

D. Hudson Smith — curriculum vitae

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Research Vision

I develop techniques for incorporating prior knowledge into machine learning systems for data-constrained applications. This synthesis of established domain knowledge with flexible machine learning methods leads to better anomaly detection rates, improved sample efficiency, and explainable inference, without sacrificing the expressive power of data-driven techniques like deep learning.

Positions

Assistant Professor <i>Dept. of Mathematical and Statistical Sciences</i>	Clemson University 8/2024 – present
Co-Lead <i>Clemson/MUSC Artificial Intelligence Hub</i>	Clemson University 7/2022 – present
Director of Applied Machine Learning <i>Research Computing and Data, CCIT</i>	Clemson University 1/2023 – 7/2024
Machine Learning Research Associate <i>Watt Family Innovation Center</i>	Clemson University 3/2018 – 12/2022
Data Scientist <i>Dynamit Technologies</i>	Columbus, OH 12/2016 – 3/2018

Education

Ohio State University <i>Ph.D. in Theoretical Atomic Physics, GPA: 3.9/4.0</i> Research: theoretical atomic physics, quantum field theory, computer simulation of quantum systems Thesis: Inducing Resonant Interactions in Ultracold Atoms with an Oscillating Magnetic Field Advisor: Dr. Eric Braaten, braaten.1@osu.edu	Columbus, OH 2011-2016
Erskine College <i>B. S. in Physics, B. A. in Mathematics, GPA: 3.9/4.0</i>	Due West, SC 2007-2011

Publications

Machine learning and Artificial Intelligence.....

1. Cull, J., Morrow, D., Manasco, C., Vaughan, A., Eicken, J. & Smith, H. A quality assessment tool for focused abdominal sonography for trauma examinations using artificial intelligence. *Journal of Trauma and Acute Care Surgery*. Epub ahead of print. <https://doi.org/10.1097/TA.0000000000004425> (Sept. 2024).

2. Fine, J. A., Smith, D. H., Oliveira, C., Deas, N., Shellnutt, S., Stotzky, R. & Clyburn, R. How negativity and policy content drive the spread of political messages. *Journal of Information Technology & Politics*, 1–10 (2024).
3. Weisensee, K. E., Tica, C. I., Atwell, M. M., Ehrett, C., Smith, D. H., Carbajales-Dale, P., Claflin, P. & Nisbet, N. geoFOR: a collaborative forensic taphonomy database for estimating the postmortem interval. *Forensic Science International*, 111934 (2024).
4. Smith, D. H., Ehrett, C. & Warren, P. L. Unsupervised detection of coordinated information operations in the wild. *arXiv preprint arXiv:2401.06205* (2024).
5. Cranmer, G. A., Linvill, D., Smith, H., Denham, B., Bober, J., Nutt, K. & Seaton, W. Social media trolls as faux third-party agents of image repair: China's disinformation campaign and statecraft in the Daryl Morey affair. *Journal of Applied Communication Research*, 1–22 (2023).
6. Kar, S., Mishra, P., Lin, J., Woo, M.-J., Deas, N., Linduff, C., Niu, S., Yang, Y., McClendon, J., Smith, D. H., *et al.* *Systematic Evaluation and Enhancement of Speech Recognition in Operational Medical Environments in 2021 International Joint Conference on Neural Networks (IJCNN)* (2021), 1–8.
7. Smith, D. H., Lineberger, J. P. & Baker, G. H. *On the Relevance of Temporal Features for Medical Ultrasound Video Recognition in International Conference on Medical Image Computing and Computer-Assisted Intervention* (2023), 744–753.
8. Erno, J., Gomes, T., Baltimore, C., Lineberger, J. P., Smith, D. H. & Baker, G. H. Automated Identification of Patent Ductus Arteriosus Using a Computer Vision Model. *Journal of Ultrasound in Medicine* (2023).
9. Smith, D. H., Ehrett, C., Weisensee, K. & Tica, C. Commentary on: Megyesi MS, Nawrocki SP, Haskell NH. Using accumulated degree-days to estimate the postmortem interval from decomposed human remains. *Journal of Forensic Sciences* **68**, 355–358 (2023).
10. Taye, M., Morrow, D., Cull, J., Smith, D. H. & Hagan, M. Deep Learning for FAST Quality Assessment. *Journal of Ultrasound in Medicine* (2022).
11. Woo, M., Mishra, P., Lin, J., Kar, S., Deas, N., Linduff, C., Niu, S., Yang, Y., McClendon, J., Smith, D. H., *et al.* Complete and Resilient Documentation for Operational Medical Environments Leveraging Mobile Hands-free Technology in a Systems Approach: Experimental Study. *JMIR mHealth and uHealth* **9**, e32301 (2021).
12. Ehrett, C., Linvill, D. L., Smith, H., Warren, P. L., Bellamy, L., Moawad, M., Moran, O. & Moody, M. Inauthentic Newsfeeds and Agenda Setting in a Coordinated Inauthentic Information Operation. *Social Science Computer Review* (June 2021).
13. Mayes, E., Lineberger, J. P., Mayer, M., Sanborn, A., Smith, H. & Walker, E. Automated Brand Color Accuracy for Realtime Video. *SMPTE Motion Imaging Journal* **130**, 45–49 (2021).
14. Freeman, D., Gupta, S., Smith, D. H., Maja, J. M., Robbins, J., Owen, J. S., Peña, J. M. & de Castro, A. I. Watson on the Farm: Using Cloud-Based Artificial Intelligence to Identify Early Indicators of Water Stress. *Remote Sensing* **11**, 2645 (Nov. 2019).

Atomic Physics.....

1. Smith, D. H. & Volosniev, A. G. Engineering momentum profiles of cold-atom beams. *Physical Review A* **100**, 033604 (2019).
2. Smith, D. H. Inducing Resonant Interactions in Ultracold Atoms with a Modulated Magnetic Field. *Physical review letters* **115**, 193002 (2015).
3. Volosniev, A. & Smith, D. H. Impenetrability in Floquet Scattering in One Dimension. *Few-Body Systems* **59**, 1–9 (2018).
4. Langmack, C., Smith, D. H. & Braaten, E. Association of atoms into universal dimers using an oscillating magnetic field. *Physical review letters* **114**, 103002 (2015).
5. Braaten, E., Langmack, C. & Smith, D. H. Born-Oppenheimer approximation for the X Y Z mesons. *Physical Review D* **90**, 014044 (2014).
6. Braaten, E., Langmack, C. & Smith, D. H. Selection Rules for Hadronic Transitions of X Y Z Mesons. *Physical review letters* **112**, 222001 (2014).
7. Smith, D. H., Braaten, E., Kang, D. & Platter, L. Two-body and three-body contacts for identical bosons near unitarity. *Physical review letters* **112**, 110402 (2014).
8. Langmack, C., Smith, D. H. & Braaten, E. Atom Loss Resonances in a Bose-Einstein Condensate. *Physical review letters* **111**, 023003 (2013).
9. Langmack, C., Smith, D. H. & Braaten, E. Avalanche mechanism for the enhanced loss of ultracold atoms. *Physical Review A* **87**, 023620 (2013).
10. Langmack, C., Smith, D. H. & Braaten, E. Avalanche mechanism for atom loss near an atom-dimer Efimov resonance. *Physical Review A* **86**, 022718 (2012).

Research awards

- 1/2024:** NIH COBRE Pilot Award \$350k
(Co-PI) Team Science Supplement: SC COBRE for Translational Research Improving Musculoskeletal Health (SC TRIMH)
- 9/2023:** CDC Center for Forecasting and Outbreak Analytics \$7MM
(Senior Personnel) Disease Modeling and Analytics to inform Outbreak Preparedness, Response, Intervention, Mitigation, and Elimination in South Carolina (DMA-PRIME)
- 8/2023:** NIH COBRE Renewal Award \$11MM
(Co-PI) COBRE Renewal: Translational Research Improving Musculoskeletal Health (TRIMH) (SC TRIMH)
- 7/2023:** Clemson/MUSC AI Hub Augmentation Award \$25k
(Co-PI) Automated Identification of Patent Ductus Arteriosus using a Computer Vision Model
- 4/2023:** Clemson University Research Foundation Technology Maturation Award \$20k
(Senior Personnel) Integration of Smart Needle Measurements and Functional Ultrasonography by Machine Learning for Quantitative Monitoring and Assessment of Acupuncture Myofascial Pain Management
- 1/2022:** Clemson-MUSC Artificial Intelligence Hub \$5k

(Fellow) Artificial Intelligence Advocate	
7/2021: RHBSSI Seed Grant (Clemson University)	\$45k
(Co-PI) ColorNet: Developing AI-based color correction tools for sports media applications	
6/2021: ACRE Competitive Grants Program (SCDA)	\$120k
(PI) AI Master Gardener for Greenhouse Supervision	
4/2021: Prisma Health Seed Grant	\$20k
(Senior Personnel) Automated Quality Assessment of FAST Exams	
2/2021: ACRE Competitive Grants Program (SCDA)	\$20k
(Co-PI) AI for Fruit and Vegetable Harvesting in South Carolina	
2/2021: CU Seed Grant, Tier 1 (Clemson University)	\$5k
(Co-PI) ColorNet: An AI-based color management system for live video	
11/2019: CURF Tech Maturation Fund (Clemson)	\$29k
(Co-PI) ColorNet: Consistent display of Clemson brand colors using artificial intelligence	
8/2019: Erwin Center for Brand Communications (Clemson University)	\$8k
(Co-PI) AI for on the fly color correction of sports footage	
7/2018: ACRE Competitive Grants Program (SCDA)	\$105k
(Co-PI) Rapid Chicken Sex Determination with Multiple Mechanisms and AI	

Teaching Experience

Mentorship Experience

Graduate students: I co-advise one PhD student in Biomedical Data Science and Informatics, two PhD students in the School of Computing, and one DMD student in the Department of Orthodontics at MUSC.

Undergraduates: In my 5 years leading the Watt AI program, I worked with over 100 Creative Inquiry students applying Machine Learning techniques to research projects at Clemson.

Interns: Since 2018, I have mentored more than 15 undergraduate student interns. These interns worked on machine-learning related projects in diverse disciplines.

Clemson University

Spring 2023–present: Instructor for Data Science, Machine Learning, and Deep Learning Workshops for Research Computing and Data. Selected topics include "Data Visualization in Python", "Introduction to Deep Learning with Pytorch", and "Attention, Transformers, and LLMs: a hands-on introduction in Pytorch"

Spring 2018–Fall 2022: Instructor for Watt AI Creative Inquiry course for 9 consecutive semesters

Spring 2020–Fall 2021: Designed intro to artificial intelligence curriculum for undergraduates from diverse majors

Fall 2021–Fall 2022: Led weekly journal club with advanced students

Fall 2018–Spring 2019: Instructor for Ulbrich CI focused on manufacturing analytics

Ohio State University

Fall 2015: Tutor for graduate level classical mechanics course

Fall 2012–Spring 2013: Recitation and lab instructor for Physics: Vibrations, Fluids, Thermodynamics, and Special Relativity

Erskine College

Spring 2010: Lab instructor for Modern Physics

Fall 2009: Teaching assistant for Calculus

Fall 2008–Fall 2009: Teaching assistant for Introductory Physics

Fall 2008–Fall 2010: Writing assistant for various subjects

Presentations

Machine learning

1. Smith, D. H. & Lineberger, J. P. *On the Relevance of Temporal Features for Medical Ultrasound Video Recognition* International Conference on Medical Image Computing and Computer Assisted Intervention. 2023, October.
2. Gemmill, J. & Smith, D. H. *Member Panel on AI: Supporting AI in an HPC Environment* Coalition for Academic Scientific Computation Fall Meeting. 2023, October.
3. Smith, D. H. *Artificial Intelligence: from Duck Digestion to Conversational Companions* Clemson University Data Science Conference. 2023, May.
4. Weisensee, K., Tica, I., Smith, D. H., Ehrett, C. & Carbajales-Dale, P. *Postmortem Interval Estimation Using a Novel Data set and Methods* Annual Meeting of the American Academy of Forensic Sciences. 2023, February.
5. Smith, D. H. *Quality Assessment of FAST Exams using Deep Learning* Clemson/MUSC AI Hub Seminar. 2021, November.
6. Smith, D. H. *SMRF: a Cloud-Based Social Media Research Framework in Research Running on Cloud Compute & Emerging Technologies* **2021** (2021, April), 11–12.
7. Walker, E. B., Smith, D. H., Lineberger, J. P., Mayer, M. L., Mayes, E. E. & Sanborn, A. T. *67-3: ColorNet: A Neural Network-Based System for Consistent Display of Brand Colors for Video* in *SID Symposium Digest of Technical Papers* **51** (2020), 1001–1004.
8. Fine, J., Deas, N., Shellnut Spencer Sargent, J. & Smith, D. H. *Content Analyzing Political Tweets using Natural Language Processing: Opportunities and Challenges* in *Southern Political Science Association Conference* (2019).
9. Zhang, T., Moody, M., Nelon, J. P., Boyer, D. M., Smith, D. H. & Visser, R. D. *Using Natural Language Processing to Accelerate Deep Analysis of Open-Ended Survey Data* in *2019 SoutheastCon* (2019), 1–3.

Physics

1. Mohapatra, A., Smith, D. H. & Braaten, E. *Dissociation of Cooper pairs in the BCS Limit using an Oscillating Magnetic Field* in *APS Division of Atomic, Molecular and Optical Physics Meeting Abstracts* (2016).

2. Smith, D. H. *Induced two-body scattering resonances from a square-well potential with oscillating depth* in *EPJ Web of Conferences* **113** (2016), 02005.
3. Braaten, E., Mohapatra, A. & Smith, D. H. *Initial Atom Loss Rate after the Sudden Ramp of a BEC to Unitarity* in *APS Division of Atomic, Molecular and Optical Physics Meeting Abstracts* (2016).
4. Smith, D. H. *Inducing Resonant Interactions in Ultracold Atoms with an Oscillating Magnetic Field* in *APS Division of Atomic, Molecular and Optical Physics Meeting Abstracts* **1** (2015), 3010.
5. Smith, D., Langmack, C., Braaten, E., *et al.* *Avalanche Mechanism for the Enhanced Loss of Ultracold Atoms* in *APS Division of Atomic, Molecular and Optical Physics Meeting Abstracts* **1** (2013), 5007P.
6. Braaten, E. & Smith, D. *Avalanche Mechanism for Multiple Atom Loss near an Efimov Atom-Dimer Resonance* in *APS Division of Atomic, Molecular and Optical Physics Meeting Abstracts* (2012).

Computational tools

- Python, R, SQL, bash, C++, C#, Java, LaTeX
- Deep Learning and Probabilistic Programming: Pytorch, Pyro, NumPyro, Jax
- Experience with Cloud and cluster computing environments
- Hardware-accelerated array programming for scientific computing

Honors and Awards

2016: Presidential Fellow, OSU

2013: Winner of Physics Dept. Poster Competition, OSU

2011: Fowler Fellow, OSU

2011: University Fellow, OSU

2010: T. Kincannon Mathematics Award, Erskine College

2010: Junkin Physics Award, Erskine College

2008: Garnet Circle Award, Erskine College

2007: Roy M. Smith Mathematics Scholarship, Erskine College