Patricia Medina

Department of Mathematics
New York City College of Technology, CUNY
300 Jay Street
Brooklyn, NY 11201
Email: FMedina@citytech.cuny.edu
Website: https://patriciamg90.github.io/

Research interests: Mathematical frameworks for machine learning (neural networks cast as dynamical systems; feature engineering and dimensionality reduction for LiDAR/3D point clouds); applied functional analysis (Banach spaces); numerical analysis; differential equations/PDEs for modeling physical phenomena.

Professional Experience

- Assistant Professor (tenure-track), Department of Mathematics, New York City College of Technology (CUNY) 8/2022–present
- Assistant Professor (tenure-track), Computer Science Department, Yeshiva College, Yeshiva University 8/2019–5/2022
- Visiting Scholar, ICERM, Brown University Spring 2019
- Postdoctoral Scholar, Worcester Polytechnic Institute 2016–2019
- Research Assistant, NSF-DMS 1115827 "Hybrid modeling in porous media", PI: Prof. M. Peszyńska Summer 2015
- Instructor, Oregon State University 9/2014–5/2016
- Graduate Research Assistant, Oregon State University (NSF-DMS 1115827), PI: Prof. M. Peszyńska 1/2012–6/2014
- Teaching Assistant, Oregon State University 2009–2013
- Teaching Assistant, Bowling Green State University 2006–2009
- Instructor, Universidad Simón Bolívar and Universidad Central de Venezuela 2003–2006

Education

- Ph.D., Mathematics, Oregon State University 5/2014
  Dissertation: *Mathematical Treatment and Simulation of Methane Hydrates and Adsorption Models.*
  Advisor: Dr. Malgorzata Peszyńska
- M.A., Mathematics, Bowling Green State University 5/2009
  Comprehensive exams: Mathematical Analysis and Abstract Algebra
- M.S., Mathematics, Universidad de los Andes 6/2003
  Thesis: *Non-complementarity of Orlicz spaces in* $L^1[0,1]$ *and* $C[0,1]$.
  Advisor: Dr. Diomedes Bárcenas

- B.Sc., Mathematics, Universidad Central de Venezuela 1/2001
  Thesis: *Regression Analysis using local polynomials (non-parametric statistics).*
  Advisor: Dr. Ricardo Ríos

Publications

Refereed publications

1. P. Medina (2026). "Integrating Product Coefficients for Improved 3D LiDAR Data Classification (Part II)." *Accepted* for presentation at the *10th International Conference on Data Management, Analytics and Innovation (ICDMAI 2026)*, January 9–11, 2026, Kolkata, India; proceedings forthcoming.

2. P. Medina (2026). "Integrating Product Coefficients for Improved 3D LiDAR Data Classification." In S. Goswami, S. Saha, K. Basu, & R. S. Beed (eds.), *Data Management, Analytics and Innovation*, Volume 2, pp. 369–372. *Lecture Notes in Networks and Systems*, vol. 1369. Springer. https://link.springer.com/chapter/10.1007/978-981-96-5860-2_21

3. F. P. Medina and R. Paffenroth, "Classification Frameworks Comparison on 3D Point Clouds," *2021 IEEE High Performance Extreme Computing Conference (HPEC)*, 2021, pp. 1–6, doi: 10.1109/HPEC49654.2021.9622842.

4. F. P. Medina and R. Paffenroth (2021), "Machine Learning in LiDAR 3D Point Clouds." In: Demir I., Lou Y., Wang X., Welker K. (eds) *Advances in Data Science*. Association for Women in Mathematics Series, vol. 26. Springer, Cham. https://doi.org/10.1007/978-3-030-79891-8_6

5. F. Patricia Medina, "Machine Learning in Crowd Flow Exit Data," *Accepted*, *2019 AWM Research Symposium Proceedings*, Association for Women in Mathematics Series.

6. K. Yacoubou Djima, F. Patricia Medina, L. Ness, and M. Weber, "Heuristic Framework for Multi-Scale Testing of the Multi-Manifold Hypothesis," pp. 47–80. In: E. Gasparovic and C. Domeniconi (eds.), *Research in Data Science*, AWM Series, vol. 17, Springer, 2019.

7. A. Grim, B. Iskra, N. Ju, A. Kryshchenko, F. Patricia Medina, L. Ness, M. Ngamini, M. Owen, R. Paffenroth, and S. Tang, "Analysis of Simulated Crowd Flow Exit Data: Visualization, Panic Detection, Exit Time Convergence, Attribution, and Estimation," pp. 239–281. In: E. Gasparovic and C. Domeniconi (eds.), *Research in Data Science*, AWM Series, vol. 17, Springer, 2019.

8. F. P. Medina and M. Peszyńska, "Hybrid Modeling and Analysis of Multicomponent Adsorption with Applications to Coalbed Methane," in *Porous Media: Theory, Properties, and Applications*, Nova Science Publishers, Editor: D. Wolfe. Chapter 1, pp. 1–52, 2016. ISBN 978-1-63485-474-0.

9. M. Peszyńska, F. P. Medina, W. Hong, and M. Torres, "Reduced Numerical Model for Methane Hydrate Formation under Conditions of Variable Salinity. Time-Stepping Variants and Sensitivity," *Computation* 4(1), 2016. https://doi.org/10.3390/computation4010001

10. N. Gibson, P. Medina, M. Peszyńska, and R. Showalter, "Evolution of phase transitions in methane hydrate," *J. Math. Anal. Appl.* 409(2) (2014), pp. 816–833, doi: 10.1016/j.jmaa.2013.07.023.

11. F. P. Medina and M. Peszyńska, "Stability for implicit-explicit schemes for non-equilibrium kinetic systems in weighted spaces with symmetrization," *J. Comput. Appl. Math.* 328 (2018), pp. 216–231. https://doi.org/10.1016/j.cam.2017.07.020

Theses

1. F. Patricia Medina, *Mathematical Treatment and Simulation of Methane Hydrates and Adsorption Models*, Ph.D. Dissertation, Oregon State University, 2014 (Corvallis, OR, USA).

2. F. Patricia Medina, *Non-complementarity of Orlicz spaces in* $L^1[0,1]$ *and* $C[0,1]$, M.S. Thesis, Universidad de Los Andes, 2003 (Mérida, Venezuela).

3. F. Patricia Medina, *Regression Analysis using local polynomials*, B.Sc. Thesis, Universidad Central de Venezuela, 2000 (Caracas, Venezuela).

Presentations

Talks (selected, reverse chronological)

1. (Seminar Talk) *From Measure Theory to Machine Learning: Product Coefficients for LiDAR Data.* Speaker Series, CUNY Graduate Center, Room 4321 (also online) October 17, 2025

2. (Invited Colloquium) *Enhancing Machine Learning with Mathematics: Better Mapping of the World.* Department of Mathematics, Kasetsart University, Bangkok, Thailand January 22, 2025

3. (Invited Lecture) *Engineering Features for Machine Learning on Multi-Class 3D Point Clouds.* Ninth International Conference on Data Management, Analytics and Innovation (ICDMAI 2025), Kolkata, India January 18, 2025

4. (Contributed) *Enhancing 3D Point Cloud Classification with Measure-Theoretic Features: Integrating Product Coefficients into LiDAR Analysis.* Ninth International Conference on Data Management, Analytics and Innovation (ICDMAI 2025), Kolkata, India January 18, 2025

5. (Invited) *Product Coefficients for Feature Engineering for ML Classification in Remote Sensing Data.* Seminario Internacional de Matemáticas November 29, 2024

6. (Invited Lecture) *Measure Theory and Machine Learning in Remote Sensing Data.* Mathematical Sciences Lecture Series, Rhode Island College September 19, 2024

7. (Invited Seminar Talk) *Measure Theory Quantities Applied to Machine Learning in LiDAR.* Department of Mathematics Seminar, Colgate University March 7, 2024

8. (Invited) *Product Coefficients: Mathematical Quantities Improving Machine Learning Frameworks.* Northwest Undergraduate Mathematics Symposium November 11, 2023

9. (Invited) *Product Coefficients: Mathematical Quantities Improving Machine Learning Frameworks.* Math Circles, Brigham Young University November 8, 2023

10. (Invited Seminar Talk) *Product Coefficients for Machine Learning on Multi-Class 3D Point Clouds.* Analysis Seminar, University of Rochester October 13, 2023

11. (Invited Tutorial) *Using Machine Learning Techniques to Explore and Analyze LiDAR 3D Point Clouds.* AMIGAs Tutorial 3, IPAM July 12, 2023

12. (Contributed) *Product Coefficients in Machine Learning in LiDAR.* The MAA Annual Meeting of the Metropolitan New York Section, Pace University April 29, 2023

13. (Workshop Talk) *City Tech–BYU Workshop (Part I)*. New York City College of Technology (CUNY), Brooklyn, NY April 4, 2023

14. (Invited) *How Math Can Help in Machine Learning for LiDAR 3D Point Clouds*. The MAA Annual Meeting of the Metropolitan New York Section May 1, 2022

15. (Contributed) *Machine Learning in LiDAR 3D Point Clouds*. AMS Special Session on *Mathematical Tools for Computer Vision Problems, II*, Joint Mathematics Meetings April 6, 2022
(co-author: Randy Paffenroth, Worcester Polytechnic Institute)

16. (Invited Colloquium) *Classification Frameworks Comparison on 3D Point Clouds*. Department of Mathematics and Computer Science Colloquium, Queensborough Community College (CUNY), Bayside, NY February 16, 2022
(co-author: Randy Paffenroth, Worcester Polytechnic Institute)

17. (Contributed) *Classification Frameworks Comparison on 3D Point Clouds*. IEEE HPEC 2021

18. (Invited) Two lectures, REU summer program "STEM for All", University of Rochester (Rochester, NY) 2021

19. (Invited) Deep learning in LiDAR and how mathematical ideas can help us in machine learning. Mathematics Graduate Student Seminar, CSU Channel Islands (Camarillo, CA) 2019

20. (Postdoc/Grad seminar) Deep learning in LiDAR and how mathematical ideas can help us in machine learning. ICERM Seminar, Brown University (Providence, RI) 2019

21. (Invited Short Research Talk) Machine learning research in geospatial data. Algebraic Vision Research Cluster, ICERM (Providence, RI) 2019

22. (Invited) Deep learning in LiDAR and how mathematical ideas can help us in machine learning. Mathematics and Computer Science Colloquium, University of Dallas (Irving, TX) 2019

23. (Invited) Deep learning in LiDAR and how mathematical ideas can help us in machine learning. Mathematics Colloquium, Cal Poly (San Luis Obispo, CA) 2019

24. (Research Group) Deep learning in LiDAR and how mathematical ideas can help us in machine learning. Paffenroth Data Science Group, WPI 2019

25. (Invited) Deep learning in LiDAR and how measure theory can help us in machine learning. Denksport series, WPI 2019

26. (Contributed) Deep Learning for classification of 3D point cloud LiDAR (joint with R. Paffenroth). SIAM Annual Meeting (Portland, OR) 2018

27. (Contributed) Deep learning in 3D point cloud LiDAR data. AWIMS New England (Worcester, MA) 2018

28. (Research Group) Analysis of Simulated Crowd Flow Exit Data: The Deep Learning Approach. Paffenroth Data Science Group, WPI 2018

29. (Research Group) Deep Learning in LiDAR Data. Paffenroth Data Science Group, WPI 2017

30. (Report) Project 2: Representation of Data as Multi-Scale Features and Measures. WiSDM Workshop, ICERM (Providence, RI) 2017

31. (Invited) Evolution of phase transitions in methane hydrate. Schlumberger Research Center (Cambridge, MA) 2017

32. (Applied Math Days) Mathematical treatments and simulation of a Methane Hydrate Model. RPI (Troy, NY) 2017

33. (Contributed) Numerical approximations for methane hydrate models. Women's Intellectual Research Symposium, Brown University (Providence, RI) 2017

34. (Seminar) A Consequence of the absence of Dunford-Pettis Property in Orlicz Spaces. WPI 2016

35. (Seminar) Numerical approximation for a model of Methane Hydrates. WPI 2016

36. (Colloquium) Hybrid Modeling and Analysis of Multicomponent Adsorption with Applications to Coalbed Methane. WPI 2016

37. (Finite Element Circus) Analysis and numerical approximations for kinetic adsorption models. WPI 2016

38. (Poster Blitz) Systems of Conservation Laws for Thermodynamically consistent Adsorption. SAMSI (RTP, NC) 2016

39. (Contributed) Analysis and numerical approximation for adsorption models. SIAM Geosciences (Stanford, CA) 2015

40. (Seminar) New stability framework for kinetic systems. Oregon State University 2015

41. (Invited) Analysis and numerical approximation for adsorption models. SIAM CSE (Salt Lake City, UT) 2015

42. (Seminar) Hyperbolic systems for adsorption. Cascade Computational & Applied Mathematics Seminar (Corvallis, OR) 2014

43. (Invited) Numerical approximation for a model of methane hydrates. PNWNAS (Seattle, WA) 2013

44. (Contributed) Numerical approximation for a model of methane hydrates. Univ. of Padova; SIAM Geosciences (Padova, Italy) 2013

45. (Seminar) Numerical approximation for a model of methane hydrates. Oregon State University 2013

46. (Seminar) Hyperbolic systems for adsorption (joint with M. Peszyńska). Oregon State University 2012

47. (Seminar) The Dunford-Pettis theorem, Orlicz spaces and related topics. Oregon State University 2010

48. (Seminar) On the convergence in mean of martingale difference sequences. Oregon State University 2010

49. (Seminar) Uniform integrability and De La Vallée Poussin / Dunford-Pettis theorems. Bowling Green State University 2008

50. (Contributed) "Non-complementarity of Orlicz spaces in $L^1[0,1]$ and $C[0,1]$." XVII Jornadas Venezolanas de Matemáticas (Trujillo, Venezuela) 2004

51. (Seminar) Orlicz Spaces. Universidad de Los Andes (Mérida, Venezuela) 2003

52. (Seminar) Topology in $C[0,1]$. Universidad de Los Andes (Mérida, Venezuela) 2003

Posters (selected)

1. *The Neighbor Matrix: Feature Engineering and Dimension Reduction to Improve Machine Learning in 3D Point Clouds* (with R. Paffenroth). City Tech Annual Poster Session (22nd) November 21, 2024
2. *The Neighbor Matrix: Feature Engineering Dimension Reduction to Improve ML in 3D Point Clouds* (with R. Paffenroth). City Tech Annual Poster Session (21st) November 16, 2023
3. *Product Coefficients on Dyadic Sets Applied to 3D Point Clouds* (with R. Karkare). City Tech Annual Poster Session (21st) November 16, 2023
4. *Heuristic Framework for Multi-Scale Testing of the Multi-Manifold Hypothesis on 3D LiDAR Point Clouds* (with K. Y. Djima, L. Ness, and M. Weber). City Tech Annual Poster Session (20th). **Award:** Top 3 Best Poster November 27, 2022
5. Mathematical treatment and simulation for a methane hydrate model. Modern Advances in Computational and Applied Mathematics (Yale University, New Haven, CT) 2017
6. Mathematical treatment and simulation for methane hydrate models. High Performance Computing Days (UMass Dartmouth) 2017
7. Mathematical treatment and simulation for methane hydrate models. Frontiers in Applied and Computational Mathematics (Brown University) 2017
8. Hybrid Modeling and Analysis of Multicomponent Adsorption with Applications to Coalbed Methane. Blackwell-Tapia Conference (University of Tennessee) 2016
9. Systems of Conservation Laws for Thermodynamically consistent Adsorption. Workshop for Women in Math Sciences (SAMSI) 2016
10. Systems of conservation laws for thermodynamically consistent adsorption with subscale diffusion and memory terms. Univ. of Padova; SIAM Geosciences (Padova, Italy) 2013
11. Systems of conservation laws for thermodynamically consistent adsorption with sub-scale diffusion (joint with M. Peszyńska). SIAM Annual Meeting (Minneapolis, MN) 2012

Grants and Awards

Grants

- PIs: F. Patricia Medina and J. Li. Google Explore grant ($15,000) 2020–2021
- PI, AI for Earth Microsoft Azure Compute Grant ($10,000): "Solutions for climate change science: using deep learning to improve vegetation classification". Co-PIs: J. Batchelor, L. M. Moskal, R. Paffenroth, G. Zhen 2018–2020
- Women Impact Network (WIN) grant (with L. Carichino and X. Zhou) to fund AWIMS New England, April 2018 ($5,000) 2017
- Co-PI, AWM Sonia Kovalevsky Days (NSF-DMS-1028861), May 2011 ($1,000) 2011

Participation in funded research

- Graduate Research Assistant, NSF-DMS 1115827 "Hybrid modeling in porous media", PI: Prof. M. Peszyńska 2012–2014

- Research Instructor, NSF-DMS 1115827 "Hybrid modeling in porous media", PI: Prof. M. Peszyńska Summer 2015

Travel grants, scholarships, and distinctions

- AWM Travel grant for invited talk, AWM Research Symposium (Rice University, Houston) 2018
- Microsoft Family Fellowship, ICERM Computer Vision Long Program (Brown University, Providence) 2018
- ICERM travel support, WiDS workshop research collaborations 2017
- AWM ADVANCE partial travel support, WiDS workshop at ICERM 2017
- NIMBioS Travel award, Blackwell-Tapia Conference (UT Knoxville) 2016
- SAMSI Travel award to present poster (North Carolina) 2016
- SIAM Travel award (contributed talk), SIAM Geosciences (Stanford) 2015
- IMA Travel award, New Directions Short Course on Uncertainty Quantification 2015
- SIAM Travel award (invited talk), SIAM CSE (Salt Lake City) 2015
- Invited Key Note Student speaker (nominated by OSU), PNWNAS 2014 (Seattle) 2014
- SIAM International student travel award, SIAM Geosciences (Padova, Italy) 2013
- SIAM Student travel award, SIAM Annual Meeting (Minneapolis) 2012
- MSRI Student travel award, MSRI summer graduate workshop (Berkeley) 2011

Professional Activities

- Co-organizer/lecturer/project leader, TRIPODS NSF REU–STEM FOR ALL 2021 Neural Networks July–Aug 2021
- Lecturer/project leader, MAA–SIAM & TRIPODS Advanced Workshop in Data Science for Mathematical Sciences Faculty Jun–Jul 2021
- Referee, *Research in Data Science* (AWM Series, Springer) 2021

Professional Development

- Geohack Week, eScience Institute, University of Washington (Seattle, WA) 2018
- Women in Data Science and Mathematics Research Collaboration Workshop (WiDSM), ICERM 2017
- Workshop for Women in Math Sciences, SAMSI 2016
- IMA New Directions Short Course: "Introduction to Uncertainty Quantification" 2015
- Oregon State University Ecampus Faculty Forum 2015
- IMA Workshop: Careers and Opportunities in Industry for Mathematical Scientists 2014
- MSRI Summer Graduate Workshop: "Dirichlet Spaces" 2011

Advising and Mentoring

Independent Studies / Seminar Mentoring

- Faculty mentor, BYU–City Tech Data Science Seminar (independent studies; two semesters) Spring 2023 and Spring 2024

Student research supervision and outcomes

- *Sentiment Analysis of Instagram Comments: Exploring Body Image Perceptions* (with H. Bloomfield, Q. Chen, and M. Hughes). Poster, City Tech Annual Poster Session (22nd) November 21, 2024
- *Comprehensive Crime Analysis: Integrating Classification, Regression, and Spatial-Temporal Insights* (with J. Mejia and B. Ndoni). Student project resulting in poster, talk, and written report 2024
- *NLP for Analyzing Mental Health Issues among College Students Using Reddit Data* (with Q. Chen, D. Dorsey, M. McGuire, and M. Hughes). Poster, City Tech Annual Poster Session (21st) November 16, 2023
- *Interdisciplinary Undergraduate Data Science Projects: A Joint Collaboration Between City Tech and Brigham Young University* (contributed poster). Contributed Poster Session, The MAA Annual Meeting of the Metropolitan New York Section, Pace University April 29, 2023 (with D. Gallego, K. Chang, Q. Chen, J. Corbridge, D. Dorsey, E. Lonsdale, A. McGuire, A. Oler, C. Razatos, and I. Roman Villanueva; advisors: M. Hughes, H. Carley, P. Medina, and C. Welker)

City Tech–BYU exchange workshops and student mentoring

- BYU–City Tech Workshop, City Tech (Brooklyn, NY) March 14–15, 2024
- BYU–City Tech Workshop, Brigham Young University (Provo, UT) May 23–25, 2024
- BYU–City Tech Workshop, City Tech (Brooklyn, NY) April 26–29, 2023
- BYU–City Tech Workshop, Brigham Young University (Provo, UT) May 30–June 1, 2023
- Faculty mentor for participating City Tech students: Q. Chen, J. Mejia, B. Ndoni, E. Peters, D. Gallego, C. Razatos 2023–2024

Service

- HSI Committee Member, New York City College of Technology (CUNY) Fall 2025–present
- Faculty advisor, City Tech SIAM Student Chapter Fall 2022–present
- Invited and supported speaker event, City Tech SIAM Student Chapter: Dr. Michael Dorff, *How Mathematics Is Making Hollywood Movies Better* (co-organized with U. Duttagupta and S. Singh) April 4, 2024
- Co-organized City Tech Math Club talk (with J. Thiel): M. Hughes (BYU), *Can AI Learn to Perform Research in Pure Mathematics?* March 14, 2024
- Invited and supported speaker event, City Tech SIAM Student Chapter: Dr. Boris Iskra, *Navigating the Realm of Online Advertising Using Machine Learning* December 7, 2023

- Session chair, Contributed Talks, The MAA Annual Meeting of the Metropolitan New York Section, Pace University April 29, 2023
- Organizational Committee, "Advancing Women's Impact in Mathematics Symposium, New England (AWIMS)", Worcester, MA 2018
- Session chair, Women's Intellectual Research Symposium, Brown University, Providence, RI 2017
- Poster judge, Graduate Research Innovation Exchange (GRIE), Worcester, MA 2017
- Organizing committee, SIAM and AWM Student Chapter speaker series (Speaker: Dr. Talitha Washington), Oregon State University 2014
- Cascade Computational and Applied Mathematics Seminar, student organizing committee, Corvallis, OR 2014
- OSU SIAM Student Chapter: President (2013–2014), Vice-President (2012–2013), Treasurer 2010–2011
- OSU AWM Student Chapter: President (2010–2011), Vice-President (2011–2012), Treasurer 2013
- Organizing committee, SIAM Student Chapter speaker series (Speaker: Dr. Thomas Grandine, Boeing) 2013
- Panelist, Q&A session for graduate students in Mathematics (MTH 599), Oregon State University 2013
- Chair, Sonia Kovalevskaya Days, Oregon State University 2011
- Chair, student committee for faculty promotion and tenure, Oregon State University 2010–2011

Technical Skills

- Programming: Python (NumPy, pandas, scikit-learn), MATLAB
- Machine Learning: PyTorch, TensorFlow
- Tools: Git/GitHub (basic)
- Scientific/Technical: LaTeX
- Web: HTML/CSS
- Platforms: Linux/Unix, macOS, Windows

Languages

- Spanish (native)
- English (fluent)
- Italian (reading proficiency)
- French (reading proficiency)

Professional Associations

- AWM (Association for Women in Mathematics)
- AMS (American Mathematical Society)
- SIAM (Society of Industrial and Applied Mathematics), Activity group: Geoscience