SAMUEL LOOMIS

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QUICK NOTES

Experience in…

Time-series analysis, dynamical systems modeling, network science, quantum computing, numerical analysis

Interested in…

Applications in AI-supported sustainable and climate-smart technologies, located in Research Triangle Park

EDUCATION

PhD University of California, Davis, Physics — In Progress, compl. 2022
Advisor: James P. Crutchfield

MS University of California, Davis, Physics — June 2018
Advisor: James P. Crutchfield

BS North Carolina State University, Physics & Mathematics — May 2016
Graduated Summa Cum Laude

COMPUTER SKILLS

Fluent: Python, FORTRAN

Experience: R, Java, Julia, C#, Haskell, C++, C

RESEARCH EXPERIENCE

Data Mechanics and Time Series Analysis Jan 2020-Present
With: Fushing Hsieh (biostatistics/data science)
Advisor: James Crutchfield

- Connected collaborators and initiated project
- Advised on $40,000 grant proposal
- Developing *ruckus* package for kernel embedding networks
- Developed *stoclust* package for ensemble clustering
- Proved convergence theorems for innovative methods
- Worked with sensors and Raspberry Pi
- First-authored paper-under-review on findings

Data Mining Carbon Emissions & Economics Data Mar 2020-Sep 2021
With: Mark Cooper (agricultural geography)
Advisor: James Crutchfield

- Spearheaded project and connected collaborators
- Wrangled & scrubbed GTAP economic database
- Ran network and clustering analyses to detect patterns
- Physics-based analysis of carbon footprint models
- First-authored paper-under-review on findings

Quantum Simulation of Time-Series Data
With: Cina Aghamohammadi, John Mahoney Mar 2017-Jan 2020
Advisor: James Crutchfield

- Developed new methodology for studying quantum hidden Markov models (QHMM)
- Proved novel theorems on QHMM energy/memory costs
- New results on modular computation for quantum computers
- First-authored 4 publications on findings
- Second author on Physical Review X publication
- Presented work at international conference
- NSF GRFP Honorable Mention

Causal Set Theory of Quantum Gravity Sep 2016-Mar 2017
Advisor: Steve Carlip

- Innovated network methods to shed light on long-standing challenges in a subfield of quantum gravity
- First-authored publication on findings

Motion of Extended Objects in Gravitational Fields May 2013- Sep 2016
Advisor: David Brown

- As undergraduate, pioneered project in general relativity
- Novel mathematical results on equations of motion for complex objects in gravitational fields
- First-authored publication on findings

PUBLICATIONS

Journal Publications

Loomis, S. P., Crutchfield, J. P. "*Thermodynamically-efficient local computation and the inefficiency of quantum memory compression*," Phys. Rev. Research **2**, 023039. 2020.

Loomis, S. P., Crutchfield, J. P. "*Thermal efficiency of quantum memory compression*," Phys. Rev. Lett. **125**, 020601. 2020.

Loomis, S. P., Mahoney, J. R., Aghamohammadi, C., Crutchfield, J. P. "*Optimizing quantum models of classical channels: The reverse Holevo problem*," J. Stat. Phys **181**, 1966–1985. 2020.

Loomis, S. P., Crutchfield, J. P. "*Strong and weak optimizations in classical and quantum models of stochastic processes*," J. Stat. Phys **176**, 1317–1342. 2019.

Aghamohammadi, C., **Loomis, S. P.**, Mahoney, J. R., Crutchfield, J. P. "*Extreme quantum memory advantage for rare-event sampling*," Phys. Rev. X **8**, 011025. 2018.

Loomis, S. P., Carlip, S. "*Suppression of non-manifold-like sets in the causal set path integral*," Class. Quantum Grav. **35** 024002. 2017.

Loomis, S. P., Brown, J. D. "*Continuous body dynamics and the Mathisson-Papapetrou-Dixon equations*," Phys. Rev. D **95**, 044025. 2017.

Journal Papers in Review

Loomis, S. P., Crutchfield, J. P. "*Topology, convergence, and reconstruction of predictive states*," Submitted to: Physica D. *arXiv:2109.09203 [cond-mat.stat-mech]*

Loomis, S. P., Cooper, M., Crutchfield, J. P. "Nonequilibrium thermodynamics in measuring carbon footprints," Submitted to: Physical Review E. *arXiv:2106.03948 [cond-mat.stat-mech]*

PRESENTATIONS

Paper Presentation, "*Thermodynamically-efficient local computation and the inefficiency of quantum memory compression*," Workshop on Agency at the Interface of Quantum and Complexity Science, Singapore 2020.

Paper Presentation, "*Thermal efficiency of quantum memory compression*," Information Engines at the Frontiers of Nanoscale Thermodynamics, Telluride 2019.

Paper Presentation, "*Suppression of non-manifold-like sets in the causal set path integral*," Pacific Coast Gravity Meeting, Santa Barbara 2017.

HONORS AND AWARDS

2020-2021 Summer Graduate Student Researcher Award 2020

NSF GRFP Honorable Mention 2018

Sigma Xi 2018

Phi Kappa Phi 2015

Our Three Winner's Scholarship 2015
The Our Three Winner's Scholarship is given to students who demonstrate a commitment to volunteerism by performing meaningful community service without compensation.

Provost's Professional Experience Program Research Assistanceship 2015

Caldwell Fellows 2013
One of 25 fellows selected from a class of over 4,000 based on leadership potential, academic excellence, and commitment to service.

TEACHING EXPERIENCE

UC Davis Intermittently 2016 to Present
Teaching Assistant, Physics

- Led Discussion Lab meetings for Physics 7A,B,C (introductory physics for biological sciences); integrated model-based reasoning and interactive learning
- Led Discussion and Lab meetings for Physics 9A,B,C (introductory physics for physical sciences/engineering). Small-group collaboration for solving problems sandwiched by large-group discussion of the relevant concepts and solutions.

PROFESSIONAL AFFILIATIONS

Graduate Organization of Physics Students, 2018-2019
Founding Member, Community Representative
GradOPS serves as a voice for the graduate students to the Physics faculty and staff. It seeks to better the department by seeking out graduate student involvement and building community. As community representative I spearheaded organizing community events and built partnerships with local service organizations.

College of Science Ambassadors, 2014-2016
Ambassador
Ambassador representing the college to prospective students and visitors.

COMMUNITY SERVICE

Yolo Inferfaith Immigration Network, 2018-2020
Board Member, Fundraising Dinner Coordinator
YIIN (the Yolo Interfaith Immigration Network) is a group of people serving and advocating for immigrants in Yolo County. As a board member, I took part in decisions about undertaking and managing new projects. As Fundraising Dinner Coordinator I led a team to plan and execute YIIN's annual spring fundraiser in 2019.

SATELLITE Camp, 2013-2015
Counselor
Each summer supervised and mentored high school sophomores for a week of science education and college preparation on NCSU campus.