

KYLE BRADBURY

CONTACT INFORMATION

Duke University
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CITIZENSHIP

United States of America

RESEARCH INTERESTS

I develop and apply machine learning techniques to better understand and manage energy and climate resources. My current research interests include developing scalable computer vision techniques for assessing energy resources, infrastructure, and access globally through the use of publicly available remote sensing data. Methodologically, I investigate how to overcome the challenge of distribution shift in computer vision through novel training paradigms that require less labeled data. The vision for this work is to advance machine learning methodologies and apply them to solve energy and climate system challenges through the development of open source, widely-applicable computational tools.

EXPERIENCE

Assistant Research Professor, Electrical & Computer Engineering *Jul 2020 – present*

Director, Energy Data Analytics Lab *Jul 2022 – present*

Lecturing Fellow, Electrical and Computer Engineering *Sep 2016 – Jun 2020*

Managing Director, Energy Data Analytics Lab, Energy Initiative *Jan 2015 – Jun 2022*

Senior Research Associate, Energy Initiative *Jan 2015 – Jun 2020*

Duke University

Electrical & Computer Engineering, Nicholas Institute, and Masters of Interdisciplinary Data Science program

- Develop and apply data science techniques to solve energy systems problems using datasets including remotely sensed earth observations and smart meter data
- Teach and mentor students across disciplines in machine learning and research best practices through MIDS, Bass Connections, and Data+ programs
- Manage an interdisciplinary research lab and research team

Postdoctoral Fellow

February 2013 – December 2014

Duke University Energy Initiative, Duke University

- Co-developed and administered the interdisciplinary, team-based educational program, Bass Connections in Energy
- Designed and led student-based research teams analyzing smart electric utility meter data using machine learning-based energy disaggregation algorithms to obtaining device-level energy insight

Business Architecture & Technology Intern

Summer 2011

ISO New England, Holyoke, MA

- Conducted a reliability assessment of power outage events for the United States
- Created a framework for jointly evaluating power system reliability and survivability

Electrical Engineering Intern

Summer 2006

MIT Lincoln Laboratory, Lexington, MA

Implemented a custom timing generator circuit for the Radar Open System Architecture on a field-programmable gate array (FPGA).

Electrical and Mechanical Intern

Summers 2004 & 2005

Dominion Energy New England, Summer 2005

National Energy and Gas Transmission, Summer 2004

Brayton Point Station, Somerset, MA (1600 MW coal, oil, and natural gas-fired plant)

- Implemented a preventive maintenance program for the coal pulverization system
- Assessed startup processes of plant generation units, plant safety, and oil analyses

EDUCATION

PhD | Duke University, Durham, NC | May 2013

Area of Study: Energy Systems Modeling, Division of Earth and Ocean Sciences

Advisor: Lincoln F. Pratson

Dissertation: The Potential of Energy Storage Systems with Respect to Generation Adequacy and Economic Viability

M.S. | Duke University, Durham, NC | December 2008

Area of Study: Electrical & Computer Engineering: Signal Processing & Machine Learning

Advisor: Leslie M. Collins

Research: Machine learning algorithm development for landmine detection using ground penetrating radar systems

B.S.E.E. | Tufts University, Medford, MA | May 2007, *Summa cum laude*

Area of Study: Electrical & Computer Engineering

Advisor: Joseph P. Noonan

Research: Image-based anomaly detection and secure communication systems

JOURNAL PUBLICATIONS

Calhoun, Z.D., S. Lahrichi, S. Ren, J.M. Malof, and [K. Bradbury](#) (2022). Self-Supervised Encoders Are Better Transfer Learners in Remote Sensing Applications. *Remote Sensing*, 14(21), p.5500.

Hu, W., [K. Bradbury](#), J.M. Malof, B. Li, B. Huang, A. Streltsov, K.S. Fujita, and B. Hoen (2022). What you get is not always what you see—pitfalls in solar array assessment using overhead imagery. *Applied Energy*, 327, p.120143.

Ren, S., W. Hu, [K. Bradbury](#), D. Harrison-Atlas, L.M. Valeri, B. Murray, and J.M. Malof, (2022). Automated Extraction of Energy Systems Information from Remotely Sensed Data: A Review and Analysis. *Applied Energy* (accepted for publication)

Xu, Y., B. Huang, X. Luo, [K. Bradbury](#) and J.M. Malof, (2022). SIMPL: Generating Synthetic Overhead Imagery to Address Custom Zero-Shot and Few-Shot Detection Problems. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, 15, pp.4386-4396.

Ren, S., J. Malof, R. Fetter, R. Beach, J. Rineer, and [K. Bradbury](#), (2022). Utilizing geospatial data for assessing energy security: Mapping small solar home systems

using unmanned aerial vehicles and deep learning. *ISPRS International Journal of Geo-Information*, 11(4), p.222.

Huang, B., J. Yang, A. Streltsov, K. Bradbury, L. M. Collins and J. Malof (2021). "GridTracer: Automatic Mapping of Power Grids using Deep Learning and Overhead Imagery," in *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, doi: 10.1109/JSTARS.2021.3124519.

Streltsov, A., J.M. Malof, B. Huang, and K. Bradbury (2020). "Estimating residential building energy consumption using overhead imagery." *Applied Energy*, 280, p.116018.

Bradbury, K., R. Saboo, T. Johnson, J. Malof, W. Zhang, A. Devarajan, L. Collins, and R. Newell (2016). "Distributed Solar Photovoltaic Array Location and Extent Dataset for Remote Sensing Object Identification." *Scientific Data*, 3. doi:10.1038/sdata.2016.106.

Malof, J., K. Bradbury, L. Collins, and R. Newell (2016). "Automatic detection of solar photovoltaic arrays in high resolution aerial imagery," *Applied Energy*, 183, 229-240.

Bradbury, K., L. Pratson, and D. Patiño-Echeverri (2014). "Economic viability of energy storage systems based on price arbitrage potential in real-time US electricity markets," *Applied Energy*, vol. 114, pp. 512–519.

BOOK CHAPTERS

Bradbury, K. (2018). "How Data Science Can Enable the Evolution of Energy Systems." Chapter in *Digital Decarbonization Promoting Digital Innovations to Advance Clean Energy Systems*. Ed. Varun Sivaram. New York, New York: Council on Foreign Relations, pp. 73-81.

CONFERENCE PUBLICATIONS

W. Hu, T. Feldman, E. Lin, J. L. Moscoso, Y. J. Ou, N. Tarn, B. Ye, W. Zhang, J. M. Malof, K. Bradbury. (2021) Synthetic Imagery Aided Geographic Domain Adaptation for Rare Energy Infrastructure Detection in Remotely Sensed Imagery. In *2021 Neural Information Processing Systems (NeurIPS) Climate Change AI Workshop*. ([link](#))

Hu, W., T. Feldman, Y. J. Ou, N. Tarn, B. Ye, Y. Xu, J. M. Malof, K. Bradbury. (2021) Wind Turbine Detection with Synthetic Overhead Imagery. In *2021 IEEE International Geoscience and Remote Sensing Symposium IGARSS* (pp. 4908-4911). IEEE.

Nair, V., P. Rhee, B. Huang, K. Bradbury, J. M. Malof. (2020) "Designing synthetic overhead imagery to match a target geographic region: preliminary results training deep learning models." *Presented at the 2020 IEEE International Geoscience and Remote Sensing Symposium*. ([Github](#))

Huang, B., K. Bradbury, L. M. Collins, J. M. Malof. (2020) "Do Deep Learning Models Generalize to Overhead Imagery from Novel Geographic Locations? The xGD Benchmark Problem." *Presented at the 2020 IEEE International Geoscience and Remote Sensing Symposium*.

Hu, W., B. Alexander, W. Cathcart, A. Hu, V. Nair, L. Zuo, J. M. Malof, L. M. Collins, K. Bradbury. (2020) "Mapping electric transmission line infrastructure from aerial imagery with deep learning." *Presented at the 2020 IEEE International Geoscience and Remote Sensing Symposium*.

- Kong, F., B. Huang, [K. Bradbury](#), and J. Malof. (2020) The Synthinel-1 dataset: a collection of high resolution synthetic overhead imagery for building segmentation. In *The IEEE Winter Conference on Applications of Computer Vision* (pp. 1814-1823). ([Github](#))
- Kong, F., C. Chen, B. Huang, L. Collins, [K. Bradbury](#), and J. Malof. (2019) Training a single multi-class convolutional segmentation network using multiple datasets with heterogeneous labels: preliminary results. In *IGARSS 2019-2019 IEEE International Geoscience and Remote Sensing Symposium* (pp. 3903-3906). IEEE.
- Lin, K., B. Huang, L. Collins, [K. Bradbury](#), and J. Malof. (2019) A simple rotational equivariance loss for generic convolutional segmentation networks: preliminary results. In *IGARSS 2019-2019 IEEE International Geoscience and Remote Sensing Symposium* (pp. 3876-3879). IEEE.
- [Bradbury, K.](#), J. Malof, M.A. Jeuland, B. Huang, B. Wong, T. Johnson, and L. Collins. (2018) "Open Energy Infrastructure Data Through Automated Assessment Using Satellite Imagery." *Presented at 2018 AGU Fall Meeting*.
- Huang, B., L. M. Collins, [K. Bradbury](#), and J. M. Malof. (2018) "Deep Convolutional Segmentation of Remote Sensing Imagery: A Simple and Efficient Alternative to Stitching Output Labels." In *IGARSS 2018-2018 IEEE International Geoscience and Remote Sensing Symposium*, 6899-6902. IEEE.
- Huang, B., K. Lu, N. Audebert, A. Khalel, Y. Tarabalka, J. Malof, A. Boulch, B. Le Saux, L. Collins, [K. Bradbury](#), S. Lefèvre, and M. El-Saban. (2018) "Large-Scale Semantic Classification: Outcome of the First Year of Inria Aerial Image Labeling Benchmark." In *IGARSS 2018-2018 IEEE International Geoscience and Remote Sensing Symposium*, 6947-6950. IEEE.
- Huang, B., D. Reichman, L. M. Collins, [K. Bradbury](#), and J. M. Malof. (2018) "On the Extraction of Training Imagery from Very Large Remote Sensing Datasets for Deep Convolutional Segmentation Networks." *IGARSS 2018 - 2018 IEEE International Geoscience and Remote Sensing Symposium*, Valencia, pp. 6895-6898. doi: 10.1109/IGARSS.2018.8519523
- Streltsov, A., [K. Bradbury](#), and J. Malof. (2018) "Automated Building Energy Consumption Estimation from Aerial Imagery." *IGARSS 2018 - 2018 IEEE International Geoscience and Remote Sensing Symposium*, Valencia, pp. 1676-1679. doi: 10.1109/IGARSS.2018.8517624
- Wang, R., L. Collins, [K. Bradbury](#), and J. Malof. (2018) "Semisupervised Adversarial Discriminative Domain Adaptation, with Application to Remote Sensing Data." In *IGARSS 2018-2018 IEEE International Geoscience and Remote Sensing Symposium*, 3611-3614. IEEE.
- Huang, B., M. Knox, [K. Bradbury](#), L. Collins, and R. Newell. (2017) "Non-intrusive load monitoring system performance over a range of low frequency sampling rates," *2017 IEEE 6th International Conference on Renewable Energy Research and Applications (ICRERA)*, San Diego, CA, pp. 505-509. doi: 10.1109/ICRERA.2017.8191111

- Wang, R., J. Camilo, L. M. Collins, [K. Bradbury](#) and J. M. Malof. (2017) "The poor generalization of deep convolutional networks to aerial imagery from new geographic locations: an empirical study with solar array detection," 2017 IEEE Applied Imagery Pattern Recognition Workshop (AIPR), Washington, DC, pp. 1-8. doi: 10.1109/AIPR.2017.8457960
- Malof, J. M., S. Chelikani, L. M. Collins and [K. Bradbury](#). (2017) "Trading spatial resolution for improved accuracy in remote sensing imagery: an empirical study using synthetic data," 2017 IEEE Applied Imagery Pattern Recognition Workshop (AIPR), Washington, DC, pp. 1-7. doi: 10.1109/AIPR.2017.8457961
- Camilo, J., L. Collins, [K. Bradbury](#), J. Malof. (2017) "Application of a semantic segmentation convolutional neural network for accurate automatic detection and mapping of solar photovoltaic arrays in aerial imagery." Presented at the IEEE Applied Imagery Pattern Recognition Workshop in Washington, D.C.
- Qian, S., S. Chelikani, P. Wang, L. Collins, [K. Bradbury](#), and J. Malof. (2017) "Trading spatial resolution for improved accuracy when using detection algorithms on remote sensing imagery," *2017 IEEE International Geoscience and Remote Sensing Symposium (IGARSS)*, Fort Worth, TX, pp. 3716-3719. doi: 10.1109/IGARSS.2017.8127806
- Malof, J., L. Collins, and [K. Bradbury](#). (2017) "A deep convolutional neural network, with pre-training, for solar photovoltaic array detection in aerial imagery," *2017 IEEE International Geoscience and Remote Sensing Symposium (IGARSS)*, Fort Worth, TX, pp. 874-877. doi: 10.1109/IGARSS.2017.8127092
- So, B., C. Nezin, V. Kaimal, S. Keene, L. Collins, [K. Bradbury](#), and J. Malof. (2017) "Estimating the electricity generation capacity of solar photovoltaic arrays using only color aerial imagery," *2017 IEEE International Geoscience and Remote Sensing Symposium (IGARSS)*, Fort Worth, TX, pp. 1603-1606. doi: 10.1109/IGARSS.2017.8127279
- Malof, J., L. Collins, [K. Bradbury](#), and R. Newell. (2016) "A Deep Convolutional Neural Network and a Random Forest Classifier for Solar Photovoltaic Array Detection in Aerial Imagery." In *2016 IEEE International Conference on Renewable Energy Research and Applications (ICRERA)*, pp. 650–54. doi:10.1109/ICRERA.2016.7884415.
- Malof, J., [K. Bradbury](#), L. Collins, R. Newell, A. Serrano, H. Wu, and S. Keene. (2016) "Image Features for Pixel-Wise Detection of Solar Photovoltaic Arrays in Aerial Imagery Using a Random Forest Classifier." *2016 IEEE International Conference on Renewable Energy Research and Applications (ICRERA)*, pp. 799–803. doi:10.1109/ICRERA.2016.7884446.
- Malof, J., R. Hou, L. Collins, [K. Bradbury](#), and R. Newell. (2015) "Automatic solar photovoltaic panel detection in satellite imagery." *2015 International Conference on Renewable Energy Research and Applications (ICRERA)*, pp. 1428–1431.

Czarnek, N., K. Morton, L. Collins, R. Newell, and K. Bradbury. (2015) "Performance Comparison Framework for Energy Disaggregation Systems." *2015 IEEE International Conference on Smart Grid Communications (SmartGridComm)*, pp. 446–452.

Bradbury, K., P. Torrione, and L. Collins. (2009) "Real-time Gaussian Markov random-field-based ground tracking for ground penetrating radar data." *Proceedings of SPIE*, Orlando, FL, USA, Vol. 7303, pp. 730320-730320-10.

Bradbury, K. and J. Noonan. (2008) "Covert Binary Communications through the Application of Chaos Theory: Three Novel Approaches," *Journal of Systemics, Cybernetics and Informatics*, Vol. 6, No. 3, pp. 28-33.

PAPERS UNDER REVIEW & WHITE PAPERS

Huang, B., Y. Xu, K. Bradbury, J. Malof. "Synthinel-2: improved generation of high resolution synthetic overhead imagery for building segmentation." *arXiv preprint arXiv:2101.06390*. Under review.

Yaris, C., B. Huang, K. Bradbury, J. M. Malof. Randomized Histogram Matching: A Simple Augmentation for Unsupervised Domain Adaptation in Overhead Imagery. *arXiv preprint arXiv:2104.14032*. Under review.

Bradbury, K., M. Knox, L. Collins, and R. Newell. (2016) "Generating Synthetic Device-level Electricity Consumption Data."

Lin, M, K. Bradbury, and R. Newell. (2016) "Energy Saving Control Strategies for Conventional Domestic Water Heaters." Final Report to Sunnovations, Inc.

Xu, F., K. Bradbury, and D. Patino-Echeverri. (2015) "Techniques for Measuring the Green Economy." Final Report to Hawaii's Department of Business, Economic Development and Tourism.

Bradbury, K. (2010) "Energy Storage Technology Review."

Bradbury, K. (2007) "Hidden Markov Models: Theory, Implementation, and Extensions."

INVITED TALKS

"Energy data analytics for the electric power and natural gas distribution sectors: research innovation and opportunities." Dominion Energy. Virtual. 1 September 2021.

"Energy data analytics for the electric power sector: research innovation and opportunities." Great Coops Data Analytics Collaborative. Virtual. 17 June 2021.

"Automatically estimating solar photovoltaic capacity and building energy consumption using satellite imagery." Energy Data Analytics Symposium. Duke University. Virtual. 8-9 December 2020.

"Automating energy system assessment with computer vision and overcoming data limitations through synthetic imagery." Co-presented with Jordan Malof. Johns Hopkins Applied Physics Lab Intelligent Systems Center Seminar Series. 3 September 2020.

"Deep learning techniques to inform energy access decisions." 2020 IEEE Power and Energy Society General Meeting. Virtual (Montreal, Canada). 2-6 August 2020.

- "Energy Breakfast Series: Big Data and Machine Learning." Duke Alumni Association. Research Triangle Park. 27 February 2020.
- "Engaging Academia and Student Researchers." Data Science Solutions to Environmental Challenges in the Electric Power Industry: An EPRI-EPIC Workshop. Washington, D.C. 7-8 November 2019.
- "Distributed energy resource and infrastructure assessment using overhead imagery." Smart Grid Edge Analytics Workshop. Georgia Tech Global Learning Center. Atlanta, Georgia. 4-5 June 2019. ([agenda](#))
- "Estimating energy access and use from satellite imagery using machine learning." Panel discussion with C. Hitaj, S. Russo, D. Sullivan, and A. Stocking. *Energy Research Insights for Decisionmaking Conference*. Resources for the Future. Washington, D.C., 29-30 December 2018. ([agenda](#))([video](#))
- "Energy Data Analytics." Moderator for panel discussion. Western Energy and Water Forum. Colorado Energy and Water Institute. Steamboat Springs, CO. 23-26 January 2019.
- "Estimating energy access and use from satellite imagery using machine learning" Human Geography Dimensions of Energy Access and Use. World-Wide Human Geography Data (WWHGD) Working Group. Georgetown University. 27 June 2018. ([agenda](#))([video](#))
- "Estimating electricity access from remote sensing data." Sustainable Energy Transitions Initiative (SETI) Third Annual Meeting. Duke University. Durham, NC, 15-17 May 2018.
- "Automated energy infrastructure assessment using satellite imagery." University of Massachusetts, Amherst. Amherst, Massachusetts, 4 May 2018.
- Workshop on: "Promoting Digital Innovations to Enable Clean Energy Systems." Council on Foreign Relations. New York, New York, 22-23 February 2018.
- "Non-intrusive Load Monitoring." Data Analytics for Energy Workshop. Duke Kunshan University. Kunshan, China, 11 October 2017.
- "Public Sector Building Energy Efficiency: Maybe There is a Silver Bullet." Panel Presentation with H. Bergmann and D. Seligman. U.S. Department of Energy Better Buildings Summit. Washington, D.C., 17 May 2017.
- "From Pixels to Knowledge: Using Machine Learning to Extract Insights from Energy Data." Analytics Experience 2016. SAS. Las Vegas, NV. 14 September 2016.
- "Energy Storage and the Grid: Prospects and Policy." Panel Presentation with M. Dorsey, S. Ackerman, V. Koritarov, and C. Hunt. American Chemical Society Science & the Congress Project. Washington, D.C. 28 June 2016. ([video](#))
- "New Research in Predictive Analytics for Utilities." Panel presentation with Arcot Rajasekar, Tim Driscoll, Ozge Kaplan, and Rudy Shankar. North Carolina Clean Tech Summit. Chapel Hill, NC. 19 February 2016.

- "Overview of the Energy Data Analytics Lab." Energy Research Collaboration Workshop. Duke University, Durham, NC. 5 May 2015.
- "Big Data & Analytics." Panel presentation with Marco Loeffke and Jack Connell. 2015 State Energy Conference. Raleigh, NC. 21-22 April 2015.
- "Using Data to Change Behavior." Data4Decisions Conference. Panel presentation with Vikram Rao and Timur Hicyilmaz. Raleigh, NC. 25 March 2015.
- "Design and Implementation of an Energy Data Analysis System." Energy and Environment Lunch and Learn, RTI International, 21 August 2014.

OTHER PRESENTATIONS AND WORKSHOP PARTICIPATION

- National Science Foundation / Power Systems Engineering Research Center (PSERC) Grid at the Edge Workshop. 23-24 March 2021.
- Patiño Echeverri, D., and K. Bradbury. "Seeing much more and better: Satellite imagery and algorithms for automatic detection of power system infrastructure." University of Texas at Austin Electricity Conference. 12 April 2018.
- "Energy + Data: The short version of the long history of energy data." Durham Engineer's Club Scholar Dinner Speaker. Durham, NC. 18 May 2017.
- "From Pixels to Knowledge: Extracting Insights from Energy Data through Visualization." Duke Visualization Friday Forum. Duke University. 15 April 2016.
- "Electric Power Systems." Energy Industry Fundamentals Conference, Fuqua School of Business, Duke University, 28 August 2014.
- "Design and Implementation of an Energy Data Analysis System." Duke University Energy Research Collaboration Workshop, Duke University, 6 May 2014.
- "Electric Power Markets." Energy Industry Fundamentals Conference, Fuqua School of Business, Duke University, 30 August 2013.
- "The University as an Energy Laboratory: Design and Implementation of an Energy Disaggregation System." Duke University Energy Researcher Workshop, Duke University, 30 August 2013.

DATASETS

- Hu, W., T. Feldman, J. M. Malof, A. Ye, E. Lin, J. Ou, J. L. Moscoso, N. Tarn, W. Zhang, K. Bradbury. (2021) Synthetic Wind Turbine Dataset. figshare. Dataset. <https://doi.org/10.6084/m9.figshare.16639546.v1>
- Hu, W., B. Huang, K. Bradbury, J. M. Malof, V. Nair, T. Pathirathna, X. You, Q. Han, J. Yang, A. Streltsov, L. Collins. (2021) Electric Transmission Infrastructure Satellite Imagery Dataset for Computer Vision. figshare. Dataset. <https://doi.org/10.6084/m9.figshare.14935434.v2>
- Kong, F., B. Huang, K. Bradbury, J. M. Malof. "The Synthinel-1 dataset: a collection of high resolution synthetic overhead imagery for building segmentation." 2020. <https://github.com/timqqt/Synthinel>

- Bradbury, K., Q. Han, V. Nair, T. Pathirathna, and X. You. 2018. "Electric Transmission and Distribution Infrastructure Imagery Dataset". *Figshare*.
<https://doi.org/10.6084/m9.figshare.6931088.v1>
- Bradbury, K., Li, B., Brigman, B., Chandrasekar, G., Hossain, S., Nagenalli, T., Collins, L., Johnson, T., Jeuland, M., "Indian Village Satellite Imagery and Energy Access Dataset." *figshare*, 2017. <https://doi.org/10.6084/m9.figshare.5552743.v1>
- Bradbury, K., Brigman, B., Chandrasekar, G., Collins, L., Hossain, S., Jeuland, M., Johnson, T., Li, B., Nagenalli, T. "Power Plant Satellite Imagery Dataset." *figshare*, 2017.
<https://doi.org/10.6084/m9.figshare.5307364.v1>
- Bradbury, K., B. Brigman, L. Collins, T. Johnson, S. Lin, R. Newell, S. Park, S. Suresh, H. Wiesner, and Y. Xi. "Aerial imagery object identification dataset for building and road detection, and building height estimation." *figshare*, 2016.
<https://dx.doi.org/10.6084/m9.figshare.c.3290519.v1>
- Bradbury, K., R. Saboo, T. Johnson, J. Malof, A. Devarajan, W. Zhang, L. Collins, R. Newell. "Distributed Solar Photovoltaic Array Location and Extent Data Set for Remote Sensing Object Identification." *figshare*, 2016.
<https://dx.doi.org/10.6084/m9.figshare.c.3255643.v1>

TEACHING EXPERIENCE

- Instructor: IDS 705: Principles of Machine Learning, Duke University, S2022 ([website](#)), S2021 ([website](#)), S2020 ([website](#)), S2019 ([website](#))
- Instructor: Bass Connections Project Team. Creating Artificial Worlds with AI to Improve Energy Access Data. ENERGY 395/396 and 795/796, Duke University, F2021-S2022 ([website](#))
- Instructor: Bass Connections Project Team. Deep learning for rare energy infrastructure in satellite imagery. ENERGY 395/396 and 795/796, Duke University, F2020-S2021 ([website](#), [final student report website](#), [video](#))
- Instructor: Bass Connections Project Team. Deep learning for rare energy infrastructure in satellite imagery. ENERGY 395/396 and 795/796, Duke University, F2020-S2021 ([website](#), [final student report website](#), [video](#))
- Instructor: Bass Connections Project Team. Energy Data Analytics Lab: A wider lens on energy: adapting deep learning techniques to inform energy access decisions. ENERGY 395/396 and 795/796, Energy Data Analytics Lab, Duke University, F2019-S2020 ([website](#), [final student report website](#), [video](#))
- Instructor: Bass Connections Project Team. Energy Data Analytics Lab: Energy Infrastructure Map of the World through Satellite Data. ENERGY 395/396 and 795/796, Energy Data Analytics Lab, Duke University, F2018-S2019 ([website](#))
- Instructor: ECE/ENERGY 590: Introduction to Machine Learning for Data Science, Duke University S2018 ([website](#))
- Instructor: Bass Connections Project Team. Energy Data Analytics Lab: Electricity Access in Developing Countries from Aerial Imagery. ENERGY 395/396 and 795/796, Energy Data Analytics Lab, Duke University, F2017-S2018 ([website](#))

Instructor: Bass Connections Project Team. Energy Data Analytics Lab: Estimating Building Energy Consumption from Aerial Imagery. ENERGY 395/396 and 795/796, Energy Data Analytics Lab, Duke University, F2016-S2017 ([website](#))

Instructor: Bass Connections Project Team. Energy Data Analytics Lab: Estimating Solar PV from Aerial Imagery. ENERGY 395/396 and 795/796, Duke University, F2015-S2016 ([website](#))

Instructor: Bass Connections Project Team. The University as a Laboratory for Smart Grid Data Analytics. ENERGY 395/396 and 795/796, Duke University, F2014-S2015 ([website](#))

Instructor: Bass Connections Project Team. Design and Implementation of an Energy Disaggregation System. ENERGY 395/396 and 795/796, Duke University, F2013-S2014 ([website](#))

Teaching Assistant: ENV 211, Energy & the Environment, Duke University, S2011

Teaching Assistant: ENV 130, Energy & the Environment, Duke University, F2010

Lecture series (12 sessions) on Electric Power Systems, Duke University, S2010

Teaching Assistant: ENV 298.19, Hydrocarbons, Houston, Duke University, F2010

Teaching Assistant: ENV 298.19, Hydrocarbons, Houston, Duke University, F2009

Sustainable Energy Fellowship Coordinator, University of Michigan, June 2009

Tutor: ES 3, Introduction to Electrical Systems, F2006-S2007

Teaching Assistant: EE 14, Microprocessor Architecture, Tufts University, F2006

MENTORING

Ph.D. Committees:

- Bohao Huang (ECE, 2020)
- Nicholas Czarnek (ECE, 2017)
- Daniël Reichman (ECE, 2017)

Preliminary Exam Committees:

- Sarah Scott (CEE, 2022)
- Matthew Inkawich (ECE, 2021)
- Bohao Huang (ECE, 2019)
- Evan Stump (ECE, 2019)

Qualifying Exam Committee:

- Francesco Luzi (ECE, 2021)
- Kaleb Kassaw (ECE, 2021)
- Matthew Inkawich (ECE, 2019)
- Nathan Inkawich (ECE, 2019)

- Bohao Huang (ECE, 2018)

Masters Committee:

- Qianyu Zhao (CEE, 2021)

Masters Project Advisor:

- Nikhil Bhargava, Dean Huang, Xiaohan Yang, Yijia Zhang. Sizing the Stack: power plant and industrial flue-gas stack height estimation from satellite imagery for tracking greenhouse gases and pollutants (2021-2022)
- Zhenxing (Charlie) Xie. Geospatial foundation models for domain adaptation (2021-2022)
- Abdullah AlOthman, Jose Moscoso, Sebastián Soriano Perez. Unlocking Earth Observation Datasets with GEODOME (Geographically diverse, Earth Observation Dataset with Multiple sEnsor modalities) (2020-2021)

Data+ Advisor:

- Creating artificial worlds with AI to improve energy access data. 2021. ([link](#))
- Deep learning for rare energy infrastructure in satellite imagery. 2020. ([link](#))
- A wider lens on energy: adapting deep learning techniques to inform energy access decisions. 2019. ([link](#))
- Energy Infrastructure Map of the World. 2018. ([link](#))
- Electricity Access in Developing Countries from Aerial Imagery. 2017. ([link](#))([video](#))
- Energy Resource Assessment. 2016. ([link](#))
- Solar Power Estimation. 2015. ([link](#))

Undergraduate Thesis Advisor: Sophia Park (ECE Pratt Fellow, 2017)

Innovations & Entrepreneurship Undergraduate Certificate Program. Fall 2016-Spring 2017

INSTITUTIONAL SERVICE

Member, Library Council. 2021-present.

Cochair of the Climate & Data Science Working Group for the Board of Trustees Task Force on Climate Change and Sustainability. 2020-2021

Interdisciplinary Data Science Master's admissions. 2018-Present

Interdisciplinary Data Science Master's curriculum development. 2017-2018

Carbon Offsets Subcommittee. 2016 - 2017

The Foundry Governing Committee. 2015 - 2018

Smart Home Faculty Advisor. Spring 2014 - 2020

PROFESSIONAL SERVICE

Member, Technical Program Committee. NILM2020: 5rd International Workshop on Non-Intrusive Load Monitoring. 2020.

Member. Capacity Building for the Utilization of EOs among Utility Providers. Convened by Battelle, NASA, and the Group on Earth Observations. 2019-Present. ([link](#))

Member, Technical Program Committee and Session Chair. NILM2016: 3rd International Workshop on Non-Intrusive Load Monitoring. 2016.

Member, Technical Review Committee. Department of Energy's (DOE's) Energy Policy and Systems Analysis (EPSA) project with Oak Ridge National Laboratory (ORNL) on Solar Photovoltaic Detection. 2016.

Member, Technical Review Committee. 2015 IEEE International Conference on Smart Grid Communications (SmartGridComm), Miami, FL. 2015.

Referee for:

- Alfred P. Sloan Foundation
- Applied Energy
- Cambridge University Press
- Climate Change AI
- Energies
- Energy & Buildings
- Energy Policy
- Environmental Science & Technology
- Harvard Data Science Review
- IEEE Transactions on Geoscience and Remote Sensing
- IET Generation, Transmission & Distribution
- International Multi-Conference on Complexity, Informatics and Cybernetics
- International Workshop on Non-Intrusive Load Monitoring
- ISPRS Journal of Photogrammetry and Remote Sensing
- McGraw Hill
- National Science Foundation
- Nature Communications
- Remote Sensing Applications – Society & Environment
- Sustainable Cities and Society

AWARDS

Master of Interdisciplinary Data Science Distinguished Faculty Award for Outstanding Teaching and Mentorship, 2021

DigitalGlobe GBDX for Sustainability Challenge (one of five selected teams). "Using high-resolution satellite imagery and computer vision to build an open database of global power plants." With Jordan Malof, Colin McCormick, and Johannes Friedrich. 2018. Access was awarded to DigitalGlobe's entire archive of satellite imagery data.

Duke University Blue Devil of the Week, 2014

Nomination: Outstanding Postdoc at Duke University, 2013

Estwing Award: Teaching Assistant of the Year, 2011

National Science Foundation, Graduate Research Fellowship, 2008
 Tufts University: Class of 1947 Victor Prather Prize, 2007
 Tufts University: The Harry Poole Burden Prize in Electrical Engineering, 2007
 Astronaut Scholarship Foundation Award, 2006
 Tau Beta Pi Scholarship, 2006
 Eta Kappu Nu, Electrical and Computer Engineering Honor Society, 2006
 Tau Beta Pi, Engineering Honor Society, 2005

GRANTS

- [K. Bradbury \(PI\)](#). "Estimating regional non-electricity building energy consumption." WattTime. 2022.
- [K. Bradbury \(PI\)](#). "Energy and Climate Data Commons." Google. 2021.
- Murray, B. (PI), Billy Pizer (Co-PI), Leslie Collins (Co-PI), and [K. Bradbury \(Co-PI\)](#). Alfred P. Sloan Foundation. "Interdisciplinary Energy Data Analytics Ph.D. Fellows Program Phase II: Training the Next generation of Energy Data Scholars." 2020.
- Fetter, R. (Co-PI), J. Malof (Co-PI), [K. Bradbury \(Co-PI\)](#), J. Rineer, R. Beach. "Mapping Solar Photovoltaic Arrays Using Unpiloted Aerial Vehicles." Duke University Nicholas School of the Environment Catalyst Program. 2020. (Partnership with RTI International)
- [Bradbury, K. \(Co-PI\)](#) and J. Malof (Co-PI). Solar Photovoltaic (PV) and Real Estate For Project PV Auto-Pop Task: Phase II. Lawrence Berkeley National Laboratory. Sponsored Research (Project Extension). Subcontract No. 7463277 (Modification). 25 September 2019.
- [Bradbury, K. \(PI\)](#), J. Malof (Co-PI), B. Murray (Co-PI), D. Harrison-Atlas (Co-PI, NREL), Johannes Friedrich (Co-PI, WRI), S. Rose (Co-PI, EPRI). "Convergence Accelerator Phase I (RAISE): Open Knowledge Network for the Global Energy Data Commons." National Science Foundation. 1 September 2019 – 31 May 2021. Award No. 1937137.
- Bergin, M. (PI), D. Shindell (Co-PI), [K. Bradbury \(Co-PI\)](#), D. Carlson (Co-PI), B. Murray (Co-PI), M. Wiesner (Co-PI), D. Mitzi (Co-PI), S. Sexton (Co-PI), G. Katul (Co-PI), and W. Walker. Minimizing the influence of Air Pollution on Solar Energy Production Globally: Framework Development to Save Billions of USD Annually. Provost's Collaboratories: Energy and Water Resources initiative. 1 July 2019 – 30 April 2020.
- [Bradbury, K. \(Co-PI\)](#) and J. Malof (Co-PI). Solar Photovoltaic (PV) and Real Estate For Project PV Auto-Pop Task. Lawrence Berkeley National Laboratory. Sponsored Research. Subcontract No. 7463277. 22 February 2019.
- Bergin, M. (PI), D. Shindell (Co-PI), [K. Bradbury](#), D. Carlson, B. Murray, and M. Wiesner. Minimizing the influence of Air Pollution on Solar Energy Production Globally: Framework Development to Save Billions of USD. Duke University Energy Initiative Research Seed Fund Grant. April 2019.
- Schaich Borg, J (PI), [K. Bradbury \(Co-PI\)](#), T. Nechyba (Co-PI), A. Calderbank (Co-PI). "IGE: Leveraging Data Science Master Programs to Enhance Professional Readiness in

STEM PhD Students." National Science Foundation. 1 September 2018 – 31 August 2021.

Malof, J. (PI), [K. Bradbury \(Co-PI\)](#). "Global Energy Infrastructure and Access Assessment Using Overhead Imagery." National Science Foundation XSEDE Allocation. January-December 2019.

[Bradbury, K. \(Co-PI\)](#), J. Malof (Co-PI). "Estimating solar PV locations and capacity in Adelaide, Australia." Australia Electric Market Operator. Sponsored Research. October-December 2018.

Malof, J. (PI), [K. Bradbury \(Co-PI\)](#), M. Jeuland (Co-PI), S. Sexton (Co-PI), and B. Bollinger (Co-PI). Provost Pilot Research Grants in the Humanities and Social Sciences. "Global Energy Resource Assessment Using Satellite Imagery." 2018.

Murray, B. (Co-PI), [K. Bradbury \(Co-PI\)](#), Billy Pizer (Co-PI), and Cynthia Rudin (Co-PI). Alfred P. Sloan Foundation. "Interdisciplinary Energy Data Analytics Ph.D. Fellows Program."

Jeuland, M. (Co-PI), M. Borsuk (Co-PI), L. Collins (Co-PI), [K. Bradbury \(Co-PI\)](#), J. Malof (Co-PI), and L. Olander (Co-PI). Nicholas Institute Catalyst Program Grant, "Does rural energy access promote economic development through improved food and water access?" 2017.

Calderbank, R. (Co-PI), B. Murray (Co-PI), L. Bennear (Co-PI), and [K. Bradbury \(Co-PI\)](#). Undergraduate Program Enhancement Fund (UPEF). "The Generator: transforming Gross Hall 100C into a flexible, accessible space for interdisciplinary learning and team-based problem solving." 2017.

[Bradbury, K. \(Co-PI\)](#), and L. Collins (Co-PI). Bass Connections Course Development Grant, "Introductory Machine Learning for Data Science." 2017.

[Bradbury, K. \(PI\)](#). NVIDIA Hardware Grant. Hardware: Titan X GPU. NVIDIA Corporation. 2016.

Newell, R. (PI), M. Harding, and [K. Bradbury](#). Alfred P. Sloan Foundation. Energy Data Analytics Lab. 2015-2017.

Newell, R. (PI) and [K. Bradbury](#). Sunnovations, Inc. Sponsored Research Agreement. 2015-2016.

Newell, R. (Co-PI), W. Pizer (Co-PI), [K. Bradbury \(Co-PI\)](#). Wells Fargo Foundation. Advanced Analytics for Smart Meter Building Data. 2015-2016.

Huettel, L. (Co-PI), [K. Bradbury \(Co-PI\)](#). Lord Foundation of North Carolina. Energy Disaggregation and Signal Processing: Connecting Fundamental Concepts to Real Problems. 2014.

[Bradbury, K.](#) National Science Foundation Graduate Research Fellowship. 2008-2012.

WEBSITES

Global Energy Data Commons partnership website. 2020. <https://sites.duke.edu/gedc/>

Principles of Machine Learning course website. IDS 705. Spring 2020. <https://kylebradbury.github.io/ids705/>

EXTERNAL MEDIA COVERAGE AND PODCASTS

Introduction to Machine Learning for Data Science course website. ECE/ENERGY 590. Spring 2018. <https://kylebradbury.github.io/ece590/>

GBDX for Sustainability Challenge: "Satellite Imagery for Sustainable Energy Development." 2018. <http://people.duke.edu/~kjb17/gbdx/>

Magazine Article. Dustin Zubke. Machine learning: "New electricity" enabling access. PV Magazine. Issue 07-2020. <https://www.pv-magazine.com/magazine-archive/machine-learning-new-electricity-enabling-access/> 13 July 2020.

Blog Post. Jack Clark. Import AI 181: Welcome to the era of Chiplomacy!; how computer vision AI techniques can improve robotics research ; plus Baidu's adversarial AI software. <https://jack-clark.net/2020/01/20/> 20 January 2020.

Blog Post. Paul Strobel. Tackling climate change with machine learning [part 1] – Electricity systems. <https://blog.codecentric.de/en/2019/09/how-to-tackle-climate-change-with-machine-learning-electricity-systems/#post-69396>. 20 September 2019.

Blog Post. A.I. in the News. Fortune. <http://fortune.com/2019/03/18/data-sheet-eye-on-ai/>. 18 March 2019.

Blog Post. The Digital Revolution Is Transforming Energy—Whether It Slows Climate Change Is Up to Policymakers. The Council on Foreign Relations. <https://www.cfr.org/blog/digital-revolution-transforming-energy-whether-it-slows-climate-change-policymakers>. 26 June 2018.

Blog Post. DigitalGlobe. "GBDX for Sustainability Challenge: Making solar count—automatically identifying renewable energy infrastructure." 4 May 2018. <http://blog.digitalglobe.com/industry/gbdx-for-sustainability-challenge-making-solar-count-automatically-identifying-renewable-energy-infrastructure/>

Blog Post. Amazon Web Services (AWS). "Q&A with GBDX for Sustainability Challenge Finalists." 14 May 2018. <https://aws.amazon.com/blogs/publicsector/qa-with-gbdx-for-sustainability-challenge-finalists/>

Newsletter. Astronaut Scholarship Foundation. "Scholar Spotlight: Kyle Bradbury." 6 March 2018. <http://campaign.r20.constantcontact.com/render?m=1109563575708&ca=6c30be93-f3f9-4777-9dc6-70bd29b9b0d9>

Podcast. "Storage Potential, the Role of EVs, and Data Analytics." The Energy Transitions Show with Chris Nelder. 1 February 2018. Episode available at: <https://xenetwork.org/ets/episodes/duke-energy-week-extra-3-storage-evs-data-analytics/>

Ask Me Anything. American Chemical Society Reddit 'Ask Me Anything' on Energy Storage and Energy Data Analytics. 11 October 2016. <https://www.reddit.com/r/science/comments/56xpas/>

TechXplore. "Engineers seek energy insights by reading a building's electrical signatures." 5 October 2016. Available at: <https://techxplore.com/news/2016-10-energy-insights-electrical-signatures.html>

Podcast. "Home Energy Use." Interview with Brian Southwell and Mike Gallaher. *The Measure of Everyday Life*. WNCU 90.7 FM. 25 January 2015. Available on iTunes at: <https://itunes.apple.com/us/podcast/the-measure-of-everyday-life/id956844695>

INTERNAL MEDIA COVERAGE

Energy Initiative. Energy Data Analytics Ph.D. Student Fellows Program announces 2021 cohort with students from Duke University, NC State University, and UNC Charlotte. <https://energy.duke.edu/news/energy-data-analytics-phd-student-fellows-program-announces-2021-cohort-students-duke>. April 2021.

Energy Initiative. Watch: A Wider Lens on Energy – Adapting Deep learning Techniques to Inform Energy Access Decisions. <https://energy.duke.edu/news/watch-wider-lens-energy-adapting-deep-learning-techniques-inform-energy-access-decisions>

Interdisciplinary Studies. Kyle Bradbury on Improving Global Energy Access through Machine Learning and Collaboration. <https://sites.duke.edu/interdisciplinary/2019/11/21/kyle-bradbury-on-improving-global-energy-systems-through-machine-learning-and-student-collaboration/>

Bass Connections. Faculty Perspectives: Kyle Bradbury. <https://bassconnections.duke.edu/kyle-bradbury>

Energy Initiative. Western Energy & Water Forum (Jan. 23-26) to highlight Duke University expertise. Energy Initiative. <https://energy.duke.edu/news/western-energy-water-forum-jan-23-26-highlight-duke-university-expertise>. 12 November 2018.

Energy Initiative. New Duke program equips scholars to lead in emerging field of energy data analytics. Energy Initiative. <https://energy.duke.edu/news/new-duke-program-equips-scholars-lead-emerging-field-energy-data-analytics>. 12 February 2019.

Nicholas Institute. Harnessing the Power of Data: Sustainable Energy Transition Initiative Conference: Proceedings. Nicholas Institute. <https://nicholasinstitute.duke.edu/publications/harnessing-power-data-sustainable-energy-transitions-initiative-conference> June 2018.

Energy Initiative. Duke undergraduates create energy datasets and tools with wide-ranging impact. Energy Initiative. <https://energy.duke.edu/news/duke-students-create-energy-datasets-and-tools-wide-ranging-impact-through-data-summer-research>. 28 September 2018.

Energy Initiative. Duke expert touts transformative potential of energy data analytics in new book on digital decarbonization. Energy Initiative. <https://energy.duke.edu/news/duke-expert-touts-transformative-potential-energy-data-analytics-new-book-digital>. 26 June 2018.

Bass Connections. "Three Graduate Students Honored for Outstanding Bass Connections Project Team Mentorship." 12 April 2018.

<https://bassconnections.duke.edu/about/news/three-graduate-students-honored-outstanding-bass-connections-project-team-mentorship>

Interdisciplinary Studies. "New Grants Will Advance Collaborative Research by 11 Groups of Duke Faculty." 3 April 2018.

<https://sites.duke.edu/interdisciplinary/2018/04/03/new-grants-will-advance-collaborative-research-by-11-groups-of-duke-faculty/>

Bass Connections. "Student-produced Performance Illuminates Links between Energy, Technology and the Body." 19 March 2018.

<https://bassconnections.duke.edu/about/news/student-produced-performance-illuminates-links-between-energy-technology-and-body>

Giving to Duke. "Crossing Boundaries to Meet Our Energy Needs." 12 March 2018.

<https://giving.duke.edu/the-duke-difference/crossing-boundaries-to-meet-our-energy-needs>

Energy Initiative. "Duke University and World Resources Institute research team is among five finalists in the GBDX Sustainability Challenge." 14 February 2018.

<https://energy.duke.edu/news/duke-university-and-world-resources-institute-research-team-among-five-finalists-gbdx>

Energy Initiative. "Duke University energy experts featured in podcast episodes recorded live during Energy Week 2017." 12 February 2018.

<https://energy.duke.edu/news/three-duke-university-energy-experts-featured-podcast-episodes-recorded-live-during-energy-week>

Energy Initiative. "Energy Data Analytics Lab team takes top prize at 2018 Duke Research Computing Symposium with electricity access project." 25 January 2018.

<https://energy.duke.edu/news/energy-data-analytics-lab-team-takes-top-prize-2018-duke-research-computing-symposium>

Energy Initiative. "Energy Initiative opens new innovation space in Gross Hall." 13

December 2017. <https://energy.duke.edu/news/new-innovation-space-opens-gross-hall>

Energy Initiative. "Energy Initiative and Duke Libraries to host CLIR Postdoctoral Fellow in Data Curation for Energy Economics." 2 December 2017.

<https://energy.duke.edu/news/energy-initiative-and-duke-libraries-host-clir-postdoctoral-fellow-data-curation-energy>

Duke Research Blog. "Mapping Electricity Access for a Sixth of the World's People." 1

August 2017. <https://researchblog.duke.edu/2017/08/01/mapping-electricity-access/>

Bass Connections. "Bass Connections Awards Grants for Three Interdisciplinary Courses."

4 May 2017. <https://bassconnections.duke.edu/about/news/bass-connections-awards-grants-three-interdisciplinary-courses>

Pratt School of Engineering. "Real Problems, Real Teamwork." 7 March 2017. Available at:

<https://pratt.duke.edu/about/news/real-problems-real-teamwork>

Pratt School of Engineering. "Distinguishing Solar Panels from Swimming Pools." 29 August 2016. Available at: <http://pratt.duke.edu/about/news/distinguishing-solar-panels-swimming-pools>

VIDEOS AND OTHER MEDIA

"Computer vision for energy data analytics." Foundations for Energy Data Analytics Series at Duke University. <https://www.youtube.com/watch?v=rQvA2jWjxSs>

"MIDS Faculty Spotlight: Kyle Bradbury." <https://www.youtube.com/watch?v=qpNhgiugL0k>

"RiiD Researcher Spotlight: Kyle Bradbury." <https://www.youtube.com/watch?v=hKS7jYwRn1I>

"Kyle Bradbury: Developing Insights Using New Data Tools." Resources for the Future Interview. <https://www.youtube.com/watch?v=ESdUAhITzR8>

"Energy and data science resource (Energy Resources)." <https://www.youtube.com/watch?v=kX1Uw4kEE-w>

"Energy and data science resources (Data Science Resources)." <https://www.youtube.com/watch?v=zA0OkIGZIJ8>

"Git Part 1: What it is and how it works." <https://www.youtube.com/watch?v=nH7qJHx-h5s>

"Git Part 2: Step-by-step tutorial." <https://www.youtube.com/watch?v=fBCwfoBr2ng&t=18s>

"Introduction to Jupyter Notebooks." <https://www.youtube.com/watch?v=IMdfXGHzz5q>

"Introduction to the Spyder IDE for Python." (over 10,000 views) <https://www.youtube.com/watch?v=zYNRqVimU3Q>

Performance from "Visualizing Energy through Live Performance" Bass Connections in Energy Team. Performed at [ChoreoLab](#). Reynold's Theater, 13-14 April 2018. ([full performance](#))([overview](#))

"The Third Generation: Electricity Access in Developing Countries from Aerial Imagery." Data+ team video documentary. July 2017. <https://www.youtube.com/watch?v=XbE8fsNQczk>

"Energy Storage and the Grid: Prospects and Policy." American Chemical Society. Science & the Congress Project. June 2016. <https://vimeo.com/175856216>

"Estimating U.S. Solar Capacity through Machine Learning." Data+ team video documentary. July 2015. <https://www.youtube.com/watch?v=lyuBylcPJi0>

- "Introduction to the Energy Data Analytics Lab." Energy Industry Fundamentals. October 2015. <https://www.youtube.com/watch?v=k56N65hnEPg>
- "Introduction of the Energy Data Analytics Lab." Duke University Energy Research Collaboration Workshop 2015. May 2015.
<https://www.youtube.com/watch?v=ioGnAQ4TKr0>
- "Energy Efficiency." HackDuke: Code for Good. Opening Ceremony. November 2014.
https://www.youtube.com/watch?time_continue=980&v=WpRdCsSbcdM
- "Electric Power Systems." Energy Industry Fundamentals. August 2014.
<https://fuqua.capture.duke.edu/Panopto/Pages/Viewer.aspx?id=09328c83-0c36-4359-b4e4-07bf1ab84c16>
- "Design and implementation of an energy data analysis system." Duke University Energy Research Workshop 2014. May 2014.
<https://www.youtube.com/watch?v=ofngPaoZfz8>
- "Design and implementation of an energy disaggregation system." Duke University Energy Research Workshop. 2013. May 2013.
https://www.youtube.com/watch?v=FA2C81_N2FM