Thomas J. Vandal, Ph.D.

Research Scientist
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My research is at the intersection of data science, machine learning, and earth sciences. I am interested in building spatio-temporal machine learning techniques for extracting information from remotely sensed satellite imagery and atmospheric models to better understand the effects of climate change.

Research Interests

Machine learning, Statistics, Data Science, Climate Science, Remote Sensing, Optical flow, High-Performance Computing, and Quantum Computing.

Education

Northeastern University, Boston, MA, USA • Ph.D., 2018
Interdisciplinary Engineering, Machine Learning in the Earth Sciences
Thesis Topic: Statistical Downscaling of Global Climate Models with Image Super-Resolution
Advisers: Prof. Auroop R. Ganguly and Prof. Jennifer Dy

University of Maryland, College Park, MD • B.S., 2012
Mathematics- Statistics

Awards

- *Outstanding Graduate Research Award*, Civil and Environmental Engineering, Northeastern University, 2018
- *Best Paper Runner-up and Best Student Paper Runner-up Awards,* Applied Data Science Track, 23rd ACM SIGKDD Conference on Knowledge Discovery and Data Mining, 2017
- Student Travel Grant, 7th International Workshop on Climate Informatics, Boulder, CO, 2017
- Student Travel Grant, 23rd SIGKDD,Halifax Nova Scotia, CA, 2017

Employment

NASA Ames Research Center / Bay Area Environmental Research Institute, Moffett Field, CA, USA
Research Scientist — August 2018 to Present
Research Associate - Intern — June 2016 to August 2016

Northeastern University, Boston, MA, USA
Graduate Research Assistant — January 2015 to August 2018

Freebird, Cambridge, MA, USA.
Machine Learning Scientist — January 2016 to February 2018

Affectiva, Waltham, MA, USA.
Data Scientist — January 2014 to December 2014
Integration Engineer — September 2013 to January 2014

Boston Technologies, Boston, MA, USA.
Market Risk Analyst — August 2012 to September 2014

Conference Papers - Peer Reviewed

- **Vandal, T.** & Nemani, R. (2019). "Optical Flow for Intermediate Frame Interpolation of Multispectral Geostationary Satellite Data". *arXiv preprint arXiv:1907.12013*. (In Review, AAAI).

- **Vandal, T.**, Kodra, E., Ganguly, S., Dy, J., Nemani, R., & Ganguly, A (2018): "Quantifying Uncertainty in Discrete-Continuous and Skewed Data with Bayesian Deep Learning," Proceedings of the 24rd ACM **SIGKDD** Conference on Knowledge Discovery and Data Mining, 1663-1672. (Research Track, 18% acceptance rate)
- **Vandal, T.**, Livingston, M., Piho, C., Zimmerman, S. (2018). "Prediction and Uncertainty Quantification of Daily Airport Flight Delays." Proceedings of The 4th International Conference on Predictive Applications and APIs, in PMLR.
- **Vandal, T.**, Kodra, E., Ganguly, S., Michaelis, A., Nemani, R., & Ganguly, A. (2018). "Generating High Resolution Climate Change Projections through Single Image Super-Resolution: An Abridged Version." Proceedings of the Twenty-Seventh International Joint Conference on Artificial Intelligence and Twenty-Third European Conference on Artificial Intelligence Sister Best Paper Track (**IJCAI** Invited Submission).
- **Vandal, T.**, Kodra, E., Ganguly, S., Michaelis, A., Nemani, R., & Ganguly, A. (2017). "DeepSD: Generating high resolution climate change projections through single image super-Resolution," Proceedings of the 23rd ACM **SIGKDD** Conference on Knowledge Discovery and Data Mining, 1663-1672. (Runner-Up Best Paper Award and Runner-up Best Student Paper Award in Applied Data Science Track, 9% oral acceptance rate)
- **Vandal, T.** & Ganguly, A. (2017), "Uncertainty Quantification of Statistical Downscaling using Bayesian Deep Learning." 7th International Workshop on Climate Informatics, Boulder, CO.
- Li, Y., Chang, Y., **Vandal**, **T.,** Das, D., Ding, A., Ganguly, A., & Dy, J. (2016), "Uncertainty Quantification of Statistical Downscaling using Bayesian Deep Learning." 7th International Workshop on Climate Informatics, Boulder, CO.
- **Vandal, T.,** McDuff, D., & Kaliouby, R. (2015), "Event Detection : Ultra Large-scale Clustering of Facial Expressions." 11th IEEE International Conference on Automatic Face and Gesture Recognition, Ljubljana, Slovenia.

Journal Papers

-Duffy, K., **Vandal, T.**, Wang, W., Nemani, R., & Ganguly, A (2019). "Deep Learning Emulation of Multi-Angle Implementation of Atmospheric Correction (MAIAC)". (In Submission)
- Wilson, M., **Vandal, T.,** Hogg, T., & Rieffel, E. (2019). "Quantum-assisted associative adversarial network: Applying quantum annealing in deep learning". *arXiv preprint arXiv:1904.10573*. (In Review).
- **Vandal, T.**, E. Kodra, and A. Ganguly, "Intercomparison of Machine Learning Methods for Statistical Downscaling: The Case of Daily and Extreme Precipitation." Theoretical and Applied Climatology. September 2018.

Book Chapter

- **Vandal, T.,** Bhatia, U., and Ganguly, A. (2017), "Statistical Downscaling in Climate with State of the Art Scalable Machine Learning." Large-Scale Machine Learning in the Earth Sciences. Taylor & Francis.

Conferences - Posters and Presentations

- **Vandal, T.** & Nemani, R. (2020). "Optical Flow for Intermediate Frame Interpolation of Multispectral Geostationary Satellite Data". 19th Conference on Artificial Intelligence for Environmental Science. Boston, MA.
- Li, S., Wang, W., Hashimoto, H., **Vandal, T.,** Yao, J., & Nemani, R (2019). "Surface Reflectance Product from Geostationary Satellite". In AGU Fall Meeting Abstracts. San Francisco, CA.
- **Vandal, T.**, Nemani, R., Wang, W., & Li, S. (2019. "Transfer Learning to Generate True Color Images from GOES-16". In AGU Fall Meeting Abstracts. San Francisco, CA.
- Duffy, K., **Vandal, T.,** Li, S., Nemani, R., & Ganguly, A. (2019). "Deep Learning Emulation of Atmospheric Correction to Geostationary Sensors". In AGU Fall Meeting Abstracts. San Francisco, CA.
- **Vandal, T.,** Duffy, K., & Nemani, R. (2019). "Deep Learning and Uncertainty Quantification For Climate Resilience," INFORMS Annual Meeting. Seattle, WA.
- Duffy, K., **Vandal, T**., Li, S., Ganguly, S., Nemani, R. & Ganguly, A. (2019). "DeepEmSat: Deep Emulation of Satellite Data Mining", **SIGKDD** workshop on Fragile Earth: Theory Guided Data Science to Enhance Scientific Discovery.
- **Vandal, T.** & Nemani, R. (2019). "Estimating Optical Flows in Satellite Imagery", Space Lidar Winds Working Group Meeting, National Institute for Aerospace, Hampton, VA.
- **Vandal, T.**, Nemani, R., & Ganguly, S. (2019). "Enhancing Climate Data with Deep Learning", 1st Workshop on Leveraging AI in the Exploitation of Satellite Earth Observations & Numerical Weather Prediction.

- Koduri, V., **Vandal, T.**, Ganguly, S., & Ganguly, A. (2018). "Data Mining for Weather Impacts on Crop Yield", SIGKDD workshop on Fragile Earth: Theory Guided Data Science to Enhance Scientific Discovery.
- **Vandal, T.**, Ganguly, S., Kodra, E., Dy, J., Michaelis, A., Nemani, R., & Ganguly, A. (2018). Image Super-Resolution and Uncertainty Quantification for Earth Science Data on NASA Earth Exchange AI Platform (Invited Talk). In AGU Fall Meeting Abstracts.
- Ganguly, S., Kalia, S., Duffy, K., Collier, E., Shreekant, G., Li, S., Mukhopadhyay, S., Prabhat, **Vandal, T.**, Albert, A., Hashimoto, H., Wang, W., Lee, T., Choudhury, D., Michaelis, A., Saatchi, S., Tucker, C., & Nemani, R (2018). NEX-AI: A Cloud and HPC Agnostic Framework for Scaling Deep Learning and Machine Learning Applications for Earth Science. In AGU Fall Meeting Abstracts.
- Duffy, K., **Vandal, T**., Li, S., Ganguly, S., Nemani, R., & Ganguly, A.,(2018). GOENEX: A Deep Learning Approach to Prediction of Surface Spectral Reflectance. In AGU Fall Meeting Abstracts.
- Wilson, A., **Vandal, T.**, Rieffel, E., & Nemani, R. (2018).Compressing Earth Science Datasets with Quantum-Assisted Machine Learning Algorithms. In AGU Fall Meeting Abstracts.
- Mage, M., Ganguly, S., **Vandal, T.**, Nemani, R. R., Li, S., Kalia, S., & Ganguly, A. R. (2017). Estimation of MODIS-like Surface-Spectral Reflectance from Geostationary Satellites using Deep Neural Networks. In AGU Fall Meeting Abstracts.
- Duffy, K., Bhatia, U., **Vandal, T.,** & Ganguly, A. R. (2017). The sensitivity of climate driven hydrologic models to statistical downscaling methods. In AGU Fall Meeting Abstracts.

Patents

- Kaliouby, R., Kodra, E., McDuff, D., & **Vandal, T**. Mental state event signature usage. United States patent application US 15/262,197. 2016 Dec 29.
- **Vandal, T**., Kodra, E., & Kaliouby, R. Mental State Event Definition Generation. United States patent application US 14/796,419. 2015 Nov 5.

Invited Talks

- (Scheduled) INFORMS Annual Meeting, Seattle, WA, October 2019.
- Space Lidar Winds Working Group Meeting, National Institute of Aerospace, Hampton, VA, 2019.
- AGU Fall Meeting Special Session on Big Data in the Geosciences: New Methods and Parallel Algorithms. Washington DC, 2018.
- Symposium on Data Science and Statistics, American Statistical Association, Reston, VA, 2018.
- University of Minnesota, Institute for Research on Statistics and its Applications. Minneapolis, MN,2018.
- Boston Area AI and Machine Learning in Medicine, Beth Israel Deaconess Medical Center, Boston, MA, 2018.
- University of New Hampshire, Statistics, Durham, NH, 2018.
- 17th Conference on Artificial and Computational Intelligence and its Applications to the Environmental Sciences, Austin, TX, 2018.
- Microsoft Research, Redmond, WA, 2017.
- Google Cloud Platform Scientific Public Datasets Workshop, Seattle, WA, 2017.

Professional Activities

Elected student member of the *Committee on Artificial Intelligence Applications to Environmental Science* for the *American Meteorological Society*

Panels

- "Scaling Machine Learning in the Earth Sciences". Earth Science Information Partners (ESIP) Winter Meeting, Bethesda, MD, 2019.

Reviewer

- *PLOS One, Scientific Reports, Neural Computing and Applications, IEEE Transactions on Big Data, Water Resources Research, IEEE Transactions on Network Science and Engineering, American Meteorological Society*

Weather and Forecasting, Journal of Hydrometeorology, Journal of Geophysical Research, Frontiers in Big Data, Journal of Computing in Civil Engineering.

Technical Skills

-Machine Learning/Image Processing: Python, Tensorflow, PyTorch.
-High-Performance Computing: OpenMPI, Hadoop, CUDA
-Cloud Technologies: Amazon AWS, Elastic MapReduce, Google Earth Engine.

Press

- **Nature News**, ''The case for technology investments in the environment" (Highlighted), December 19, 2017.
- **Phys Org**, "Zooming in on Climate Projections." August 17 2017.
- **Leiphone**, Shenzhen, China (Interview, Article). August 17 2017.