Christopher L. Krapu

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Research Positions

Research Associate GeoAI Research Group, Oak Ridge National Laboratory 2020–present

- Developing novel expert-informed graphical models of spatial multivariate data for modeling every building on the planet under the Global Building Intelligence program
- Analysis of large geostatistical datasets with Gaussian processes and small area estimation models in service of ORNL/Georgetown/VA collaboration on environmental determinants of health

Contract R&D Engineer, In4mation Insights 2020

- Devising novel spatial hierarchical media mix models for assessing effectiveness of media campaigns in retail and consumer goods
- Implementing filtering and variational Bayes algorithms in Tensorflow to fit multivariate dynamic modeling for high-dimensional demand forecasting

Doctoral Candidate, Pratt School of Engineering, Duke University 2014–2020

- Supervised by Mark Borsuk and Mukesh Kumar, funded by NSF WISeNet IGERT (2014-2016) and NASA Earth & Space Science Fellowship (2017-2020)
- Researching scalable statistical models of environmental phenomena with relevance to hydrology and ecology

Education

Ph.D. Civil & Environmental Engineering, Duke University 2020

M.S. Statistical Science, Duke University 2020

B.A Physics, Macalester College 2013

Teaching and service

Lecturer, Duke University 2019

- Primary instructor for new graduate-level course in probabilistic modeling for engineers
- Advised 12 students developing individual term projects for Bayesian modeling of engineering systems

Research advisor, Duke University 2018-2019

- Mentoring undergraduate and M.Eng students in environmental engineering research
- Writing proposals to fund grant opportunities for student researchers

Graduate Teaching Assistant, Duke University 2016

- Developing material, grading, and holding office hours in Probabilistic Machine Learning (STA 561) under instructor Dr. Cynthia Rudin

Reviewer for *Communications in Biology*, *Geophysical Research Letters*, *Journal of Hydrology*, *Environmental Science: Processes and Impacts*, *AI in Food, Agriculture, and Water* (Frontiers in Artificial Intelligence)

Awards, Fellowships & Grants

Civil & Environmental Engineering Outstanding Scholar Duke University 2021

Young Scientist Summer Program Fellow IIASA 2019

NASA Earth and Space Science Fellow 2017–2020

James B. Duke Fellow Duke University 2014–2017

Nvidia GPU Grant 2017

Nicholas School NPAC Grant Duke University 2017

Duke Wetland Center Graduate Student Grant 2016

Amazon Web Services Cloud Research Grant 2016

NSF IGERT Trainee National Science Foundation 2014–2016

NSF REU Grantee Texas Christian University 2014–2016

National Merit Scholar 2009

Other Employment

Research Intern Advanced Systems Analysis Group, IIASA 2019

Database Support Engineer Epic Systems 2013–2014

Publications

Identifying wetland consolidation using remote sensing in the North Dakota Prairie Pothole Region
Christopher Krapu, Mark Borsuk and Mukesh Kumar
Water Resources Research, 2018

Probabilistic programming: a review for environmental modellers
Christopher Krapu. and Mark Borsuk
Environmental Modelling and Software, 2019

Gradient-based inverse estimation for a rainfall-runoff model
Christopher Krapu, Mark Borsuk and Mukesh Kumar
Water Resources Research, 2019

Spatial community regression for joint species distribution modelling
Christopher Krapu and Mark Borsuk
Methods in Ecology and Evolution, 2020

Mapping post-climate change biogeographical regions with deep latent variable models
Christopher Krapu
To appear in Tackling Climate Change with Machine Learning, NeurIPS 2021 workshop

Crop yield response to water availability in the U.S. over the past thirty years
Emily Burchfield, Danielle Touma, Max Steifel, Rui Zhu, **Christopher Krapu** and John Nay
Under review

A parsimonious Bayesian model of upland-embedded wetlands
Christopher Krapu, Mark Borsuk and Mukesh Kumar
Under review, Water Resources Research

A review of spatial data for Bayesian networks
Christopher Krapu, R. Stewart and A. Rose
Under review, ACM Transactions on Spatial Algorithms and Systems

A comparison of novel dynamic priors for Bayesian estimation of time-varying parameters in rainfall-runoff modeling via Hamiltonian Monte Carlo
Christopher Krapu, and Mark Borsuk
Under review, Water Resources Research

A graphical model for multivariate categorical data using spatial and expert information
Christopher Krapu, Robert Stewart, Kuldeep Kurte, Nolan Hayes, Amy Rose, Alex Sorokine, Marie Urban
Under internal ORNL review, to be submitted to Spatial Statistics

Reports & White Papers

AI-Improved Resolution Projections of Population Characteristics and Imperviousness Can Improve Resolution and Accuracy of Urban Flood Predictions
Christa Brelsford, **Christopher Krapu**, Joe Tuccillo, Matt McCarthy, Jake McKee, Nagendra Singh (2021)
White paper under Department of Energy AI for Earth Systems Predictions program

End-to-End Differentiable Modeling and Management of the Environment
Christopher Krapu and Tyler Felgenhauer (2021)
White paper under Department of Energy AI for Earth Systems Predictions program

Software

lidisa owner
Rapid implementation of direct sampling for infilling and imputation of image data

SpRCom owner
Scalable dimension reduction with covariates for non-Gaussian data with GPU-accelerated inference

PyMC3 contributor
Python-centric Markov chain Monte Carlo framework backed by Theano and Jax