Aditya Jaishankar

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EDUCATION

MASSACHUSETTS INSTITUTE OF TECHNOLOGY, Cambridge, MA
Ph.D. in Mechanical Engineering, Minor in Mathematics — **June 2014**
Master of Science in Mechanical Engineering (MIT Presidential Fellowship Awardee) — **June 2011**

INDIAN INSTITUTE OF TECHNOLOGY MADRAS, Chennai, India.
Bachelor of Technology in Mechanical Engineering, Minor in Chemistry — **July 2009**

EXPERIENCE

EXXONMOBIL CORPORATE STRATEGIC RESEARCH, Annandale, NJ — **July 2014-Present**

Program Leader (July 2018 – Present):

- Directed a multidisciplinary team of 8 PhD researchers including polymer physicists, synthetic chemists and chemical engineers, on a fundamental research program on the discovery and development of new ultra-high-strength polymers for infrastructural applications.
- Defined research goals and aligned the research program with business objectives while also progressing state-of-the-art basic science.
- Intellectual Property Strategy sub-team leader involving interactions across multiple business lines and functions across the discovery pipeline.

Senior Researcher (January 2017 – Present):

- Provided polymer science expertise on research program involving artificial neural networks for materials discovery and design.
- Computationally solved a coupled set of non-linear partial differential equations with simultaneous convection, diffusion, and chemical reactions for carbon capture applications using `numpy`, `numba`, `scipy`, `sympy`, and `scikit-learn`. This work led to new insights on increasing efficiency of carbon dioxide capture directly from ambient air.

Advanced Researcher (July 2014 – January 2017):

- Performed experiments on the thermodynamics of self-assembled nanometer-thick monolayers and wrote detailed high-throughput experimental data cleaning, analysis, and model fitting routines using `numpy`, `pandas`, `scikit-learn, matplotlib.` Findings helped improve surface coatings for ultra-low friction surfaces and improved energy efficiency in internal combustion engines.
- Measured the solution properties of self-assembling aqueous polymers using a range of experimental techniques (UV and Fluorescence Spectroscopy, Dynamic Light Scattering, Infrared Spectroscopy). Wrote data analysis routines using `numpy, scipy, matplotlib.` Discoveries developed polymer solutions very stable to high stretching forces.

NON-NEWTONIAN FLUIDS LAB (MIT), Cambridge, MA — **August 2009- June 2014**

Graduate Research Assistant:

- Developed a mathematical framework using fractional differential equations to predict the mechanical response of materials with fractal-like arrangements of atoms. Wrote detailed model prediction codes in `Matlab` and `Mathematica`. This theory unified and connected many different models for such materials under one master framework with predictive power.
- Performed polarization microscopy and extensional flow measurements on the biopolymers comprising lubrication fluid in knee joints of arthritis patients for rapid detection and diagnosis.
- Investigated the properties of self-assembled interfacial monolayers of protein-antibody solutions to discover new strategies for long-term shelf-stable bio-active antibody and protein solutions.
- Analyzed data using `Matlab` and `Mathematica` for flow property measurements of polymer melts performed under zero-gravity aboard the International Space Station. Discovered new fundamental findings about the behavior of particles suspended in polymer melts.

SELF-STUDY

Coursework:

Certificates of completion and course notes available on personal website.

- Prof. Tim Roughgarden's Algorithms Specialization (Stanford University)
- Prof. David Silver's course on Reinforcement Learning (University College London) (`http://www0.cs.ucl.ac.uk/staff/d.silver/web/Teaching.html`)
- Machine learning with Python-From Linear Models to Deep Learning (MITx)

- Fundamentals of Statistics (MITx)
- Algorithmic Design and Techniques (UCSD)
- Probability – The Science and Uncertainty of Data (MITx)
- Prof. Lorena Barba's course on Python for Computation Fluid Dynamics (Boston University) (https://lorenabarba.com/blog/cfd-python-12-steps-to-navier-stokes/)
- Python for Data Science (UCSD)
- Reading peer reviewed journal publications in ML/AI for scientific discovery

Projects:
All projects implemented from scratch. Jupyter notebooks available on personal website.

- Automatic denoising of images of text using an autoencoder network
- Extracting signal from noise in the Higgs Boson Machine Learning Challenge (Kaggle) using feed forward neural networks
- Automatic scientific abstract text-generation using LSTMs
- Automatic SMILES string generation using recurrent neural networks
- Molecule solubility predictions using convolutional neural networks and feed forward neural networks from generated images of molecular polar charge density.
- MNIST digit classification using fully connected and convolutional neural networks
- Titanic survival prediction using k-Nearest Neighbors algorithm
- Mushroom toxicity prediction using Naïve Bayes Classifier

SKILLS

Scientific Python Universe:
`pytorch` (including use of `cudatoolkit`), `scikit-learn`, `numpy`, `scipy`, `pandas`, `sympy`, `numba`, `matplotlib`, basic familiarity with `rdkit` (python package for computational chemistry)

Computational Tools:
Various general interest python packages and tools, `Mathematica`, `Matlab`, `LaTeX`.

Experimental Techniques:
UV Spectroscopy, Fluorescence Spectroscopy, Infrared Spectroscopy, Dynamic Light Scattering, Rheometry, Optical, birefringence and polarization microscopy. Performed data cleaning, analysis and model fitting on all experiments as required using `python`, `Matlab` or `Mathematica`.

PUBLICATIONS

In addition to the peer-reviewed journal publications below, I have **5** US patent applications and **9** scientific conference presentations.

Google Scholar Profile: https://scholar.google.com/citations?user=wlEFlw8AAAAJ&hl=en

- Jusufi, A., **Jaishankar, A.**, Onodera, K., Vreeland, J., Konicek, A.R., Watanabe, H., Sato, T., Manabe, K., Yamamori, K. and Schilowitz, A.M., 2019. Adsorption properties of molybdenum based FMs on boron-doped DLC. *Wear*, *426*, pp.805-812.
- **Jaishankar, A.**, Jusufi, A., Vreeland, J.L., Deighton, S., Pellettiere, J. and Schilowitz, A.M., 2019. Adsorption of Stearic Acid at the Iron Oxide/Oil Interface: Theory, Experiments, and Modeling. *Langmuir*, *35*(6), pp.2033-2046.
- **Jaishankar, A.**, Jusufi, A., Vreeland, J.L., Deighton, S.P. and Schilowitz, A.M., 2018. Correcting for solvent replacement effects in quartz crystal microbalance measurements. *Sensors and Actuators A: Physical*, *277*, pp.60-64.
- Faber, T.J., **Jaishankar, A.** and McKinley, G.H., 2017. Describing the firmness, springiness and rubberiness of food gels using fractional calculus. Part II: Measurements on semi-hard cheese. *Food hydrocolloids*, *62*, pp.325-339.
- Faber, T.J., **Jaishankar, A.** and McKinley, G.H., 2017. Describing the firmness, springiness and rubberiness of food gels using fractional calculus. Part I: Theoretical framework. *Food Hydrocolloids*, *62*, pp.311-324.

- **Jaishankar, A.**, Wee, M., Matia-Merino, L., Goh, K.K. and McKinley, G.H., 2015. Probing hydrogen bond interactions in a shear thickening polysaccharide using nonlinear shear and extensional rheology. *Carbohydrate polymers*, *123*, pp.136-145.
- **Jaishankar, A.** and McKinley, G.H., 2014. A fractional K-BKZ constitutive formulation for describing the nonlinear rheology of multiscale complex fluids. *Journal of Rheology*, *58*(6), pp.1751-1788.
- **Jaishankar, A.** and McKinley, G.H., 2014. An analytical solution to the extended Navier–Stokes equations using the Lambert W function. *AIChE Journal*, *60*(4), pp.1413-1423.
- Holten-Andersen, N., **Jaishankar, A.**, Harrington, M.J., Fullenkamp, D.E., DiMarco, G., He, L., McKinley, G.H., Messersmith, P.B. and Lee, K.Y.C., 2014. Metal-coordination: using one of nature's tricks to control soft material mechanics. *Journal of Materials Chemistry B*, *2*(17), pp.2467-2472.
- Critchfield, A.S., Yao, G., **Jaishankar, A.**, Friedlander, R.S., Lieleg, O., Doyle, P.S., McKinley, G., House, M. and Ribbeck, K., 2013. Cervical mucus properties stratify risk for preterm birth. *PloS one*, *8*(8), p.e69528.
- Haward, S.J., **Jaishankar, A.**, Oliveira, M.S.N., Alves, M.A. and McKinley, G.H., 2013. Extensional flow of hyaluronic acid solutions in an optimized microfluidic cross-slot device. *Biomicrofluidics*, *7*(4), p.044108.
- **Jaishankar, A.** and McKinley, G.H., 2013. Power-law rheology in the bulk and at the interface: quasi-properties and fractional constitutive equations. *Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences*, *469*(2149), p.20120284.
- **Jaishankar, A.**, Sharma, V. and McKinley, G.H., 2011. Interfacial viscoelasticity, yielding and creep ringing of globular protein–surfactant mixtures. *Soft Matter*, *7*(17), pp.7623-7634.
- Sharma, V., **Jaishankar, A.**, Wang, Y.C. and McKinley, G.H., 2011. Rheology of globular proteins: apparent yield stress, high shear rate viscosity and interfacial viscoelasticity of bovine serum albumin solutions. *Soft Matter*, *7*(11), pp.5150-5160.