Deepanshu Verma — Curriculum Vitae

School of Mathematical and Statistical Sciences
Clemson University
O-224 Martin Hall
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Clemson, SC 29634

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Professional Experience

Clemson University, School of Mathematical and Statistical Sciences — Clemson, SC

2024 - Present **Assistant Professor**

Emory University, Department of Mathematics — Atlanta, GA

2021 - 2024 **Distinguished Visiting Assistant Professor**

Emory University, NSF REU/RET Computational Mathematics for Data Science — Atlanta, GA

Summer 2022, 2024 **Project Mentor**
Summer 2022, 2024 **Executive Board Member**

Lawrence Livermore National Lab — Livermore, CA

Summer 2021 **Summer Graduate Computing Student Intern**

George Mason University — Fairfax, VA

2018 - 2021 **Graduate Research Assistant**
Summer 2019 **Summer Research Intern**
Fall 2019-2021 **Executive Board Member**, *SIAM GMU Student Chapter*

Education

2018 - 2021 **Ph.D. in Mathematics** | George Mason University, Fairfax, VA
Advisor: Prof. Harbir Antil
GPA: 4.0

2015 - 2018 **M.Sc. in Mathematics** | Indian Institute of Technology (IIT) Bombay, Mumbai, India
CPI: 9.65/10

2012 - 2015 **B.Sc.(Hons.) in Mathematics** | Shri Guru Teg Bahadur Khalsa College, Delhi University, India.
Percentage: 95%

Research Interests

Deep learning, numerical analysis, scientific computing, PDE-constrained optimization, inverse problems, reinforcement learning

Honors and Awards

George Mason University

2018-2021	Presidential Merit Fellowship
2019-2020	Dean's Graduate Award for Excellence
Summer 2020	Presidential Scholar Summer Research Fellowship
May 2019	Achievements in Analysis Award

Indian Institute of Technology, Bombay

2017-2018	PhD Scholarship
2017	Institute Silver Medal for academic excellence
2017	Mrs. Rama Mathur Award for securing highest GPA
2017	Prof. P.V. Sukhatme Memorial Prize Award for securing highest GPA

Shri Guru Teg Bahadur Khalsa College, Delhi University

2015	1^{st} rank holder

Additional Honors

2017	Graduate Aptitude Test in Engineering in Mathematics; All India Rank: 70
2016	Junior Research Fellowship Awardee; All India Rank: 09
2015	Joint Admission test for Masters; All India Rank: 21

Funding

SIAM Student Travel Award

July 2021	SIAM Annual Meeting
March 2021	SIAM Conference on Computational Science and Engineering

George Mason University

2018-2021	Presidential Merit Fellowship *Stipend and Tuition support during PhD.*
Summer 2020	Presidential Scholar Summer Research Fellowship *Financial support during the summer term for research.*
August 2019	Graduate Student Travel Fund (GSTF)

Local Support from Organizing Committees

November 2023	Workshop on Control Methods in Hyperbolic Partial Differential Equations Mathematisches Forschungsinstitut Oberwolfach, Germany
February 2020	Workshop on Finite Elements for Nonlinear and Multiscale Problems Indian Institute of Sciences (IISc), Bangalore, India
October 2019	Special Semester on Optimization Johann Radon Institut (RICAM), Linz, Austria
August 2019	Sixth International Conference on Continuous Optimization (ICCOPT) TU Berlin, Germany
December 2018	Workshop on Dynamics, Control and Numerics for Fractional PDEs University of Puerto Rico, San Juan, Puerto Rico

Mentoring

Emory Honors Program

Summer 2022 - 2023	Oliver Wang Co-advised with Dr. Lars Ruthotto	*Current: Ph.D student in Aeronautics and Aeronautics at MIT, Fall 2023*

Indian Institute of Technology, Bombay

Fall 2022 - Spring 2023	Sylvia Vincent Co-advised with Dr. Neela Nataraj	*Current: Ph.D student in Statistical Sciences at Duke University, Fall 2023*

Emory REU Mentees

Summer 2024	Callihan Bertley Claire Gan Rishi Leburu Malia Walewski	The University of Texas at Austin The University of Nevada Reno Emory University Emory University
Summer 2022	Emma Hayes Mathias Heider *Current: Masters in CS at University of Delaware* Carrie Vanty	Carnegie Mellon University University of Delaware Middlebury College

Scholarly Work

In Preparation

(1) E. Newman, L. Ruthotto, **D. Verma**, and S.W. Fung. Gauss-Newton for Deep Neural Networks.

(2) **(advised)** E. Hayes, M. Heider, and C. Vanty. HINNs: Hamiltonian Inspired Neural Networks.

(3) **(advised)** C. Bertley, C. Gan, R. Leburu and M. Walewski. Improving VAEs with Conditional Normalizing Flows.

Submitted Articles

(1) L. Ruthotto, **D. Verma**, N. Winovich and B. v Bloemen Waanders. Amortized Control Polices using Hamilton-Jacobi-Bellman equations and Reinforcement Learning. arXiv: https://arxiv.org/pdf/2402.10033.pdf

(2) Z. Wang, R. Baptista, Y. Marzouk, L. Ruthotto and **D. Verma**. Efficient Neural Network Approaches for Conditional Optimal Transport with Applications in Bayesian Inference. arXiv: https://arxiv.org/pdf/2310.16975.pdf

Published/Accepted

(1) X. Li, **D. Verma** and L. Ruthotto. A Neural Network approach for Stochastic Optimal Control problems. Accepted in *SISC*. arXiv: https://arxiv.org/pdf/2209.13104.pdf. ZOOM

(2) M. Madondo, **D. Verma**, L. Ruthotto, N. A. Yong. Learning Control Policies of Hodgkin-Huxley Neuronal Dynamics. Accepted in *Machine Learning for Health.* arXiv: https://arxiv.org/pdf/2311.07563.pdf

(3) B. P. Lamichhane, N. Nataraj, **D. Verma**. A mixed finite element method using a biorthogonal system for optimal control problems governed by a biharmonic equation. Accepted in *ANZIAMJ 2023*. DOI: https://doi.org/10.21914/anziamj.v64.17961

(4) H. Antil, H.C. Elman, A. Onwunta, **D. Verma**. A deep neural network approach for parameterized PDEs and Bayesian inverse problems. *Mach. Learn.: Sci. Technol. 4 035015*. DOI: https://doi.org/10.1088/2632-2153/ace67c.

(5) H. Antil, T.S Brown, R. Löhner, F. Togashi, and **D. Verma**. Deep Neural Nets with Fixed Bias Configuration. *Numer. Algebra Control Optim. (NACO) 2022*. DOI: 10.3934/naco.2022016.

(6) H. Antil, R. Arndt, C. N. Rautenberg, and **D. Verma**. Non-Diffusive Variational Problems with Distributional and Weak Gradient Constraints. *Advances in Nonlinear Analysis 2022*. DOI: https://doi.org/10.1515/anona-2022-0227

(7) T.S. Brown, H. Antil, R. Lohner, F. Togashi, and **D. Verma**. Parallel Deep ResNets for Chemically Reacting Flows. *AIAA SciTech Forum 2022-1076*. DOI: https://arc.aiaa.org/doi/10.2514/6.2022-1076.

(8) H. Antil, T.S. Brown, R. Khatri, A. Onwunta, **D. Verma**, and M. Warma. Optimal Control, Numerics, and Applications of Fractional PDEs. *Handbook of Numerical Analysis, Volume 23, 2022, Pages 87-114*. DOI: https://doi.org/10.1016/bs.hna.2021.12.003

(9) H. Antil, T.S. Brown, **D. Verma** and M. Warma. Optimal Control of Fractional PDEs with State and Control Constraints. Accepted in *Pure and Applied Functional Analysis 2021*. arXiv: https://arxiv.org/pdf/2106.13289.pdf.

(10) T.S. Brown, H. Antil, R. Löhner, F. Togashi, and **D. Verma**. Novel DNNs for Stiff ODEs with Applications to Chemically Reacting Flows. *International Supercomputing Conference (ISC) Computational Fluid Dynamics Simulations and Analysis (CFDML) 2021*. DOI: https://doi.org/10.1007/978-3-030-90539-2_2.

(11) H. Antil, R. Khatri, R. Löhner and **D. Verma**. Fractional Deep Neural Network via Constrained Optimization. *Machine Learning: Science and Technology 2020*. DOI: https://doi.org/10.1088/2632-2153/aba8e7.

(12) H. Antil, **D. Verma** and M. Warma. Optimal Control of Fractional Elliptic PDEs with State Constraints and Characterization of the dual of Fractional Order Sobolev Spaces. *J Optim Theory Appl (2020).* DOI: https://doi.org/10.1007/s10957-020-01684-z.

(13) H. Antil, **D. Verma** and M. Warma. External Optimal Control of Space-Time Fractional Parabolic PDEs. *ESAIM: COCV 26 (2020) 20.* DOI: https://doi.org/10.1051/cocv/2020005.

Core Repositories

(1) PCP-map: A Neural Network Approach towards conditional optimal transport

(2) NeuralOC-DBS: A Neural Network Approach towards closed-loop DBS

(3) fractional DNNs: Fractional DNNs using PyTorch

(4) Neural SOC: A Neural Network Approach for Stochastic Optimal Control using PyTorch

Conferences and Workshops

Workshops

November 2023	Control Methods in Hyperbolic Partial Differential Equations *Mathematisches Forschungsinstitut Oberwolfach*
June 2023	Scientific Machine Learning *Banff International Research Station, Banff*

Invited Talks

July 2024	Session: Recent advances in optimization for training neural networks *SIAM Annual Meeting (AN24)*
March 2024	Session: Optimization of Complex Physics-Based Systems *INFORMS Optimization Society Conference (IOS)*
January 2024	Session: Theoretical and Numerical Aspects of Nonlocal Models *Joint Mathematical Conference (JMM)*
July 2023	Minisymposium: Systems and Control *SIAM Conference on Control and Its Applications (CT23)*
May 2023	Minisymposium: Advances in Optimization and Feasibility Methods for and with Machine Learning *SIAM Conference on Optimization (OP23)*
April 2023	*University of Delaware*
April 2023	*University of Tennessee, Knoxville*
March 2023	Minisymposium: Recent Development of Theory and Algorithms of Scientific Machine Learning *Southeastern Atlantic Section Conference (SEAS) 2023*
March 2023	Minisymposium: PDE Constrained Optimization and Applications *Southeastern Atlantic Section Conference (SEAS) 2023*
February 2023	Minisymposium: Recent advances and challenges in robust optimization and optimal design of experiments for large-scale inverse problems *SIAM Conference on Computational Science and Engineering (CSE23)*
November 2022	*University of Utah*
October 2022	*Center for Mathematics and Artificial Intelligence* (ZOOM recording)
September 2022	Minisymposium: Scientific Machine Learning to Enable Outer Loop Analysis *SIAM Conference on Mathematics of Data Science (MDS22)*
September 2022	*Colorado School of Mines*
July 2022	Minisymposium: Optimization and Dynamics Based Deep Neural Networks *International Conference on Continuous Optimization (ICCOPT22)*
September 2021	Minisymposium: RISE of the Machines* *Mechanistic Machine Learning and Digital Twins (MMLDT) for Computational Science conference*

September 2021	Minisymposium: Recent Developments in Nonlocal Continuum Modeling[‡] *SIAM Southeastern Atlantic Section Conference (SEAS)*
August 2021	Minisymposium: Optimal Control and Optimization for nonlocal and fractional problems[‡] *IFIP TC7 Conference on System Modelling and Optimization*
July 2021	Minisymposium: Nonlocal Problems in Analysis and Numerics[‡] *SIAM Annual Meeting (AN21)*
March 2021	Minisymposium: Optimal Control and Deep Learning[‡] *SIAM Conference on Computational Science and Engineering (CSE21)*
August 2021	Minisymposium: Modelling with Fractional PDEs: Numerical Analysis and Applications[†] *The Second Joint SIAM/CAIMS Annual Meeting 2020, Toronto, Canada*
May 2020	Minisymposium: Numerical Methods for Optimization Problems with PDE Constraints[§] *Second International Conference on Computational Methods and Applications in Engineering (ICCMAE), Mississippi State University*
March 2020	*16th Copper Mountain Conference on Iterative Methods*[§]
October 2019	Special Semester on Optimization *Johann Radon Institut (RICAM), Linz, Austria*
October 2019	Student Research Talks (StReeTs), George Mason University
August 2019	Minisymposium: Fractional/Nonlocal PDEs: applications, control, and beyond *International Conference on Continuous Optimization, TU Berlin, Germany*

Contributed Talks

September 2023	AWM Research Symposium
November 2020	Finite Element Circus[‡]
September 2020	Sayas Numerics Seminar[‡] (link to zoom recording)
November 2019	Finite Element Circus at Virginia Tech
May 2019	DelMar Numerics Day 2019 at University of Maryland, College Park
April 2020	East Coast Optimization Meeting 2020[§] at George Mason University
April 2019	East Coast Optimization Meeting 2019 at George Mason University

Teaching

Undergraduate Courses

Fall 2021	Math 111: Calculus I
Spring 2022	Math 221: Linear Algebra
Fall 2022	Math 221: Linear Algebra
Spring 2023	Math 221: Linear Algebra
Fall 2024	Math 485: Convex Optimization
Spring 2023	Math 221: Linear Algebra
Fall 2024	Math 3650: Numerical Methods for Engineering

Learning Seminar

Fall 2020	PDE Control and Learning from Data Seminar[‡]	George Mason University
Spring 2020	PDE Control and Learning from Data Seminar[†]	George Mason University
Fall 2019	PDE Control Seminar[†]	George Mason University
Fall 2018	PDE Control Seminar[†]	George Mason University

Teaching Assistant

[‡]held virtually
[§]did not take place due to COVID-19
[‡]For a list of topics, visit http://math.gmu.edu/pde-control-seminar.php.

Feb 2020	Workshop on Finite Elements for Nonlinear and Multiscale Problems	Indian Institute of Sciences (IISc), Bangalore
Spring 2019	Moderator, Deep Learning and Optimization Discussion Group	George Mason University
2017 - 2018	Linear Algebra	Indian Institute of Technology Bombay

Conferences, Workshops and Seminars Organized

Minisymposium Co-Organizer

May 2023	Efficient Optimization in High Dimensions *SIAM Conference on Optimization (OP23)*
September 2022	Optimal Control and PDE insights into Deep Learning *SIAM Conference on Mathematics of Data Science (MDS22)*
July 2022	Optimization and Dynamics Based Deep Neural Networks *International Conference on Continuous Optimization (ICCOPT22)*
July 2021	Advances in Shape Optimization Algorithms *SIAM Conference on Optimization (OP21)*
March 2021	Optimal Control and Deep Learning *SIAM Conference on Computational Science and Engineering (CSE21)*
November 2019	SIAM Symposium *SIAM Student Chapter-George Mason University*

Support Team Member and SIAM Representative

April 2021	Annual East Coast Optimization Meeting (ECOM) 2021
April 2020	Annual East Coast Optimization Meeting (ECOM) 2020
April 2019	Annual East Coast Optimization Meeting (ECOM) 2019

Student Coordinator/Volunteer

Fall 2019-2021	Student Coordinator for PDE-Control Seminar
Spring 2018	Volunteer for New Directions in PDE Constrained Optimization

Additional Professional Services and Memberships

Services

Poster Judge

September 2022	SIAM conference on Mathematics of Data Science

SIAM GMU Student Chapter

Fall 2019-2021	Executive Board Member

George Mason University

Spring 2020	Reviewer for Spring 2020 Mason Core Assessment
Fall 2019	Volunteer for Tea/Coffee time organized by Department of Mathematics
Spring 2018	Grader for Northern VA Regional MATHCOUNTS Competition
Fall 2018	Volunteer for Outreach for middle school students organized by Mason Experimental Geometry Lab(MEGL)

Indian Institute of Technology, Bombay

July 2016-2017	Core team member of Public Relation team in Mathematics Olympiad *Responsibilities included contacting and informing high and middle schools about the benefits of participating in olympiad*
May 2016-2017	Member of the Institute Student Companion Programme (ISCP) *Responsibilities included facilitating overall development of the new entrants*

Reviewer

Society for Industrial and Applied Mathematics

Journal on Scientific Computing (SISC)

Elsevier

Journal of Computational Physics (JCOMP)

Springer

Journal of Optimization Theory and Applications (JOTA)

Wiley

Mathematical Methods in Applies Sciences (MMA)

Memberships

- Member of the American Mathematical Society (AMS).
- Member of the Association for Women in Mathematics (AWM), Student Chapter GMU.
- Member of the Society for Industrial and Applied Mathematics (SIAM).