

Reinaldo Sanchez-Arias

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Research Interests include: numerical optimization, operations research, computational linear algebra, data mining, machine learning, data science education

Research and Teaching Experience

- **Assistant Professor of Data Science** **Florida Polytechnic University**
Department of Data Science and Business Analytics *August 2018 – Present*

Courses taught: (* indicates graduate courses)

CAP 4770 Data Mining and Text Mining	IDC 4942 Data Analytics Capstone
COP 2073 Introduction to Data Science	QMB 5565 Quantitative Research Methods *
STA 3241 Statistical Learning	CAP 5320 Data Wrangling and Exploratory Data Analysis *
CDA 4910 Directed Research	CAP 5771 Data Mining *
CIS 3301 Business Intelligence	COP 5910 Scientific Computing and Programming*

- **Assistant Professor of Applied Mathematics** **St. Thomas University**
Program Director Master of Science in Big Data Analytics, School of Science *August 2016 – July 2018*

Also served as **Mathematics and Data Science Program Coordinator**. Courses taught: (* indicates graduate courses)

MAC 1140 Precalculus	CIS 546 Data Visualization *
MAC 2311 Calculus I	CIS 544 Data Mining and Machine Learning*
CIS 204 Introduction to Data Science	MAT 602 Applied Machine Learning*
MAT 502 Statistical Methods *	CIS 626 Big Data Analytics Applications*
CIS 543 Programming for Big Data Analytics*	CIS 627 Big Data Analytics Capstone*

- **Assistant Professor of Applied Mathematics** **Wentworth Institute of Technology**
Department of Applied Mathematics *September 2014 – July 2016*

Taught courses for Applied Mathematics and Engineering majors; served as Academic Advisor for Applied Mathematics students; nominated and served as the Faculty Advisor for the Society of Industrial and Applied Mathematics (SIAM) Student Chapter; coordinated multiple sections of MATH 2860; reviewed and developed material for MATH 1900, MATH 3700, and MATH 5000; and was member of the Science Committee for the BS in Engineering program.

Courses taught:

MATH 1500 Precalculus	MATH 2800 Finite Math
MATH 1850 Engineering Calculus II	MATH 2860 Linear Algebra and Matrix Theory
MATH 1900 Introduction to Operations Research	MATH 2500 Differential Equations
MATH 2025 Multivariable Calculus	MATH 3700 Operations Research
MATH 2300 Discrete Math	MATH 5000 Applied Math Final Year Design I

- **Postdoctoral Researcher** **The University of Texas at El Paso**
Department of Mathematical Sciences *June 2013 – August 2014*

Postdoctoral Researcher in the Computational Science Program, for the Army High Performance Computing Research Center (AHPARC) grant in collaboration with Stanford University.

Advisors : Dr. Miguel Argaez and Dr. Martine Ceberio.

Emphasis: Reduced-order modeling, data analysis and sparse optimization.

- **Adjunct Instructor** **The University of Texas at El Paso**
Department of Mathematical Sciences *January 2013 – December 2013*
 Courses taught: MATH 2301 Mathematics for the Social Sciences II
- **Research Assistant** **The University of Texas at El Paso**
Department of Mathematical Sciences *January 2009 – January 2013*
 Computational Science Program, for the Army High Performance Computing Research Center (AHPARC) grant. PI: Dr. Miguel Argaez and Dr. Leticia Velazquez.
 – Implementation of conjugate gradient based methods for large KKT systems in constrained optimization.
 – Algorithmic implementation of ℓ_1 -optimization problems.
 – Applications in Compressed Sensing, Large Scale Parameter Estimation, and Classification problems.
- **Research Intern** **Repsol USA, The Woodlands, TX**
Research and Innovation Geophysics Department *July 2012*
 Seismic Image Segmentation and classification via Sparse Representation. PI: Dr. G. Larrazabal, Dr. P. Guillen and Dr. M. Argaez.
- **Research Intern** **Repsol USA, The Woodlands, TX**
Research and Innovation Geophysics Department *June 2011 – August 2011*
 Study and implementation of absorbing boundary conditions for the wave equation. Dip and Azimuth angles computation for seismic ray tracing. PI: Dr. German Larrazabal and Dr. Miguel Argaez.
- **Teaching Assistant** **The University of Texas at El Paso**
Department of Mathematical Sciences *Fall 2008 and Fall 2009*
 Grader for MATH 1411 Calculus I, MATH 2300 Discrete Mathematics, MATH 1319 Math in the Modern World, and MATH 3323 Matrix Algebra. Grader and responsible for MATLAB and problem solving sessions in MATH 5345 Numerical Optimization.
- **Teaching Assistant** **Universidad del Valle. Cali, Colombia.**
Department of Mathematical Sciences *January 2007 – June 2008*
 Tutor and Problem Solving Session Leader for Calculus, Linear Algebra, and Differential Equations.

Education

- **Ph.D. Computational Science** **The University of Texas at El Paso**
El Paso, TX. United States *May 2013*
 - Dissertation Title: “A Convex Optimization Algorithm for Sparse Representation and Applications in Classification Problems”
 - Advisor: Dr. Miguel Argaez.
 - Area of Study: Sparse Optimization, Dimensionality Reduction. GPA: 4.0/4.0
- **M.S. Computational Science** **The University of Texas at El Paso**
El Paso, TX. United States *May 2011*
 - Thesis Title: “A Sparse Representation Technique for Classification Problems”
 - Advisor: Dr. Miguel Argaez.
 - Area of Study: ℓ_1 -optimization methods. GPA: 4.0/4.0
- **B.S Mathematics** **Universidad del Valle**
Cali, Valle. Colombia *May 2008*
 - Thesis Title: “A Hierarchic a Posteriori Estimate for the Approximation of a Nonlinear Elastic Problem”, Honors Distinction.
 - Advisor: Dr. Jairo Duque.
 - Area of Study: Finite Element Methods for Elasticity Problems. GPA: 4.4/5.0

Relevant Coursework.....

Computational Methods for Linear Algebra, Numerical Optimization, Numerical Partial Differential Equations, Numerical Analysis, Mathematical and Computer Modeling, Parallel and Concurrent Programming, Advanced Algorithms, Advanced Numerical Optimization, Data Mining and Machine Learning, Digital Signal Processing, Geophysical Inverse Theory.

Awards

- **Travel Award.** NSF funded Big Data Spoke Bootcamps. *Data Wrangling and Electronic Health Records Analysis using R*. H. Qin (University of Tennessee at Chattanooga), E. Fong and Z. Miao (Center for Health Systems Innovation at the Oklahoma State University)
July 29th - Aug 2nd, 2019, Chattanooga, TN, USA.
- **Travel Award.** *NSF CISE Proposal Writing Workshop*.
April 9-10th, 2018, Alexandria, VA, USA.
- **Travel Award.** *The National Conference on Race and Ethnicity in American Higher Education (NCORE)*.
May 26-30th, 2015, Washington, D.C, USA.
- **Travel Award.** NSF funded NIMBioS Tutorial, *Computing in the Cloud: What Every Computational Life Scientist Should Know*. National Institute for Mathematical and Biological Synthesis (NIMBioS).
April 6-8th 2014, Knoxville, TN, USA.
- **Travel Award.** NSF Funded Workshop, *Academic Careers Workshop 2014*.
March 27-30th 2014, Northwestern University, Evanston, IL, USA.
- **Outstanding Ph.D. Dissertation Award Computational Science Program.**
April 25th, 2014, El Paso, TX, USA.
- **Best Student Interval Paper Award.** *IFSA/NAFIPS Congress 2013*.
June 24-28th 2013, Edmonton, Canada.
- **Academic Excellence Graduate Student Award UTEP College of Science.**
May 10th 2013, El Paso, TX, USA.
- **Second Place Best Oral Presentation.** *UTEP Graduate Research Expo*.
November 9th 2012, El Paso, TX, USA.

Publications

- R. Sanchez-Arias, R. Batista. "Unsupervised Learning on the Health and Retirement Study using Geometric Data Analysis". In: *Proceedings of the 18th IEEE International Conference on Machine Learning and Applications (ICMLA)*, Boca Raton, FL, 2019, pp. 335-340.
- Q. Goss, M. I. Akbas, L. G. Jaimes and R. Sanchez-Arias. "Street Network Generation with Adjustable Complexity Using k-Means Clustering". In: *Proceedings of the IEEE SoutheastCon*, April, 2019.
- Sanchez-Arias R., Sole A., Rojas J. "Semi-supervised Learning Methods for Early Prediction and Forecasting of Clinical Deterioration". *Technical Report for MediKos Inc*, 2018.
- Husowitz B., Sanchez-Arias R. "A Machine Learning Approach to Designing Guidelines for Acute Aquatic Toxicity". In: *J Biom Biostat*, vol. 8, no. 6. 2017.
- Bonavides-Aguilar C., Sanchez-Arias R., Lanzas C. "Accurate Prediction of Major Histocompatibility Complex Class II Epitopes by Sparse Representation via ℓ_1 -minimization". In: *BioData Mining*, vol. 7, 2014.
- Ramirez C., Sanchez R., Kreinovich K., Argaez M. " $\sqrt{x^2 + \mu}$ is the Most Computationally Efficient Smooth Approximation to $|x|$ ". In: *Journal of Uncertain Systems*, vol. 8, no. 3, pp 205-210. 2014.
- Sanchez R., Servin C., Argaez M. "Sparse Fuzzy Techniques Improve Machine Learning". In: *Joint World Congress of the International Fuzzy Systems Association and Annual Conference of the North American Fuzzy Information Processing Society IFSA/NAFIPS*, pp. 531-535. 2013.
- Argaez M., Sanchez R., Ramirez C., "Face Recognition from Incomplete Measurements via ℓ_1 -minimization". In: *American Journal of Computational Mathematics AJCM*, vol. 2, no. 4, pp 287-294. 2012.
- Sanchez R., Argaez M., Guillen P. "Sparse Representation via ℓ_1 -minimization for Underdetermined Systems in Classification of Tumors with Gene Expression Data". In: *IEEE 33rd Annual International Conference Proceedings of the Engineering in Medicine and Biology Society*, pp. 3362 - 3366. August 2011.
- Guillen P., Martinez-de-Pinson F., Sanchez R., Argaez M., Velazquez L. "Characterization of Subcortical Structures during Deep Brain Stimulation utilizing Support Vector Machines". In: *IEEE 33rd Annual International Conference Proceedings of the Engineering in Medicine and Biology Society*, pp. 7949 - 7952. August 2011.

- Hernandez, M., Olaya, J., Sanchez, R., Ramirez, C., Romero, R., Velazquez, L., Argaez, M. "Performance Comparison of an HPC ℓ_1 -optimization algorithm for compressed sensing". In: *IEEE proceedings of Department of Defense High Performance Computing Modernization Program Users Group Conference*, pp. 391-400, June 2011.
- Argaez, M., Ramirez, C., Sanchez, R. "An ℓ_1 -algorithm for underdetermined systems and applications". In: *IEEE proceedings of the North American Fuzzy Information Processing Society*, pp.1 - 6. March 2011.
- Velazquez, L., Argaez, M., Sanchez, R., Ramirez, C., Hernandez, M., Culbreth, M., Jameson A. "Hybrid optimization schemes for wing modeling of micro-aerial vehicles". In: *IEEE proceedings of Department of Defense High Performance Computing Modernization Program Users Group Conference*, pp. 149-154. June 2010.

Talks

- ◇ "Data Science of Social Networks", *St. Thomas University, Library Lecture Series*, Miami, FL. April 2018
- ◇ "A Discussion on Data Analytics and Machine Learning Applications for Engineering and Science", *Florida International University, Department of Biomedical Engineering*, (Wallace H. Coulter Lecture Series), Miami, FL. USA. October 2017
- ◇ "Data Science and Big Data Analytics for Social Good", *Marines 4th Civil Affairs Group (CAG) Planning Exercise*, (Invited Talk), Miami, FL. USA. July 2017
- ◇ "A Duality Approach For Sparse Representation In Classification", *SIAM Annual Meeting 2016*, (Contributed Talk), Boston, MA. USA. July 2016
- ◇ "Introduction to Sparse Optimization and Applications in Machine Learning", *Taller de Avances en Matemática Aplicada y Biomatemática 2013*, Two-day mini-course. (Invited Talk at Universidad Autónoma de Occidente), Cali, Colombia. November 2013.
- ◇ "Sparse Representation and Applications in Classification - Keep it sparse, be happy -". *UTEP 2nd Annual Graduate Research Expo*. El Paso, TX, USA. November 2012.
- ◇ "Sparse Representation via ℓ_1 -minimization for Underdetermined Systems in Classification of Tumors with Gene Expression Data". *IEEE 33rd Annual International Conference Proceedings of the Engineering in Medicine and Biology Society*. Boston, MA, USA. August 2011.
- ◇ "An ℓ_1 -algorithm for underdetermined systems and applications". *North American Fuzzy Information Processing Society, NAFIPS 2011*. The University of Texas at El Paso, TX USA. March 2011.
- ◇ "Hybrid Optimization for Parameter Estimation Problems". *The International Conference for High Performance Computing (SC10)*. Demonstration at AHPCRC booth. New Orleans, LA USA. November 2010.
- ◇ "Hybrid Optimization Schemes for Parameter Estimation Problems". *Army High Performance Research Computing Center (AHPCRC) Annual Review*. Stanford University, Palo Alto, CA USA. July 2010.
- ◇ "A Path Following Method for large scale ℓ_1 -underdetermined problems". *6th Joint UTEP/NMSU Workshop on Mathematics, Computer Science and Computational Sciences*. The University of Texas at El Paso. El Paso, TX USA. November 2009.
- ◇ "A Path Following Method for large scale ℓ_1 -underdetermined problems". *XVII Colombian Congress of Mathematics*. Cali, Colombia. August 2009.

Poster Presentations

- ◇ "Attitudes Towards Hot Lanes Using Dimensionality Reduction And Clustering". (with S. Vadlamani and Y. Lou) *Transportation Research Board Annual Meeting*, Washington, DC. January 2020.
- ◇ "Unsupervised Learning on the Health and Retirement Study using Geometric Data Analysis". (with R. Batista) *18th IEEE International Conference on Machine Learning and Applications (ICMLA)*, Boca Raton, FL, December 2019.
- ◇ "A dimensionality reduction and sparse representation approach for classification". *Society for Industrial and Applied Math (SIAM) Annual Meeting 2012*, Minneapolis, MN. July 2012.
- ◇ "Project 4-6: Hybrid Optimization Schemes For Parameter Estimation Problems". *Army High Performance Computing Research Center Program Management Board Meeting*, Stanford University, Palo Alto, CA. November 2011.
- ◇ "Characterization of Subcortical Structures during Deep Brain Stimulation utilizing Support Vector Machines". *IEEE 33rd Annual International Conference Proceedings of the Engineering in Medicine and Biology Society*, Boston, MA. August 2011.
- ◇ "A Sparse Representation Technique for Classification Problems". *7th International Congress on Industrial and Applied Mathematics - ICIAM 2011*, Vancouver, BC Canada. July 2011.
- ◇ "An algorithm for constrained ℓ_1 -minimization problems and applications". *Sixth Blackwell-Tapia Conference*, Columbus, OH. November 2010.

- ◇ “A Path Following Method for large scale ℓ_1 -underdetermined problems”. *Minority Serving Institutions Research Partnerships Consortium (MSIRPC) Conference*, Baltimore, MD. April 2010.
- ◇ “A Path Following Method for large scale ℓ_1 -underdetermined problems”. *The International Conference for High Performance Computing (SC09)*, Portland, OR USA. November 2009.
- ◇ “A Fixed Point Algorithm for ℓ_1 large scale underdetermined systems”. *UTEP SACNAS Research Expo 2009*, El Paso, TX. April 2009.
- ◇ “Parallel Global Optimization Schemes for Solving Parameter Estimation Problems”. *The International Conference for High Performance Computing (SC08)*, Austin, TX. November 2008.

Service

- **UTEP SIAM Student Chapter Vice-president.** Spring 2011 - Spring 2013.
- **UTEP Graduate Research Expo Judge.** Fall 2013.
- **Member, Applied Mathematics Faculty Hiring Committee**
Wentworth Institute of Technology. Spring 2015, Summer 2015, Spring 2016, Summer 2016
- **Faculty Advisor, SIAM Student Chapter.**
Wentworth Institute of Technology. Summer 2015 - Summer 2016.
- **Member, Dean School of Science Search Committee.**
St. Thomas University, Spring 2017.
- **Member, Faculty Lead Dual Enrollment Program.**
St. Thomas University, Fall 2017, Spring 2018.
- **Member, General Education Committee.**
St. Thomas University, Spring 2018.
- **Chair, Computer Science Faculty Hiring Committee.**
St. Thomas University, Spring 2018.
- **Member, Data Science and Business Analytics Faculty Hiring Committee.**
Florida Polytechnic University, Fall 2018, Spring 2020.
- **Member, Graduate Curriculum Committee.**
Florida Polytechnic University, Fall 2018 – Present.
- **Chair, Curriculum Committee Data Science and Business Analytics Department.**
Florida Polytechnic University, Fall 2018 – Present.
- **Member, INFORMS Education Outreach Committee**
INFORMS, Fall 2019 – Present.

Academic Supervision and Mentoring

Graduate.....

- *Graduate Advisor* for Levi Nicklas. *MS in CS Data Science Track*. Florida Polytechnic University.
Expected graduation: Spring 2021.
- *Thesis Supervisor* for Roberto Batista. *MS in CS Data Science Track*. Florida Polytechnic University.
Expected graduation: Spring 2020. Topic: Data Mining and Machine Learning Methods for Healthcare Data.
- *Capstone Project Supervisor* for Jonathan Ferrer. *MS in Computer Science*. Florida Polytechnic University, 2019.
Topic: Supervised Machine Learning Algorithm for the IB Program Hillsborough County Florida.
- *Capstone Project Supervisor* for Yasshin Lozano. *MS in Big Data Analytics*. St. Thomas University, 2018.
Topic: Development of an Analytics App for the Canvas Learning Management System.
- *Capstone Project Supervisor* for Javier Rojas. *MS in Big Data Analytics*. St. Thomas University, 2017.
Topic: Predictive Modeling and Development of an Early Warning Score for Patient Deterioration.

Undergraduate.....

- *Fulbright Canada Killam Fellow Mentor Fall 2019*. Peter Akioyamen’s (Western University, Applied Mathematics and Data Science) semester abroad at Florida Polytechnic University.
- *STU Summer Research Institute 2017 and 2018 Mentor and Supervisor*. Eliana Espinosa and Sierra Hawthorne (STU, Math), Jayden Carr (STU, Computer Science), Sandy Benito and Celeste Pereira (STU, Biology), Kevin Osorio, Acxel Vega, Jose Muguira and Sabrina Romero (MDC, Computer Science), Maudeline Deus (MDC, Math)

Professional Affiliations

- Society for Industrial and Applied Mathematics (SIAM).
- Institute for Operations Research and the Management Sciences (INFORMS).
- Institute of Electrical and Electronics Engineers (IEEE).

Technical and Personal Skills

- **Technology:** R, Python, C, MATLAB, Tableau, UNIX Shell scripting
- **Languages:** English (Fluent), Spanish (Native).