Sudeb Majee

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Postdoctoral Researcher
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Current employment

- **University of North Carolina at Charlotte** *Charlotte, USA*
  Postdoctoral Researcher *Nov. 2023 - July 2025*
  – **Project:** Solving inverse problems with deep learning approaches
  – **Supervisor:** Prof. Taufiquar Khan

Postdoctoral experience

- **Umeå University** *Umeå, Sweden*
  Postdoctoral Researcher *Sep. 2021 - Aug. 2023*
  – **Project:** Generalization theory for deep learning in an application-specific setting
  – **Supervisors:** Dr. Niklas L.P. Lundström and Prof. Åke Brännström

Education

- **Indian Institutes of Technology Mandi** *Mandi, India*
  Ph.D. Mathematics *July 2015 - Dec. 2020*
  – **Thesis title:** Development and Analysis of a Class of Telegraph-Diffusion Models: Application to Image Restoration
  – **Supervisor:** Prof. Rajendra K. Ray
- **Visva-Bharati University, Siksha-Bhavana** *Santiniketan, India*
  Master of Science in Mathematics *Aug. 2011 - June 2013*
  – Graduated with 79.5% score, Grade $\mathcal{A}+$
- **University of Burdwan, Balarampur College** *Purulia, India*
  Bachelor of Science in Mathematics *Aug. 2006 - June 2010*
  – Graduated with 62.75% score, First Class

Fellowships

- One year postdoctoral fellowship at TIFR Centre for Applicable Mathematics, Bangalore, India (Not used) *April 2021*
- Two year postdoctoral fellowship under Kempe Foundations at Umeå University, Sweden *Sept. 2021 - Aug. 2023*

Current research interests

- Inverse problems in medical imaging
- Bayesian inverse problems
- Deep neural networks
- Physics-informed neural networks
- Mathematical image processing
- Numerical Methods and Analysis of PDEs

Publications

Submitted publications

1. **Sudeb Majee**, Anuj Abhishek, Thilo Strauss, and Taufiquar Khan, MCMC-Net: Accelerating Markov Chain Monte Carlo with Neural Networks for Inverse Problems. https://arxiv.org/abs/2412.16883
2. **Sudeb Majee**, Åke Brännström, and Niklas L.P. Lundström, Well-posedness of a Variable-Exponent Telegraph Equation Applied to Image Despeckling. https://arxiv.org/abs/2411.08175

Peer-reviewed journal publications

1. S. K. Jain, **S. Majee**, R. K. Ray, and A. K. Majee, On the Existence and Uniqueness of Weak Solutions of a Coupled Diffusion System Related to Image Restoration, *Inverse Problems and Imaging (IPI)*, Early access: (2023) https://doi.org/10.3934/ipi.2023027
2. A. Kumar, **S. Majee**, and S. K. Jain, CDM: A Coupled Deformable Model for Image Segmentation with Speckle Noise and Severe Intensity Inhomogeneity, *Chaos, Solitons & Fractals*, 172: (2023) https://doi.org/10.1016/j.chaos.2023.113551
3. **S. Majee**, R. K. Ray, and A. K. Majee, A New Non-Linear Hyperbolic-Parabolic Coupled PDE Model for Image Despeckling, *IEEE Transactions on Image Processing (TIP)*, 31: 1963-1977 (2022) https://doi.org/10.1109/TIP.2022.3149230
4. **S. Majee**, S. K. Jain, R. K. Ray, and A. K. Majee, A Fuzzy Edge Detector Driven Telegraph Total Variation Model for Image Despeckling, *Inverse Problems and Imaging (IPI)*, 16(2): 367-396 (2021) https://doi.org/10.3934/ipi.2021054
5. **S. Majee**, S. K. Jain, R. K. Ray, and A. K. Majee, On the Development of a Coupled Nonlinear Telegraph-Diffusion Model for Image Restoration, *Computers & Mathematics with Applications (CAMWA)*, 80(7): 1745-1766 (2020) https://doi.org/10.1016/j.camwa.2020.08.010
6. **S. Majee**, R. K. Ray, and A. K. Majee, A Gray Level Indicator-Based Regularized Telegraph Diffusion Model: Application to Image Despeckling, *SIAM Journal on Imaging Sciences (SIIMS)*, 13(2): 844-870 (2020) https://doi.org/10.1137/19M1283033

Computer programming skills

- MATLAB, Python, C (Basic)

Teaching

- I assisted in tutorial sessions in a postgraduate level two-week workshop on Partial Differential Equations: From Theory to Computation at IIT Mandi, India. https://www.ncmath.org/archives/atms/2019/ist/pdeftc *June 3 - 15, 2019*
- Teaching Assistant for Mathematics, IIT Mandi, India *July 2015 - June 2020*
- Guest Lecturer at Kashipur Michael Madhusudan Mahavidyalaya, India *July 2014 - July 2015*

Awards

Best Teaching Assistant Award, IIT Mandi *2019*

Other merits

- Secured all India rank-164 in Graduate Aptitude Test in Engineering (GATE) in Mathematical Science conducted by MHRD, Govt. Of India *2015*

Seminar organizer

- Organized a Special Session on "Recent Developments in Physics Informed Machine Learning for Inverse Problems" at the AMS Fall Eastern Sectional Meeting, University at Albany, Albany, NY. Co-organized with Prof. Taufiquar Khan. https://meetings.ams.org/math/fall2024e/meetingapp.cgi/Symposium/952 *October 19 - 20, 2024*

Talks and seminars

- Accelerating Markov Chain Monte Carlo using Convolutional Neural Networks for Inverse Problems, University at Albany, Albany, NY, USA, AMS Sectional Meeting. https://meetings.ams.org/math/fall2024e/meetingapp.cgi/Paper/39895 *Oct. 19, 2024*
- An overview of PDE-based approach to image restoration, Umeå University, Umeå, Sweden. https://www.umu.se/en/research/groups/mathematical-modeling-and-analysis/events-and-seminars/ *Feb 2, 2022*
- Development and Analysis of a Class of Partial Differential Equation-Based Models: Application to Image Restoration, TIFR CAM Bangalore, India. https://www.math.tifrbng.res.in/events/development-and-analysis-of-a-class-of-partial-differential-equation-based-models-application-to-image-restoration *Jan 14, 2021*

Paper and poster presentations

- A Gray Level Indicator Based Telegraph Diffusion Model: Application to Poisson Noise Reduction (poster), School of Data Science research poster session, The University of North Carolina at Charlotte, USA. *April 26, 2024*
- Fractional Order Partial Differential Equations in Image Processing (poster), ANUSANDHAN-2017, Indian Institute of Technology Mandi, Himachal Pradesh, India. *4 March, 2017*

Conferences and workshops attended

- International Conference on Differential Equations and Control Problems: Modeling, Analysis, and Computation (ICDECP19), IIT Mandi, India. *June 17 - 19, 2019*
- Instructional School for Teachers (IST) On Partial Differential Equations: From Theory to Computation, sponsored by National Centre for Mathematics (NCM), IIT Mandi, India. https://www.ncmath.org/archives/atms/2019/ist/pdeftc *June 3 - 15, 2019*
- Advance Level Training Programme on Differential Equations with Application in Engineering, IIT Mandi, India. *July 1 - 8, 2016*
- Post Graduate Level Training Programme on Differential Equations (NPDE-TCA), sponsored by the Department of Science and Technology, Government of India. IIT Ropar, India. https://www.iitrpr.ac.in/npde-2016 *May 16 - June 04, 2016*
- Advance Level Workshop on Controllability of Heat and Wave Equations (NPDE-TCE), sponsored by Department of Science and Technology, IIT Mandi, India. http://www.npde-tca.math.iitb.ac.in/html/workshop_mandi_2015venue.html *November 16 - 20, 2015*

Collaboration

- Dr. Ananta K. Majee, Assistant Professor, Department of Mathematics, Indian Institute of Technology Delhi, India, https://sites.google.com/view/amajee/home.
- Dr. Subit K. Jain, Assistant Professor, Department of Mathematics, National Institute of Technology Hamirpur, India, https://portfolios.nith.ac.in/index.php?/nith/dr-subit-kumar-jain.
- Dr. Åke Brännström, Professor, Department of Mathematics and Mathematical Statistics, Umeå University, Umeå, Sweden, https://www.umu.se/en/staff/ake-brannstrom/.
- Dr. Thilo Strauss, Associate Professor, School of AI and Advanced Computing, Xi'an Jiaotong-Liverpool University ((XJTLU)), China, https://scholar.xjtlu.edu.cn/en/persons/ThiloStrauss.
- Dr. Anuj Abhishek, Assistant Professor, Department of Mathematics, Applied Mathematics, and Statistics, Case Western Reserve University, USA, https://mathstats.case.edu/faculty/anuj-abhishek/.

Referees

1. **Dr. Taufiquar Khan**
   Professor, Department of Mathematics and Statistics, The University of North Carolina at Charlotte, Charlotte, USA-28223, https://math.charlotte.edu/directory/taufiquar-khan
   +1-704-687-0635
   taufiquar.khan@charlotte.edu

2. **Dr. Rajendra K. Ray**
   Professor, School of Mathematical and Statistical Sciences, Indian Institute of Technology Mandi, Mandi, Himachal Pradesh, India-175005, http://faculty.iitmandi.ac.in/~rajendra/
   +91-19-0526-7041
   rajendra@iitmandi.ac.in, rajendra.ray@gmail.com

3. **Dr. Ananta K. Majee**
   Assistant Professor, Department of Mathematics, Indian Institute of Technology Delhi, Delhi, India-110016, https://sites.google.com/view/amajee/home
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4. **Dr. Niklas L.P. Lundström**
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5. **Dr. Subit K. Jain**
   Assistant Professor, Department of Mathematics, National Institute of Technology Hamirpur, Himachal Pradesh, India-177005, https://portfolios.nith.ac.in/index.php?/nith/dr-subit-kumar-jain
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6. **Dr. Thilo Strauss**
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