

Hannah R. Kerner

Curriculum Vitae
September 29, 2020

University of Maryland, College Park
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College Park, MD 20740

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EDUCATION

Ph.D. School of Earth and Space Exploration, Arizona State University, 2019
B.S. Department of Computer Science, University of North Carolina at Chapel Hill, 2014

PROFESSIONAL APPOINTMENTS/EMPLOYMENT

Assistant Research Professor Department of Geographical Sciences University of Maryland, College Park	2019-Present College Park, MD
Machine Learning and Domestic Strategy Lead NASA Harvest	2020-Present College Park, MD
Machine Learning Advisor World Resources Institute	2020-Present Washington, DC
Onboard Software Engineer Planet Labs (Planet, Inc.)	2014-2015 San Francisco, CA

PUBLICATIONS

Peer-Reviewed Journal Articles

1. Handwerger, A. L., Jones, S. J., Huang, M-H., Amatya, P., **Kerner, H. R.**, and Kirschbaum, D. B. Rapid landslide identification using synthetic aperture radar amplitude change detection on the Google Earth Engine. Under review in *Natural Hazards and Earth System Science*.
2. Gray, P. C., Chamorro, D. F., Ridge, J. T., **Kerner, H. R.**, Ury, E. A., and Johnston, D. W. Temporally Generalizable Land Cover Classification: A Recurrent Convolutional Neural Network Unveils Major Coastal Change through Time. Under review in *Remote Sensing of Environment*.
3. **Kerner, H. R.**, Wagstaff, K. L., Bue, B. D., Wellington, D. F., Jacob, S., Horton, P., Bell, J. F., Kwan, C. Ben Amor, H. (2020). Comparison of Novelty Detection Methods for Multispectral Images in Rover-Based Planetary Exploration Missions. *Data Mining and Knowledge Discovery*, <https://doi.org/10.1007/s10618-020-00697-6>.

4. **Kerner, H. R.**, Hardgrove, C., Czarnecki, S., Gabriel, T. S. J., Mitrofanov, I., Litvak, M., Sanin, A., Lisov, D. (2020). Analysis of Active Neutron Measurements from the Mars Science Laboratory Dynamic Albedo of Neutrons Instrument: Intrinsic Variability, Outliers, and Implications for Future Investigations. *Journal of Geophysical Research: Planets*, 125(5), e2019JE006264, <https://doi.org/10.1029/2019JE006264>.
5. **Kerner, H. R.**, Wagstaff, K. L., Bue, B. D., Gray, P., Bell III, J. F., Ben Amor, H. (2019). Deep Learning Methods Toward Generalized Change Detection on Planetary Surfaces. *Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, 12(10), pp. 3900-3918, <https://doi.org/10.1109/JSTARS.2019.2936771>.
6. **Kerner, H. R.**, Ben Amor, H., Bell III, J. F. (2018). Context-Dependent Image Quality Assessment of JPEG-Compressed Mars Science Laboratory Mastcam Images using Convolutional Neural Networks. *Computers and Geosciences*, 118, pp. 109-121, <https://doi.org/10.1016/j.cageo.2018.06.001>.
7. Kwan, C., Chou, B., Kwan, L., Larkin, J., Ayhan, B., Bell III, J. F., **Kerner, H. R.** (2017). Demosaicing Enhancement using Pixel-Level Fusion. *Signal, Image and Video Processing*, 12(4), pp. 749-756, <https://doi.org/10.1007/s11760-017-1216-2>.

Peer-Reviewed Conference Proceedings

8. Wagstaff, K. L., Francis, R., **Kerner, H.**, Lu, S., Nerrise, F. (2020). Novelty-Driven Onboard Targeting for Mars Rovers. *International Symposium on Artificial Intelligence, Robotics and Automation in Space (i-SAIRAS)*.
9. **Kerner, H. R.**, Sahajpal, R., Skakun, S., Becker-Reshef, I., Barker, B., Hosseini, M. (2020). Resilient In-Season Crop Type Classification in Multispectral Satellite Observations using Growth Stage Normalization. *ACM SIGKDD Conference on Knowledge Discovery and Data Mining Workshops*, <https://arxiv.org/abs/2009.10189>.
10. **Kerner, H. R.**, Tseng, G., Becker-Reshef, I., Barker, B., Munshell, B., Paliyam, M., Hosseini, M. (2020). Rapid Response Crop Maps in Data Sparse Regions. *ACM SIGKDD Conference on Knowledge Discovery and Data Mining Workshops*, <https://arxiv.org/abs/2006.16866>.
11. **Kerner, H. R.**, Nakalembe, C., Becker-Reshef, I. (2020). Field-Level Crop Type Classification with k-Nearest Neighbors: A Baseline for a New Kenya Smallholder Dataset. *Proceedings of the International Conference on Learning Representations (ICLR) Workshops*, <https://arxiv.org/abs/2004.03023>.
12. **Kerner, H. R.**, Wellington, D. F., Wagstaff, K. L., Bell III, J. F., Kwan, C., Ben Amor, H. (2019). Novelty Detection for Multispectral Images with Application to Planetary Exploration. *Proceedings of the AAAI Conference on Artificial Intelligence*, pp. 9484-9491, <https://doi.org/10.1609/aaai.v33i01.33019484>.

Other Publications

13. Azari, A. R., Biersteker, J. B., Dewey, R. M., Doran, G., Forsberg, E., Harris, C. D. K., **Kerner, H. R.**, Skinner, K. A., Smith, A. W. (2020). Integrating Machine Learning for Planetary Science: Perspectives for the Next Decade. *A White Paper to the NRC Planetary Science and Astrobiology Decadal Survey 2023-2032*, <https://arxiv.org/pdf/2007.15129.pdf>.
14. **Kerner, H. R.** (2019). Machine Learning on Mars: A New Lens on Data from Planetary Exploration Missions. Ph.D. Dissertation, Arizona State University.

Conference Abstracts

15. Horton, P., **Kerner, H.**, Jacobs, S., Cisneros, E., Wagstaff, K. L., and Bell III, J. F. (2021). Integrating Novelty Detection Capabilities with MSL Mastcam Operations to Enhance Data Analysis. IEEE Aerospace Conference, Big Sky, Montana, March 6-13.
16. Horton, P., Ravichandar, S., Lee, J., **Kerner, H.**, Natha, A., Soliman, T. K., Grimes, K., Wagstaff, K., Verma, R., and McAuley, J. (2020). Novelty and Discovery Content Analysis Methods for the Planetary Data System Image Atlas. American Geophysical Union (AGU) Fall Meeting, Virtual Conference, December 1-17. (Under review)
17. Nerrise, F., **Kerner, H.**, Wagstaff, K., Lu, S., Francis, R., Rebbapragada, U., Bell III, J. F. (2020). Evaluation of Machine Learning Methodologies for Novelty-based Target Selection in Planetary Imaging Data Sets: Examples from the Mars Science Laboratory Mission. American Geophysical Union (AGU) Fall Meeting, Virtual Conference, December 1-17. (Under review)
18. **Kerner, H.**, Tseng, G., Becker-Reshef, I., and Nakalembe, C. (2020). Post-season and in-season crop type classification for smallholder farms: reducing reliance on labeled data by learning latent features in unlabeled data. American Geophysical Union (AGU) Fall Meeting, Virtual Conference, December 1-17. (Under review)
19. Tseng, G., **Kerner, H.**, Becker-Reshef, I., and Nakalembe, C. (2020). Leveraging Global Crop-Land Datasets to Improve Model Performance for Crop Classification in Data-Sparse Regions. American Geophysical Union (AGU) Fall Meeting, Virtual Conference, December 1-17. (Under review)
20. Shirzaei, M., Khoshmanesh, M., Ojha, C., Werth, S., **Kerner, H.**, Carlson, G., Sherpa, S. F., Zhai, G., and Lee, J. (2020). Unprecedented Crop Loss in the U.S. Midwest Caused by 2019 Flooding. American Geophysical Union (AGU) Fall Meeting, Virtual Conference, December 1-17. (Invited)
21. Gold, K., Galvan, F. R., **Kerner, H.**, Whitcraft, A., Cadle-Davidson, L., and Jiang, Y. (2020). Deep learning enabled detection of low incidence plant disease with integrated proximal and remote sensing. American Geophysical Union (AGU) Fall Meeting, Virtual Conference, December 1-17. (Under review)

22. Nakalembe, C., Becker-Reshef, I., **Kerner, H.**, Sahajpal, R., and Skakun, S. (2020). Using Satellites and Machine Learning to Enhance and Protect Food Security in Africa. Geological Society of America (GSA) Annual Meeting, Virtual Conference, October 26-30. (Under review)
23. Becker-Reshef, I., Whitcraft, A. K., Justice, C., Nakalembe, C., Barker, B., Justice, C., Sahajpal, R., Humber, M., **Kerner, H.**, Hansen, M., Husak, G., Skakun, S., Vermote, E., Franch, B., Deines, J., Doorn, B., Lobell, D., Guan, K., Torbick, N., Coutu, S., Puricelli, E., and Verdin, J. (2020). NASA Harvest: Earth Observations for Informed Agricultural Decisions. EO for Agriculture Under Pressure Workshop, Virtual, October 5-9. (Oral presentation)
24. **Kerner, H. R.**, Wagstaff, K. L., Bue, B. D., Gray, P. C., Bell III, J. F., Ben Amor, H. (2019). Toward Generalized Change Detection on Planetary Surfaces with Deep Learning. American Geophysical Union (AGU) Fall Meeting, San Francisco, CA, December 9-14. (Poster presentation)
25. **Kerner, H. R.**, Wagstaff, K. L., Bue, B. D., Wellington, D. F., Jacob, S., Bell III, J. F., Ben Amor, H. (2019). Comparison of Novelty Detection Methods for Multispectral Images from the Mastcam Instrument Onboard Mars Science Laboratory. 3rd Planetary Data Workshop, Flagstaff, AZ, June 18-20. (Oral presentation)
26. **Kerner, H. R.**, Hardgrove, C., Czarnecki, S. (2019). Analysis of Intrinsic Variability and Outliers in Pulsed Neutron Data using the Mars Science Laboratory Dynamic Albedo of Neutrons Instrument. 50th Lunar and Planetary Science Conference, The Woodlands, TX, March 18-22. (Poster presentation)
27. **Kerner, H. R.**, Wagstaff, K. L., Bue, Ben Amor, H. (2018). Change Detection on Mars: A Deep Learning Approach. Women in Machine Learning Workshop, NeurIPS, Montreal, Quebec, December 3. (Poster presentation)
28. Wronkiewicz, M., **Kerner, H. R.**, Harrison, T. (2018). Autonomous Mapping of Surface Features on Mars. American Geophysical Union (AGU) Fall Meeting, Washington, DC, December 10-14. (Poster presentation)
29. **Kerner, H. R.**, Wagstaff, K. L., Bue, B. D., Wellington, D. F., Bell III, J. F., Ben Amor, H. (2018). Novelty Detection for Multispectral Planetary Images. American Geophysical Union (AGU) Fall Meeting, Washington, DC, December 10-14. (Oral Presentation)
30. **Kerner, H. R.**, Wagstaff, K. L., Bue, B. D., Wellington, D. F., Bell III, J. F., Ben Amor, H. (2018). Novelty Detection for Multispectral Images with Application to Planetary Exploration. IMA Workshop on Recent Advances in Machine Learning and Computational Methods for Geoscience, Minneapolis, MN, October 22-26. (Poster presentation)

31. **Kerner, H. R.**, Bell III, J. F., Ben Amor, H. (2017). Context-dependent image quality assessment of JPEG compressed Mars Science Laboratory Mastcam Curiosity images using convolutional neural networks. American Geophysical Union (AGU) Fall Meeting, New Orleans, LA, December 11-15. (Oral presentation)
32. **Kerner, H. R.**, Bell III, J. F., Ben Amor, H. (2017). Detecting and characterizing compression-related artifacts in Mars Science Laboratory Mastcam images. 48th Lunar and Planetary Science Conference, The Woodlands, TX, March 20-24. (Oral presentation)

Editing

- Aye, K. M., D’Amore, M., Helbert, J., Kerner, H. R. (est. 2021). Machine Learning for Planetary Science. In preparation for *Elsevier Science and Technology Books*.
- Guest editor, “Advances in AI applications for small-scale agricultural systems,” special issue in *Frontiers in AI in Food, Agriculture, and Water* (2020, to appear)
- Guest editor, “Recent Advances in Crop Mapping and Monitoring Using Remote Sensing Data,” special issue in *Remote Sensing* (2020, to appear)

PUBLIC DATASETS

- 2020 MSL Curiosity Rover Images with Science and Engineering Classes
<https://doi.org/10.5281/zenodo.3892023>
- 2020 Togo 10m Cropland Map and Labels (2019)
<https://doi.org/10.5281/zenodo.3836628>
- 2020 Mars Novelty Detection Mastcam Labeled Dataset
<https://doi.org/10.5281/zenodo.1486195>
- 2019 Dynamic Albedo of Neutrons (DAN) Simulated and Observed Die-Away Data
<https://doi.org/10.5281/zenodo.3592014>
- 2019 Planetary Surface Features Change Detection Dataset
<https://doi.org/10.5281/zenodo.2373797>

GRANTS AND FELLOWSHIPS

- 2020 “In-Season Crop Monitoring Using Earth Observation in Major Food-Producing Countries to Mitigate Market Uncertainty Caused by COVID-19 Pandemic” (PI)
NASA Rapid Response and Novel Research in Earth Sciences
- 2020 Microsoft AI for Earth Grant
- 2020 “Earth Observations for Field Level Agricultural Resource Mapping (EO-Farm): Pilot in Kenya and Mexico in Support of Small Holders” (Co-I)
SwissRe Foundation
- 2019 “Novelty-Driven Onboard Targeting for MSL and Mars 2020 Rovers” (Co-I)
NASA Center Innovation Fund Advanced Concepts
- 2019 NASA Small Business Technology Transfer (SBIR/STTR) Phase I

- Arizona State University, Development Seed
- 2018 NASA JPL Strategic University Research Partnership (SURP) Fellowship
Arizona State University, Jet Propulsion Laboratory
- 2016 NASA Small Business Technology Transfer (SBIR/STTR) Phase I
Busek Co., Inc.; Arizona State University

HONORS AND AWARDS

- 2019 ASU College of Liberal Arts and Sciences Graduate Excellence Award
- 2018 Google Women Techmakers Scholarship
- 2018 ASU College of Liberal Arts and Sciences Student Leader
- 2018 ASU Graduate and Professional Student Association Outstanding Mentor Award
- 2017 ASU College of Liberal Arts and Sciences Doctoral Fellowship for First-Generation
College Graduates
- 2016 Interact Fellowship

INVITED TALKS

- 2020 “Using Satellites and Machine Learning to Monitor Agriculture and Enhance Food
Security.” NeurIPS Workshop on AI for Earth Science, Virtual.
- 2020 “How to Shape Your Career.” IEEE GRSS and IGARSS Webinar Series.
- 2020 “Coding is My Superpower: the Magic of Code to Reach Across Earth and
Beyond.” Brooke Owens Fellowship Webinar, Virtual.
- 2020 “Using Machine Learning in Space.” Ubiquity Extended Team Webinar, Virtual.
- 2020 “Monitoring Agriculture at the Field Scale using Satellite Data and Machine
Learning.” Measuring Development 2020: Data Integration and Data Fusion,
Virtual.
- 2020 “Machine Learning for Agricultural Monitoring.” NASA Harvest Emerging
Technologies workshop, National Agricultural Library, Beltsville, MD.
- 2020 “Enhancing Planetary Exploration Mission Planning and Data Analysis using
Machine Learning.” Solar System Exploration Division Seminar, NASA Goddard
Space Flight Center, Greenbelt, MD.
- 2020 “Machine Learning for Agricultural Monitoring.” Advancing Application of
Machine Learning Tools for NASA’s Earth Observation Data, Washington, DC.
- 2019 “Actionable Insights from Remote Sensing Enabled by Machine Learning, from
Earth to Mars.” International Space University, Strasbourg, France.
- 2019 “Actionable Insights from Remote Sensing Enabled by Machine Learning, from
Earth to Mars.” Arizona State University, Tempe, AZ.
- 2019 “Space for Earth” (Panel). SpaceVision 2019, Tempe, AZ.
- 2019 “Actionable Insights from Remote Sensing Enabled by Machine Learning, from
Earth to Mars.” Women in Data Science at Stanford Earth, Palo Alto, CA.
- 2019 “Machine Learning for Remote Sensing.” Committee on Seismology and
Geodynamics (COSG) Fall Meeting, National Academies of Science, Engineering,
and Medicine, Washington, DC.
- 2019 “AI and Machine Learning.” Space4Earth Hackathon, 70th International
Astronautical Congress, Washington, DC.

CONFERENCE SERVICE

- 2020 Session Chair/Co-Convener, “Machine Learning for Planetary Science,” American Geophysical Union (AGU) Fall Meeting, Virtual Conference, December 1-17.
- 2020 Co-Chair, “Robots in the Wild: Challenges in Deploying Robust Autonomy for Robotic Exploration,” Workshop at Robotics: Science and Systems (RSS), Virtual Conference, July 12.
- 2019 Session Chair/Co-Convener, “Machine Learning for Planetary Science,” American Geophysical Union (AGU) Fall Meeting, San Francisco, CA, December 9-13.
- 2018 Session Co-Convener, “Machine Learning in Planetary Science: Introductions and Applications,” American Geophysical Union (AGU) Fall Meeting, Washington, DC, December 10-14.
- 2017 Session Co-Convener, “Rise of Machine Learning: Salvation for Planetary Science in Times of Increasing Data Volume and Complexity,” American Geophysical Union (AGU) Fall Meeting, New Orleans, LA, December 11-15.
- 2017 Co-Chair, NewSpace Europe Conference, Luxembourg City, November 16-17.

TEACHING EXPERIENCE

Courses Taught

CS for People Who Don’t Know CS (Yet!) Spring 2015
Department of Computer Science, University of North Carolina at Chapel Hill

Courses Assisted

Introduction to Programming Spring 2014
Department of Computer Science, University of North Carolina at Chapel Hill

Introduction to Scientific Programming Fall 2013
Department of Computer Science, University of North Carolina at Chapel Hill

Guest Lectures

Introduction to Machine Learning for Remote Sensing Spring 2020
Department of Geology, University of Maryland

Coding for Exploration Fall 2019
School of Earth and Space Exploration, Arizona State University

Artificial Intelligence Fall 2019+
School of Computing, Informatics, and Decision System Engineering, Arizona State University (Coursera)

RESEARCH EXPERIENCE

Appointments

Assistant Research Professor 2019-Present
Department of Geographical Sciences College Park, MD
University of Maryland, College Park

Graduate Research Assistant 2015-2019
School of Earth and Space Exploration Tempe, AZ

Arizona State University

Research Intern

Machine Learning and Instrument Autonomy Group

Jet Propulsion Laboratory, California Institute of Technology

2018, 2019
Pasadena, CA

Mission Experience

Science Team Member, Mars Science Laboratory

2016-2020

Payload Downlink Lead, Opportunity Mars Exploration Rover

2016-2019

MEDIA

Opinion Articles

1. Too many AI researchers think real-world problems are not relevant. *MIT Technology Review*, 2020.
2. Our path to Mars needs to look beyond launch. *Houston Chronicle*, 2016.
3. Space technology can help sustain Earth. *Scientific American*, 2016.
4. What's The Point? The Real Reason Scientists Study Space. *Space.com*, 2015.
5. The Space Destination Debate Gets Us Nowhere... Literally. *Space.com*, 2015.
6. It's Not Them It's You: Why Top Tech Talent Isn't Going to the Satellite Industry. *Via Satellite*, 2015.

Featured Articles, Podcasts, and Other Media

7. How Farmers Can Help NASA Assess the Impacts of the Derecho in Iowa, AgriTalk Radio, 2020.
8. NASA Funds Eight New Projects Exploring Connections Between the Environment and COVID-19. *NASA Earth Sciences Division*, 2020.
9. Smart Machines: Enabling a New Era of Planetary Exploration. *CuttingEdge*, 2020.
10. Harvest Hub: Food Security from Space. *Via Satellite*, On Orbit podcast, 2020.

SERVICE

Reviewing

- 2020- NASA ROSES External Reviewer
- 2020- Europlanet 2024 Research Infrastructure (RI) Virtual Access Review Board (VARB)
- 2020- Women in Machine Learning Scholarships for ICLR 2020
- 2020- *Remote Sensing of Environment*
- 2020- *Journal of Selected Topics in Applied Earth Observations and Remote Sensing*
- 2019- *IEEE Transactions on Geoscience and Remote Sensing*
- 2020- *Hydrology and Earth System Science*

- 2020- *Agronomy*
- 2020- *Agriculture*
- 2020- *Remote Sensing*
- 2019- Brooke Owens Fellowship
- 2019- SpaceVision Conference Student Scholarships
- 2019 Women in Machine Learning Workshop, NeurIPS
- 2018 NASA Frontier Development Lab

Organizations and Committees

Internal (UMD Geographical Sciences)

- 2020- Diversity Committee
- 2020- Graduate Committee
- 2020- Department Committee Voting Representative (Research Faculty)

External

- 2020- Technical Advisory Panel, The Lacuna Fund: Our Voice on Data
Meridian Institute and Rockefeller Foundation
- 2020- Co-organizer, Machine Learning for Remote Sensing
Online Discussion Group, <https://bit.ly/2KoEX7K>
- 2020 Technical Committee, 2020 NSF CPS Challenge “SoilScope – Mars edition”
- 2019- Volunteer, Board of Directors, Research & Policy Committee
Women in Machine Learning (WiML)
- 2019- Member (advising early-stage investments)
Ubiquity Ventures Extended Team (UXT)
- 2015- Member, Board of Advisors
Students for the Exploration and Development of Space (SEDS) USA
- 2018-2019 Co-Chair, Women in Science Program
School of Earth and Space Exploration, Arizona State University
- 2015-2019 Member, Colloquium Committee
School of Earth and Space Exploration, Arizona State University

Advising and Mentoring

- 2020- Doctoral Committee Member for Yiming Zhang (UMD Geog)
- 2020- Advisor for Afolarin Lawal, graduate student researcher (UMD Geog)
- 2020- Advisor for William Cao, undergraduate student researcher (UMD CS)
- 2020- Advisor for Bissaka Kenah, undergraduate student researcher (UMD CS)
- 2020- Advisor for Madhava Paliyam, undergraduate student researcher (UMD CS)
- 2020- Advisor for Favour Nerrise, undergraduate student researcher (UMD CS)
- 2020- Advisor for Anchit Jain, undergraduate student researcher (UMD CS)
- 2020- Advisor for Avi Grant, undergraduate student researcher (UMD Geog)
- 2020- Advisor for Dhruv Pai, high school student researcher (Montgomery Blair High School)
- 2020- Faculty Advisor, Students for the Exploration and Development of Space (SEDS) at UMD)

- 2020- Tutor for multiple scholars (anonymous), From Prison Cells to PhD (P2P)
- 2020 Advisor for Students for the Exploration and Development of Space (SEDS) Grad School Application Virtual Bootcamp
- 2020 Mentor & Judge, NASA COVID-19 Space Apps Challenge (SDGs category)
- 2017 Mentor for Julia Odden, high school summer intern (ASU)

Outreach

- 2018-2019 Curriculum Development, Prison Education Program
School of Earth and Space Exploration, Arizona State University
- 2018 Algebra 1A and GED Math Instructor
Adobe Mountain School, Arizona Department of Juvenile Corrections
- 2018-2019 President, Devil Divers (Scuba Club)
Arizona State University
- 2016-2019 Instructor, Girls Who Code
Maie Bartlett Heard K-8 School

Professional Membership

- Member, Association for the Advancement of Artificial Intelligence (AAAI)
- Member, American Geophysical Union (AGU)
- Member, Women in Machine Learning (WiML)