
mrinal.roychowdhury@utrgv.edu

Quantization for probability distributions refers to the idea of estimating a given probability by a discrete probability supported on a set with no more than n points. Quantization dimension gives the speed how fast the specified measure of the error goes to zero as n approaches to infinity. It has broad application in signal processing and data compression. The research in quantization is spreading and getting popular day by day among the scientists including the young researchers because of its connections in many different areas. In quantization one can work in at least two different directions: Finding the optimal sets, and determining the quantization dimension.
Finding the optimal sets is more applied and has numerous applications in real world problems.
On the other hand, the work in quantization dimension is more theoretical. This talk will be based on my work with Josef Rosenblatt (Professor, Indiana University-Purdue University Indianapolis), Carl Dettmann (Professor, University of Bristol), and my colleagues Hansapani Rodrigo, Josef Sifuentes, Erwin Suazo, and a Master's student Gabriela Pena.

Randomized Response Techniques: Theory and Applications

Sarjinder Singh
Department of Mathematics, Texas A&M University-Kingsville
sarjinder.singh@tamuk.edu

Warner (1965) proposed an interviewing technique, called randomized response, to protect an interviewee's privacy and to reduce a major source of bias (evasive answers or refusing to respond) in estimating the prevalence of sensitive characteristics in surveys of human populations. The objective of this talk will be to discuss new developments in the field of randomized response sampling and show how to implement it in practice.

Random Network Models of Parental Vaccine Acceptance and Disease Spread

Courtney Stuart
School of Mathematical and Statistical Sciences, University of Texas Rio Grande Valley, Edinburg, TX

Households with parents and children are connected to each other through different layers of social networks. Children make face-to-face contacts through biological/physical networks and pediatric disease transmission occur. Parents' decisions are shaped through social networks through which information and opinions about vaccination diffuse. We establish stochastic models for two different types of networks: the Erdős-Rényi network model and the Barabási-Albert network model. The models also include birth process. High performance parallel computations are carried out in order to understand the mutual influence emerging on the multiplex network model.

Population Dynamics for One and Multiple Species

Tiffany Tooke,
Texas A&M University-San Antonio

In this talk, we analyze population dynamics for a single or multiple species. The models include continuous growth model, logistic model and interacting species models. The original models are nondimensionalized for convenient analysis and easy parameter effect interpretation. Equilibrium solutions are obtained for each population model, and corresponding stability analysis is provided to see the long-term behavior of interruption from the steady solutions. We also demonstrate how to apply these models to explain various natural phenomena involving population variation.

Robust Explicit Relaxation Technique for Solving the Green-Naghdi Equations

Eric J. Tovar
Texas A&M University
ejtovar@math.tamu.edu

We revisit a relaxation technique introduced in Favrie and Gavrilyuk (2017) for solving the Green-Naghdi equations. We propose a version of the method and a space/time approximation thereof that is scale invariant. The approximation in time is explicit and the approximation in space uses a length scale for the relaxation that is proportional to the mesh size. The method is compatible with dry states and is provably positivity preserving under the appropriate CFL condition. The method is numerically validated against manufactured solutions and is illustrated by comparison with experimental results.
N Favrie, S Gavrilyuk. A rapid numerical method for solving Serre-Green-Naghdi equations describing long free surface gravity waves. Nonlinearity, IOP Publishing, 2017.

Primes and Composites: From Old to New and Beyond

Rafael Colunga Vasquez
Department of Mathematics and Physics, Texas A&M International University, Laredo, Texas 78041-1900
rafaelcolunga@dusty.tamiu.edu

While prime numbers are simply defined as positive integers whose divisors are 1 and themselves, the conjectures and applications that come with them are both equally complex yet compelling. On one side, we have the famous unsolved Goldbach's Conjecture written back in the 18th century, regarded as one of the most important unsolved problems in mathematics. On the other, thanks to the

technological developments created in the last decades, important implementations have been developed, particularly in the field of cryptography. Thus, forging a new path for further research, looking far beyond what figures such as Fermat and Eratosthenes of Cyrene were even able to articulate at their lifetimes. Moreover, number theory in general is one of the biggest cornerstones of the modern world, for it allowed the development of Enigma machines, and thus, changing the course of World War II. In addition, in more recent times, popular algorithms such as RSA encryption allowed applications ranging from secure e-mails to bank transactions.

Constant Scalar Curvature Metrics

Dimiter Vassilev
University of New Mexico
vassilev@unm.edu

I will describe some results on uniqueness of constant scalar curvature metrics in sub-Riemannian geometries.

Analysis of Out-of-Sample Extensions of Diffusion Maps

Jianzhong Wang
Sam Houston State University, Huntsville, TX
jzwang@shsu.edu

Many unsupervised learning algorithms have been developed to provide dimensionality reduction (DR) that embeds high-dimensional data to a low-dimensional space, giving the feature representation of the data. However, these algorithms do not offer a direct way to give the DR for new samplings. An out-of-sample extension method then provides the approximate DR for them. Among various out-of-sample DR extension methods, those based on Nystrom approximation are very attractive. Many papers have developed such out-of-extension algorithms and shown their validity by numerical experiments. Among them, Diffusion-Maps Method is significant. Utilizing the reproducing kernel Hilbert space (RKHS) theory, this paper develops a preliminary mathematical analysis on the out-of-sample DR extension of Diffusion Maps. We treat the out-of-sample DR extension operator as an extension of the identity on the RKHS defined on the data set. Then the Diffusion-Maps DR extension turns out to be an orthogonal mapping. In the paper, we present the conditions for the exact DR extension, give the

estimate for the error of the extension, and show the effectiveness of the extension in several examples.

A Curious Variation on the Warner Device for Use in Randomized Response

*Zakry Zapata, Sarjinder Singh, and Stephen Sedory**
Department of Mathematics, Texas A&M University-Kingsville

The paper studies optimal dividend distribution for an insurance company whose risk reserves in the absence of dividends follow a Markov-modulated jump-diffusion process with a completely monotone jump density where jump densities and parameters including discount rate are modulated by a finite-state irreducible Markov chain. The major goal is to maximize the expected cumulative discounted dividend payments until ruin time when risk reserve is less than or equal to zero for the first time. I extend the results of Jiang [Journal of Applied Probability, 52(2015), 209-223] for a Markov-modulated jump-diffusion process from exponential jump densities to completely monotone jump densities by proving that it is also optimal to take a modulated barrier strategy at some positive regime-dependent levels and that value function as the fixed point of a contraction is explicitly characterized.

Inverse Spectral Transform for the Ragnisco-Tu Equation with Heaviside Initial Condition

Junyi Zhu, UTRGV scholar
School of Mathematical and Statistical Sciences, University of Texas Rio Grande Valley, Edinburg, TX
jyzhu@zzu.edu.cn

The Ragnisco–Tu equation with the Heaviside initial condition is studied in this paper through the inverse spectral transform method. The procedure based on the regularization is applied to construct the relation between potentials and dressing matrices. The explicit solutions are obtained and their dynamic behaviors are discussed.

Analysis of the CNN Algorithm in Target Recognition using SAR Images

Ligang Zou and Zhijun Qiao*

School of Mathematical and Statistical Sciences, University of Texas Rio Grande Valley, Edinburg, TX

With the rapid development of artificial intelligence technology and the emergence of a large number of innovative theories, the concept of deep learning is widely used in object detection, speech recognition, language translation and other fields. One of the important practices is target recognition in SAR images. Although it shows certain effectiveness in some researches, when using deep learning algorithm, there are still many problems that have not yet been solved. For example, the convergence of algorithms have not shown intuitively, although the high accuracy of experimental results can be obtained. There are many reasons that lead to the results divergence, such as the size of the database, the type of model, and the algorithm used in the experiment. This paper aims at analyzing the factors that influence the convergence of the results from the perspective of the CNN algorithm. The goal can be achieved by means of constraint of convergence condition. Firstly, by controlling the amount of data in the database, the influence of the size of the database will be determined. Secondly, “the radius of convergence” will be analyzed, based on which, the scope of application will be found. Combining the above two factors, a corresponding method can be given in the final paper, which gives rise to the “convergence” of the result. Finally, the effectiveness of this method is verified theoretically and experimentally using the data set.

4th Coastal Bend Mathematics & Statistics Conference
Saturday, March 23 - The University of Texas Rio Grande Valley

Organizers:

Chairs: Dr. Zhijun Qiao (zhijun.qiao@utrgv.edu) and Dr. George Yanev (george.yanev@utrgv.edu)

Organizing Committee Members:

Dr. Dambaru Bhatta (dambaru.bhatta@utrgv.edu)

Dr. Alexey Glazyrin (alexey.glazyrin@utrgv.edu)

Dr. Sergey Grigorian (sergey.grigorian@utrgv.edu)

Dr. Tamer Oraby (tamer.oraby@utrgv.edu)

Dr. Erwin Suazo (erwin.suazo@utrgv.edu)

Dr. Kristina Vatcheva (kristina.vatcheva@ utrgv.edu)

PARTICIPANTS

1. *Aden Ahmed,Texas A&M University – Kingsville, aden.ahmed@tamuk.edu.*
2. *Shameem Alam, Quaid-i-Azam University Islamabad Pakistan/University of Texas A & M Kingsville shamimalamqau@gmail.com*
3. *Vaishnavi Bollaboina, Stephen Sedory and Sarjinder Singh Department of Mathematics, Texas A&M University-Kingsville vaishnavi.bollaboina@students.tamuk.edu*
4. *Yufeng Cao, Washington State University yufeng.cao@wsu.edu*
5. *Sy Han (Steven) Chiou, Department of Mathematical Sciences, University of Texas at Dallas schiou@utdallas.edu*
6. *Jorge Cisneros, University of Washington, jorgec5@uw.edu*
7. *Miguel A. Contreras*

Department of Mathematics and Physics, Texas A&M International University, Laredo, TX
miguel.contreras@tamiu.edu

8. *Pablo D. Morales, Department of Mathematics and Physics, Texas A&M International University, Laredo, TX*
   pablod.morales@tamiu.edu
9. *Christin Variathu Eappen, Department of Mathematics, Texas A&M University-Kingsville*
   christin.variathu_eappen@students.tamuk.edu
10. *Stephen A. Sedory, Department of Mathematics, Texas A&M University-Kingsville*
    kfsas00@tamuk.edu
12. *Sarjinder Singh, Department of Mathematics, Texas A&M University-Kingsville*
    kuss2008@tamuk.edu
13. *Lorna P. Espinoza, Department of Mathematics and Physics, Texas A&M International University, Laredo*
    lorna.espinoza@tamiu.edu
14. *Ximing Fang, School of Mathematical and Statistical Sciences, University of Texas Rio Grande Valley, Edinburg, TX*
    fangxm504@163.com
15. *Eleftherios Gkioulekas, School of Mathematical and Statistical Sciences, University of Texas Rio Grande Valley, Edinburg, TX*
    eleftherios.gkioulekas@utrgv.edu
16. *Kun Gou, Texas A&M University-San Antonio*
    kgou@tamusa.edu
17. *Ramezani Hamidreza, University of Texas Rio Grande Valley, Edinburg, TX*
    hamidreza.ramezani@utrgv.edu
18. *Qi Han,Texas A&M University at San Antonio*
    qhan@tamusa.edu
19. *Jacinto De La Cruz Hernandez, Department of Mathematics and Physics, Texas A&M International University, Laredo*

Jacinto.DelaCruz@tamiu.edu

20. *Mengqi Hu, University of Texas at Dallas*
Mengqi.Hu@utdallas.edu

21. *Zhengjun Jiang, School of Mathematical and Statistical Sciences, University of Texas Rio Grande Valley, Edinburg, TX*
zhengjun.jiang@utrgv.edu

22. *Roger Knobel, School of Mathematical and Statistical Sciences, University of Texas Rio Grande Valley, Edinburg, TX*
roger.knobel@utrgv.edu

23. *Xianqi Li, Harvard University*
xli71@mgh.harvard.edu

24. *George Livadiotis, Southwest Research Institute, San Antonio, TX*
glivadiotis@swri.edu

25. *Arturo Martinez, School of Mathematical and Statistical Sciences, University of Texas Rio Grande Valley, Edinburg, TX*
arturo.j.martinez01@utrgv.edu

26. *Mallikarjunaiah S. Muddamallappa, Texas A&M University-Corpus Christi*
m.muddamallappa@tamucc.edu

27. *Hon Keung Tony Ng, Department of Statistical Science, Southern Methodist University, Dallas, TX*
ngh@mail.smu.edu

28. *Hansapani Rodrigo, School of Mathematical and Statistical Sciences, University of Texas Rio Grande Valley, Edinburg, TX*
hansapani.rodrigo@utrgv.edu

29. *Mrinal Roychowdhury, School of Mathematical and Statistical Sciences, University of Texas Rio Grande Valley, Edinburg, TX*
mrinal.roychowdhury@utrgv.edu

30. *Sarjinder Singh*, *Department of Mathematics, Texas A&M University-Kingsville*
kuss2008@tamuk.edu

31. *Tiffany Tooke, Texas A&M University-San Antonio*

ttook02@jaguar.tamu.edu

32. *Eric J. Tovar, Texas A&M University*
ejtovar@math.tamu.edu

33. *Rafael Colunga Vasquez, Department of Mathematics and Physics, Texas A&M International University, Laredo, Texas 78041-1900*
rafaelcolunga@dusty.tamiu.edu

34. *Dimiter Vassilev, University of New Mexico*
vassilev@unm.edu

35. Jianzhong Wang, Sam Houston State University, Huntsville, TX
jzwang@shsu.edu

37. *Zakry Zapata, Department of Mathematics, Texas A&M University-Kingsville*

38. *Sarjinder Singh, Department of Mathematics, Texas A&M University-Kingsville*
kfsas00@tamuk.edu,

39. *Stephen Sedory, Department of Mathematics, Texas A&M University-Kingsville*
kuss2008@tamuk.edu

40. *Junyi Zhu, School of Mathematical and Statistical Sciences, University of Texas Rio Grande Valley, Edinburg, TX*
jyzhu@zzu.edu.cn

41. *Ligang Zou, School of Mathematical and Statistical Sciences, University of Texas Rio Grande Valley, Edinburg, TX*
ligang.zou01@utrgv.edu