Tirtharaj Dash (he/him/his)

+1 (619) 878-0587 ◆ tdash [at] ucsd.edu ◆ tirtharajdash.github.io

Interests

Neuro-Symbolic Learning (combination of symbolic- and deep learning): Concepts, Implementations and Applications; Deep Learning: Concepts, Implementations and Applications; Graph Representation Learning: Concepts, Implementations and Applications; Machine Learning: Concepts, Implementations and Applications; Stochastic and Evolutionary Optimisation: Implementations and Applications.

Special interests: Drug discovery, Healthcare

Experience

University of California, San Diego Sep 2022 – present

Postdoctoral Scholar-Employee, The Boolean Lab
Supervisor: Debashis Sahoo
Funded by: The National Institute of Health (NIH), USA
Research: AI for Health, specifically: Boolean analysis of biological datasets and developing deep learning techniques to solve problems in the field of drug Discovery

APPCAIR, BITS Pilani Jun 2020 – Aug 2022

Assistant Professor (Grade-II)
Research: Involved in several collaborative research projects with industries and academia
Grants: The TCS DataLab Projects (PI, Co-PI), The Reflexis CoLab Project (Co-PI)

Birla Institute of Technology and Science Pilani Aug 2015 – Aug 2022

Assistant Professor (Grade-II), Dept. of Computer Science, K.K. Birla Goa Campus
Research: Member of Data Science Research Group
Teaching: Deep Learning*, Neural Networks*, Machine Learning*, AI, Database Systems
Others: Designing new courses for the university, developing laboratories, mentoring undergrad and grad students in several research projects, Coaching undergrad students for ACM-ICPC

National Institute of Science & Technology Berhampur May 2016 – Jul 2016

Summer Research Fellow, Center for Multiscale Modelling
Supervisor: Prabhat K. Sahu (Now at: Sambalpur University)
Research: Protein sequence analysis using machine learning methods

Indian Statistical Institute Kolkata May 2015 – Jul 2015

IASc-INSA-NASI Summer Research Fellow, ECS Unit
Supervisor: Nikhil R. Pal
Research: Studying the effects of various distance measures on Self Organizing Feature Map

National Institute of Science & Technology Berhampur Jun 2014 – Aug 2015

Assistant Professor, School of Computer Science
Research: Member of Center for Multiscale Modelling, Data Science Group
Teaching: Analysis and Design of Algorithms, Object-Oriented Programming
Others: Developing laboratories for research in data science

Veer Surendra Sai University of Technology Burla Aug 2012 – May 2014

Teaching and Research Assistant, Department of Computer Science and Engineering
Research: List update problems, Concepts and implementations of evolutionary neural networks
Teaching: Labs in programming, database systems; Tutorials for software engineering

Education

Birla Institute of Technology and Science Pilani, India Jan 2017 – May 2022
Ph.D. in Computer Science (Thesis submitted: May 13, 2022, defended: Jul 19, 2022)
Thesis: *Inclusion of Symbolic Domain-Knowledge into Deep Neural Networks* ▷www
Supervisor: Ashwin Srinivasan
Co-supervisor: Sukanta Mondal

Veer Surendra Sai University of Technology Burla, India Jul 2012 – Jun 2014
M.Tech. in Computer Science & Engineering (*GPA: 9.78/10; University medalist*)
Thesis: *Pattern Recognition using Soft Computing Approaches*
Supervisor: H.S. Behera

National Institute of Science and Technology, Berhampur, India Aug 2008 – Jul 2012
B.Tech. in Information Technology (*GPA: 8.91/10; Institute medalist*)
Thesis: *Designing Parallel Algorithms for Solving Ordinary Differential Equations*
Supervisor: Motahar Reza

Selected Honors & Awards

Best PhD Thesis Award from BITS Pilani, India 2023

Best Short Paper Award from the ACM in ACMSE 2022

ICML 2021 Workshop on Computational Biology Fellowship 2021

Selected to participate at the **Google Research India Graduate Symposium** 2021

AWSAR Award 2019 from DST, Govt. of India (Country Rank: **9** in Best-100 Category) 2020

Best Student Research Paper Award from the Machine Learning Journal in ILP 2018

Travel Grant from EurAI to attend ACAI-2018, Ferrara, Italy 2018

Summer Research Fellowship from NIST Berhampur 2016

IASc-INSA-NASI Summer Research Fellowship 2015

Qualified **Graduate Aptitude Test in Engineering (GATE)** 2012, 2015

Qualified **UGC National Eligibility Test (NET)** 2014

University Silver Medal for Best Post Graduate in Computer Science and Engineering 2014

GATE Scholarship from MHRD, India during my masters' studies 2012–2014

Participated in the Regional Round of the **ACM ICPC** 2012, 2013

Institute Silver Medal for Best Graduate in Information Technology 2013

Director's Certificates for Academic Performances during B.Tech. 2008–2012

Sponsored Proposals

1. R.P. Pradhan, T. Dash (Co-PI): Indian Ocean Region Seaport and vessel traffic atlas project for classroom teaching; Received funding of INR 140,000 from Teaching-Learning Center, BITS Pilani, Goa Campus for Oct 2021 – Mar 2022
2. T. Dash: The TCS DataLab Project; Received funding of INR 619,500 from TCS Research, India for Jul 2021 – Dec 2021
3. T. Dash: The TCS DataLab Project; Received funding of INR 619,500 from TCS Research, India for Jan 2021 – Jun 2021
4. A. Srinivasan, T. Dash (Co-PI): The TCS DataLab Project; Received funding of INR 2,550,000 from TCS Research, India for Jul 2019 – Jul 2020

5. A. Srinivasan, T. Dash (Co-PI): The CoLab Project; Received funding of INR 2,500,000 from Reflexis Systems, USA for Jul 2019 – Dec 2019
6. A. Srinivasan, T. Dash (Co-PI): The TCS DataLab Project; Received funding of INR 2,500,000 from TCS Research, India for Jan 2019 – Jun 2019

Refereed Journal Publications

1. B.R. Senapati, P.M. Khilar, T. Dash, R.R. Swain, "AI-assisted Emergency Healthcare using Vehicular Network and Support Vector Machine", *Wireless Personal Communication*, 2023, DOI: 10.21203/rs.3.rs-1224943/v1. (accepted: Mar 6, 2023)
2. R.R. Swain, T. Dash, P.M. Khilar, "Automated Fault Diagnosis in Wireless Sensor Networks: A Comprehensive Survey", *Wireless Personal Communications*, 2022, DOI: 10.1007/s11277-022-09916-3.
3. T. Dash, S. Chitlangia, A. Ahuja, A. Srinivasan, "A Review of Some Techniques for Inclusion of Domain-Knowledge into Deep Neural Networks", *Nature Scientific Reports*, 2022, DOI: 10.1038/s41598-021-04590-0.
4. I. Olier, O.I. Orhobor, T. Dash, A. Davis, L.N. Soldatova, J. Vanschoren, R.D. King, "Transformational machine learning: Learning how to learn from many related scientific problems", *Proceedings of the National Academy of Sciences of the U.S.A.*, 2021, DOI: 10.1073/pnas.2108013118. ▹news
5. T. Dash, A. Srinivasan, A. Baskar, "Inclusion of domain-knowledge into GNNs using mode-directed inverse entailment", *Machine Learning*, 2021, DOI: 10.1007/s10994-021-06090-8.
6. T. Dash, A. Srinivasan, L. Vig, "Incorporating symbolic domain knowledge into graph neural networks", *Machine Learning*, 2021, DOI: 10.1007/s10994-021-05966-z.
7. R. Kaushik, S. Jain, S. Jain, T. Dash, "Performance evaluation of deep neural networks for forecasting time-series with multiple structural breaks and high volatility", *CAAI Transactions on Intelligence Technology*, 2021, DOI: 10.1049/cit2.12002.
8. R.R. Swain, T. Dash, P.M. Khilar, "Lightweight approach to automated fault diagnosis in WSNs", *IET Networks*, 2020, DOI: 10.1049/iet-net.2019.0117.
9. R.R. Swain, T. Dash, P.M. Khilar, "A complete diagnosis of faulty sensor modules in a wireless sensor network", *Ad Hoc Networks*, 2019, DOI: 10.1016/j.adhoc.2019.101924.
10. T. Dash, S.N. Dambekodi, P.N. Reddy, A. Abraham, "Adversarial neural networks for playing hide-and-search board game Scotland Yard", *Neural Computing and Applications*, 2018, DOI: 10.1007/s00521-018-3701-0.
11. T. Dash, H.S. Behera, "A comprehensive study on evolutionary algorithm-based multilayer perceptron for real-world data classification under uncertainty", *Expert Systems*, 2018, DOI: 10.1111/exsy.12327. ▹ Listed in journal's most read articles in 2020
12. R.R. Swain, P.M. Khilar, T. Dash, "Fault diagnosis and its prediction in wireless sensor networks using regressional learning to achieve fault tolerance", *International Journal of Communication Systems*, 2018, DOI: 10.1002/dac.3769.
13. R.R. Swain, P.M. Khilar, T. Dash, "Multifault diagnosis in WSN using a hybrid metaheuristic trained neural network", *Digital Communications and Networks*, 2018, DOI: 10.1016/j.dcan.2018.02.001.
14. R.R. Swain, P.M. Khilar, T. Dash, "Neural network based automated detection of link failures in wireless sensor networks and extension to a study on the detection of disjoint nodes", *Journal of Ambient Intelligence and Humanized Computing*, 2018, DOI: 10.1007/s12652-018-0709-3.
15. P.P. Pai, T. Dash, S. Mondal, "Sequence-based discrimination of protein-RNA interacting residues using a probabilistic approach", *Journal of Theoretical Biology*, 2017, DOI: 10.1016/j.jtbi.2017.01.040.

16. R.R. Swain, T. Dash, P.M. Khilar, "An effective graph-theoretic approach towards simultaneous detection of fault(s) and cut(s) in wireless sensor networks", *International Journal of Communication Systems*, 2017, DOI: 10.1002/dac.3273.

17. T. Dash, "A study on intrusion detection using neural networks trained with evolutionary algorithms", *Soft Computing*, 2015, DOI: 10.1007/s00500-015-1967-z.

18. T. Dash, "Automatic navigation of wall following mobile robot using Adaptive Resonance Theory of Type-1", *Biologically Inspired Cognitive Architectures*, 2015, DOI: 10.1016/j.bica.2015.04.008.

19. T. Dash, P.K. Sahu, "Gradient Gravitational Search: An Efficient Metaheuristic Algorithm for Global Optimization", *Journal of Computational Chemistry*, 2015, DOI: 10.1002/jcc.23891.

Refereed Conference Publications

1. R. Patra, R. Hebbalaguppe, T. Dash, G. Shroff, L. Vig, "Calibrating Deep Neural Networks using Explicit Regularisation and Dynamic Data Pruning", *IEEE/CVF Winter Conference on Applications of Computer Vision* (WACV), 2023, DOI: 10.48550/arXiv.2212.10005. ▷ Spotlight Paper

2. V. Shah, A. Sharma, G. Shroff, L. Vig, T. Dash, A. Srinivasan, "Knowledge-based Analogical Reasoning in Neuro-symbolic Latent Spaces", *16th International Workshop on Neural-Symbolic Learning and Reasoning* (NeSy), 2022, DOI: 10.48550/arXiv.2209.08750. (accepted)

3. G. Chhablani, A. Sharma, H. Pandey, T. Dash, "Superpixel-based Knowledge Infusion in Deep Neural Networks for Image Classification", *ACM Southeast Regional Conference* (ACMSE), 2022, Virtual, USA, DOI: 10.1145/3476883.3520216. ▷ Best Short Paper Award

4. A. Sonwane, G. Shroff, L. Vig, A. Srinivasan, T. Dash, "Solving Visual Analogies Using Neural Algorithmic Reasoning (Student Abstract)", *AAAI Conference on Artificial Intelligence* (AAAI), 2022, DOI: 10.1609/aaai.v36i11.21664. [CORE: A*]

5. A. Lalwani, A. Saraiya, A. Singh, A. Jain, T. Dash, "Machine Learning in Sports: A Case Study on Using Explainable Models for Predicting Outcomes of Volleyball Matches", *2nd International Conference on Sports Engineering* (ICSE), 2022. DOI: 10.48550/arXiv.2206.09258

6. S. Chitlangia, A. Sonwane, T. Dash, L. Vig, A. Srinivasan, G. Shroff, "Using Program Synthesis and Inductive Logic Programming to solve Bongard Problems", *10th International Workshop on Approaches and Applications of Inductive Programming* (AAIP), 2021, Online.

7. T. Dash, A. Srinivasan, L. Vig, A. Roy, "Using Domain-Knowledge to Assist Lead Discovery in Early-Stage Drug Design", *30th International Conference on Inductive Logic Programming* (ILP), 2021, Online, DOI: 10.1007/978-3-030-97454-1_6. [CORE: B]

8. H. Shah, A. Vaswani, T. Dash, R. Hebbalaguppe, A. Srinivasan, "Empirical Study of Data-Free Iterative Knowledge Distillation", *30th International Conference on Artificial Neural Networks* (ICANN), 2021, Online, DOI: 10.1007/978-3-030-86365-4_44. [CORE: B]

9. A. Sharma, H. Pandey, G. Chhablani, Y. Bhartia, T. Dash, "LRG at SemEval-2021 Task 4: Improving Reading Comprehension with Abstract Words using Augmentation, Linguistic Features and Voting", *The 15th International Workshop on Semantic Evaluation* (SemEval), 2021, Online, DOI: 10.18653/v1/2021.semeval-1.21.

10. K. Mahajan, M. Sharma, L. Vig, R. Khincha, S. Krishnan, A. Niranjan, T. Dash, A. Srinivasan, G. Shroff, "CovidDiagnosis: Deep Diagnosis of Covid-19 Patients using Chest X-rays", *MICCAI Workshop on Thoracic Image Analysis* (TIA), 2020, Lima, Peru, DOI: 10.1007/978-3-030-62469-9_6.

11. S. Krishnan, R. Khincha, L. Vig, T. Dash, A. Srinivasan, "A Case Study of Transfer of Lesion-Knowledge", *MICCAI Workshop on Medical Image Learning with Less Labels and Imperfect Data* (MIL3ID), 2020, Lima, Peru, DOI: 10.1007/978-3-030-61166-8_15.

12. S. Yalburgi, T. Dash, R. Hebbalaguppe, S. Hegde, A. Srinivasan, "An Empirical Study of Iterative Knowledge Distillation for Neural Network Compression", *28th European Symposium on Artificial Neural Networks, Computational Intelligence and Machine Learning* (ESANN), 2020, Bruges, Belgium. [CORE: B]

13. T. Dash, A. Srinivasan, R.S. Joshi, A. Baskar, "Discrete Stochastic Search and Its Application to Feature-Selection for Deep Relational Machines", *28th International Conference on Artificial Neural Networks* (ICANN), 2019, Munich, Germany, DOI: 10.1007/978-3-030-30484-3_3. [CORE: B]

14. T. Dash, A. Srinivasan, L. Vig, O.I. Orhobor, R.D. King, "Large-Scale Assessment of Deep Relational Machines", *28th International Conference on Inductive Logic Programming* (ILP), 2018, Ferrara, Italy, DOI: 10.1007/978-3-319-99960-9_2. [CORE: B] ▷ Best Student Paper Award

15. P.S.M. Saladi, T. Dash, "Genetic Algorithm-Based Oversampling Technique to Learn from Imbalanced Data", *7th International Conference on Soft Computing for Problem Solving* (SocProS), 2017, IIT Bhubaneswar, India, DOI: 10.1007/978-981-13-1592-3_30.

16. S. Iyer, S. Chaturvedi, T. Dash, "Image Captioning-Based Image Search Engine: An Alternative to Retrieval by Metadata", *7th International Conference on Soft Computing for Problem Solving* (SocProS), 2017, IIT Bhubaneswar, India, DOI: 10.1007/978-981-13-1595-4_14.

17. R.R. Swain, T. Dash, P.M. Khilar, "Investigation of RBF Kernelized ANFIS for Fault Diagnosis in Wireless Sensor Networks", *International Conference on Computational Intelligence* (ICCI), 2017, IIT Kanpur, India, DOI: 10.1007/978-981-13-1135-2_20.

18. A. Saboo, A. Sharma, T. Dash, "GASOM: Genetic Algorithm Assisted Architecture Learning in Self Organizing Maps", *24th International Conference on Neural Information Processing* (ICONIP), 2017, Guangzhou, China, DOI: 10.1007/978-3-319-70087-8_25. [CORE: A]

19. P.N. Reddy, S.N. Dambekodi, T. Dash, "Towards Continuous Monitoring of Environment under Uncertainty: A Fuzzy Granular Decision Tree Approach", *ISEC Workshop on Development aspects of Intelligent Adaptive Systems workshop* (DIAS), 2017, Jaipur, India

20. T. Dash, T. Nayak, R.R. Swain, "Controlling Wall Following Robot Navigation Based on Gravitational Search and Feed Forward Neural Network", *International Conference on Perception and Machine Intelligence* (PerMIn), 2015, Kolkata, India, DOI: 10.1145/2708463.2709070.

21. T. Dash, S.K. Nayak, H.S. Behera, "Hybrid Gravitational Search and Particle Swarm Based Fuzzy MLP for Medical Data Classification", *International Conference on Computational Intelligence in Data Mining* (ICCIDM), 2014, Burla, India DOI: 10.1007/978-81-322-2205-7_4.

22. R. Mohanty, T. Dash, B. Khan, S.P. Dash, "An Experimental Study of a Novel Move-to-Front-or-Middle (MFM) List Update Algorithm", *International Conference on Applied Algorithms* (ICAA), 2014, Kolkata, India, DOI: 10.1007/978-3-319-04126-1_16.

Selected Preprints

1. S.B. Brahmavar, R. Rajesh, T. Dash, L. Vig, T.T. Verlekar, M.M. Hasan, T. Khan, E. Meijering, A. Srinivasan, "IKD+: Reliable Low Complexity Deep Models for Retinopathy Classification", *arXiv*, 2023, DOI: 10.48550/arXiv.2303.02310.

2. S.R. Chitnis, S. Liu, T. Dash, T.T. Verlekar, A. Di Ieva, S. Berkovsky, L. Vig, A. Srinivasan, "Domain-Specific Pretraining Improves Confidence in Whole Slide Image Classification", *arXiv*, 2023, DOI: 10.48550/arXiv.2302.09833.

3. A. Srinivasan, A. Baskar, T. Dash, D. Shah, "Composition of Relational Features with an Application to Explaining Black-Box Predictors", *arXiv*, 2022, DOI: 10.48550/arXiv.2206.00738.

4. A. Sonwane, G. Shroff, L. Vig, A. Srinivasan, T. Dash, "Solving Visual Analogies Using Neural Algorithmic Reasoning", *arXiv*, 2021, DOI: 10.48550/arXiv.2111.10361. (The short version of this preprint appears at AAAI-22: SA-00413.)
5. T. Dash, S. Chitlangia, A. Ahuja, A. Srinivasan, "Incorporating Domain Knowledge into Deep Neural Networks", *arXiv*, 2021, DOI: 10.48550/arXiv.2103.00180. (The journal version of this preprint is published at 10.1038/s41598-021-04590-0.)
6. R. Khincha, S. Krishnan, T. Dash, L. Vig, A. Srinivasan, "Constructing and Evaluating an Explainable Model for COVID-19 Diagnosis from Chest X-rays", *arXiv*, 2020, DOI: 10.48550/arXiv.2012.10787.

Patents

1. Method and System for Iterative Knowledge Distillation for Neural Network Compression (Filed at Indian Patent Office, Appl. No. 202021055409, 2021).

Participations & Talks

1. Invited Talk: "Graph Neural Networks: Concepts, Implementations and Application" at SAiDL-APPCAIR AI Symposium 2022, BITS Pilani, Goa Campus, India, October 9, 2022.
2. Invited Lecture: "Deep Learning in a Human-in-the-Loop Setting" at Amity University, Patna, India, September 2, 2022.
3. Invited Talk: "Deep Learning in a Human-in-the-Loop Setting" at IISER Pune, India, July 28, 2022.
4. Invited Talk: "Inclusion of domain-knowledge into GNNs using mode-directed inverse entailment" at The Intelligent Data Analysis Lab, Czech Technical University, Prague, June 30, 2022.
5. Invited Talk: "Human-in-the-Loop Machine Learning: Inclusion of Domain-Knowledge into Deep Neural Networks" at Davis Institute for Artificial Intelligence, USA, February 25, 2022.
6. Indo-German Spring School on Algorithms for Big Data, IIT Bombay, February 18-22, 2019 (also delivered a talk on: "Learning in the Presence of Expert Knowledge: A talk on Inductive Logic Programming").
7. Google Faculty Institute Program, Google India, December 11, 2018. I actively participated in various practical sessions on ML@Google.
8. Summer School on Statistical Relational AI (ACAI), Univ. of Ferrara, Italy, August 27-31, 2018. I was awarded official credit for this course: 30 Hours, 5 ECTS credits.

Professional Services

Editorial Board Member (mentioning the start year)

PLOS One	2023

Journal Reviewer (listing only the frequent ones and the start year)

IEEE Transactions on Industrial Electronics	2018
IEEE Transactions on Cybernetics	2018
Neural Processing Letters	2017
Information Fusion	2016

Program Committee Member

International Joint Conference on Artificial Intelligence (IJCAI-ECAI)	2022–2023
AAAI–International Workshop on Combining Learning and Reasoning (CLeaR)	2022

International Conference on Database Systems for Advanced Applications (DASFAA) 2022
International Joint Conference on Neural Networks (IJCNN) 2019–2023
International Conference on Inductive Logic Programming (ILP) 2019
International Conference on Artificial Neural Networks (ICANN) 2019–2022

Organising Member

International Conference on Computational Intelligence (ICCI) at IIT Kanpur 2017

Memberships and Affiliations

Association for Computing Machinery (ACM) 2019 – present

Computer Skills

GitHub	https://github.com/tirtharajdash
Languages	Python, MATLAB, C, C++, Unix shell
OS	Unix, Windows

Personal Details

DOB	July 3, 1991
Citizenship	Indian
Languages	English, Hindi, Odia, Sambalpuri
Postal Address	3844 Radcliffe Ln San Diego, CA 92122 USA

References

Available upon request.