

Timothy[Havens]

1400 Townsend Dr. / GLRC 307 | Houghton, MI 49931

Phone: 231-360-8444 | Fax: 906-487-2949

E-mail: thavens@mtu.edu | Web: timhavens.com

EDUCATION**University of Missouri**, Columbia, MO

Ph.D., Electrical and Computer Engineering, 2010

Thesis: Clustering in relational data and ontologies (advisor: Prof. James M. Keller)

Michigan Technological University, Houghton, MI

M.S., Electrical Engineering, 2000

B.S., Electrical Engineering, 1999

PROFESSIONAL EXPERIENCE

Director, Great Lakes Research Center, Michigan Tech University	(2022 –)
Director, Institute of Computing and Cybersystems (ICC), Michigan Tech University	(2018 –)
William and Gloria Jackson Professor, CS/ ECE, Michigan Tech University	(2021 –)
Director, ICC Center for Data Sciences, Michigan Tech University	(2016 –)
Associate Dean for Research, College of Computing, Michigan Tech University	(2019 – 2021)
William and Gloria Jackson Associate Professor, CS / ECE, Michigan Tech University	(2016 – 2021)
Director, Data Science Program, Michigan Tech University	(2017 – 2018)
William and Gloria Jackson Assistant Professor, ECE / CS., Michigan Tech University	(2012 – 2016)
NSF / CRA Computing Innovation Fellow, Michigan State University	(2010 – 2012)
Research Associate, Center for Geospatial Intelligence, University of Missouri	(2010 – 2012)
Teaching Fellow, University of Missouri	(2007 – 2010)
Graduate Research Assistant, University of Missouri	(2007 – 2010)
NSF GK-12 Graduate Fellow, University of Missouri	(2006 – 2007)
Associate Technical Staff, MIT Lincoln Laboratory	(2000 – 2005)

TEACHING EXPERIENCE

Project-based education: Advisor for SENSE Enterprise (2020 – present)

Courses taught: Intro to C/C++, Intro to Data Sciences, Probability – Signal Analysis, Data Mining, Machine Learning, Intro to Communication Theory, Computational Intelligence, Digital Logic and Lab

Short Course: Introduction to radar and forward-looking ground penetrating radar

As a Teaching Fellow at the University of Missouri, I was instructor of the following courses:

Microcomputer Architecture and Interfacing; Computing for Embedded Systems; Signals and Linear Systems; Real-Time Embedded Systems

RESEARCH FUNDING (\$8,480,461 AS PI; \$792,918 OF TOTAL \$5,170,931 AS CO-PI)

- Verification, validation, assurance, and trust of machine learning models and data for safety-critical applications, Phase I and II (\$392,000), ARiA / US Army, 2024-2026, PI (awarded)
- Subject matter expertise for algorithm development (\$107,749), Signature Research Inc., 2024
- Operation and Maintenance: High Frequency Radar in the Straits of Mackinac, Michigan – Year V (\$70,000), GLOS, 2023-2024, PI
- Generative modeling of multispectral satellite imagery – STTR Phase I (\$60,006), ARiA / DTRA, 2023, PI
- Heating management system for vessels in dock in cold weather ports (\$17,500), Fincantieri Marinette Marine, 2023-2024, PI
- CR-02: Robust Algorithms for Complex Autonomous Robot Systems (\$419,633), US Navy, 2023-2026, PI
- SAR Signature Management (\$1,000,000), US Army ERDC, 2023-2028, PI
- Fiddler – Rapid SAR Signature Generation (\$1,180,762), Signature Research Inc. / DARPA, 2022-2024, PI
- Enabling the Future of Great Lakes Biological Resource Assessment (\$1,356,822 to date of \$5M ceiling), USGS, 2022-2027, PI.
- Machine Learning and Data Collection Using Acoustic Sensors (\$50,000), Ford Motor Company, 2022-

2023, PI.

- Operation and Maintenance: High Frequency Radar in the Straits of Mackinac, Michigan – Year IV (\$70,000), GLOS, 2022-2023, PI
- Machine Learning for Automated Detection of Shipwreck Sites from Large Area Robotic Surveys (\$119,136), NOAA, 2021-2023, PI
- SCC-CIVIC-FA Track B: Helping Rural Counties to Enhance Flooding and Coastal Disaster Resilience and Adaptation (\$88,105/\$1,119,877), NSF, 2021-2024, Co-PI (PI: Thomas Oommen)
- Algorithm Performance Evaluation with Low Sample Size (\$49,995), Signature Research Inc. / NGA, 2021-2022, PI
- Redesign and Implementation of USDS-Proxy Language – Phase II+Option (\$186,229/\$509,997), ARiA / US Navy, 2021-2024, Co-PI (PI: Charles Wallace)
- Continuation: Machine Learning and Artificial Intelligence Using Acoustic Sensors in Connected Vehicles and Roadside Units (\$150,000), Ford Motor Company, 2021-2022, PI
- SCC-CIVIC-PG Track B: Helping Rural Counties to Enhance Flooding and Coastal Disaster Resilience and Adaptation (\$4,080/\$49,999), NSF, 2021, Co-PI (PI: Thomas Oommen)
- Redesign and Implementation of USDS-Proxy Language (\$17,231/\$76,610), ARiA / US Navy, 2020, Co-PI (PI: Charles Wallace)
- Modeling and Algorithm Development for Adaptive Adversarial AI for Complex Autonomy (\$755,142), SOSSEC / US Army ERDC, 2020-2024, PI
- DURIP: Acoustic Sensing System and High-Throughput Computing for Environment and Threat Monitoring in Naval Environments Using Machine Learning (\$243,169), Office of Naval Research, 2020-2021, PI
- Machine Learning and Artificial Intelligence Using Acoustic Sensors in Connected Vehicles and Roadside Units (\$149,518), Ford Motor Company, 2020-2021, PI
- Defending the Nation's Digital Frontier: Cybersecurity Training for Tomorrow's Officers (\$66,377/\$248,517), Office of Naval Research, 2020-2021, Co-PI (PI: Andrew Barnard)
- Duty Cycle Aggregation, Warranty Mitigation, and Fleet Prognostics using Customer Usage Data (Part II) (\$199,847), Ford Motor Company, 2020-2022, PI
- Algorithms for Look-Down Infrared Target Exploitation – Phase II (\$999,979), Signature Research Inc. / NGA, 2020-2022, PI
- Machine Learning for Human-Based Visual Detection Metrics (\$120,000), Signature Research Inc., 2020-2021, PI
- Localization, Tracking, and Classification of On-Ice and Underwater Noise Sources Using Machine Learning (\$299,533), Naval Undersea Warfare Center, 2019-2022, PI
- Duty Cycle Aggregation and Warranty Mitigation using Customer Usage Data (\$50,000), Ford Motor Company, 2019, PI
- Algorithms for Look-Down Infrared Target Exploitation (\$99,998), Signature Research Inc. / NGA, 2018-19, PI
- Distributed Array Processing for Aperture Level STAR (\$50,000), MIT Lincoln Laboratory, 2017-18, PI
- Self-Interference Modeling in Active Phased Arrays (\$15,000), MIT Lincoln Laboratory, 2017, PI
- Multistatic GPR Phase II (\$100,000), Akela, Inc. / US Army, 2017-19, PI
- Multisensor Analysis and Algorithm Development for Detection and Classification of Buried and Obscured Targets (\$99,779), Army Research Office, 2016-2019, PI
- Implementation of Unmanned Aerial Vehicles (UAVs) for Assessment of Transportation Infrastructure (\$87,620/\$598,526), Michigan DOT, 2016-2019, Co-PI (PI: Colin Brooks)
- Multistatic GPR for Explosive Hazards Detection (\$49,987), Akela, Inc. / US Army SBIR, 2016-2017, PI
- Heterogeneous Multisensor Buried Target Detection Using Spatiotemporal Feature Learning (\$381,200), Army Research Office, 2015-2018, PI

- Spatial Coherence Imaging and Machine Learning Approach for Standoff Detection Using Forward-Looking Ground-Penetrating Radar (\$386,942), US Army, 2013-2105, PI
- Advanced Signal-Processing and Detection Algorithms for Handheld Explosive Hazard Detection (\$227,016/\$1,238,255), US Army, 2013-2015, Co-PI (PI: Joseph Burns)
- Evaluating the Use of Unmanned Aerial Vehicles for Transportation Purposes (\$71,088/\$240,889), Michigan Dept. Transportation (MDOT), 2013-2014, Co-PI (PI: Colin Brooks)
- REF-RS: Preliminary Development Towards Simultaneous Localization and Mapping Using Heterogeneous Clouds of Unmanned Aerial Vehicles (UAVs) (\$26,000), MTU, 2013-2014, PI
- NURail – Tier I (\$299,966), USDOT-RITA, 2013-2018, Co-PI (PI: Pasi Lautala)
- NURail Center – Phase II (\$45,172/\$788,295), USDOT-RITA, 2012-2016, Co-PI (PI: Pasi Lautala)
- CI Fellows Project: Clustering of Large Data Sets (\$267,500), NSF / CRA, 2010-2012, PI
- Synthetic Aperture Radar Signal Processing (\$438,193), Leonard Wood Institute, 2010-2011, Co-PI (PI: James Keller)
- Developing Interfaces to Provide Range of Motion Feedback to Elderly People Using Exercise Equipment (\$40,000), RAND/Hartford Foundation, 2007-2008, Co-I (PI: Gregory Alexander)

JOURNAL ARTICLES

- E. Lucas, D. Kangas, and T.C. Havens. Extra global attention designation using keyword detection in sparse transformer architectures. In review, *Natural Language Processing*.
1. Kayastha, M.B.; Liu, T.; Titze, D.; Havens, T.C.; Huang, C.; Xue, P (Aug, 2023). Reconstructing 42 Years (1979–2020) of Great Lakes Surface Temperature through a Deep Learning Approach. *Remote Sens.*, 15(17), 4253.
 2. Stanton R. Price, D.T. Anderson, T.C. Havens, and Steven R. Price (June, 2022). Kernel matrix-based heuristic multiple kernel learning. *Mathematics*, 10(12), 2026. [Editor's Choice](#)
 3. S. Whitaker, A. Barnard, G. Anderson, T.C. Havens (May, 2022). Ice anthropogenic classification with acoustic vector sensors using transformer neural networks. *Proc. Mtgs. Acoust.*, 46(1), 070003.
 4. S. Whitaker, A. Barnard, G. Anderson, T.C. Havens (June, 2022). Through-ice acoustic source tracking using vision transformers with ordinal classification. *Sensors*, 22(13), 4703.
 5. S. Yazdanparast, T.C. Havens, and M. Jamalabdollahi (Dec, 2021). Linear time community detection by a novel modularity gain acceleration in label propagation. *IEEE Trans. Big Data*, 7(6), 961-966.
 6. S.K. Kakula, A.J. Pinar, M.A. Islam, D.T. Anderson, and T.C. Havens (Oct, 2021). Novel regularization for learning the fuzzy Choquet integral with limited training data. *IEEE Trans. Fuzzy Systems*, 29(1), 2890-2901.
 7. M.A. Islam, D.T. Anderson, T.C. Havens, and J. Ball (Sept, 2021). A generalized fuzzy extension principle and its application to information fusion. *IEEE Trans. Fuzzy Systems*, 25(9), 2726-2738. [CIS Publication Spotlight](#)
 8. B. Murray, M.A. Islam, A. Pinar, D.T. Anderson, G. Scott, T.C. Havens, and J.M. Keller (Aug, 2021). Explainable AI for the Choquet integral. *IEEE Trans. Emerging Topics Comp. Intell.*, 5(4), 520-529.
 9. S.J. Whitaker, A. Barnard, G.D. Anderson, and T.C. Havens (July, 2021). Recurrent networks for DOA identification of anthropogenic acoustic sources in a shallow water channel using a vector sensor. *J. Acoustical Society of America*, 150(1), 111-119.
 10. S. Yazdanparast, T.C. Havens, and M. Jamalabdollahi (June, 2021). Soft overlapping community detection in large-scale networks via fast fuzzy modularity maximization. *IEEE Trans. Fuzzy Systems*, 29(6), 1533-1543.
 11. S. Kabir, C. Wagner, T.C. Havens, and D.T. Anderson (Nov, 2020). A similarity measure based on bidirectional subethood for intervals. *IEEE Trans. Fuzzy Systems*, 28(11), 2890-2904.
 12. M.A. Islam, D.T. Anderson, A. Pinar, T.C. Havens, G. Scott, and J.M. Keller (July, 2020). Enabling explainable fusion in deep learning with fuzzy integral neural networks. *IEEE Trans. Fuzzy Systems*, 28(7), 1291-1300.
 13. I.T. Cummings, T.J. Schulz, J.P. Doane, and T.C. Havens (Dec, 2020). Aperture-level simultaneous transmit and receive with digital phased arrays. *IEEE Trans. Signal Processing*, 68(1), 1243-1258.

14. J. Bialas, T. Oommen, and T.C. Havens (Oct, 2019). Optimal segmentation for building class in high spatial resolution images using random forests. *Int. J. App. Earth Obs. Geoinf.* 82, 101895.
15. C.D. Demars, M.C. Roggemann, A.J. Webb, and T.C. Havens. (Oct, 2018) Target localization and tracking by fusing Doppler differentials from cellular emanations with a multi-spectral video tracker. *Sensors*, 18(11), 3687.
16. A.J. Webb, T.C. Havens, and T.J. Schulz (Sept, 2018). Fast image reconstruction in forward looking GPR using dual l1 regularization. *IEEE Trans. Computational Imaging*, 4(3), 470-478.
17. M.A. Islam, D.T. Anderson, A.J. Pinar, and T.C. Havens (Aug, 2018). Data-driven compression and efficient learning of the Choquet integral. *IEEE Trans. Fuzzy Systems*, 26(4), 1908-1922.
18. H. Deilamsalehy and T.C. Havens (Apr, 2018). Fuzzy adaptive extended Kalman filter for robust 3D pose estimation. *Int. J. Intelligent Unmanned Systems*, 6(2), 50-68.
19. H.I. Sweidan and T.C. Havens (Apr, 2018). Sensor relocation for improved target tracking. *IET Wireless Sensor Systems*, 8(2), 76-86.
20. A.J. Pinar, D.T. Anderson, A. Zare, T.C. Havens, and T. Adeyeba (2017). Measures of the shapley index for learning lower complexity fuzzy integrals. *Granular Computing*, 2(4), 303-319.
21. J. Frank, U. Rebbapragada, J. Bialas, T. Oommen, and T.C. Havens (2017). Effect of label noise on the machine-learned classification of earthquake damage. *Remote Sensing*, 9(8), 803.
22. H. Deilamsalehy, T.C. Havens, P. Lautala, E. Medici, and J. Davis (2017). An automatic train car wheel flat spot detection method using thermal camera imagery. *J. Rail and Rapid Transit*, 231(6), 690-700.
[Editor's Choice Selection](#)
23. H. Deilamsalehy, T.C. Havens, J. Manela (2017). Heterogeneous multi-sensor fusion for mobile platform 3D pose estimation. *J. Dynamic Systems, Measurement, and Control*, 139(7), 071002.
24. S. Yazdanparast and T.C. Havens (2017). Modularity maximization using completely positive programming. *Physica A: Statistical Mechanics and its Applications*, 471(1), 20-32.
25. A.J. Pinar, J. Rice, L. Hu, D.T. Anderson, and T.C. Havens (Dec, 2017). Efficient multiple kernel classification using feature and decision level fusion. *IEEE Trans. Fuzzy Systems*, 25(6), 1403-1416. [CIS Publication Spotlight](#)
26. D.T. Anderson, P. Elmore, F. Petry, and T.C. Havens (2016). Fuzzy Choquet integration of homogeneous possibility and probability distributions. *Information Sciences*, 363, 24-39.
27. S. Nuchitprasitchai, M. Roggemann, and T.C. Havens (2016). An algorithm for reconstructing three dimensional images from overlapping two dimensional intensity measurements with relaxed camera positioning requirements. *Int. J. Modern Engineering Research*, 6(9), 69-81.
28. C. Demars, M. Roggemann, and T.C. Havens (2015), Multi-spectral detection and tracking of multiple moving targets in cluttered urban environments. *Optical Engineering*, 54(12), 123106.
29. D. Kumar, J.C. Bezdek, M. Palaniswami, S. Rajasegarar, C. Leckie, and T.C. Havens (2016). A hybrid approach to clustering in big data. *IEEE Trans. Systems, Man, and Cybernetics*, 46(10), 2372-2385.
30. T.C. Havens, D.T. Anderson, and C. Wagner (2015). Data-informed fuzzy measures for fuzzy integration of intervals and fuzzy numbers. *IEEE Trans. Fuzzy Systems*, 23(5), 1861-1875.
31. J. Su and T.C. Havens (2015). Quadratic program-based modularity maximization for fuzzy community detection in social networks. *IEEE Trans. Fuzzy Systems*, 23(5), 1356-1371.
32. A.J. Pinar, B. Wijnen, G.C. Anzalone, T.C. Havens, P.G. Sanders, and J.M. Pearce (2015). Low-cost open-source voltage and current monitor for gas metal arc weld 3-D printing. *J. Sensors 2015*, paper ID 876714, 8 pages.
33. C. Wagner, S. Miller, J.M. Garibaldi, D.T. Anderson, and T.C. Havens (2015). From interval-valued data to general type-2 fuzzy sets. *IEEE Trans. Fuzzy Systems* 23(2), 248-269.
34. M. Moshtaghi, J.C. Bezdek, T.C. Havens, C. Leckie, S. Karunasekera, S. Rajasegarar, and M. Palaniswami (2014). Streaming analysis in wireless sensor networks. *Wireless Communications and Mobile Computing*, 14(9), 905-921.
35. D.T. Anderson, T.C. Havens, C. Wagner, J.M. Keller, M.F. Anderson, and D.J. Wescott. Extension of the fuzzy integral for general fuzzy set-valued information (2014). *IEEE Trans. Fuzzy Systems*, 22(6), 1625-1639.
36. S. Rajasegarar, T.C. Havens, S. Karunasekera, C. Leckie, J.C. Bezdek, M. Jamriska, A. Gunatilaka, A.

- Skvortsov, and M. Palaniswami (2014). High resolution monitoring of atmospheric pollutants using a system of low-cost sensors. *IEEE Trans. Geoscience and Remote Sensing* 52(7), 3823-3832.
37. T.C. Havens, J.C. Bezdek, C. Leckie, K. Ramamohanarao, and M. Palaniswami (2013). A soft modularity function for detecting fuzzy communities in social networks. *IEEE Trans. Fuzzy Systems* 21(6), 1170-1175.
 38. M. Popescu, J.C. Bezdek, T.C. Havens, and J.M. Keller (2012). A cluster validity framework based on induced partition dissimilarity. *IEEE Trans. Cybernetics*, 43(1), 308-320.
 39. T.C. Havens, J.C. Bezdek, C. Leckie, L.O. Hall, and M. Palaniswami (2012). Fuzzy c-means algorithms for very large data. *IEEE Trans. Fuzzy Systems*, 20(6), 1130-1146. [CIS Publication Spotlight](#)
 40. T.C. Havens and J.C. Bezdek (2012). A new formulation of the coVAT algorithm for visual assessment of clustering tendency in rectangular data. *Int. J. Intelligent Systems*, 27(6), 590-212.
 41. T.C. Havens and J.C. Bezdek (2012). An efficient formulation of the improved visual assessment of tendency (iVAT) algorithm. *IEEE Trans. Knowledge and Data Engineering*, 24(5), 813-822.
 42. J.C. Bezdek, S. Rajasegarar, M. Moshtaghi, C. Leckie, M. Palaniswami, and T.C. Havens (2011). Anomaly detection in environmental monitoring networks. *Computational Intelligence Magazine*, 6(2), 52-58.
 43. M. Moshtaghi, T.C. Havens, J.C. Bezdek, L. Park, C. Leckie, S. Rajasegarar, J.M. Keller, and M. Palaniswami (2011). Clustering ellipses for anomaly detection. *Pattern Recognition*, 44(1), 55-69.
 44. I.J. Sledge, T.C. Havens, J.C. Bezdek, and J.M. Keller (2010). Relational duals of cluster validity functions for the c-means family. *IEEE Trans. Fuzzy Systems*, 18(6), 1160-1170. [CIS Publication Spotlight](#)
 45. I.J. Sledge, J.C. Bezdek, T.C. Havens, and J.M. Keller (2010). Relational generalizations of validity indexes. *IEEE Trans. Fuzzy Systems*, 18(4), 771-786.
 46. T.C. Havens, J.M. Keller, and M. Popescu (2010). Computing with words with the ontological self organizing map. *IEEE Trans. Fuzzy Systems*, 18(3), 473-485.
 47. T.C. Havens, G.L. Alexander, C. Abbott, J.M. Keller, M. Skubic, and M. Rantz (2010). Tracking exercise motions of older adults using contours. *J. Applied Computer Science Methods*, 1(2), 21-42.
 48. G.L. Alexander, T.C. Havens, M. Rantz, J.M. Keller, and C.C. Abbott (2010). An analysis of human motion detection systems use during elder exercise routines. *Western J. of Nursing Research*, 32(2), 233-249. [MNRS Best Paper Award](#)
 49. T.C. Havens, J.C. Bezdek, J.M. Keller, M. Popescu, and J.M. Huband (2009). Is VAT really single linkage in disguise? *Ann. Mathematics and Artificial Intelligence*, 55(3), 237-251.
 50. I.J. Sledge, T.C. Havens, J.M. Huband, J.C. Bezdek, and J.M. Keller (2009). Finding the number of clusters in ordered dissimilarities. *Soft Computing*, 13(12), 1125-1142.
 51. T.C. Havens, J.C. Bezdek, J.M. Keller, and M. Popescu (2009). Clustering in ordered dissimilarity data. *Int. J. Intelligent Systems*, 24(5), 504-528.
 52. J.T. Beyer, M.C. Roggemann, L.J. Otten, T.J. Schulz, T.C. Havens, and W.W. Brown (2003). Experimental estimation of the spatial statistics of turbulence-induced index of refraction fluctuations in the upper atmosphere. *Applied Optics*, 42, 908-921.
 53. T.C. Havens, M.C. Roggemann, T.J. Schulz, W.W. Brown, J.T. Beyer, and L.J. Otten (2002). Measurement and data-processing approach for detecting anisotropic spatial statistics of turbulence-induced index of refraction fluctuations in the upper atmosphere. *Applied Optics* 41, 2800-2808.
 54. W.W. Brown, M.C. Roggemann, T.J. Schulz, T.C. Havens, J.T. Beyer, and L.J. Otten (2001). Measurement and data-processing approach for estimating the spatial statistics of turbulence-induced index of refraction fluctuations in the upper atmosphere. *Applied Optics*, 40, 1863-1871.

CONFERENCE PAPERS

55. I. Helman, S.A. Senczyszyn, A.J. Webb, T.C. Havens. SAR signature generation using constrained inverse scattering. In preparation, *MSS*.
56. D. Kangas, M. Salem, K. Li, T. Ryyanen, S. Senczyszyn, A.J. Pinar, S.R. Price, S.R. Price, S.L. Taylor, T.O. Murphy, T.C. Havens. Developing robust unmanned surface vehicles with ROS. To appear, *SPIE DSS*.
57. J. Christian, A. Olson, T.C. Havens, J. Summers. Generative EO/IR multi-scale vision transformer for improved object detection. To appear, *SPIE DSS*.
58. N. Hamilton, A.J. Webb, M. Wilder, B. Hendrickson, M. Blanck, E. Nelson, W. Roemer, and T.C. Havens. Synthetic augmentation methods for object detection in infrared overhead imagery. To appear,

SPIE DSS.

59. S. Senczyszyn, A.J. Pinar, M. Salem, E. Donogue, S. Wills, M. Broestl, A.J. Webb, T.C. Havens, and S.R. Price. Comparing performance of robot operating system (ROS) mapping algorithms in the presence of degraded or obscured depth sensors. To appear, *SPIE DSS*.
60. E. Lucas, D. Kangas, and T.C. Havens (Dec, 2023). A reference-free segmentation quality index (SegReFree). *EMNLP Findings*.
61. E. Lucas and T.C. Havens (Aug, 2023). Cluster validity for fuzzy text segmentation. *IEEE Int. Conf. Fuzzy Systems*.
62. E. Lucas and T.C. Havens (July, 2023). GPTs don't keep secrets: searching for backdoor watermark triggers in autoregressive language models. *ACL TrustNLP Workshop*, 242-248.
63. K. Hartwig, E. Lucas, and T.C. Havens (July, 2023). Identification of dialect for eastern and southwestern Ojibwe word using a small corpus. *ACL Workshop on NLP for Indigenous Languages of Americas*, 58-66.
64. A. Geglio, E. Hedayati, M. Tascillo, D. Anderson, J. Barker, and T.C. Havens (Dec, 2022). Deep convolutional autoencoder for assessment of drive-cycle anomalies in connected vehicle sensor data. *Symp. Ser. Comp. Intell.*
65. E. Lucas, S. Whitaker, and T.C. Havens (Dec, 2022). Online learning with binary feedback for multi-class problems. *Symp. Ser. Comp. Intell.*
66. N. Hamilton, A. Webb, M. Wilder, B. Hendrickson, M. Blanck, W. Roemer, and T.C. Havens (Dec, 2022). Enhancing visualization and explainability of computer vision models with Local Interpretable Model-Agnostic Explanations (LIME). *Symp. Ser. Comp. Intell.*
67. S. Whitaker, A. Barnard, T.C. Havens, G.D. Anderson (May, 2022). Ice anthropogenic classification with acoustic vector sensors using transformer neural networks. presented at *ASA Conference*.
68. Y. Wang, T.C. Havens, and A. Barnard (Dec, 2021). Environment sound classification (ESC) with Choquet integral fusion. *Symp. Ser. Comp. Intell.*
69. E. Hedayati, T.C. Havens, and J.P. Bos (July, 2021). Light field compression by residual CNN-assisted JPEG. *Int J. Conf. Neural Networks*.
70. S.J. Whitaker, Z. Dekraker, A. Barnard, T.C. Havens, G.D. Anderson II (July, 2021). Uncertain inference using ordinal classification in deep networks for acoustic localization. *Int. J. Conf. Neural Networks*.
71. B. Murray, D.T. Anderson, T.C. Havens (July, 2021). Actionable XAI for the fuzzy integral. *IEEE Int. Conf. Fuzzy Systems*.
72. M. Deardorff, D.T. Anderson, T.C. Havens, B. Murray, S.K. Kakula, and T. Wilkin (July, 2021). Earth mover's distance as a similarity measure for linear order statistics and fuzzy integrals. *IEEE Int. Conf. Fuzzy Systems*.
73. S.K. Kakula, A.J. Pinar, T.C. Havens, and D.T. Anderson (July, 2021). Online sequential learning of fuzzy measures for Choquet integral fusion. *IEEE Int. Conf. Fuzzy Systems*.
74. N. Hamilton, A. Webb, Z. Dekraker, B. Hendrickson, M. Blanck, E. Nelson, W. Roemer, and T.C. Havens (Apr, 2021). Augmentation methods for object detection in overhead imagery. *SPIE DSS*, 11729, 1172901.
75. A.J. Pinar, A.J. Webb, J.L. Brown, T.C. Havens, B. Alvey, G.N. DeSouza, D.T. Anderson, and S.R. Price (Apr, 2021). Effects of perturbed depth sensors in autonomous ground vehicles. *SPIE DSS*, 11746, 117461F.
76. S.K. Kakula, A.J. Pinar, T.C. Havens, and D.T. Anderson (Dec, 2020). Visualization and analysis tools for explainable Choquet integral regression. *IEEE Symp. Ser. Comp. Intell.*
77. S.K. Kakula, A.J. Pinar, D.T. Anderson, and T.C. Havens (Oct., 2020). Online learning of the fuzzy Choquet integral. *IEEE Int. Conf. Systems, Man, and Cybernetics*.
78. S.K. Kakula, A.J. Pinar, T.C. Havens, and D.T. Anderson (July, 2020). Extended linear order statistic (ELOS) aggregation and regression. *IEEE Int. Conf. Fuzzy Systems*.
79. A. Wilbik, T.C. Havens, and T. Wilkin (July, 2020). On a paradox of extended linguistic summaries. *IEEE Int. Conf. Fuzzy Systems*.
80. S.K. Kakula, A.J. Pinar, T.C. Havens, and D.T. Anderson (July, 2020). Choquet integral ridge regression. *IEEE Int. Conf. Fuzzy Systems*.
81. B.J. Murray, D.T. Anderson, T.C. Havens, T. Wilkin, and A. Wilbik (June, 2020). Information fusion-2-

- text: explainable aggregation via linguistic protoforms. *Int. Conf. Info. Process. and Management of Uncertainty*, 1239, 114-127.
82. T.C. Havens and D.T. Anderson (June, 2019). Machine learning of Choquet integral regression with respect to a bounded capacity (or non-monotonic fuzzy measure). *IEEE Int. Conf. Fuzzy Systems*.
 83. C. Veal, A. Yang, A. Hurt, M. Islam, D.T. Anderson, G. Scott, T.C. Havens, J.M. Keller and B. Tang (June, 2019). Linear order statistic neuron. *IEEE Int. Conf. Fuzzy Systems*.
 84. B. Murray, M. Islam, A.J. Pinar, D.T. Anderson, G. Scott, T.C. Havens, F. Petry and P. Elmore (June, 2019). Transfer learning for the Choquet integral. *IEEE Int. Conf. Fuzzy Systems*.
 85. S. Kabir, C. Wagner, T.C. Havens and D.T. Anderson (June, 2019). Measuring similarity between discontinuous intervals – challenges and solutions. *IEEE Int. Conf. Fuzzy Systems*.
 86. I.T. Cummings, T.J. Schulz, J.P. Doane, S.A. Zekavat, and T.C. Havens (Oct, 2018). Information-theoretic optimization of full-duplex communication between digital phased arrays. *Allerton Conf. Comm., Control, and Comp.*, 373-377.
 87. T.C. Havens, A.J. Pinar, D.T. Anderson, and C. Wagner (July, 2018). SPFI: shape-preserving Choquet fuzzy integral for non-normal fuzzy set-valued evidence. *IEEE Int. Conf. Fuzzy Systems*.
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 94. T.C. Havens and A.J. Pinar (2017). Generating random fuzzy (capacity) measures for data fusion simulations. *IEEE Symp. Series Comp. Intell.*
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 97. S. Kabir, C. Wagner, U. Aickelin, D.T. Anderson, and T.C. Havens (2017). Novel similarity measure for interval-valued data based on their overlapping ratio. *IEEE Int. Conf. Fuzzy Systems*.
 98. T.C. Havens, C. Wagner, and D.T. Anderson (2017). Efficient modeling and representation of agreement in interval-valued data. *IEEE Int. Conf. Fuzzy Systems*.
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- 104.A. Webb, T.C. Havens, and T.J. Schulz (2016). Iterative image formation for forward looking GPR. *MSS Battlefield, Survivability, and Discrimination*.
105. H. Sweidan and T.C. Havens (2016). Coverage optimization in a terrain-aware wireless sensor network. *IEEE Cong. Evolutionary Computation*, 3687-3694.
106. J. Manela and T.C. Havens (2016). Histogram particle swarm optimization (HistPSO): evolving non-parametric acceleration distributions. *IEEE Cong. Evolutionary Computation*, 2071-2076.
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121. M.P. Masarik, J. Burns, B.T. Thelen, and T.C. Havens (2015). GPR anomaly detection with robust principal component analysis. *Proc. SPIE*, 9454, 945414.
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123. A. Pinar, M. Masarik, J. Kelly, T.C. Havens, J. Burns, B. Thelen, and J. Becker (2015). Approach to explosive hazard detection using sensor fusion and multiple kernel learning with downward-looking GPR and EMI sensor data. *Proc. SPIE*, 9454, 94540B.
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 141. T.C. Havens, J.C. Bezdek, and M. Palaniswami (2013). Scalable single linkage hierarchical clustering for big data. *Proc. ISSNIP*, 396-401.
 142. T.C. Havens (2012). Approximation of kernel k-means for streaming data. *Proc. Int. Conf. Pattern Recognition*, 509-512.
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 157. D.T. Anderson, J.M. Keller, and T.C. Havens (2010). Learning fuzzy-valued fuzzy measures for the fuzzy-valued Sugeno fuzzy integral. *Proc. Int. Conf. Information Processing and Management of Uncertainty in Knowledge-Based Systems*, 6178, 502-511.
 158. T.C. Havens, J.C. Bezdek, and J.M. Keller (2010). A new implementation of the co-VAT algorithm for visual assessment of clusters in rectangular relational data. *Artificial Intelligence and Soft Computing*, Part I, 363-371.
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 168. T.C. Havens, C.J. Spain, N.G. Salmon, and J.M. Keller (2008). Roach infestation optimization. *Proc. IEEE Swarm Intelligence Symposium*, 1-7.
 169. T.C. Havens, J.M. Keller, M. Popescu, and J.C. Bezdek (2008). Ontological self-organizing maps for cluster visualization and functional summarization of gene products using Gene Ontology similarity measures. *Proc. IEEE Int. Conf. Fuzzy Systems*, 104-109.
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 171. T.C. Havens, J.M. Keller, E. MacNeal Rehrig, H.M. Appel, M. Popescu, J.C. Schultz, and J.C. Bezdek

(2008). Fuzzy cluster analysis of bioinformatics data composed of microarray expression data and Gene Ontology annotations. *Proc. North American Fuzzy Information Processing Society*, 1-6.

BOOK CHAPTERS AND OTHER ARTICLES

172. D.T. Anderson, M. Deardorff, T.C. Havens, S.K. Kakula, T. Wilkin, M.A. Islam, A.J. Pinar, and A.R. Buck (2020). Fuzzy integral = contextual linear order statistic. arXiv:2007.02874.
173. T.C. Havens, D.T. Anderson, K. Stone, J. Becker, and A.J. Pinar (2016). Computational Intelligence in Forward Looking Explosive Hazard Detection. In R. Abielmona et al. (Eds.), *Recent Advances in Computational Intelligence in Defense and Security* (pp. 13-44). Berlin: Springer.
174. T.C. Havens, J.C. Bezdek, and M. Palaniswami (2012). Incremental Kernel Fuzzy c-Means. In V. Pedrosa (Ed.), *Computational Intelligence: Revised and Selected Papers from IJCCI 2010* (pp. 3-18). Berlin: Springer.
175. M. Popescu, T.C. Havens, J.M. Keller, and J.C. Bezdek (2009). Clustering with Ontologies. In M. Popescu and D. Xu (Eds.), *Data Mining in Biomedicine Using Ontologies* (pp. 45-62). Boston, MA: Artech House.

INVITED TALKS

- Autonomy and Sensing for Disaster Prevention, Response, and Mitigation, *NO SPILLS Conference & NMAC Meeting* (Feb, 2023)
- MTU Great Lakes Research Center: Services and Facilities, *USCG Great Lakes Oil Spill Center of Expertise Stakeholder Workshop*, NOAA GLERL (Sept, 2022)
- Explainable deep fusion, *ISR-2 Seminar Series: Advancing Toward Modern Detection and Estimation Theory*, Los Alamos National Laboratory (July, 2020)
- Introduction to Deep Learning, *GSG Programming Seminar Series*, Michigan Tech Graduate Student Government (July, 2020)
- Introduction to Machine Learning with Python, *GSG Programming Seminar Series*, Michigan Tech Graduate Student Government (July, 2020)
- Explainable deep fusion, Technological University of Eindhoven (May, 2019)
- Interpretable deep fusion using non-linear deep learning architectures, Ford M.C. (March, 2019)
- Making sense of deep fusion using explainable AI, NGA (January, 2019)
- Agile simultaneous transmit and receive phased arrays, AFRL (November, 2018)
- How to win on trivia night: sensor fusion beyond the weighted average, AFIT (November, 2018)
- How to win on trivia night: sensor fusion beyond the weighted average, MIT LL (July, 2018)
- How to win on trivia night: sensor fusion beyond the weighted average, CCC (May, 2018)
- How to win on trivia night: sensor fusion beyond the weighted average, U. Mich. (March, 2018)
- Sensor fusion and radar signal processing, Argo AI (February, 2018)
- Agile simultaneous transmit and receive phased arrays, Mississippi State University (May, 2017)
- Regularized learning of linear order statistics, University of Nottingham, UK (June, 2016)
- Kernel clustering of big data, University of Missouri (March, 2015)
- Kernel clustering of big data, University of Nottingham, UK (February, 2013)
- Aggregating crowd-sourced data using fuzzy integrals and fuzzy measure of generalized accord, University of Missouri (March, 2013)
- Ontological self-organizing map, University of Missouri (March, 2012)
- Fuzzy kernel clustering of large scale biomedical and bioinformatics data, Wayne State University (October, 2011)
- Incremental fuzzy c-means for large-scale data
- Saginaw Valley State University (February, 2012)
 - Oakland University (September, 2011)
- Fuzzy kernel clustering of large-scale data
- Wayne State University (November, 2011)
 - Western Michigan University (October, 2011)

- University of Michigan-Flint (October, 2011)
 - University of Michigan-Dearborn (September, 2011)
 - University of Melbourne, Australia (May, 2011)
- Advances in clustering for next-generation data sets. Old Dominion University (April, 2011)
- Approximation of c-means clustering for large scale data. University of Missouri. (March, 2011)
- Computing with words using self-organizing maps. Michigan State University. (September, 2010)
- Fuzzy cluster analysis of genes using Gene Ontology similarity measures. University of Kansas (April, 2008)
- Exercise feedback system to improve efficacy and safety of elder's exercise routines. (March, 2008)
- RAND / Hartford Foundation Career Development Institute, RAND Corporation
- Recognition technology for the functional assessment of older adults. University of Illinois-Urbana Champaign (November, 2007)

ADVISING

PhD Students

- Current: Steven Senczyszyn (anticipated, 2028), Dylan Kangas (anticipated, 2028), Kevin Li (anticipated, 2028), Ian Helman (anticipated, 2028)
- Graduated: Evan Lucas (2023, Michigan Tech ICC), Stephen Whitaker (2022, NUWC-Newport), Adam Webb (2021, MTRI), Siva Krishna Kakula (2021, startup), Ian Cummings (2020, LANL), Sakineh Yazdanparast (2019, Cisco), Husam Sweidan (2018, CCC), Hanieh Deilamsalehy (2017, Adobe), Anthony Pinar (2017, Michigan Tech ECE)

MS Students: 12 graduated thesis students

Undergraduate Research

- Advisor, Summer Undergraduate Research Fellows: Aaron Dean (2018), Joshua Manela (2014)
- Advisor, Pavlis Honors College Academic Year Research Interns (2015-16, 2016-17, 2018-19, 2019-20)
- Co-advisor, IT/Oxygen Enterprise (2015-16)
- Advisor, Blue Marble Security: Security Team (2014-15)
- Advisor, College of Engineering Honors Program (2008), Advisees, Christopher Spain and Nathan Salmon, were two of ten undergraduates featured in, "The Challenges and Rewards of Undergraduate Research," the Summer 2008 cover story of *Midwest Engineer Magazine*. Published results of research in the *Proc. IEEE Swarm Intelligence Symposium 2008*.

PROFESSIONAL SERVICE

- Senior member, IEEE (Computational Intelligence Society)
- General Co-Chair, *IEEE OCEANS 2025*
- Member, IEEE Computational Intelligence Society Fuzzy Systems Technical Committee (2018 – present)
- Conference Publication Editor, IEEE Computational Intelligence Society (2021 – 2023)
- Member, IEEE Computational Intelligence Society Social Media Committee (2015 – 2023)
- Conflict of Interest Chair, *IEEE Int. Conf. Fuzzy Systems 2023*
- Plenary Chair, *IEEE Congress on Evolutionary Computation 2023*
- Member, *IEEE Trans. Fuzzy Systems* Best Paper Panel (2018 - 2022)
- Associate Editor, *IEEE Trans. Fuzzy Systems* (2012 – 2021)
- Co-Chair, IEEE CIS Task Force on Cybersecurity for Smart World (2017 – 2021)
- Panel Sessions Co-Chair, *IEEE Int. Conf. Fuzzy Systems 2021*
- General Co-Chair, *IEEE Int. Conf. Fuzzy Systems 2019*
- Area Chair: *IEEE Int. Conf. Fuzzy Systems 2015*
- Technical Program Committee: *IPMU 2020; CISDA-SSCI 2016; FUZZ-IEEE 2017, 2021; IEEE ISSNIP 2015; LAPR CIBB & PRIB 2013; IEEE WCCI 2012; IEEE CEC 2009*
- Session Chair: *SPIE DSS 2016, FUZZ-IEEE 2015, IPMU 2014, IEEE WCCI 2014*

- Special Session Co-Chair: Special Session on CI for Security, Surveillance, and Defense, *IEEE WCCI 2016*, Special Session on Emerging Applications and Extensions of Fuzzy Measures and Integrals, *FUZZ-IEEE 2013*
- Special Session Chair: Special Session on Fuzzy Logic and Fuzzy Systems for Very Large Data, *FUZZ-IEEE 2012*, Special Session on Large-Scale Clustering, *FUZZ-IEEE 2011*
- NSF reviewer (2021)
- External reviewer: Maryland Industrial Partnerships Program, National Institute of Justice, US Army ERDC, Research Grants Council—Hong Kong
- Journal reviewer, *Entropy*, *Fuzzy Sets and Systems*, *The Imaging Science Journal*, *Soft Computing*, *J. Intelligent and Fuzzy Systems*, *Neural Networks*, *J. Theoretical Biology*, *Digital Signal Processing*, *IEEE Trans. Pattern Analysis and Machine Intelligence*, *Int. J. Computers and Applications*, *Int. J. Uncertainty, Fuzziness, and Knowledge-Based Systems*, *IEEE Trans. Fuzzy Systems*, *IEEE Trans. Geoscience and Remote Sensing*, *IEEE Trans. Image Processing*, *IEEE Trans. Evolutionary Computation*, *Computational Intelligence Magazine*, *Pattern Recognition Letters*, *Information Sciences*, *J. Engineering and Computer Innovations*, *J. Computer Engineering Research*, *J. Computer Science and Technology*

HONORS AND AWARDS (*DENOTES TEACHING AWARD)

*Outstanding Enterprise Advisor, Michigan Technological University	(2023)
*IEEE Eta Kappa Nu, Beta Gamma Chapter, Professor of the Year	(2015)
*Jackson Creative Canvas Course Contest Award	(2014)
Best Paper – <i>FUZZ-IEEE</i>	(2012)
IEEE Franklin V. Taylor Memorial Award (best paper at <i>IEEE SMC</i>)	(2011)
NSF / CRA Computing Innovation Fellowship	(2010-2012)
NSF CI TraCS Postdoctoral Fellowship (declined)	(2010)
Best Paper – Midwest Nursing Research Society	(2009)
Preparing Future Faculty Fellowship	(2008-2009)
IEEE Computational Intelligence Society Student Travel Award	(2008, 2010)
MU Graduate Professional Council Student Travel Award	(2008)
Top-20 Amazing Graduate Student, University of Missouri	(2008)
Featured in <i>IEEE CI Magazine's</i> "Focus on Students"	(2008)
2 nd Place – Mizzou GPC Research and Creative Arts Forum	(2007)
NSF GK-12 Fellowship	(2006-2007)
2 nd Place – IEEE Computational Intelligence Society-Mizzou Chapter Poster Competition	(2006)
Best Exhibit Award – University of Missouri Engineering Open House	(2006)

CONSULTING ACTIVITY

Signature Research, Inc. , subject matter expert in AI and machine learning	(2018 –)
Thermoanalytics, Inc. , subject matter expert in AI and machine learning	(2017-2020)
ARiA LLC , subject matter expert in AI and machine learning	(2015-2016)

VISITING APPOINTMENT

Visiting Scholar, University of Melbourne , Australia	(2011, 2012)
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