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Last updated on June 11, 2024

Data engineer & Artificial Intelligence Specialist
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I aspire to rehaul education through innovative technology, and advocating research-backed and data-informed policies, supported by my 14+ years of research experience in behavioral science, data handling and artificial intelligence. Driven by my commitment to providing "high-quality education for all for a better world", I am now leveraging my expertise in data architecture and AI to create impactful learning solutions and empower learners worldwide. I am also an educator, media content creator, and mentor.

Skills

Skills: Tech-related

- **Python and R programming:** Fluent in using packages, libraries, and modules for data engineering, data science, and data visualization – Pandas, NumPy, Airflow, scikit-learn, Scipy, matplotlib, seaborn, Bokeh, Plotly, tidyr, ggplot2.
- **Data exploration and visualization:** Created interactive data visualizations for research presentations and digital dashboards for diverse audiences.
- **Creating AI-assisted end-to-end ETL pipelines:** Built ETL pipelines that processed and analyzed terabytes of experimental structured, semi-structured, and unstructured data.
- **Databases & SQL:** Experienced in database management, modeling, optimization, and administration using MySQL, PostgreSQL, SQLite.
- **Cloud computing**: Working knowledge of Azure, AWS, and Databricks for efficient large-scale data processing.
- **Tech environment management:** Utilized Git for version control, Docker containers, and Conda for environment management, promoting collaboration and reproducibility.
- **Computer vision and behavioral data analysis:** Developed custom computer vision algorithms and dashboards for automated behavioral data extraction from video, and for pattern recognition, segmentation, and key points detection from images and videos.
- **Artificial intelligence algorithms and libraries:** Implemented machine learning models (Tensorflow, Keras, and PyTorch) for automatic characterization and prediction of animal behavior.
- **Generative AI with Large Language Models (LLMs):** Experienced in model fine-tuning, evaluation, benchmarking, PEFT, prompt tuning, prompt engineering.
- **Web development:** Experienced in creating user-friendly interfaces using HTML5, CSS, and Figma.

Skills: Education-related

- **Course development and teaching:** Developed and delivered courses in molecular and cellular biology, neuroscience, behavioral science, computational biology, ecology, and evolution.
- **Online educational content development:** Developed online learning materials and curricula to promote creativity, active learning, attention retention, scientific thinking, and research methodology.
- **Open-source pipeline development:** Developed an open-source pipeline for an automated sports and exercise monitoring system using computer vision and AI. Hosted the material online, targeting advanced high school and undergraduate students.

Skills: Media-related

- **Science communication:** Engagingly conveyed complex scientific concepts to diverse audiences including the general public, students, scientific experts, lawmakers, and potential stakeholders/investors.
- **Media production:** Wrote screenplays, produced music, and directed, filmed, and edited documentary movies, demonstrating a comprehensive understanding of the production process.
- **Graphic design:** Extensively worked on creating sophisticated visual content using industry-standard tools including Adobe Photoshop, Illustrator, and Firefly.
- **Fine arts:** Practiced painting and played the Tabla drums for over a decade, earning professional certifications in both disciplines.

Professional Certifications

Professional Certifications: Tech-related

1. Data Engineering Fundamentals | IBM certification (Course ID: DB0100EN)
2. Generative AI with large language models | AWS and deeplearning.ai certification
3. IT and Cybersecurity Risk Management Essential Training | IIBA certification) (Course ID: 104867979)
4. IT Security Foundations - Core Concepts | NASBA certification (Course ID: 512684043)
5. IT Security Foundations - Network Security | NASBA certification (Course ID: 593097330)
6. IT Security Foundations - Operating System Security | NASBA & IIBA certification (Course ID: 827648163)
7. Networking Foundations: Networking Basics | LinkedIn Learning certification (Course ID: 472838329)

Harvard IT Academy Certification
8. Data engineering Foundations (Course ID: 578833875)
9. Hands On Introduction Data Engineering (Course ID: 385637430)
10. Database Foundations: Intro to Databases (Course ID: 030642317)
11. Database Foundations: Database Management (Course ID: 660697984)
12. Relational Databases Essential Training (Course ID: 201629903)

13. Data Engineering with AWS Part 1 (Course ID: 084908579)
14. Data Engineering with AWS Part 2 (Course ID: 413860687)
15. Introduction to Data Science (Course ID: 305351321)
16. Python for Data Visualization (Course ID: 751022131)
17. Advanced Python: Working with Data (Course ID: 021877650)
18. Advanced Python: Working with Databases (Course ID: 627529950)
19. Information Management - Document Security (Course ID: 547376239)
20. The Data Science of Educational Management and Policy (Course ID: 626747902)

Professional Certifications: Education-related

- Undergraduate Science Mentoring | Harvard University | 2021
- Project Management Strategies For Research Team Members | Harvard University | 2020

Formal Education

- Ph.D. in Behavioral Ecology from Centre for Ecological Sciences, Indian Institute of Science, Bangalore, India | 2017
- M.Sc. in Zoology, Specialization – Ecology & Animal Behavior from Presidency College, University of Calcutta, India | 2009
- B.Sc. in Zoology (honors), Chemistry & Botany (minor) from Presidency College, University of Calcutta, India | 2007

Experience

Experience: Tech

2023 October – now | Data Engineer & AI specialist | Harvard University, Cambridge, MA

Experience: Research

2018 April – 2023 October | Postdoctoral Scientist | Harvard University, Cambridge, MA

- Conducted research on cooperation, decision-making, resource searching and retrieval mechanisms in ants utilizing behavior science, computer vision, data science, AI.
- Heavily utilized Python and R for data collection, transformation, analysis and modeling.

- Awardee of Harvard Brain Initiative Postdoc Pioneers Grant.

2016 | Visiting Scientist | Centre de Recherches sur la Cognition Animale, Toulouse, France

- Studied the neural and behavioral basis of cooperative defense in honeybees.
- Performed computational modeling in research analysis using R.

Experience: Teaching and Mentoring

Course design, development, and teaching
- 2020 – 2022 | Harvard University, MA, USA: LS/MCB100 - Computational Ethology - Provided hands-on training on ETL pipeline on movement and behavioral data, based on Python, created a website for hosting all course materials online and class management.

Teaching assistance Responsibilities included leading class discussions, supervising labs, grading assignments, conducting office hours, meeting with students individually.
- 2018 | Harvard University, MA, USA LIFESCI 1A: An integrated introduction to the life sciences: Chemistry, Molecular Biology, and Cell Biology
- 2011 – 2013 | Indian Institute of Science, Bangalore, India UB 101(2:1): Introductory Biology-I (Organismal Biology and the Molecular Basis of Life)

Mentoring
- Mentored 26 undergrads for 3-6 months projects, 9 undergrads for 6+ months projects, 5 summer interns, 3 grad (Ph.D.) students at Harvard University, MA, USA.
- Mentored 4 undergrads, 3 master's, and 1 grad (Ph.D.) student at Indian Institute of Science, Bangalore, India.

Experience: Outreach
- Virtual outreach scientist - Harvard Science Education Partner.
    - 2024 | Reach Cyber Charter School, PA
    - 2023 | Phineas Bates Elementary School, Boston Public Schools, MA
    - 2022 | Revere Garfield Middle School, MA
    - 2022 | Uncommon Charter High School, Brooklyn, NY

Invited talks: Academic
- 2024 | "PhD, Post-doc, and Beyond: Things I learned, and Things I wish I had Known" – Indian Institute of Science, Bengaluru, India
- 2022 | "The Evolution of Behavior Science through Integrating Modern Computation" - Bard College, NY, USA
- 2020 | "Computational Ethology" - Boston University
- 2019 | "Understanding animal behavior in the era of machine learning: lessons from ants" - Georgia Institute of Technology, USA

- 2016 | "Navigational strategies in tropical wasps" - Queen Mary University of London, UK

Invited talks: Public
- 2020 | "[What we can learn from Covid-19 and Black Lives Matter Movement in USA](#)" – Virtual, organized by Students' Federation of India
- 2020 | "Understanding bees for a sustainable future" at Barnstable County Beekeepers Association, MA, USA
- 2016 | "Voice of Researcher" at European research day - organized by European Union, at Chandigarh, India

Experience: Professional Media Production
- 2017 | Photographer, Archives and Publications Cell, Indian Institute of Science
- 2017 | Documentary video production head, Archives and Publications Cell, Indian Institute of Science
- 2015 – 2016 | Seminar video production head – Centre for Contemporary Studies, Indian Institute of Science
- Featured photographer - Sanctuary Asia magazine (2005), BMC Ecology (2014)

Experience: Event Organization & Management
- 2023 | Symposium organizer "Collective and cooperative behaviour" at the conference Behaviour 2023, Germany
- 2022 | Co-organizer - Workshop on Reinforcement learning at Harvard University
- 2014 – 2016 | Head event manager - six inter-university events, 12 pan-university events
- 2012 – 2015 | Students' dining committee head, managing four meals per day for 500+ students
- 2006 - 2008 | Managed logistics of four ecological field trips for excursion teams consisting of 30+ people

Experience: Editorial & Peer Reviewing
Reviewed and edited manuscripts for following scientific journals, ensuring the quality and integrity of published research.
- Proceedings of the National Academy of Sciences of the United States of America
- Frontiers in Psychology - Cognition (Review Editor)
- Journal of Experimental Biology

Awards & Recognitions for science communication
- 2013-2017 | Received multiple best presentation awards at international congresses held in India, Europe, Australia, and the USA.

- 2015-2016 | Achieved recognition in public science communication, becoming a national finalist in FameLab International (organized by the British Council) and winning the Euraxess Science Slam (organized by the European Union).

Selected publications (please find the full list on Google scholar)

- Ganga Prasath S*, **Mandal S***, Giardina F*, Kennedy J, Murthy VN, Mahadevan L (2022) Dynamics of cooperative excavation in ant and robot collectives. *eLife*
- **Mandal S**, Brahma A. (2019) Getting older, getting smarter: Ontogeny of foraging abilities in a tropical social wasp. *Journal of Experimental Biology*
- **Mandal S**. (2018) How do animals find their way back home? A brief overview of homing behavior with special reference to social Hymenoptera. *Insectes Sociaux*
- Brahma A, **Mandal S**, & Gadagkar R. (2018) Current indirect fitness and future direct fitness are not incompatible. *Biology Letters*
- Nouvian M, **Mandal S**, Jamme C, Claudianos C, d'Ettorre P, Reinhard J, Barron AB, Giurfa M. (2018) Cooperative defence operates by social modulation of biogenic amine levels in honeybees. *Proceeding of Royal Society B*
- Brahma A, **Mandal S**, & Gadagkar R. (2018) Emergence of cooperation and division of labor in the primitively eusocial wasp *Ropalidia marginata*. *PNAS*