

Mihir Arjunwadkar :: Curriculum Vitae

Scientific Computing, Modeling & Simulation • SP Pune University • Pune 411007 India
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Synopsis

Computational scientist, researcher and teacher with extensive experience in

- multidisciplinary research; esp., adaptation/design of problem-specific statistical methodologies;
- computational statistics, statistical data modeling and analysis, machine learning;
- pedagogy; especially, teaching probability, statistics, computation and mathematical modeling;
- STEM curriculum design and development.

Research and Teaching Statements

Attached, together with list of publications.

Curriculum Design & Development, Organizational Work, Outreach

Please see the attached statements.

Education

Ph.D. (1996), M.Sc. (1989) and B.Sc. (1987) in Physics from University of Pune.

Academic Succession

Professor	02/2015	Till date	SCMS ¹ , SPPU ²
Visiting Professor	07/2011	06/2013	NCRA ³ , TIFR
Associate Professor / Reader	08/2005	01/2015	SCMS, SPPU
Assistant Professor / Lecturer	12/2003	07/2005	SCMS, SPPU
Postdoctoral Research Associate	11/1998	09/2003	Statistics ⁴ , CMU
Faculty Research Associate	06/1998	08/1998	IPST ⁵ , UMD
CSIR Postdoctoral Research Associate	04/1996	09/1997	Physics ⁶ , SPPU
CSIR Junior/Senior Research Fellow	07/1989	06/1994	Physics, SPPU
UGC Masters Scholar	07/1987	06/1989	Physics, SPPU

¹ Department of Scientific Computing, Modeling & Simulation – formerly, Centre for Modeling and Simulation

² Savitribai Phule Pune University – formerly, University of Pune

³ National Centre for Radio Astrophysics, Tata Institute for Fundamental Research

⁴ Department of Statistics, Carnegie Mellon University, Pittsburgh, PA, USA

⁵ Institute for Physical Science and Technology, University of Maryland, College Park, MD, USA

⁶ Department of Physics, Savitribai Phule Pune University

Administrative Experience

Head/Director 12/2017 06/2022 SCMS, SPPU

Acting Director 07/2007 06/2008 SCMS, SPPU

There were several other short stints as Acting Director over the years.

On the Web

SCMS, SPPU <https://scms.unipune.ac.in/~mihir>

Google Scholar <https://scholar.google.co.in/citations?user=G4ZUJrkAAAAJ>

arXiv https://arxiv.org/a/arjunwadkar_m_1

ResearchGate https://www.researchgate.net/profile/Mihir_Arjunwadkar/

ORCID <https://orcid.org/0000-0002-7653-8494>

LinkedIn <https://in.linkedin.com/in/mihir-arjunwadkar-a4b2029>

Research Statement

- My broad research interests include statistical and computational science, statistical data modeling and analysis, development of computational + statistical methodologies for challenging (scientific) problems, mathematical modeling and simulation methodologies. A sustained research focus has been astrostatistics; specifically, data-intensive \pm theory-driven investigations related to radio astronomy.
- Of late, I was engaged in collaborative research on a geophysics/minerology problem which we addressed using ab initio atomistic simulation and probabilistic modeling.
- In the past, I have worked on research problems in the following areas
 - Cosmic microwave background (CMB) data analysis & cosmological parameter estimation.
 - Computational biology; specifically, genomic sequence analysis.
 - Computational condensed matter physics (Ph.D. work).

Recognition/Honour

- The American Statistical Association's 2005 Outstanding Statistical Application Award was given to our work *Nonparametric Inference for the Cosmic Microwave Background* by C. R. Genovese, Christopher Miller, Robert Nichol, Mihir Arjunwadkar, and Larry Wasserman, *Statistical Science* **19**(2), 308–321 (2004).

Ph.D. theses supervised

- Amir Aghamousa (Scholar: 54sVHIYAAAAJ), *Cosmological Parameter Estimation: New Methodologies for Better Inference* (2013). Co-Advisor: Tarun Souradeep (Scholar: v0JEc1IAAAAAJ). Thesis availability: <https://scms.unipune.ac.in/reports/th-20130914/>.
- Sameet Mehta (Scholar: 6jX4D0wAAAAJ), *Computational Analysis of Primary Sequence Patterns in the Human Genome Linked with Regulation of Gene Expression and Chromatin Organization* (2009). Advisor: Sanjeev Galande (Scholar: i_7PrIAAAAAJ). While I was formally not the guide/advisor, I was the advisor for the statistical and computational parts of this thesis which form the bulk of the thesis. Thesis availability: <https://scms.unipune.ac.in/reports/th-20081031/>.
- Prachi Chandrachud, *Thermodynamics, Geometry and Electronic Structure of Confined Systems* (2013). Co-Advisor: Dilip Kanhere (Scholar: RY70A_sAAAAJ). My role in the work presented in this thesis was formal and minimal. Thesis availability: <https://scms.unipune.ac.in/reports/th-20130331/>.

Past research funding

- 3-year funding (jointly with Sanjeev Galande (Scholar: i_7PrIAAAAAJ), 2008-11) from the Department of Biotechnology (DBT), Government of India, for a multi-disciplinary research project titled *Systems Biology of Global Regulatory Networks: Unraveling Sequence Features in Promoters that Dictate Tissue-Specificity of Gene Expression*.
- Minor funding for exploratory research from University of Pune (jointly with Vaishali Shah, 2006-07) for the development of material-specific force-fields for use in atomistic simulations.

Professional memberships

- International Astrostatistics Association (IAA): <http://iaa.mi.oa-brera.inaf.it/IAA/home.html>
- Global Burden of Disease (GBD): <https://www.healthdata.org/research-analysis/gbd/collaborator-network>

List of publications

Attached.

Teaching Statement

I have exclusively taught in the higher-education setting. Over the years, my style of teaching has evolved from meticulously presenting content oneself (and hoping that students learn – which seems to have worked somehow for some students) to facilitating learning by understanding the audience as well as possible. Considering and treating the students, especially the younger learners and freshers, as responsible adults is an integral part of my outlook. In my experience, students with some capability, sufficient interest and strong motivation will eventually overcome any handicaps in their prior background. Some non-academic issues that students seem to struggle with include inability to manage time and stress, lack of focus and attention, irregular or bad study habits inculcated from prior education, lack of independence, predisposition towards being spoon-fed, uncritical thinking, disinclination towards excellence, etc. Often is the case that such problems have been created or have cascaded through their prior education uncorrected and higher education is the last opportunity of attempt to correct them. As for strategies to help/coax students to learn, I have experimented with variety of formats and activities – such as seminar courses, allowing/encouraging students teach small topics in the class, asking students to prepare before a class and use the class time for discussion, extensive use of computation to illustrate formal mathematical concepts and entities, computation as a hands-on class activity, course miniprojects, unconventional tests and quizzes, etc.

Courses taught over the years

Since 2004, I have taught various courses to varied undergraduate, postgraduate, and research audiences consisting of engineers and scientists.

- Centre for Modeling and Simulation / Department of Scientific Computing, Modeling & Simulation, University of Pune / Savitribai Phule Pune University
 - Statistical/Machine learning, 2020 onwards; jointly with Ankita Katre (Scholar: V9agn6gAAAAJ)
 - Data visualization, 2018 onwards; jointly with Bhalchandra Pujari (Scholar: nEWv0MIAAAAAJ)
 - Probability theory, 2005–08, 2016 onwards
 - Statistical inference, 2008 onwards
 - Stochastic simulation/Monte Carlo methods, 2005 onwards
 - Statistical computing using R, 2005 onwards
 - Numerical optimization, 2005–08
 - Finite-precision arithmetic, 2005–08
- University of Pune / Savitribai Phule Pune University
 - Mathematical modeling for biologists, 2014, 2018 & 2022, Department of Zoology, SPPU; jointly with Bhalchandra Pujari (Scholar: nEWv0MIAAAAAJ) & B. W. Gore (Scholar: GdLCszYAAAAJ).
 - Computational physics, 2004 & 2012, Department of Physics, SPPU.
 - Statistical physics, 2005, Institute of Bioinformatics and Biotechnology, SPPU.
 - Introduction to programming, 2004, Department of Physics, SPPU.
- Inter-University Centre for Astronomy and Astrophysics: Introductory lectures on astrostatistics as part of SWAYAM courses developed by IUCAA, 2018. Videos are available at <https://www.youtube.com/@ace-nrciucaa5403>. This was my first foray into online teaching and in the absence of audience. Much may seem lacking in the presentation style, content organization, etc.
- Indian Institute of Science Education and Research, Pune. Statistical inference, 2012; jointly with Dipanjan Mitra, NCRA.
- National Centre for Radio Astrophysics, 2011–13: Statistical inference, numerical computing, Monte Carlo methods, computational physics.

Curriculum Design and Development

As the very first faculty to join the Centre for Modeling and Simulation, University of Pune in December 2003, I was asked to take up the task of designing a multidisciplinary academic program related to mathematical modeling & simulation. An internal precursor document by Abhijat Vichare had already laid out a framework for such a programme. Based on this, we ended up adopting the following design guidelines:

- Combine mathematics, statistics, computing and (mathematical) modeling in a coherent bundle – very few such programmes existed even in the Western world in the early 2000s;
- Give a high level of choice and time flexibility to the student – this was way before choice-based credit systems became common in India.
- Assume a minimal mathematics background (at about the level of the infamous Engineering M1-M2-M3 or F.Y.B.Sc. mathematics) as the only prerequisite/eligibility for joining the programme – irrespective of the prior study domain, thereby making both the programme and the expected student population multidisciplinary;
- A futuristic outlook so definitively expressed by John Gardner (Excellence, 1961): *“We don’t even know what skills may be needed in the years ahead. That is why we must train our young people in the fundamental fields of knowledge, and equip them to understand and cope with change. That is why we must give them the critical qualities of mind and durable qualities of character that will serve them in circumstances we cannot now even predict.”* – which, practically, translated to considering time- and stress-management skills as an integral part of the programme, realistic time-budgeting for a typical student, activities (e.g., student-led colloquia, internship poster exhibitions), policies (e.g., 24x7 access to the Centre’s premises and facilities), and practises (e.g., exposing them to research-oriented critical enquiry by asking hard questions to probe and deepen/strengthen their understanding).

I contributed extensively to all aspects of curriculum design (vision, design, refinements, syllabi) of the Master of Technology (M.Tech.) Programme in Modeling and Simulation⁰⁷ (2007) and coordinated their entire development from conception to implementation. To gain experience in running a programme without any precedent in the Indian education system, we ran a shorter precursor, the Advanced Diploma Programme in Modeling and Simulation (2004), between 2005-08, and started the full-fledged M.Tech. programme during AY 2008-09. Our original conception is extensively documented in the original programme document <http://scms.unipune.ac.in/reports/pd-20070223/> and the conference paper <http://scms.unipune.ac.in/reports/pd-20120121/>. Later, I also coordinated and contributed to revisions of the M.Tech. programme in 2016, 2018, 2019, 2022.

In hindsight, the original vision of combining mathematics, statistics, computing and mathematical modeling has proved useful and enduring given that many students made interesting and successful career transitions from their native domain to entirely new domains such as computational / statistical / algorithmic finance, aeronautics, fluid dynamics, etc. and, of late, to data science / machine learning / AI. Some students also chose to pursue research degrees in fields not related to their original domain education.

Organizational Work

- Over the years, I have contributed to
 - building an environment conducive of serious academics and excellence;
 - measures to help students face the world better;
 - supporting initiatives by students, staff, and faculty colleagues;
 - establishing academic ties with research institutes and industry;
 - all aspects of academic planning, coordination, & logistics;
 - organizing multidisciplinary colloquia/seminars;
 - development of innovative academic programmes and curricula;
 - curriculum review meetings with experts from industry and academics;
 - development of the in-house library;
 - development, management, supervision of in-house computational resources;
 - development and maintenance of websites (cms.unipune.ac.in, scms.unipune.ac.in);
 - installation and management of the in-house moodle course management set-up apps.scms.unipune.ac.in/moodle/ (operational since 2015);
 - routine & non-routine administrative work;
 - active support and preference for open-source software (<https://fsf.org.in/case-study/unipune/>);
 - OpenCourseWare via apps.scms.unipune.ac.in/moodle/course/index.php?categoryid=15;

etc.

- Organization of GIAN (<http://www.gian.iitkgp.ac.in/>) courses, 2016 – jointly with Bhalchandra Pujari (Scholar: nEWvOMIAAAAJ)
 - *An Introduction to Modern Methods of Brain Exploration with a Focus on Functional Magnetic Resonance Imaging (fMRI)* by Rebecca L. McNamee, University of Pittsburgh Medical Center, Pittsburgh, PA, USA.
 - *Fracture and Fatigue of Engineering Materials* by John D. Landes, University of Tennessee, Knoxville, TN, USA.

Guest access to the course material and lecture videos is freely available at <https://apps.scms.unipune.ac.in/moodle/course/index.php?categoryid=13>.

Outreach

- (2022–) Co-organizer, Pune Data Science Colloquia – a joint initiative by SPPU SCMS, SPPU Statistics, IISER Data Science, and FLAME Computer Science, run sporadically.
- (2021) *Chemistry in the Time of Lockdown*, a little book by Neehar Arjunwadkar (together with Surabhee & Mihir Arjunwadkar), released on the occasion on the Indian National Science Day 2021: This book describes some of Neehar's chemistry explorations during the 2020 lockdown months. This book is an invitation for everybody with any level of interest in chemistry to try out these explorations, try to make sense of observations, improvise, break things, make them work again, document them, explore new ideas, design new experiments with whatever is readily available around. The book is available at <http://scms.unipune.ac.in/~mihir/>.
- (2016–20) Associate Editor, *Resonance* science education magazine published by the Indian Academy of Sciences, Bangalore.
- (2012) Marathi translation of the comic book *Transit of Venus–6th June 2012* by Niruj Mohan Ramanujam and Reshma Barve (illustrator). Available at <https://scms.unipune.ac.in/~mihir/>.