Shounak Datta

ML Researcher
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Areas of specialization

Machine Learning * Deep Learning * Vision Transformers * Few-shot Learning * Imbalanced Classification * Multi-objective Optimization * Missing Features * Data Clustering

Research interests & experience

* Working on machine learning, data mining and stochastic optimization for 10+ years.
* Expertise on data analysis mechanisms like classification, clustering, feature learning, dimensionality reduction, etc.
* Proficient in deep learning platforms like Tensorflow, PyTorch, as well as Python programming.
* Expertise on machine learning with irregularities characterizing real-world data, such as class imbalance, missing feature values, sampling bias, etc.
* Experience on developing deep learning algorithms, specifically vision transformers, for resource-restricted and/or edge devices such as mobile phones, embedded systems, etc.
* Expertise on multi-objective optimization methods.
* Knowledgeable about convex as well as non-convex optimization techniques (including evolutionary computation).
* Supervised 20+ undergraduate and postgraduate research interns (from various notable academic institutes in India and USA) on projects leading to presentations, technical reports, dissertations, and papers since 2013.

Selected projects

2020-now **Developing and modifying deep learning models for deployment on resource-restricted devices**, ARM Research, Austin, TX, USA.

2020-now **Manifold preservation in deep few-shot learning models for better generalization**, (in adjunct capacity with) Electronics and Communication Sciences Unit, Indian Statistical Institute, Kolkata, India.

2019-2020 **Deep learning models for Glaucoma diagnosis**, Dept. of Electrical and Computer Engineering, Duke University, Durham, NC, USA.

2019-2020 **Counterfactual neural learning using weight rebalancing strategies**, Dept. of Electrical and Computer Engineering, Duke University, Durham, NC, USA.

2019-2020 **Deep natural language processing models for generating syntactically proper sentences**, Dept. of Electrical and Computer Engineering, Duke University, Durham, NC, USA.

2018-2019 **Deep generative network based resampling of data to tackle class imbalance in classification**, Electronics and Communication Sciences Unit, Indian Statistical Institute, Kolkata, India.

2013-2019 **Developing learning algorithms resilient to data irregularities such as class imbalance, small disjuncts, missing features**, Electronics and Communication Sciences Unit, Indian Statistical Institute, Kolkata, India.

2015-2019 **Developing fuzzy partitional clustering methods which can automatically determine the required level of fuzziness**, Electronics and Communication Sciences Unit, Indian Statistical Institute, Kolkata, India.

2011-2013 **Analysis and predicting of stock market indices**, Department of Electronics and Telecommunication, Jadavpur University, Kolkata, India.

2011-2013 **Developing electrooculogram based control mechanisms for wheelchair to facilitate rehabilitation**, Department of Electronics and Telecommunication jointly with the School of Bioscience and Engineering, Jadavpur University, Kolkata, India.

Positions held

2020-now ML Research Scientist, ARM Research, Austin TX, USA.

2019-2020 Postdoctoral Associate, Duke University, Durham NC, USA.

2015-2019 Senior Research Fellow, Indian Statistical Institute, Kolkata, India.

2013-2015 Junior Research Fellow, Indian Statistical Institute, Kolkata, India.

Education

2019 PH.D. in Computer Science, *On the Design of Learning Systems with Resilience to Data Irregularities*, Indian Statistical Institute, Kolkata, India, under the supervision of Prof. (Dr.) Swagatam Das

2013 M.E. in Electronics and Telecommunication Engineering (Specialization: Control Engineering), Jadavpur University, Kolkata, India. CGPA: **9.78**

2011 B.TECH. in Electronics and Communication Engineering, Maulana Abul Kalam Azad University of Technology, Kolkata, India. CGPA: **9.01**

Programming Languages & Tools

Tensorflow, Keras, Tensorflow-Lite, PyTorch, Python, MATLAB.
Experience of deploying deep learning workloads in the cloud using Amazon Web Services.
Experience of regularly coding collaboratively with a large team using Git.
Extensive experience of preparing articles and presentations using LaTeX.

Publications

16 journal- and 6 peer-reviewed conference-papers; for more details please visit Google Scholar page at https://scholar.google.co.in/citations?user=qtW4ugoAAAAJ

Journal articles

2021 "RetiNerveNet: Using Recursive Deep Learning to Estimate Pointwise 24-2 Visual Field Data based on Retinal Structure", Shounak Datta, Eduardo B Mariottoni, David Dov, Alessandro A Jammal, Lawrence Carin, Felipe A Medeiros, *Scientific Reports (Nature)*.

2021 "A black-box adversarial attack strategy with adjustable sparsity and generalizability for deep image classifiers", Arka Ghosh, Sankha Subhra Mullick, Shounak Datta, Swagatam Das, Asit Kr. Das, Rammohan Mallipeddi, *Pattern Recognition (Elsevier)*.

2020 "Appropriateness of Performance Indices for Imbalanced Data Classification: An Analysis", Sankha Subhra Mullick, Shounak Datta, Sourish Gunesh Dhekane, Swagatam Das, *Pattern Recognition (Elsevier)*.

2020 "Artificial Intelligence Mapping of Structure to Function in Glaucoma", Eduardo Mariottoni, Shounak Datta, David Dov, Alessandro Jammal, Samuel Berchuck, Ivan Tavares, Lawrence Carin, Felipe Medeiros, *Translational Vision Science and Technology (ARVO)*.

2019 "Boosting with Lexicographic Programming: Addressing Class Imbalance without Cost Tuning", Shounak Datta, Sayak Nag, Swagatam Das, *IEEE Transactions on Knowledge and Data Engineering*.

2019 "Fuzzy Clustering to Identify Clusters at Different Levels of Fuzziness: An Evolutionary Multi-Objective Optimization Approach", Avisek Gupta, Shounak Datta, Swagatam Das, *IEEE Transactions on Cybernetics*.

2018 "Clustering with Missing Features: A Penalized Dissimilarity Measure based approach", Shounak Datta, Supritam Bhattacharjee, Swagatam Das, *Machine Learning*.

2018 "Multi-Objective Support Vector Machines: Handling Class Imbalance with Pareto Optimality", Shounak Datta, Swagatam Das, *IEEE Transactions on Neural Networks and Learning Systems*.

2018 "Fast Automatic Estimation of the Number of Clusters from the Minimum Inter-Center Distance for Center-Based Clustering", Avisek Gupta; Shounak Datta; Swagatam Das, *Pattern Recognition Letters (Elsevier)*.

2018 "Handling data irregularities in classification: Foundations, trends, and future challenges", Swagatam Das, Shounak Datta, Bidyut B. Chaudhuri, *Pattern Recognition* 81, 674-693.

2018 "Adaptive Learning-Based k-Nearest Neighbor Classifiers With Resilience to Class Imbalance", Sankha Subhra Mullick, Shounak Datta, Swagatam Das, *IEEE Transactions on Neural Networks and Learning Systems*.

2017 "Generalized mean based back-propagation of errors for ambiguity resolution", Shounak Datta, Sankha Subhra Mullick, Swagatam Das, *Pattern Recognition Letters* 94, 22-29.

2017 "A Radial Boundary Intersection aided interior point method for multi-objective optimization", Shounak Datta, Abhiroop Ghosh, Krishnendu Sanyal, Swagatam Das, *Information Sciences* 377, 1-16.

2016 "A feature weighted penalty based dissimilarity measure for k-nearest neighbor classification with missing features", Shounak Datta, Debaleena Misra, Swagatam Das, *Pattern Recognition Letters* 80, 231-237.

2015 "Near-Bayesian Support Vector Machines for imbalanced data classification with equal or unequal

misclassification costs", Shounak Datta, Swagatam Das, *Neural Networks* 70, 39-52.

2012 "Development strategy of eye movement controlled rehabilitation aid using Electrooculogram", Anwesha Banerjee, Shounak Datta, Amit Konar, D. N. Tibarewala", *International Journal of Scientific and Engineering Research* 3 (6), 1-6.

Conference articles

2019 "Counterfactual Representation Learning with Balancing Weights", Serge Assaad, Shuxi Zeng, Chenyang Tao, Shounak Datta, Nikhil Mehta, Ricardo Henao, Fan Li, Lawrence Carin, *AISTATS 2021, Proceedings of*, 1972-1980.

2019 "Generative Adversarial Minority Oversampling", Sankha Subhra Mullick, Shounak Datta, Swagatam Das, *ICCV 2019*, 1695-1704.

2015 "Rough-Fuzzy Collaborative Multi-level Image Thresholding: A Differential Evolution Approach", Sujoy Paul, Shounak Datta, Swagatam Das, *MENDEL 2015, Proceedings of*, 329-341.

2013 "Real time electrooculogram driven rehabilitation aid", Anwesha Banerjee, Pratyusha Das, Shounak Datta, Amit Konar, Ramadoss Janarthanan, D. N. Tibarewala", *International Conference on Advances in Computing, Proceedings of the*, 435-440.

2012 "Single channel electrooculogram (EOG) based interface for mobility aid", Anwesha Banerjee, Sumantra Chakraborty, Pratyusha Das, Shounak Datta, Amit Konar, D. N. Tibarewala", *Intelligent Human Computer Interaction (IHCI), Proceedings of the 4th International Connference on*, 1-6.

2012 "Electrooculogram based online control signal generation for wheelchair", Anwesha Banerjee, Shounak Datta, Pratyusha Das, Amit Konar, D. N. Tibarewala, Ramadoss Janarthanan, *Electronic System Design (ISED), Proceedings of the International Symposium on*, 251-255.

Theses & Dissertations

2018 "On the Design of Learning Systems with Resilience to Data Irregularities", Shounak Datta, under the guidance of Prof. (Dr.) Swagatam Das, *Ph.D. Thesis*, Indian Statistical Institute, Kolkata, India.

2013 "Analysis and prediction of time series indices obtained from stock market indices", Shounak Datta, under the guidance of Prof. (Dr.) Amit Konar, *M.E. Dissertation*, Jadavpur University, Kolkata, India.

Preprint, Abstracts, and Others

2022 "Interval Bound Propagation–aided Few-shot Learning", Shounak Datta, Sankha Subhra Mullick, Swagatam Das, *arXiv* 2204.03511.

2020 "A Deep Learning-Based Mapping of Structure to Function in Glaucoma", Eduardo Mariottoni, Shounak Datta, David Dov, Alessandro Jammal, Samuel Berchuck, Ivan Tavares, Lawrence Carin, Felipe Medeiros, *Investigative Ophthalmology & Visual Science*.

2020 "Double robust representation learning for counterfactual prediction", Shuxi Zeng, Serge Assaad, Chenyang Tao, Shounak Datta, Lawrence Carin, Fan Li, *arXiv* 2010.07866.

2017 "Diversifying Support Vector Machines for Boosting using Kernel Perturbation: Applications to Class Imbalance and Small Disjuncts", Shounak Datta, Sayak Nag, Sankha Subhra Mullick, Swagatam Das, *arXiv* 1712.08493.

Professional activities

Reviewer Duties

2018-now IEEE Transactions on Knowledge and Data Engineering
2018-now IEEE Transactions on Neural Networks and Learning Systems
2017-now Transactions on Knowledge Discovery from Data (ACM)
2017-now Pattern Recognition (Elsevier)
2015-now Information Sciences (Elsevier)
2014-now Neurocomputing (Elsevier)
2014-now Engineering Applications of Artificial Intelligence (Elsevier)
2014-2015 IEEE Transactions on Systems, Man, and Cybernetics: Systems
2020 British Machine Vision Conference
2021 British Machine Vision Conference
2017 Ninth International Conference on Advances in Pattern Recognition
2015 Eight International Conference on Advances in Pattern Recognition

Grants Obtained

I have participated in the drafting of a successful grant application for the award of an NVIDIA Titan Xp GPU to my Ph.D. supervisor Prof. Swagatam Das.

Invited talks & lectures

2022 "Few-shot Learning", *Winter School on Deep Learning*, Indian Statistical Institute, Kolkata, India.
2022 "Ethics in Artificial Intelligence", *Winter School on Deep Learning*, Indian Statistical Institute, Kolkata, India.
2018 "Data Irregularities in Pattern Classification", *SSCVGIP 2018*, Indian Statistical Institute, Kolkata, India.
2014 "Evolutionary Algorithms", *Lectures on Bio-Inspired Computing*, Indian Statistical Institute, Kolkata, India.

Personal information

Born	September 03, 1989, Kolkata, India.
Nationality	Indian
Languages known	English (fluent) * Bengali (mother language) * Hindi (fluent)
Extracurricular interests	Painting, Calligraphy, Micrography, Graphic narratives