

Mihir Arjunwadkar :: Curriculum Vitae

Scientific Computing, Modeling & Simulation (SCMS) • SP Pune University (SPPU) • Pune, India

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About

I am a professor, computational scientist, researcher and teacher with extensive experience in

- multidisciplinary research; esp., adaptation/design of problem-specific statistical methodologies;
- computational and statistical science, statistical data modeling, machine learning;
- pedagogy; esp., probability, inference, machine learning, computing, mathematical modeling;
- STEM curriculum design and development.

Career Summary

I have followed a unique academic career path.

- As computational scientist and researcher:
 - Starting from conventional research in computational/theoretical physics (University of Pune and Institute of Mathematical Sciences, Chennai), I switched to research involving problem-centric statistical data modeling and machine learning (Statistics, Carnegie Mellon University).
 - I have successful and productive cross-discipline research collaborations in astrophysics (ongoing), geology (ongoing) and biology.
- As founder faculty, I have had the unique privilege of dedicating effort into
 - building and establishing from scratch the Centre for Modeling and Simulation (CMS) & the Department of Scientific Computing, Modeling & Simulation (SCMS) at SPPU – with elements of liberal education tacitly built into their ethos from the beginning;
 - establishing an academic programme without precedent, the success of which may be gauged from what alumni think about it: <https://scms.unipune.ac.in/alumni/feedback/>;
 - a range of science outreach activities.
- As teacher, I have taught a number of STEM courses and experimented with the teaching-learning process so as to be able to help students learn better.

Details can be found in the attached statements.

Award / Recognition

- Postdoctoral Researcher, Department of Statistics, Carnegie Mellon University; 1998-2003.
- **American Statistical Association's 2005 Outstanding Statistical Application Award** for *Nonparametric Inference for the Cosmic Microwave Background* by Christopher R. Genovese, Christopher Miller, Robert Nichol, Mihir Arjunwadkar, and Larry Wasserman, *Statistical Science* **19**(2), 308–321 (2004).
- Visiting Professor, National Centre for Radio Astrophysics, TIFR; 2011-13.
- Associate Editor, *Resonance* Science Education Magazine; 2016-20.
- Honorary Adjunct Professor, Department of Data Science, IISER Pune; 2025-27.

Education

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

On the Web

Google Scholar
SCMS, SPPU

<https://scholar.google.co.in/citations?user=G4ZUJrkAAAAJ>
<https://scms.unipune.ac.in/~mihir>

Research Statement

Broadly, my **research interests** span statistical and computational science (including machine learning); statistical data modeling and analysis; development of computational + statistical methodologies for challenging problems; and multidisciplinary collaborative problem-centric research.

A **sustained research focus** has been Astrostatistics; specifically, data-intensive \pm theory-driven investigations related to radio astronomy (collab.: NCRA-TIFR).

Recently, I have ventured into **geophysics** by addressing a mineralogy problem specific to Pune (collab.: SPPU SCMS & Geology) which we addressed using atomistic simulations and probabilistic modeling.

Ongoing research. I am currently working on a few problems in pulsar astrophysics / astrostatistics (jointly with Dipanjan Mitra, NCRA-TIFR) and on identification of craters and rilles from Chandrayaan-2 images (jointly with Bhalchandra Pujari, SCMS-SPPU) using machine learning.

Past research areas include nonparametric inference for the CMB (collab.: CMU Statistics & IUCAA), genomic sequence analysis (collab.: IISER), and computational condensed matter physics (Ph.D. work; UoP Physics & IMSc, Chennai).

Research software. A byproduct of my research has been code/tool development using **fortran**, C, C++ and R.

Award

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

Ph.D. Theses Supervised

- Amir Aghamousa, *Cosmological Parameter Estimation: New Methodologies for Better Inference* (2013). Jointly with Tarun Souradeep. Thesis availability: <https://scms.unipune.ac.in/reports/th-20130914/>.
- Sameet Mehta, *Computational Analysis of Primary Sequence Patterns in the Human Genome Linked with Regulation of Gene Expression and Chromatin Organization* (2009). Jointly with Sanjeev Galande. Thesis availability: <https://scms.unipune.ac.in/reports/th-20081031/>.
- Prachi Chandrachud, *Thermodynamics, Geometry and Electronic Structure of Confined Systems* (2013). Jointly with Dilip Kanhere. Thesis availability: <https://scms.unipune.ac.in/reports/th-20130331/>.

Research Funding

- Indian Space Research Organization (ISRO), Government of India, for research on generating large-scale open database of geological features of Moon using Chandrayaan-2 data, jointly with Bhalchandra Pujari (PI), 2022-25.
- Department of Biotechnology (DBT), Government of India, for research on identifying genomic sequence features in promoters that are associated with tissue-specificity of gene expression, jointly with Sanjeev Galande, 2008-11.
- University of Pune, for exploratory research on the development of material-specific force-fields for use in atomistic simulations, jointly with Vaishali Shah, 2006-07.

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>

Teaching Statement

I have exclusively taught in the higher-education setting since 2004. Over the years, my style of teaching has evolved from meticulously presenting content oneself to facilitating learning by understanding the audience (as well as possible, depending on its size).

Considering and treating the students, especially 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 – with some push and help when required.

As for strategies to help students engage meaningfully with learning, I have experimented with variety of formats and activities – such as seminar courses, encouraging students to 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 results, computation as a hands-on class activity, course miniprojects, unconventional tests and quizzes, etc. The purpose is to nudge the students towards understanding, ability to put understanding into practice, self-reliance and excellence.

Here are a few gracious and perceptive comments from alumni of the M.Tech. Programme in Modeling and Simulation:

Mihir Sir teaches the Applied Statistics subjects with a unique flair and panache ... His tests and assignments all are aimed at making the students think-and-apply rather than the traditional by-heart-and-reproduce.

Classroom lectures and discussions on topics ... that nobody would have thought so much interesting. Explaining doubts so calmly and sarcastically (in a funny way) at the same time is not an easy task.

... assignments ... given to students by Dr. Mihir ... challenge the understanding ... of students.

Dr. Mihir is always open to after-class discussions whenever students need it ... He guides you towards good research material so that you don't get lost in the information storm on internet.

Courses Taught Over the Years

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

- Courses include
 - Statistical/Machine learning
 - Probability theory
 - Statistical inference
 - Introductory lectures on astrostatistics (a) as part of SWAYAM courses developed by IUCAA and (b) separately in collaboration with SPPU Department of Statistics
 - Monte Carlo methods: Visit <https://apps.scms.unipune.ac.in/moodle/course/view.php?id=190>
 - Life after death by R: Work in progress, available at <https://scms.unipune.ac.in/~mihir/>
 - Statistical computing using R
 - Data visualization
 - Numerical optimization
 - Numerical computing
 - Mathematical modeling for biologists
 - Computational and statistical physics
- Institutions include
 - NCRA-TIFR, IUCAA, IISER Pune
 - SPPU SCMS, Zoology, IBB, Physics
 - Persistent Computing Institute (Persistent Systems, Pune)

Curriculum Design and Development from Scratch

[curriculum] is unique! Please do not disturb it. (student feedback)

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 and simulation. An internal precursor document by Abhijat Vichare (<https://india.acm.org/education/learning/esp/abhijat-vichare>) had already laid out an interesting and innovative framework for such a programme. Based on this, we ended up adopting the following design guidelines:

- Combine mathematics, statistics, computing and (mathematical) modeling into 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 – way before choice-based credit systems became common in India. Together with treating students as equals and as responsible adults, this key aspect of liberal education was included in our STEM curricula from the beginning.
- 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 and eloquently 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 translated not only into the choice of curricular material but also to

- considering time- and stress-management skills as an integral part of the programme;
- realistic time-budgeting for a typical student;
- student-led activities; e.g., colloquia, internship poster exhibitions;
- policies; e.g., 24×7 access to the Centre's premises and facilities; trusting the student;
- practices; e.g., exposing students to research-oriented critical enquiry by asking hard questions to probe, deepen and strengthen their understanding.

M.Tech. Programme in Modeling and Simulation. I contributed extensively to all aspects of curriculum design (vision, design, refinements, syllabi) of the Master of Technology (M.Tech.) Programme in Modeling and Simulation (2007) and coordinated their entire development from conception to implementation. 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/>. This practice is quite unusual for Indian academic programmes. 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. We started the full-fledged M.Tech. programme during AY 2008-09. Later, I also coordinated and contributed to revisions of the M.Tech. programme in 2016, 2018, 2019, 2022.

Placement. In hindsight, the original vision of combining mathematics, statistics, computing and mathematical modeling has proved useful and enduring: Everyone who went through the rigors of the programme successfully was placed immediately. Many made interesting and successful career transitions to entirely new domains such as finance, aeronautics, fluid dynamics and, of late, to data science/ML/AI/NLP. Employers over the years include CIBIL, CRISIL, Fidelity, Principal Global Finance, Varphi, AlgoAnalytics, ThoughtWorks, SAS, Tridiagonal Solutions, Mondelez, Thermax, EY, PSPL, Spar Solutions, Subex, C-DAC, IBM, Geometric, Dassault/3DPLM, Flow Science, Siemens, JCB, Tech Mahindra, CRIF, etc. A handful chose to pursue research degrees at IITs, IISER, HBCSE-TIFR, U. Victoria (CA), Max Planck (DE), École Polytechnique (FR), CMU (US), GMU (US), etc.

Building an Academic Department from Scratch

The [CMS] culture is very simply 'for the students' ... very open ... new ideas are always welcome ... [CMS is] the best thing [that] happened to me. (student feedback)

In 2003, I was the first faculty member to join the newly-formed Centre for Modeling and Simulation (CMS), University of Pune. CMS was formally given the status of a department in 2020. It has been a privilege to be in a position to spearhead and contribute to bringing up a new academic entity from scratch. This had its own unique set of challenges and opportunities; it was a team effort with advice, guidance and help from seniors and dedication and cooperation from juniors. My contributions over the years include

- Defining and implementing a vision for the Centre/Department
 - Building an environment conducive to serious academics and to excellence
 - Leading by example: E.g., exploring new and multidisciplinary research areas unrelated to prior background or experience, treading untrodden paths in curriculum design and implementation, etc., where there is no guarantee of success whatsoever
 - Measures to help students face the world better
 - Supporting worthy initiatives by students, staff, and faculty colleagues
 - Helping colleagues, especially the younger, get due recognition for their outstanding work
 - Exploring and establishing academic ties with academic/research institutions and industry
 - All aspects of academic planning, coordination, & logistics
 - All aspects of routine & non-routine administrative work, financial planning, etc.
 - 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 (scms.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/ as early as 2007, but continuously operational since 2015
 - Active support and preference for open-source software (<https://fsf.org.in/case-study/unipune/>)
 - SCMS OpenCourseWare via apps.scms.unipune.ac.in/moodle/course/index.php?categoryid=15
 - Organization of GIAN (<http://www.gian.iitkgp.ac.in/>) courses, 2016
 - *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>.
- Etc.

Formal administrative experience

Head/Director	12/2017	06/2022	SCMS, SPPU
Acting Director	07/2007	06/2008	SCMS, SPPU

There were several more short stints as Acting Director over the years. Currently, I am the Chair for the ad hoc Board of Studies in Scientific Computing, Modeling & Simulation, SPPU (2024-26).

Outreach

- (2022–) Co-organizer, Pune Data Science Colloquia – A joint initiative by people at SPPU SCMS, SPPU Statistics, Department of 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 as editors): This book describes some of Neehar’s (a class-8 student then) chemistry explorations during the 2020 lockdown months. Freely available at <http://scms.unipune.ac.in/~mihir/>.
- (2020–21) Various contributions to the Indian Scientists’ Response to COVID-19 initiative (<https://indscicov.in/>), including translation of educational material in Marathi, discussions about a predictive model of COVID-19 spread, etc.
- (2019-20) Support for R-Ladies Pune, a Meetup group focused on the R statistical computing platform: This was an initiative by a SPPU SCMS and a SPPU Statistics student which was supported by SCMS organizationally and by myself personally. It was inaugurated by Prof. Susan Holmes (Stanford Statistics) in person in December 2019 at SCMS-SPPU. This activity was short-lived due to COVID-19 pandemic, but is now being revived.
- (2017) Fast-paced course on probability+inference for engineers (Persistent Computing Institute).
- (2016–20) Associate Editor, *Resonance* science education magazine (Indian Academy of Sciences, Bangalore). Work primarily involved (a) soliciting quality pedagogic articles from accomplished teachers, researchers and science communicators; (b) reviewing articles; and (c) working closely with authors to improve their articles to engage the target audience better.
- (2015) *Life After Death by R*, a collection of problems illustrating the process of designing computational solutions & implementing them in R. Work in progress; available at <https://scms.unipune.ac.in/~mihir/>.
- (2014-20) Engagement with the SPPU Science Park – A science outreach initiative. This involved brainstorming, advisory roles in various activities, connecting people, and administrative support.
- (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/>.

Career Succession Details

Honorary Adjunct Professor	01/2025	12/2027	DS ¹ , IISER Pune
Visiting Professor	07/2011	06/2013	NCRA ² , TIFR
Professor	02/2015	Till date	SCMS ³ , SPPU ⁴
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 ⁵ , CMU
Faculty Research Associate	06/1998	08/1998	IPST ⁶ , UMD
CSIR Postdoctoral Research Associate	04/1996	09/1997	Physics ⁷ , SPPU
CSIR Junior/Senior Research Fellow	07/1989	06/1994	Physics, SPPU
UGC Masters Scholar	07/1987	06/1989	Physics, SPPU

¹ Department of Data Science, Indian Institute of Science Education and Research, Pune

² National Centre for Radio Astrophysics, Tata Institute for Fundamental Research

³ Department of Scientific Computing, Modeling & Simulation, SPPU – formerly, Centre for Modeling and Simulation, SPPU

⁴ Savitribai Phule Pune University – formerly, University of Pune

⁵ Department of Statistics, Carnegie Mellon University, Pittsburgh, PA, USA (with Christopher R. Genovese & Larry Wasserman)

⁶ Institute for Physical Science and Technology, University of Maryland, College Park, MD, USA (with J. Robert Dorfman)

⁷ Department of Physics, University of Pune (Thesis advisor/mentor: Dilip Kanhere)