ANUJ KARPATNE

Contact Details
+1 (540) 231-6420
karpatne@vt.edu
people.cs.vt.edu/karpatne

Mailing Address
1160 Torgersen Hall
Dept. of CS, Virginia Tech
Blacksburg, VA 24061

WORK EXPERIENCE

Assistant Professor 2018 – present
Department of Computer Science, Virginia Tech

PostDoctoral Associate 2017 – 2018
Kumar Research Group, University of Minnesota (UMN)

EDUCATION

PhD, Computer Science 2011 – 2017
University of Minnesota (UMN), Twin Cities
Thesis: "Predictive Learning with Heterogeneity in Populations"
Advisor: Vipin Kumar

Integrated M.Tech, Mathematics and Computing 2006 – 2011
Indian Institute of Technology Delhi (IITD)

RESEARCH INTERESTS

Science-guided machine learning; Knowledge-guided machine learning; Theory-guided data science; Physics-guided machine learning; Data mining and machine learning.

FUNDING

Total Amount: $18,541,374. Personal Share: $1,510,747.

- Naval Engineering Education Consortium (NEEC), "Seafloor Characterization From Free Fall Penetrometers Using Machine Learning ," **co-PI**, $390,766 (personal share: $138,839), Duration: 04/01/2022-03/31/2025.
- NSF-OAC-2118240, "HDR Institute: Imageomics: A New Frontier of Biological Information Powered by Knowledge-Guided Machine Learning," **VT PI**, $14,969,077 (personal share: $578,000), Duration: 10/01/2021-09/30/2026, Collaborative project in cooperative agreement with Ohio State University as the lead institution.
- NSF-IIS-2107332, "III: Medium: Physics-guided Machine Learning for Predicting Cell Trajectories, Shapes, and Interactions in Complex Dynamic Environments," **Lead PI**, $1,000,000 (personal share: $317,456), Duration: 10/01/2021-09/30/2025.
- NSF-OAC-1940247, "Collaborative Research: Biology-guided neural networks for discovering phenotypic traits," **VT PI**, $1,982,810 (personal share: $422,000), Duration: 10/01/2019-09/30/2022; Collaborative project with Battelle, Tulane University, Drexel University, and University of Washington Seattle's Children Hospital.
- NSF-IIS-2026710, "EAGER: Collaborative Research: III: Exploring Physics Guided Machine Learning for Accelerating Sensing and Physical Sciences," **VT PI**, $198,721 (personal share: $54,452), Duration: 05/01/2020-04/30/2022; Collaborative project with Ohio State University, SUNY Binghamton, and University of Massachussetts Lowell.

TEACHING

Instructor for "CS (STAT) 5525: Data Analytics I", Virginia Tech, Spring 2022.

Instructor for "CS (STAT) 5525: Data Analytics I", Virginia Tech, Fall 2021.

Co-Instructor for Tutorial on "Physics-Guided AI for Large-Scale Spatiotemporal Data" at KDD 2021 Conference, August 14, 2021.

Instructor for "CS (STAT) 5525: Data Analytics I", Virginia Tech, Spring 2021.

Instructor for a session on "Science Guided Machine Learning" at the Geilo Winter School, Norway (conducted virtually), 2021.

Instructor for "CS 6804: Science-guided Machine Learning", Virginia Tech, Fall 2020.

Instructor for "CS 4824 / ECE 4424: Machine Learning", Virginia Tech, Spring 2020.

Instructor for "CS(STAT) 5525: Data Analytics I", Virginia Tech, Fall 2019.

Instructor for "CS(STAT) 5525: Data Analytics I", Virginia Tech, Spring 2019.

Instructor for "CS 6804: Machine Learning Meets Physics", Virginia Tech, Fall 2018.

Instructor for Summer School on "Intelligent Systems for Geosciences (IS-GEO)", UT Austin, 2017.

HONORS AND AWARDS

Received the **Outstanding New Assistant Professor Award** by the College of Engineering at Virginia Tech in 2022.

Received the **Rising Star Faculty Award** by the Department of Computer Science at Virginia Tech in 2021.

Named the **Inaugural Research Fellow** by the Intelligent Systems for Geosciences (IS-GEO), sponsored by Petrobras, for 2019.

Recipient of the **Doctoral Dissertation Fellowship** by the University of Minnesota for 2015.

Recipient of University of Minnesota Informatics Institute **(UMII) Graduate Fellowship** for 2015.

Recipient of **Student Travel Awards** at SIAM International Conference on Data Mining (SDM) 2014 and 2015, IEEE International Conference on Data Mining (ICDM) 2015, Conference on Intelligent Data Understanding (CIDU) 2012, and Climate Informatics Workshop 2013, 2014, and 2016.

Recipient of two consecutive **Director's Merit Awards** at IIT Delhi.

ADVISING AND MENTORING ROLES

Advising or Co-advising the following Ph.D. students (6 in total):

- *Arka Daw*, Dept. of Computer Science, Virginia Tech (Fall 2018 – present).
- *Md Abdullah Al Maruf*, Dept. of Computer Science, Virginia Tech (Summer 2019 – present).
- *Mohannad Elhamod*, Dept. of Computer Science, Virginia Tech (Fall 2019 – present).
- *Jie Bu*, Dept. of Computer Science, Virginia Tech (Summer 2019– present).
- *Nikhil Muralidhar*, Dept. of Computer Science (co-advised with Prof. Naren Ramakrishnan), Virginia Tech (Spring 2021 – present).
- *Snehal More*, Dept. of Forest Resources and Environmental Conservation (co-advised with Prof. Randolph Wynne), Virginia Tech (Fall 2019 – present).

Advising or Co-advising the following M.S. students (4 in total):

- *Medha Sawhney*, Dept. of Computer Science, Virginia Tech (Fall 2021 – present).

- *Naveen Gupta*, Dept. of Computer Science (co-advised with Prof. Russell Hewett), Virginia Tech (Fall 2021 – present).
- *Hirva Bhagat*, Dept. of Computer Science (co-advised with Prof. Lynn Abbott), Virginia Tech (Spring 2022 – present).
- *Surendrabikram Thapa*, Dept. of Computer Science (co-advised with Dr. Abhijit Sarkar), Virginia Tech (Spring 2022 – present).

Advised or Co-advised the following graduated students (6 in total):

- *Zheng Li*, M.S. in Computer Science, Virginia Tech, Graduated in Spring 2020, First Employment: Vanguard.
- *Sandhya Bhaskar*, M.S. in Electrical and Computer Engineering (co-advised with Prof. Kevin Kochersberger), Virginia Tech, Graduated in Spring 2020, First Employment: Ford Research.
- *Ioannis Papakis*, M.S. in Computer Science (co-advised with Dr. Abhijit Sarkar), Virginia Tech, Graduated in Spring 2021, First Employment: Bertrandt.
- *Arya Shahadi*, M.S. in Computer Science (co-advised with Prof. Bahareh Nojabaei), Virginia Tech, Graduated in Spring 2021, First Employment: Lowe's.
- *Prathamesh Kalyan Mandke*, M.Eng. in Electrical and Computer Engineering (co-advised with Prof. Lynn Abbott), Virginia Tech, Graduated in Spring 2021, First Employment: Qualcomm.
- *Reza Sepasdar*, M.S. in Computer Science (co-advised with Prof. Maryam Shakiba), Virginia Tech, Graduated in Spring 2021, First Employment: IMS Engineers.

PROFESSIONAL SERVICE

Co-Editor-in-Chief (EiC) of the ACM Special Interest Group in Artificial Intelligence (SIGAI) quarterly newsletter, "AI Matters."

Senior Program Committee Member for SDM 2022.

Poster Co-chair for KDD 2022.

Poster Co-chair for the IEEE International Conference on Big Data 2020.

Workshop Co-chair for KDD 2019.

Co-organizer of "Third Symposium on Knowledge-guided Machine Learning," to be held as part of the AAAI Fall Symposium Series 2022.

Co-organizer of "Second Symposium on Science-guided AI," held as part of the AAAI Fall Symposium Series 2021.

Co-organizer of symposium on "Combining Artificial Intelligence and Machine Learning with Physics Sciences," held as part of the AAAI Spring Symposium Series 2021.

Co-organizer of session on "Knowledge Guided Machine Learning in Biology," in the Great Lakes Bioinformatics (GLBIO) Conference 2021.

Co-organizer of symposium on "Physics-guided AI for Accelerating Scientific Discovery," held as part of the AAAI Fall Symposium Series 2020.

Co-organizer of session on "How AI and Knowledge Centers are Changing Societal Views of Critical Earth Resources" at *American Association for the Advancement of Science (AAAS) Annual Meeting*, 2019.

Co-organizer of workshop on "Fragile Earth: Theory Guided Data Science to Enhance Scientific Discovery (FEED)" at *KDD*, 2018.

Convener for session on "Intelligent Systems for Geosciences: Accelerating Discovery and Building Community" at *AGU Fall Meeting*, 2017.

Program Committee Member for the following workshops and conferences:

- *AAAI* 2022, 2021, 2020 (AI for Social Impact Track), 2019; *KDD* 2022, 2021, 2020, 2019, 2018; *SDM* 2021, 2020, 2019; *SDM Workshop on Mining Big Data in Climate and Environment* 2017; *IEEE Big Data* 2020; *IJCAI* 2020, 2013;

Reviewer for the following conferences and journal proceedings:

- *NeurIPS 2019, ICML 2019, Medical Physics 2020, Remote Sensing of Environment 2019, Wiley Ecosphere 2018, IEEE Transactions on Knowledge and Data Engineering (TKDE) 2018, Elsevier: Information Sciences 2012.*

INVITED TALKS

[T21] "Science-guided Machine Learning: Advances in an Emerging Paradigm Combining Scientific Knowledge with Machine Learning," **Invited Talk in the AI-guided Materials Thrust Workshop organized by the College of Engineering at Virginia Tech**, April 8, 2022.

[T20] "Science-guided Machine Learning: Advances in an Emerging Paradigm Combining Scientific Knowledge with Machine Learning," **Invited Talk in the ML/AI Speaker Series of the Dept. of Civil and Environmental Engineering at Virginia Tech**, Feb 25, 2022.

[T19] "Biology-guided Neural Networks: Integrating Biological Knowledge with Neural Networks for Discovering Phenotypic Traits from Fish Images," **Invited Talk in the Session on Aquatic Sciences of the NSF-funded Second Workshop on Knowledge Guided Machine Learning**, August 10, 2021.

[T18] "Science-guided Machine Learning: Advances in an Emerging Paradigm Combining Scientific Knowledge with Machine Learning," **Invited Talk in the Seminar Series of the Dept. of Earth System Science at Stanford University**, April 21, 2021.

[T17] "Science-guided Machine Learning: Advances in An Emerging Paradigm Combining Scientific Knowledge with Machine Learning," **Invited Talk in the "Small Data Approaches in Earthquake Engineering" Session at the Earthquake Engineering Research Institute (EERI) Annual Meeting**, March 25, 2021.

[T16] "Science-guided Machine Learning: Advances in an Emerging Paradigm Combining Scientific Knowledge with Machine Learning," **Invited Talk as a Featured Speaker in the University of Idaho Institute for Modeling Collaboration and Innovation Seminar Series**, March 11, 2021.

[T15] "Science-guided Machine Learning: Advances in An Emerging Paradigm Combining Scientific Knowledge with Machine Learning," **Invited Talk at the Engineering Mechanics Seminar Series in the Dept. of Biomedical Engineering and Mechanics (BEAM) at Virginia Tech**, January 27, 2021.

[T14] "Science-guided Machine Learning: Advances in An Emerging Paradigm Combining Scientific Knowledge with Machine Learning," **Invited Talk at the Indian Symposium on Machine Learning (IndoML)**, December 18, 2020.

[T13] "Science-guided Machine Learning: Advances in An Emerging Paradigm Combining Scientific Knowledge with Machine Learning," **Invited Talk in the Plenary Session of the NSF-funded Workshop on Knowledge Guided Machine Learning: A Framework for Accelerating Scientific Discovery**, August 18, 2020.

[T12] "Physics-guided Machine Learning: Advances in an Emerging Paradigm Combining Scientific Knowledge with Machine Learning," **Invited Talk at the Macromolecules Innovation Institute (MII) Workshop on "Learning About Machine Learning"**, November 4, 2019.

[T11] "Theory-guided Data Science: Foundations of an Emerging Paradigm Combining Physics and Machine Learning," **Keynote Talk at DARPA Physics of AI (PAI) Review Meeting**, Ann Arbor, MI, October 2, 2019.

[T10] "Theory-guided Data Science: How Can Machine Learning and Physical Knowledge Come Together to Accelerate Scientific Discovery," **Invited Talk at Oak Ridge National Lab (ORNL) AI Workshop**, Oak Ridge, TN, September 20, 2019.

[T9] "Physics-guided Data Science: Challenges and Opportunities in Combining Machine Learning with Physical Knowledge in Geosciences," **Invited Talk at the VT Office of GIS and Remote Sensing (OGIS) Research Symposium**, April 26, 2019.

[T8] Lightning Talk Representing the NSF Expeditions project: "Understanding Climate Change: A Data-driven Approach" at the **NSF Expeditions in Computing PI Meeting: 10 Years of Transforming Science and Society**, Washington D.C., December 10, 2018.

[T7] "Theory-guided Data Science: A New Paradigm for Scientific Discovery from Data," **Invited Talk at UCLA IPAM Workshop on HPC for Computationally and Data-Intensive Problems**, November 9, 2018.

[T6] "Theory-guided Data Science: A New Paradigm for Scientific Discovery from Data," **Invited Talk at IS-GEO Seminar for Energy Industry (with support from Petrobras) at Texas Advanced Computing Center (TACC)**, September 20, 2018.

[T5] "Theory-guided Data Science: A New Paradigm for Scientific Discovery Combining Physics with Machine Learning," **Invited CISL Seminar Talk at National Center for Atmospheric Research (NCAR)**, May 3, 2018.

[T4] "Theory-guided Data Science: A New Paradigm for Scientific Discovery from Data," **Invited Talk at Oak Ridge National Laboratory (ORNL)**, March 6, 2018.

[T3] "How Can Physics Inform Deep Learning Methods in Earth System Science?: Recent Progress and Future Prospects," **Invited Keynote Talk at ICDM Workshop on Data Mining in Earth System Science**, November 18, 2017.

[T2] "Theory-guided Data Science: A New Paradigm for Scientific Discovery in the Era of Big Data," **Invited Talk at American Institute of Chemical Engineers (AIChE) Annual Meeting**, October 30, 2017.

[T1] "Global Monitoring of Inland Surface Water Dynamics Using Remote Sensing Data," **Invited Talk at 96th American Meteorological Society Annual Meeting**, January 11–14, 2016.

PANEL DISCUSSIONS

[PD6] "Leveraging AI to Extend Specimen Networks," **Discussion Session at the Fifth Annual Digital Data Conference Organized by iDigBio**, Virtual, June 9, 2021.

[PD5] " AI Research Challenges in Accelerating Material Science and Engineering," **Panel Discussion in the NSF-funded Workshop on Accelerating Materials Discovery, Design, and Synthesis: A Grand Challenge for Artificial Intelligence**, Virtual, April 9, 2021.

[PD4] "Data Mining Challenges and Opportunities for Earth Science," **Panel Discussion at ACM SIGKDD 2019 Earth Day Session**, Anchorage, AK, August 5, 2019.

[PD3] "Augmenting Advances in the Next Century: Why AI and Knowledge-Centered Research in Geosciences Is Important Now and How It Will Change the Next Century I," **Panel Discus-**

sion Session at American Geophysical Union (AGU) Annual Meeting, Washington D.C., December 10, 2018.

[PD2] "Theory-guided Data Science: A New Paradigm for Scientific Discovery," **Panel Discussion at International Conference on Scientific and Statistical Database Management (SSDBM)**, June 29, 2017.

[PD1] "Understanding and Narrowing Gaps Between Data Science and Mechanistic Theories in Physical Sciences," **Panel Discussion at SDM Workshop on Mining Big Data in Climate and Environment**, April 29, 2017.

PUBLICATIONS

Note: Authors that are my direct advisees are underlined.

BOOKS

[B2] **A. Karpatne**, R. Kannan, and V. Kumar (Eds.), "Knowledge-guided Machine Learning: Accelerating Discovery using Scientific Knowledge and Data," *Data Mining and Knowledge Discovery Series of CRC Press*, to appear in July 2022.

[B1] P. Tan, M. Steinbach, **A. Karpatne**, and V. Kumar "Introduction to Data Mining (2^{nd} Ed.)," *Pearson Addison–Wesley*, ISBN-13: 978-0133128901, 2018.

JOURNAL ARTICLES

[J22] A. Khandelwal, **A. Karpatne**, P. Ravirathinam, R. Ghosh, Z. Wei, H. Dugan, P. Hanson, and V. Kumar, "ReaLSAT, A Global Dataset of Reservoir and Lake Surface Area Variations," *Nature Scientific Data*, 9, 356, 2022 (Impact Factor: 9.051).

[J21] A. Ghosh, M. Elhamod, J. Bu, W.-C. Lee, **A. Karpatne**, and V. Podolskiy, "Physics-Informed Machine Learning for Optical Modes in Composites," *Advanced Photonics Research*, 2200073, 2022, DOI: `https://doi.org/10.1002/adpr.202200073` (Impact Factor: 7.08).

[J20] R. Sepasdar, **A. Karpatne**, and M. Shakiba, "A data-driven approach to full-field nonlinear stress distribution and failure pattern prediction in composites using deep learning," *Computer Methods in Applied Mechanics and Engineering*, 397, 115126, 2022 (Impact Factor: 6.756).

[J19] M. Elhamod, J. Bu, C. Singh, M. Redell, A. Ghosh, V. Podolskiy, W.-C. Lee, and **A. Karpatne**, "CoPhy-PGNN: Learning Physics-guided Neural Networks with Competing Loss Functions for Solving Eigenvalue Problems," *ACM Transactions on Intelligent Systems and Technology (TIST)*, 2022 *(accepted)* (Impact Factor: 2.861).

[J18] N.R. Ashwin, Z. Cao, N. Muralidhar, D. Tafti, and **A. Karpatne**, "Deep Learning Methods for Predicting Fluid Forces in Dense Particle Suspensions," *Powder Technology*, 401, 117303, 2022 (Impact Factor: 5.134).

[J17] M. Elhamod, K.M. Diamond, A.M. Maga, Y. Bakis, H.L. Bart, P. Mabee, W. Dahdul, J. Leipzig, J. Greenberg, B. Avants, and **A. Karpatne**, "Hierarchy-guided Neural Networks for Species Classification," *Methods in Ecology and Evolution*, 00, 1-11, 2021, DOI: `https://doi.org/10.1111/2041-210X.13768` (Impact Factor: 7.78).

[J16] A. Shahdi, S. Lee, **A. Karpatne**, and B. Nojabaei, "Exploratory Analysis of Machine Learning Methods in Predicting Subsurface Temperature and Geothermal Gradient of Northeastern United States," *Geothermal Energy: Science, Society, and Technology*, 9(18), 2021, DOI: `https://doi.org/10.1186/s40517-021-00200-4` (Impact Factor: 2.8).

[J15] X. Jia, J. Willard, **A. Karpatne**, J.S. Read, J.A. Zwart, M. Steinbach, and V. Kumar, "Physics-guided machine learning for scientific discovery: An application in simulating lake temperature profiles," *ACM Transactions on Data Science*, 2 (3), 1-26, 2021.

[J14] Y. Dong, E. Spinei, and **A. Karpatne**, "A feasibility study to use machine learning as an inversion algorithm for aerosol profile and property retrieval from multi-axis differential absorption spectroscopy measurements," *Atmospheric Measurement Techniques*, 13 (10), 5537-5550, 2020 (Impact Factor: 4.176).

[J13] N. Muralidhar, J. Bu, Z. Cao, L. He, N. Ramakrishnan, D. Tafti, and **A. Karpatne**, "Physics-guided deep learning for drag force prediction in dense fluid-particulate systems," *Big Data Journal*, 8 (5), 431-449, 2020 (Impact Factor: 2.128).

[J12] P. C. Hanson, A. B. Stillman, X. Jia, **A. Karpatne**, H. A. Dugan, C. C. Carey, J.Stachelek, N. K. Ward, Y. Zhang, J. S. Read, and V. Kumar, "Predicting lake surface water phosphorus dynamics using process-guided machine learning," *Elsevier: Ecological Modelling*, 430, 109-136, 2020 (Impact Factor: 2.974).

[J11] J. S. Read, X. Jia, J. Willard, A. P. Appling, J. A. Zwart, S. K. Oliver, **A. Karpatne**, G. J. A. Hansen, P. C. Hanson, W. Watkins, M. Steinbach, and V. Kumar, "Process-guided deep learning predictions of lake water temperature," *Water Resources Research*, 55, 9173-9190, 2019 (Impact Factor: 5.240).

[J10] **A. Karpatne**, I. Ebert-Uphoff, S. Ravela, H. A. Babaie, and V. Kumar, "Machine Learning for the Geosciences: Challenges and Research Opportunities," *IEEE Transactions on Knowledge and Data Engineering*, 31(8), 1544-1554, 2019 (Impact Factor: 6.977).

[J9] *G. Atluri, ***A. Karpatne**, and V. Kumar, "Spatio-temporal Data Mining: A Survey of Data Types, Problems, and Methods," *ACM Computing Surveys*, 51(4), 83:1–83:41, 2018 (* equal contribution) (Impact Factor: 10.28).

[J8] **A. Karpatne**, G. Atluri, J. Faghmous, M. Steinbach, A. Banerjee, A. Ganguly, S. Shekhar, N. Samatova, and V. Kumar, "Theory-guided Data Science: A New Paradigm for Scientific Discovery from Data," *IEEE Transactions on Knowledge and Data Engineering (TKDE)*, 29(10), 2318–2331, 2017 (Impact Factor: 6.977).

[J7] *A. Khandelwal, ***A. Karpatne**, *M.E. Marlier, J. Kim, D. P. Lettenmaier, and V. Kumar, "An Approach for Global Monitoring of Surface Water Extent Variations Using MODIS Data," *Remote Sensing of Environment, Elsevier*, 202: 113–128, 2017 (* equal contribution) (Impact Factor: 10.164).

[J6] **A. Karpatne**, Z. Jiang, R. R. Vatsavai, S. Shekhar, and V. Kumar, "Monitoring Land Cover Changes: A Machine Learning Perspective," *IEEE Geoscience and Remote Sensing Magazine*, 4(2), 8–21, 2016 (Impact Factor: 8.225).

[J5] **A. Karpatne** and S. Liess, "A Guide to Earth Science Data: Summary and Research Challenges," *IEEE Computing in Science & Engineering*, 17(6), 14–18, 2015 (Impact Factor: 2.08).

[J4] F. Schrodt, J. Kattge, H. Shan, F. Fazayeli, J. Joswig, A. Banerjee, M. Reichstein, G. Bónisch, S. Díaz, J. Dickie, A. Gillison, **A. Karpatne**, S. Lavorel, P.W. Leadley, C. Wirth, I. Wright, S.J. Wright, and P.B. Reich, "BHPMF - A Hierarchical Bayesian Approach to Gap-filling and Trait Prediction for Macroecology and Functional Biogeography," *Global Ecology and Biogeography*, 24(12), 1510–1521, 2015 (Impact Factor: 7.148).

[J3] R. Khemchandani, **A. Karpatne**, and S. Chandra, "Twin Support Vector Regression for the Simultaneous Learning of a Function and its Derivatives," *International Journal of Machine Learning and Cybernetics*, 4(1), 51–63, 2013 (Impact Factor: 4.012).

[J2] R. Khemchandani, **A. Karpatne**, and S. Chandra, "Proximal Support Tensor Machines," *International Journal of Machine Learning and Cybernetics*, 4(6), 703–712, 2013 (Impact Factor: 4.012).

[J1] R. Khemchandani, **A. Karpatne**, and S. Chandra, "Generalized Eigenvalue Proximal Support Vector Regressor," *Expert Systems with Applications*, 38(10), 13136–13142, 2011 (Impact Factor: 6.954).

PEER-REVIEWED CONFERENCE PRESENTATIONS

[C22] J. Bu, A. Daw, M. Maruf, and **A. Karpatne**, "Learning Compact Representations of Neural Networks using DiscriminAtive Masking (DAM)," *NeurIPS*, 2021 (Acceptance Rate: 26%).

[C21] N. Muralidhar, J. Bu, Z. Cao, N. Raj, N. Ramakrishnan, D. Tafti, and **A. Karpatne**, "Phyflow: Physics-guided deep learning for generating interpretable 3d flow fields," *ICDM*, 2021 (Acceptance Rate: 20%).

[C20] I. Papakis, A. Sarkar, and **A. Karpatne**, "A Graph Convolutional Neural Network Based Approach for Traffic Monitoring Using Augmented Detections with Optical Flow," *IEEE International Intelligent Transportation Systems Conference (ITSC)*, 2980–2986, 2021.

[C19] A. Daw, M. Maruf, and **A. Karpatne**, "PID-GAN: A GAN Framework based on a Physics-informed Discriminator for Uncertainty Quantification with Physics," *KDD*, 2237–247, 2021 (Acceptance Rate: 15.4%).

[C18] M. Maruf and **A. Karpatne**, "Maximizing Cohesion and Separation in Graph Representation Learning: A Distance-aware Negative Sampling Approach," *SDM*, 271–279, 2021 (Acceptance Rate: 21.25%).

[C17] J. Bu and **A. Karpatne**, "Quadratic Residual Networks: A New Class of Neural Networks for Solving Forward and Inverse Problems in Physics Involving PDEs," *SDM*, 675–683, 2021 (Acceptance Rate: 21.25%).

[C16] J. Leipzig, Y. Bakis, X. Wang, M. Elhamod, K. Diamond, M. Maga, W. Dahdul, **A. Karpatne**, P. Mabee, H. Bart Jr., and J. Greenberg, "Biodiversity Image Quality Metadata Augments Convolutional Neural Network Classification of Fish Species," *International Conference on Metadata and Semantics Research (MTSR)*, 1355, 3-12, 2020 **(won best research paper award)** (Acceptance Rate: 24.6%).

[C15] A. Daw, R. Q. Thomas, C. C. Carey, J. S. Read, A. P. Appling, and **A. Karpatne**, "Physics-Guided Architecture (PGA) of Neural Networks for Quantifying Uncertainty in Lake Temperature Modeling," *SDM*, 532–540, 2020 (Acceptance Rate: 19.3%).

[C14] N. Muralidhar, J. Bu, Z. Cao, L. He, N. Ramakrishnan, D. Tafti, and **A. Karpatne**, "PhyNet: Physics Guided Neural Networks for Particle Drag Force Prediction in Assembly," *SDM*, 559–567, 2020 (**invited for special issue on "Best of SDM20" in the Big Data Journal**) (Acceptance Rate: 19.3%).

[C13] X. Jia, M. Wang, A. Khandelwal, **A. Karpatne**, and V. Kumar, "Recurrent generative networks for multi-resolution satellite data: An application in cropland monitoring," *IJCAI*, 2628–2634, 2019 (Acceptance Rate: 20%).

[C12] X. Jia, J. Willard, **A. Karpatne**, J. Read, J. Zwart, M. Steinbach, and V. Kumar, "Physics Guided RNNs for Modeling Dynamical Systems: A Case Study in Simulating Lake Temperature

Profiles," *SDM*, 558–566, 2019 (Acceptance Rate: 22.7%).

[C11] X. Jia, G. Nayak, A. Khandelwal, **A. Karpatne**, and V. Kumar, "Classifying Heterogeneous Sequential Data by Cyclic Domain Adaptation: An Application in Land Cover Detection," *SDM*, 540–548, 2019 (Acceptance Rate: 22.7%).

[C10] X. Jia, S. Li, A. Khandelwal, G. Nayak, **A. Karpatne**, and V. Kumar, "Spatial Context-Aware Networks for Mining Temporal Discriminative Period in Land Cover Detection," *SDM*, 513–521, 2019 (Acceptance Rate: 22.7%).

[C9] N. Muralidhar, M. Islam, M. Marwah, **A. Karpatne**, and Naren Ramakrishnan, "DANN: Incorporating Prior Domain Knowledge into Model Training," *IEEE Big Data*, 2018 (Acceptance Rate: 17.8%).

[C8] X. Jia, Y. Hu, A. Khandelwal, **A. Karpatne**, and V. Kumar, "Joint Sparse Auto-encoder: A Semi-supervised Spatio-temporal Approach in Mapping Large-scale Croplands," *IEEE International Conference on Big Data*, 1173–1182, 2017 (Acceptance Rate: 18%).

[C7] S. Agrawal, G. Atluri, **A. Karpatne**, S. Chatterjee, S. Liess, and V. Kumar, "Tripoles: A New Class of Relationships in Time Series Data," *ACM International Conference on Knowledge Discovery and Data Mining (KDD)*, 697–706, 2017 (Acceptance Rate: 17.5%).

[C6] X. Jia, X. Chen, **A. Karpatne**, and Vipin Kumar, "Identifying Dynamic Changes with Noisy Labels in Spatial-temporal Data: A Study on Large-scale Water Monitoring Application," *IEEE International Conference on Big Data*, 1328–1333, 2016 (Acceptance Rate: 19.39%).

[C5] **A. Karpatne** and V. Kumar, "Adaptive Heterogeneous Ensemble Learning Using the Context of Test Instances," *IEEE International Conference on Data Mining (ICDM)*, 787–792, 2015 (Acceptance Rate: 18.2%).

[C4] **A. Karpatne**, A. Khandelwal, and V. Kumar, "Ensemble learning methods for binary classification with multi-modality within the classes," *SDM*, (82) 730–738, 2015.

[C3] **A. Karpatne**, A. Khandelwal, S. Boriah, and V. Kumar, "Predictive learning in the presence of heterogeneity and limited training data," *SDM*, (29) 253–261, 2014.

[C2] **A. Karpatne**, M. Blank, M. Lau, S. Boriah, K. Steinhaeuser, M. Steinbach, and V. Kumar, "Importance of vegetation type in forest cover estimation," *NASA Conference on Intelligent Data Understanding (CIDU)*, 71–78, 2012.

[C1] *X. Chen, ***A. Karpatne**, *Y. Chamber, V. Mithal, M. Lau, K. Steinhaeuser, S. Boriah, M. Steinbach, V. Kumar, C.S. Potter, S.A. Klooster, T. Abraham, J.D. Stanley, and J.C. Castilla-Rubio, "A new data mining framework for forest fire mapping," *CIDU*, 104–111, 2012
(* equal contribution).

BOOK CHAPTERS

[BC6] A. Daw, **A. Karpatne**, W. Watkins, J. S. Read, and V. Kumar, "Physics-guided Neural Networks (PGNN): An Application in Lake Temperature Modeling," In *Knowledge-guided Machine Learning: Accelerating Discovery using Scientific Knowledge and Data*, A. Karpatne, R. Kannan, and V. Kumar (Eds.), Data Mining and Knowledge Discovery Series of CRC Press, to appear in July 2022.

[BC5] A. Daw, R. Q. Thomas, C. C. Carey, J. S. Read, A. P. Appling, and **A. Karpatne**, "Physics-Guided Architecture (PGA) of LSTM Models for Uncertainty Quantification in Lake Temperature Modeling," In *Knowledge-guided Machine Learning: Accelerating Discovery using Scientific Knowledge and Data*, A. Karpatne, R. Kannan, and V. Kumar (Eds.), Data Mining and Knowledge

Discovery Series of CRC Press, to appear in July 2022.

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