Uttam Bhat

Data Scientist, Climate LLC
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uttambhat13@gmail.com, GitHub, Google Scholar

Education

2012–2017, Boston University
Ph.D, Department of Physics

2008–2012, Indian Institute of Technology, Bombay
B.Tech, Department of Physics

References

- Prof. Sidney Redner, Santa Fe Institute, NM, redner@santafe.edu
- Prof. Justin Yeakel, University of California Merced, CA, jyeakel@ucmerced.edu
- Prof. Stephan Munch, University of California Santa Cruz, CA, smunch@ucsc.edu

Research interests

- **Complex systems modeling, ecosystems modeling, interdisciplinary science**
- **Machine learning for science, Neural Networks, Gaussian process, data-driven approaches**
- Optimization, Stochastic optimization, Stochastic dynamic programming, Markov decision processes
- Computational modeling, efficient simulations incorporating analytical methods
- Nonlinear dynamics, chaos, empirical dynamical modeling
- Random walks, first passage processes and stochastic processes.
- Random graph models, clustering, phase-transitions in graph properties

Research and professional experience

- **Data Scientist, Climate LLC** Mar, 2022 - Present
  - Developing crop-disease models using weather, agronomic and biological features using both machine-learning and domain-informed mechanistic modeling tools
  - Designed canopy-weather field experiments to collect temperature and humidity data from research fields to enable canopy-weather modeling
  - Co-created agronomic model-building guidelines pooling my own experience as well as experiences of other data scientists with guidelines on data processing, feature engineering, incorporating domain knowledge, model selection etc, into modeling decisions.

- **Postdoctoral Scholar, University of California, Santa Cruz, CA** Nov, 2019 - Feb 2022
  Department: Data Scientist
  Advisor: Stephan B. Munch
  - Developed data-driven approaches to model-building, using time-delay embedding, dynamical theory, Gaussian process and neural networks
  - Secured NOAA's High Performance Computing Incubator grant ($101,245) - "Transparent ML: Unpacking the black box and incorporating mechanism" to develop interpretable machine learning tools for ecological nonlinear dynamics

- **Postdoctoral Scholar, University of California, Merced, CA** Sept,2017 - Oct 2019
  Department: Life and environmental Sciences
  Advisor: Justin D. Yeakel
  - First principles modeling of population dynamics incorporating life-histories, and connected them to evolutionary dynamics

- **Graduate Fellow, Santa Fe Institute** July 2014 - Sept 2017
  Advisor: Sidney Redner
  - Built new framework to study animal foraging, using statistical mechanics principles
  - Analysed the effect of greed, sensing and memory on the fitness of a stochastic forager
  - Analysed the effect of second order linking on clustering of networks

□ **Internship at Finisar Corporation, Malaysia** May - July 2011
- Aided in the implementation of a new Bit Error Rate Test
- Evaluated the effectiveness of the test by analyzing the error distributions across test conditions.

Research articles

Machine Learning

1. **Uttam Bhat**, and Stephan B. Munch, *Recurrent Neural Networks for Partially Observed Dynamical Systems*, Phys. Rev. E 2022, 105, 044205, arXiv: 2109.11629

Ecosystem and Complex systems modeling

2. Megha Suswaram, **Uttam Bhat**, and J. D. Yeakel *Rising above the noise: The influence of population dynamics on the evolution of acoustic signaling*, J. Phys. Complex. 2024, 5 035007 bioRXiv
3. Wheeler et al 2024 *Predicting spring phenology in deciduous broadleaf forests: NEON phenology forecasting community challenge*, Agricultural and Forest Meteorology 2024, 345, 109810
4. S. B. Munch, T. L. Rogers, B. J. Johnson, **Uttam Bhat**, and C. Tsai, *Rethinking the Prevalence and Relevance of Chaos in Ecology*, Annual Review of Ecology, Evolution, and Systematics, 2022, 53, 1, 227-249
5. **Uttam Bhat**, S Redner, *How smart should a forager be?* J. Stat. Mech. (2022) 033402 arXiv: 2201.05254
6. J. D. Yeakel, **Uttam Bhat**, and S. D. Newsome, *Caching in or falling back at the Sevilleta*, Am. Nat. Aug 2020, 196 (2) arXiv: 1907.06305
7. **Uttam Bhat**, C. P. Kempes, and J. D. Yeakel, *Scaling of the risk landscape drives optimal life history strategies and the evolution of grazing*, PNAS Jan 21, 2020 117 (3) 1580-1586 arXiv: 1905.01540
8. L. Hébert-Dufresne, A. F. A. Pellegrini, **Uttam Bhat**, S. Redner, S. W. Pacala, and A. Berdahl, *"Edge fires drive the shape and stability of tropical forests"*, Ecology Letters, vol. 21, p. 794, 6, 2018
9. C. L. Rager, **Uttam Bhat**, O. Bénichou, and S. Redner, *"The Advantage of Foraging Myopically"*, Journal of Statistical Mechanics: Theory and Experiment, (2018) 073501 arXiv: 1804.08045
10. O. Bénichou, **Uttam Bhat**, P. Krapivsky, and S. Redner, *"Optimally Frugal Forager"*, Phys. Rev. E 97, 022110 9 February 2018 arXiv: 1711.03610
11. **Uttam Bhat**, S. Redner, and O. Bénichou, *"Starvation Dynamics of a Greedy Forager"*, Journal of Statistical Mechanics: Theory and Experiment, (2017) 073213 arXiv: 1704.05861
12. **Uttam Bhat**, S. Redner, and O. Bénichou, *"Does Greed Help a Forager Survive?"*, Physical Review E, vol. 95, p. 062119, Jun 2017. arXiv: 1703.03434
13. N. J. Dominy, J. D. Yeakel, **Uttam Bhat**, L. Ramsden, R. W. Wrangham, and P. W. Lucas, *"How Chimpanzees Integrate Sensory Information to select Figs"*, Interface Focus, vol. 6, no. 3, 2016.
14. J. D. Yeakel, **Uttam Bhat**, E. A. Elliott Smith, and S. D. Newsome, *"Exploring the Isotopic Niche: Isotopic Variance, Physiological Incorporation, and the Temporal Dynamics of Foraging"*, Frontiers in Ecology and Evolution, vol. 4, p. 1, 2016. arXiv: 1510.00767

Social Network Dynamics

15. **Uttam Bhat**, M. Shrestha, and L. Hébert-Dufresne, *"Exotic Phase Transitions of k-cores in Clustered Networks"*, Physical Review E, vol. 95, p. 012314, Jan 2017. arXiv: 1607.08637
16. **Uttam Bhat**, P. Krapivsky, R. Lambiotte, and S. Redner, *"Densification and Structural Transitions in Networks that Grow by Node Copying"*, Physical Review E, vol. 94, p. 062302, Dec 2016. arXiv:1610.01662
17. R. Lambiotte, P. Krapivsky, **Uttam Bhat**, and S. Redner, *"Structural Transitions in Dense Networks"*, Physical Review Letters, vol. 117, p. 218301, Nov 2016. arXiv: 1607.03850
18. **Uttam Bhat**, P. L. Krapivsky, and S. Redner, *"Emergence of Clustering in an Acquaintance Model without Homophily"*, Journal of Statistical Mechanics: Theory and Experiment, vol. 2014,no. 11, p. P11035, 2014. arXiv: 1408.6596

Random Walk, Brownian Processes, Lattice Gas

19. **Uttam Bhat**, C. De Bacco, and S. Redner, *"Stochastic Search with Poisson and Deterministic Resetting"*, Journal of Statistical Mechanics: Theory and Experiment, vol. 2016, no. 8, p. 083401, 2016. arXiv: 1605.08812
20. **Uttam Bhat** and S. Redner, *"Intermediate-Level Crossings of a First-Passage Path"*, Journal of Statistical Mechanics: Theory and Experiment, vol. 2015, no. 6, p. P06035, 2015. arXiv: 1505.01184
21. **Uttam Bhat** and P. L. Krapivsky, *"Exclusion Processes with Avalanches"*, Physical Review E, vol. 90, p. 012133, Jul 2014. arXiv: 1406.1937

Conference Talks

- *"Connecting mechanistic models to data-driven and predictive models in highly-coupled many-species ecosystems"* Ecological Society of America Annual Conference. Aug 3, 2020
- *"Resource investment strategies in uncertain and patchy environments"* (poster), Unifying ecology across scales, Gordon Conference, University of New England. July 21, 2018
- *"Stochastic Search with Reset"*, Statistical Mechanics Conference, Rutgers University. May 08, 2016
- *"Transitive Linking in Networks"*, Kinetic Networks: From Topology to Design, Santa Fe Institute. Sept 18, 2015
- *"Emergence of Clustering in Friendship Networks"*, Statistical Mechanics Conference, Rutgers University. Dec 15, 2013
- *"Emergence of Clustering in Friendship Networks"*, Greater Boston Area Statistical Mechanics Conference. Oct 12, 2013

Other Talks

- "Linking the persistence of the Sevilleta rodent community to alternative caching and foraging strategies", SEV-LTER Science Symposium, University of New Mexico. Sept 21, 2018
- "Surprises in Brownian Motion" *Departmental Seminar*, Department of Physics, Boston University. May 10, 2016
- "Little Knowledge is a Dangerous Thing" (on greedy forager dynamics), *Slice of Science Seminar*, Santa Fe Institute. Feb 9, 2016
- "Taming the Search-Space in Music" (on degrees of freedom in melodic music and their relation to aesthetics and human psychology), *Reckless Ideas Seminar*, Santa Fe Institute. Nov 6, 2015
- "Transitive Linking in Acquaintance Dynamics", *Slice of Science Seminar*, Santa Fe Institute. Feb 10, 2015

Programming and Math Languages

- C++, C, Python, Julia, Shell, Mathematica, MATLAB

Teaching and Mentoring Experience

- Mentored a doctoral and an undergraduate student. Guided them to construct sound mathematical models and helped polish their research goals.
- Teaching Assistant for the Physics Lab for premedical students, Boston University. Fall 2012
- Head Teaching Assistant for the First Course in Probability and Statistics for Engineers, Indian Institute of Technology, Bombay. Spring 2012
- Teaching Assistant for the First Course in Probability and Statistics for Engineers, Indian Institute of Technology, Bombay. Spring 2011
- As a Student Facilitator for the Training and Selection Camp for Astronomy Olympiad in India, I helped prepare tutorial sessions, problems and solutions for camp tests and guide the students on academic and non-academic issues throughout the camp. May 2009, May 2010 and May 2012

Awards and Participation in International Olympiads

- Bronze medal for the Indian team in the 2nd International Olympiad on Astronomy and Astrophysics (IOAA), Indonesia, 2008
- Silver medal for the Indian team in the 12th International Astronomy Olympiad (IAO), Ukraine, 2007

Extra-Curriculars

As an amateur musician, I am well-versed in playing flute and have basic skills on piano, guitar and bass (published work at https://soundcloud.com/uttambhat13). I won the 'Cultural Citation' award (2012) and the 'Cultural Person of the Year' award (2011) for my contributions to music as a performer and organizer at Indian Insitute of Technology, Bombay. I also enjoy hiking, outdoor activities, photography and painting.