Karan N. Shah — Curriculum Vitæ

CONTACT INFORMATION

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EDUCATION

Georgia Institute of Technology, Atlanta, Georgia USA

M.S. Computational Science & Engineering *December 2020*
Primary Focus: Machine Learning applied to data-intensive *Physics* problems

B.S. Computer Science (Threads: Intelligence, Modeling-Simulation) *May 2018*
B.S. Physics
Thesis: *"Analysis of Uncertainty Quantification of Machine Learned Density Functionals"*
Advisor: Dr. Andrew Medford

EXPERIENCE

Lawrence Livermore National Laboratory, Livermore, CA USA
Hosted by: Dr. Michael Schneider
Astronomy and Astrophysics Analytics Group
Technical Scholar, Physics Division *Aug 2017 - present*
Graduate Intern, Physics Division *May 2019 - Aug 2019*
Intern, Data Science Summer Institute *May 2017 - Aug 2017*

Projects: 1) Gaussian Processes with neural network equivalent kernels to estimate cosmological parameters from mass density fields with uncertainty
2) Probabilistic Inference of Cosmic Shear & Intrinsic Galaxy Properties through Hierarchical Graphical Models. Used MCMC techniques to determine cosmic shear and galaxy morphology (for LSST)

Georgia Institute of Technology, Atlanta, GA USA

Medford Group, School of Chemical & Biomolecular Engineering *Jan 2017 - Aug 2019*
Advisor: Dr. Andrew Medford
Project: Determination of Exchange Correlation Functionals through Deep Learning
Using ensembles of neural networks to build surrogate density functionals

Gravity Group, Center for Relativistic Astrophysics *Aug 2018 - May 2019*
Advisor: Dr. Deirdre Shoemaker
Project: Modeling surrogate gravitational waveforms through Gaussian Processes

Otte Lab, Center for Relativistic Astrophysics *Jan 2016 - May 2018*
Advisor: Dr. A. Nepomuk Otte
Project: Segmented Schwarzschild-Couder Telescope Model for GrOptics ray tracing package
Open Source Contrib.: Added telescope model to GrOptics, written in C++(with CERN ROOT)

Brown Lab, School of Computational Science & Engineering *Apr 2016 - Aug 2016*
Advisor: Dr. Kenneth Brown
Project: Python-based exact full-density-matrix quantum circuits simulator

Wolfram Research, Boston, MA USA
Wolfram Mentorship Program *Nov 2016 - Jan 2017*
Wolfram Summer School *June 2016- July 2016*
Project: Classifying Cellular Automata using Machine Learning

Teaching Experience

Graduate Teaching Assistant, College of Computing *Aug 2018 - present*

TA for Junior Level *CS 3510 - Design-Analysis of Algorithms*, under Dr. Constantine Dovrolis *F'20*
TA for Graduate Level *CSE 6730 - Modeling & Simulation*, under Dr. Richard Vuduc *S'19*
TA for Senior Level *CS 4510 - Automata & Complexity*, under Dr. Richard Peng *F'18*

Publications

Dzanic, T., Shah, K., Witherden, F, 'Fourier Spectrum Discrepancies in Deep Network Generated Images', Accepted to NeurIPS 2020 arXiv:1911.06465

Shah, K., & Schneider, M. D., 'Hierarchical Probabilistic Inference of Galaxy Size Morphology Relation for Wide-Field Optical Imaging Surveys' MANUSCRIPT IN PREP

Computer Skills

Python (Data) Science Stack, PyMC3, Keras(Tensorflow), PyTorch
Mathematica, C/C++, Matlab, LaTeX, Arduino Processing

Honors and Awards

- Datmo Applied Machine Learning Fellowship, December 2017
- Amazon Web Services Research Grant ($8000), September 2017 (Advisor: Dr. Madden)
- President's Undergraduate Research Award: Fall 2017, Fall 2016
- Fellow, Data Science Summer Institute, LLNL, Summer 2017
- Student Travel Awards: JupyterCon 2017 (NYC), WSSSPE 2016 (Manchester, UK)
- Top 10 percentile in Indian National Astronomy Olympiad, 2012

Memberships

- Large Synoptic Survey Telescope Dark Energy Science Collaboration (LSST-DESC)
- Cherenkov Telescope Array Consortium
- American Physical Society
- Society of Industrial and Applied Mathematicians

Outreach and Leadership

Volunteer, ICML 2020, Remote *July 2020*
Volunteer, ICLR 2019, New Orleans, LA *May 2019*

Reviewer, President's Undergraduate Research Award (PURA) *May 2018 - Present*
Reviewed Physics and CS research proposals for PURA, a competitive undergraduate research award.

Senator, Graduate Student Senate, Georgia Tech *Sept 2018 - Present*
Representing Computational Science & Engineering in the Student Government Association.

Co-founder, Bitcoin@Tech, Georgia Tech's Bitcoin Club *Aug 2014 - May 2015*

Presentations

Estimation of Cosmological Parameters from n-body simulations through Gaussian Processes *Aug 2019*
Astronomy & Astrophysics Analytics Group Summer Presentation (*talk*)

Hierarchical Probabilistic Inference of Multivariate Galaxy Properties *Dec 2018*
Bay Area LSST & Machine Learning Meeting, Berkeley, CA (*talk*)

Analysis of Uncertainty in Machine Learned Density Functionals *Apr 2018*
Annual Undergraduate Research Spring Symposium, Georgia Tech, Atlanta GA (*poster*)

Inferring Student Success Predictors for CS1301x Online Course at Georgia Tech *Nov 2017*
Georgia Tech STEM Education Research Expo, Atlanta GA (*poster*)

Hierarchical Bayesian Inference of Cosmic Shear & Intrinsic Galaxy Properties *Aug 2017*
LLNL Summer Symposium, Livermore CA (*poster*)

Introduction to Blockchain & Cryptocurrencies *July 2017*
DSSI Brownbag Seminar, Livermore GA (*talk*)

Classifying cellular automata using machine learning *July 2016*
Wolfram Summer School Symposium, Waltham MA (*talk, poster*)

Cellular Automata *Mar 2016*
Senior Seminar, School of Physics, Georgia Tech, Atlanta GA (*talk*)

Research Products

Machine Learning approaches to Density Functional Theory
Link: http://www.github.com/karanprime/surrogate_functionals

GrOptics Telescope Package (Open Source)
Link: http://www.github.com/groptics/GrOptics (branch "karan")

Cellular Automata Classification through Machine Learning
Link: http://www.github.com/karanprime/mlforca

Selected Academic Projects

Gaussian Processes and the Schrodinger equation (For CSE 8803 Advanced Scientific Computing)
Link: http://karan.sh/GPNN_schrodingers_equation/

Predicting Chaos using Deep Reservoir Computing (For CS 7643 Deep Learning)
Link: http://karan.sh/TiamathsPool/

Modeling human migration as an N-body problem (For CX 4230 Simulations)
Link: http://www.github.com/karanprime/MigrationSimulator

Supplemental Experience

Analyst and Developer, Cryptomen.com - Startup *July 2014 - Feb 2015*
Part of a five-person startup that raised $47,000 in cryptocurrency investment.

Student Assistant, Center for Non Linear Science, GT *Jan 2015 - Aug 2015*
Supervisor: Dr. Predrag Cvitanovic
Assisted Dr. Cvitanovic in producing video lectures and maintaining website for a MOOC on chaos theory (Link: http://chaosbook.org)

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