

# Avishek Kumar

DATA SCIENTIST

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## Professional Experience

### Center for Data Science and Public Policy at The University of Chicago

Chicago, IL

DATA SCIENTIST/RESEARCH SCIENTIST

May, 2016 - Present

- I created a risk assessment tool to predict which HIV+ patients are likely to drop out of care for use by the University of Chicago HIV clinic. Awarded over \$50,000 for an initial pilot study.
- I deployed into production a machine learning model for predicting which homes in the city of Chicago are likely to have lead hazards that lead to early childhood lead poisoning, in partnership with the Chicago Department of Public Health, the Chicago Department of Innovation and Technology and Alliance HealthCare. This work was awarded the Academy Health Local/State Innovation Prize.
- I created an early warning machine learning model to identify which city blocks were most at risk of having water main breaks for the city of Syracuse, NY. This work has been featured in State Scoop, Water Online, and Politico.
- Developed a point-in-service predictive model for predicting general and technical recidivism for the Illinois Department of Corrections. Also did a retrospective study to understand the effect of technical recidivism violations on offender's ability to obtain employment.
- Developed and taught the curriculum for the Coleridge Initiative, a 3-month long course to train the heads of city and state government agencies on how to use data science methods to solve public policy problems. Topics include Shell Scripting, Python, Git, SQL, GIS Analysis, Text Analysis, Network Analysis, Machine Learning, Inference, and Ethics.

### Postdoctoral Research Associate/Systems Administrator

Tempe, AZ

OZKAN GROUP, ARIZONA STATE UNIVERSITY, P.I. ASSOCIATE PROFESSOR S. BANU OZKAN

August 2014 - September 2016

- Worked on problems related to protein dynamics, protein structure refinement, genetic disease prediction, and antibiotic resistance using molecular dynamics and machine learning methods.
- Wrote several software packages for studying protein dynamics and analyzing genetic disease in Python.
- Built and maintained a 1408 node supercomputer as systems administrator.
- Authored six publications in peer reviewed journals
- Mentored two doctoral students to the completion of their doctorates.

### Thorpe Group, Arizona State University, P.I. Foundation Professor Michael F. Thorpe

Tempe, AZ

GRADUATE RESEARCH ASSISTANT

September 2009 - August 2014

- Developed software, in C++, to create a model of amorphous graphene in order to study its structural properties
- Developed a model of a vitreous silica bilayer in C++ (<https://github.com/avishekrk/BilayerStudies>).
- Developed a model of jamming using rigidity percolation using legacy FORTRAN code and Python code.
- Developed a method for refining homology models of proteins that can be used in drug design.
- Authored five publications.
- Awarded over \$60,000 through multiple fellowships to fund research.

## Skills

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<b>DevOps</b>	AWS, Docker, Kubernetes, CircleCI
<b>Operating Systems</b>	Linux, MacOS, Windows
<b>Software</b>	MS Office, Maple, Mathematica, Matlab, Git, PostgreSQL, SQLite
<b>Programming</b>	C/C++, Python, Java, FORTRAN90, SQL, R, HTML, CSS, JavaScript, $\text{\LaTeX}$
<b>Proficient</b>	OpenMP, MPI, Pandas, NumPy, Machine Learning, GIS, Text Analysis, Network Analysis

## Education

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### Arizona State University

PH.D. IN PHYSICS

Tempe, AZ

December 2014

- Emphasis: Theoretical/Computational Condensed Matter and Biological Physics
- Advisor: Foundation Professor Michael F. Thorpe

### Arizona State University

M.S. IN PHYSICS (PHI KAPPA PHI)

Tempe, AZ

December 2012

### Carnegie Mellon University

B.S. IN PHYSICS WITH HONORS

Pittsburgh, PA

May 2009

## Honors & Awards

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2016	Data Science for Social Good Fellowship
2014	Winner Inagural Clinton Global Initiative University Codeathon
2011-2014	ARCS Foundation Fellowship for College Scientists
2013	Outstanding Graduate Teaching Assistant Award
2012	Wally Stoetzel Physics Fellowship
2011	Molecular Imaging Corporation Fellowship
2011	Phi Kappa Phi
2009	Graduate Assistance in Areas of National Need (GAANN) Fellowship
2009	Sigma XI, The National Honor Society in Scientific Research

## Teaching Experience

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### Coleridge Initiative, The University of Chicago

INSTRUCTOR

Chicago, IL

October 2017 - Present

- The Coleridge Initiative is an executive education course that is taken by members of city and state government in order to learn how to use data science tools and methods to solve public policy problems.
- I developed and taught the curriculum for the class. Topics include Command Line, Git, SQL, Machine Learning, Text Analysis, GIS Analysis, Network Analysis

### Department of Physics, Arizona State University

TEACHING ASSISTANT

Tempe, AZ

January 2013 - August 2014

- Held On-Line Recitations using Adobe Connect.
- Recorded Recitations using ScreenCast and developed modus operandi for Recorded Recitations.
- Proctored Examinations.

### Department of Physics, Arizona State University

INSTRUCTOR PHY112

Tempe, AZ

August 2012 - December 2012

- Lectured three times a week to 120 students.
- Responsible for all aspects of the course—lectures, examinations, and recitations.

## Service

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2014-Present	<b>Instructor</b> Software Carpentry Workshops
2010-2014	<b>Organizer</b> Graduate Seminar Series
2011	<b>Judge</b> Arizona Middle School Science Bowl
2010-2014	<b>Reviewer</b> GPSA Grant Committee

## Publications

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### Peer Reviewed Journal Articles

- Brandon M. Butler, Avishek Kumar, S. Banu Ozkan. Dynamic allosteric residue coupling reveal disease mechanism for Gaucher disease and nSNVs across the proteome. (Submitted, Equal Contributor)
- Butler BM, Kazan IC, Kumar A, Ozkan SB (2018) Coevolving residues inform protein dynamics profiles and disease susceptibility of nSNVs. PLoS Comput Biol 14(11): e1006626. <https://doi.org/10.1371/journal.pcbi.1006626>
- Avishek Kumar, Syed Ali Asad Rizvi, Benjamin Brooks, R. Ali Vanderveld, Kevin H. Wilson, Chad Kenney, Sam Edelstein, Adria Finch, Andrew Maxwell, Joe Zuckerbraun, and Rayid Ghani. 2018. Using Machine Learning to Assess the Risk of and Prevent Water Main Breaks. In Proceedings of the 24th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (KDD '18). ACM, New York, NY, USA, 472-480. DOI: <https://doi.org/10.1145/3219819.3219835>
- Avishek Kumar, Brandon M. Butler, Sudhir Kumar, Sefika B. Ozkan. Integration of structural dynamics and molecular evolution via protein interaction networks: a new era in genomic medicine. Current Opinion In Structural Biology 35, 135 (2015)
- Sean L. Seyler, Avishek Kumar, M.F. Thorpe, and Oliver Beckstein. Path Similarity Analysis: A method for Quantifying Macromolecular Pathways. PLoS Comput Biol (10): e1004568 (2015).
- Avishek Kumar, Paul Campitelli, M.F. Thorpe, S. Banu Ozkan, Partial Unfolding and refolding for structure refinement: A unified approach of geometric simulations and molecular dynamics. Proteins: Structure, Function, and Bioinformatics 83(12), 2279 (2015)
- Avishek Kumar, T.J. Glembo, S. Banu Ozkan, The Role of Conformational Dynamics and Allostery in Disease Development. Biophysical Journal 109(6),1273 (2015)
- W.G. Ellenbroek, Varda F Hagh, Avishek Kumar, M.F. Thorpe, Martin van Hecke, Rigidity Loss in Disordered Systems: Three Scenarios. Phys. Rev. Lett. 114, 135501 (2015)
- Avishek Kumar, Mark Wilson, David Sherrington, M.F Thorpe, Ring statistics of silica bilayers. Journal of Physics: Condensed Matter 26, 395401 (2014)
- Mark Wilson, Avishek Kumar, David Sherrington, M.F. Thorpe, Modeling vitreous silica bilayers. Phys. Rev. B 87, 214108 (2013)
- D Van Tuan, Avishek Kumar, Stephan Roche, F. Ortmann, MF Thorpe, P Ordejon, Insulating behavior of an amorphous graphene membrane. Phys. Rev. B 86 (12), 121408 (2012)
- Avishek Kumar, Mark Wilson, M.F. Thorpe, Amorphous graphene: a realization of Zachariassen's glass. Journal of Physics: Condensed Matter 24(48), 485003 (2012)
- Y Li, F. Inam, Avishek Kumar, M.F. Thorpe, D.A. Drabold, Pentagonal puckering in a sheet of amorphous graphene. physica status solidi (b). doi: 10.1002/pssb.201147195 (2011)

## Book Chapters

- Using GPUs to Study Protein Evolution in Order to Understand Antibiotic Resistance, *Strategies in Biomedical Data Science: driving force for innovation* by Jay A. Etchings