

# Soumadeep Saha

Senior Research Fellow, *Indian Statistical Institute, Kolkata*

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## Summary

My current research is focused on trying to inculcate key strengths of **symbolic AI** techniques, like **domain knowledge adherence**, **logical coherence**, etc., into **deep learning** systems. Addition of logical constraints and pre-existing knowledge not only makes these systems more aligned to critical applications but also makes them more data efficient. This problem shows up in many domains and thus leads me to

work in several fields like natural language, medicine, biology, astrophysics and diverse business applications.

I am a final year PhD candidate at the **Computer Vision and Pattern Recognition Unit, Indian Statistical Institute, Kolkata** working under the supervision of **Prof. Utpal Garain**.

## Education

**Indian Institute of Science Education and Research, Kolkata**

KOLKATA, INDIA

**Integrated BS-MS** (Major in Physics, Minor in Mathematics)

2015 – 2020

- ❑ Majored in **Physics** and a minor in **Mathematics**.
- ❑ Master's dissertation - **Towards Robust Deep Learning Systems**.

**Bhavan's G.K. Vidyamandir**

KOLKATA, INDIA

**10+2** (Pre-University Secondary Education)

2002 – 2015

- ❑ Scored 91.2% in CBSE 10th Standard and 92% in Senior Secondary (12th Standard) exams.
- ❑ Recipient of the prestigious National Talent Search Examination (NTSE) Scholarship from NCERT, Govt. of India.
- ❑ Recipient of the Kishore Vigyan Pratoshan Yojna (KVPY) fellowship from the Department of Science and Technology, Govt. of India.

## Publications

- ❑ **Language Models are Crossword Solvers** S. Saha, S. Chakraborty, S. Saha, U. Garain  
NAACL 2025 (main). Arxiv preprint, 10.48550/arXiv.2406.09043 Accepted 22/01/2025
- ❑ **Analyzing Semantic Faithfulness of Language Models via Input Intervention on Conversational Question Answering** A. Chaturvedi, S. Bhar, S. Saha, U. Garain, N. Asher  
Computational Linguistics, 10.1162/coli.a.00493 Accepted 17/7/2023
- ❑ **VALUED - Vision and Logical Understanding Evaluation Dataset** S. Saha, S. Saha, U. Garain  
DMLR, (13):1-18, 2024. Accepted 27/7/2024
- ❑ **MedTric : A clinically applicable metric for evaluation of multi-label computational diagnostic systems** S. Saha, U. Garain, A. Ukil, A. Pal, S. Khandelwal,  
PLOS One, 10.1371/journal.pone.0283895 Accepted 20/3/2023
- ❑ **DOST – Domain Obedient Self-supervised Training for Multi Label Classification with Noisy Labels** S. Saha, U. Garain, A. Ukil, A. Pal, S. Khandelwal  
AAAI 2024 Workshop (W3PHIAI), 10.1007/978-3-031-63592-2\_10 Accepted 15/12/2023
- ❑ **LADDER: Revisiting the Cosmic Distance Ladder with Deep Learning Approaches and Exploring its Applications** R. Shah, S. Saha, P. Mukherjee, U. Garain, S. Pal  
APJS, 10.3847/1538-4365/ad5558 Accepted 1/6/2024
- ❑ **Deep Learning Based Recalibration of SDSS and DESI BAO Alleviates Hubble and Clustering Tensions** R. Shah, P. Mukherjee, S. Saha, U. Garain, S. Pal  
Arxiv preprint, 10.48550/arXiv.2412.14750 Under review at PRL.

## Patents

- ❑ Method and System for Contradiction Avoided Learning for Multi-class Multi-label Classification  
S. Saha, U. Garain, A. Ukil, A. Pal  
US Patent - US12038949B2 Application Granted 16/07/2024
  - ❑ Method and System for Evaluating Clinical Efficiency of Multi-label Multi-class Computational Diagnostic Models  
U. Garain, S. Saha, A. Ukil, T. Deb, S. Richa A. Pal, S. Khandelwal  
Application No. 20221052587 Filed on 14th September 2022
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## Experience

- Helmholtz Visiting Researcher** Jul 24 – Sep 24  
Recipient of the Helmholtz Information and Data-science Academy (HIDA) visiting researcher grant to work at the Institute of Aerospace Medicine, DLR (German Aerospace Center).
  - Alleima** Mar 24 – May 24  
Worked on computer vision aided industrial automation scheme, delivering an end to end solution for object detection/tracking with cameras installed on the assembly line.
  - TCS Research** Nov 21 – Jul 22  
We worked on diagnosing cardiovascular diseases from ECG signals. I started from scratch, analysing the problem, and pointed out several key challenges that are not yet addressed in the literature, and came up with state of the art solutions, leading to two patents and publications.
  - Deep Analysis of Pain Management** Jun 20 – Nov 20  
Collaborated with medical professionals in the field of radiodiagnosis to formulate a problem statement and set up data gathering protocols to create a high quality data set for analysis of back pain from MRI images.
  - Teaching and Presentations**
    - ❑ Subject matter expert for Be10x - delivered video tutorials and live classes to 500+ participants (2024).
    - ❑ Organized a 4 day workshop for DataLab, **Capital One**, Bangalore (2023)
    - ❑ Instructor at the Winter School of Deep Learning (WSDL), ISI Kolkata (2021, 2022, 2023, 2024).
    - ❑ Instructor for the Comprehensive Course on Business Analytics, ISI Kolkata (2022).
    - ❑ TA for Natural Language Processing course at ISI Kolkata (2022, 2023, 2024).
    - ❑ Presented my work on Logically Coherent Deep Learning at Amazon Research Days (ARD 22)
    - ❑ Presented my work on Domain Obedient Self-supervision at W3PHIAI, 38th AAAI Conference, Vancouver, Canada (AAAI 24)
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## Skills

- ❑ I am intimately familiar with the state of the art vision (**SAM, CLIP, ViT, ResNet, etc.**) and language models (**LLMs, BERT, XLNet, etc.**).
  - ❑ In addition to being well-versed in supervised, semi-supervised and unsupervised training paradigms, I am also familiar with techniques like **Q-LORA, PEFT, fine-tuning, transfer learning, prompting, RAG, adversarial training, distillation, etc.**
  - ❑ Adept at Deep Reinforcement Learning (**DQN, PPO, MCTS, etc.**). Well-versed in time series modelling.
  - ❑ Significant expertise in Numpy, pyTorch and Python in general.
  - ❑ Have worked with several programming languages (C++, FORTRAN, bash, etc) and comfortable with Photoshop, GIMP, Premiere, 3D Modelling (blender), CAD (onshape),  $\text{\LaTeX}$ , HTML/CSS, etc.
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## Interests

- ❑ **DIY-ing** - I have an active interest in 3D printing, robotics, electronics, etc. I have conducted introductory workshops on robotics and was the Secretary of the Robotics and Astronomy club at IISER Kolkata.
  - ❑ **Music** - Classically trained pianist and enjoy listening to and performing works by Chopin, Beethoven, etc.
  - ❑ **Sports** - Represented my college in national level sports meets in Basketball and Volleyball. Played in my state's Senior Division Men's Basketball League.
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