Pouria Mistani

Computational Scientist
with physics background

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My LinkedIn Profile

p.a.mistani@gmail.com

Hard Skills

- Multi-Variable Calculus, Statistics, Linear Algebra, Stochastic Processes
- Machine Learning, Scientific Computing
- Data Intuition Extraction
- Python, C/C++, HTML
- Tensorflow, Keras, Scikit-Learn, Scipy, Pandas, Boost, GSL
- SQL, Apache Spark
- Matplotlib, ParaView, Seaborn
- MPI, Petsc
- Linux, Mac OS, Windows

Soft Skills

- Multi-disciplinary ●●●●●
- Fast-paced ●●●●●
- Critical Thinking ●●●●●
- Problem Solving ●●●●●
- Team Player ●●●●●
- 6 years experience in several scientific collaborations
- Communication ●●●●○
- 10 years of teaching experience

Certificates

- Fundamentals of Scalable Data Science
- Applied AI with Deep Learning
- Advanced Machine Learning and Signal Processing

Working Experience

2016 – now **Research/Teaching Assistant** — University of California Santa Barbara
Developed two parallel computing softwares to numerically integrate nonlinear PDEs. Also I developed a stochastic model based on data.

2013 – 2016 **Research/Teaching Assistant** — University of California Riverside
Analyzed terabytes of high-dimensional datasets produced by the `illustris` simulations of the Universe, and developed a theory for assembly of dwarf galaxies from data.

2014 – 2014 **Visiting Scholar** — Harvard University
Developed several `Python` routines to effectively filter through `illustris` datasets.

2012 – 2013 **Scientific Software Developer** — RCISP, Iran
I was involved in development of a real-time star identification system. This project involved data acquisition and calibration of opto-electronic devices, followed by image processing and fast search algorithms for pattern recognition.

Education

2016 – now **PhD in Mechanical Engineering** — University of California, Santa Barbara
Focus: Computational Science and Engineering (GPA: 3.95/4.0)

2013 – 2016 **MS Physics** — University of California, Riverside
Focus: Computational Astrophysics (GPA: 3.95/4.0)

2009 – 2013 **BS Physics** — Sharif University of Technology
Focus: Astronomy (GPA: 18.45/20.0)

2008 – 2013 **BS Aerospace Engineering** — Sharif University of Technology
Focus: Astronautics (GPA: 18.45/20.0)

Projects

Inverse PDEs (Machine Learning) 2019-now
</> `Python`, `Tensorflow`, `Keras`, `Linux`
We developed the "Blended Inverse-PDE Networks" (BIPDE-Nets) that combine traditional methods for numerical computations of PDEs with modern deep learning architectures to discover hidden fields in data. BIPDE-Nets seamlessly incorporate domain-knowledge about physics of the problem.

Electroporation (Biophysics) 2016-now
</> `C++`, `Petsc`, `Python`, `Scikit-Learn`, `Scipy`, `Tensorflow`, `Keras`, `Visualization`, `Data Wrangling`, `Linux`
We numerically solved partial differential equations with nonlinear boundary conditions on tens of thousands of interfaces with arbitrary geometries. We used a finite volume discretization on adaptive interface-fitted Voronoi grids. I implemented more than $5,000$ lines of parallel `C++` code, tested, then ran it on `Stampede2` supercomputer using $2,048$ processors for 24 hours. I used `ParaView` in parallel over 256 processors to visualize the results, then I extensively analyzed the datasets in `Python`. The product is a high fidelity reduced model that predicts observations with minimal computations.

Epitaxy (Materials) 2016-2019
</> `C++`, `Petsc`, `Boost`, `p4est`, `Visualization`, `Linux`
We developed a novel approach for simulating epitaxial growth in parallel. In this approach we made use of a forest of quadtree adaptove grids using `p4est` library in a parallel environment. This work extended previous studies by combining mesh adaptivity and multi-core parallelism that enabled simulations of mound formation in orders of magnitude larger domains. We used `C++` using parallel framework `Petsc` as an interface to `BLAS` and `LAPACK` linear algebra libraries, as well as `Boost` for fast mathematical operations.

Dwarf Galaxies (Astrophysics) 2014-2016
</> `Python`, `C`, `MPI`, `GSL`, `matplotlib`, `Scipy`, `Scikit-Learn`, `Pandas`, `Data Wrangling`, `Linux`
I analyzed 250TB of correlated datasets generated by the Illustris cosmological and hydrodynamical simulation suite to study the assembly of dwarf galaxies. I developed a semi-analytic model for the formation and stripping of globular clusters that support our findings.

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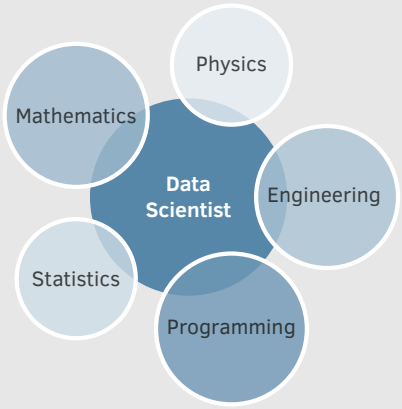
About Me

I build multiscale mathematical models from big data. I develop parallel scientific computing softwares (multi-core and GPU) to generate and analyze large datasets, which I then use to develop physics-informed predictive models at different scales of time and length. These models can accelerate decision making or enhance complex technological, biomedical and financial processes.

Persona



Barskills

- Programming
- Analysis
- Presentation
- Conceptualization

Memberships

Society for Industrial and Applied Mathematics, USA

National Elite Foundation, Iran

Awards

2019 **Travel award for SIAM conference on computational science and engineering**
Spokane, Washington, USA

2017 **Finalist for the 3rd edition of the IEEE entrepreneurship forum and startup contest IEEE Robotics and Automation Society**
IEEE RAS

2016 **Awarded 740,082 SUs computing allocation on Stampede supercomputer**
XSEDE TACC

2015 **FIELDS fellowship for big data and visualization**
NASA MIRO program

2015 **Michael Devirian award for outstanding research by a 2nd year graduate student**
University of California, Riverside

2013 **Winner of dean's distinguished fellowship award**
University of California, Riverside

2013 **Merit based admission offer to the graduate program in aerospace engineering**
Sharif University of Technology

2013 **Ranked 1st among BS students in department of aerospace engineering**
Sharif University of Technology

2008 **Top 0.1% (rank 258) among more than 300,000 high school students in the national university entrance exam**
Ministry of Education, Iran

2007 **4 year "National Elite Foundation Undergraduate Fellowship Award"**
Ministry of Education, Iran

2007 **Silver medal in the 3rd national olympiad in astronomy**
Ministry of Education, Iran

Publications

2020 **Solving inverse-PDE problems with physics-aware neural networks** — arXiv (under review)
S Pakravan, Pouria Mistani, MA Calvo, F Gibou

2019 **A parallel Voronoi-based approach for meso-scale simulations of cell aggregate electropermeabilization** — Journal of Computational Physics
Pouria Mistani, A Guittet, C Poignard, F Gibou

2019 **Towards a tensor network representation of complex systems** — Springer International Publishing
Pouria Mistani, S Pakravan, F Gibou

2019 **Tensor network renormalization as an ultra-calculus for complex system dynamics** — Springer International Publishing
Pouria Mistani, S Pakravan, F Gibou

2018 **The island dynamics model on parallel quadtree grids** — Journal of Computational Physics
Pouria Mistani, D Bochlov, A Guittet, J Schneider, D Margetis, C Ratsch, F Gibou

2016 **On the assembly of dwarf galaxies in clusters and their efficient formation of globular clusters** — Monthly Notices of Royal Astronomical Society
Pouria Mistani, L Sales, A Pillepich, R Sanchez-Janssen, M Vogelsberger, D Nelson, V Rogriguez-Gomez, P Torrey, L Hernquist

Teaching

ME	Engineering Dynamics (main instructor)	UC Santa Barbara
ME	Statics	UC Santa Barbara
ME	Fluid Mechanics I, II (twice)	UC Santa Barbara
ME	Engineering Vibrations (twice)	UC Santa Barbara
PHYS	Intermediate Mechanics	UC Santa Barbara
PHYS	General Physics Discussions (sections 2A, 2B, 2C)	UC Riverside
PHYS	Physics General Labs (sections 2LA, 2LC, 2C)	UC Riverside
AE	Orbital Mechanics (5 semesters)	Sharif University of Technology
AE	Aircraft Design II	Sharif University of Technology

January 24, 2020 Pouria Mistani