Soumadeep Saha

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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 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*

I graduated with a major in **Physics** and a minor in **Mathematics**. The plethora of advanced Mathematics and Physics courses equipped me with the tools required to tackle today's challenges in the field of Deep Learning and gives me a deeper insight into its inner machinations. My master's dissertation dealt with the issue of **Adversarial Robustness in Deep Learning systems**. We found that there is a natural correspondence between the 'over-fitting' problem and the lack of robustness. We demonstrated that some of the techniques we use to avoid over-fitting also yield better adversarial robustness and that model architecture should be informed by these considerations.

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

❏ 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 March 20, 2023*

❏ 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, In Press — *Accepted July 17, 2023*

❏ DOST – Domain Obedient Self-supervised Training for Multi Label Classification with Noisy Labels — **S. Saha**, U. Garain, A. Ukil, A. Pal, S. Khandelwal
In Press.10.48550/arXiv.2308.05101 — *Accepted AAAI 2024 (W3PHIAI); December 15, 2023*

❏ VALUED - Vision and Logical Understanding Evaluation Dataset — **S. Saha**, S. Saha, U. Garain
arXiv preprint, 10.48550/arXiv.2311.12610 — *Submitted to DMLR; February, 2024*

❏ LADDER: Revisiting the Cosmic Distance Ladder with Deep Learning Approaches and Exploring its Applications — R. Shah, **S. Saha**, P. Mukherjee, U. Garain, S. Pal
arXiv preprint, 10.48550/arXiv.2401.17029 — *Submitted to ApJS; March, 2024*

Patents

❏ 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*

❏ Method and System for Contradiction Avoided Learning for Multi-class Multi-label Classification
S. Saha, U. Garain, A. Ukil, A.Pal
Application No. 202221062230 *Filed on 1st November 2022*

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).

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.

Lattice Gauge Theory Simulations May '19 – Jul '19
I worked on parallelising simulation programs for lattice gauge theory problems using OpenMP, meant to run on cutting edge massively parallel super computers under the supervision of Dr.Pushan Majumdar at IACS, Kolkata.

Teaching and Presentations

- ❏ Instructor at the Winter School of Deep Learning (WSDL), ISI Kolkata (2021, 2022, 2023).
- ❏ Insturctor for the Comprehensive Course on Business Analytics, ISI Kolkata (2022).
- ❏ TA for Natural Language Processing course at ISI Kolkata (2022, 2023).
- ❏ 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)

Skills

❏ I am intimately familiar with the state of the art vision (**ViT, ResNets, 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), LaTeX, HTML/CSS, etc.

Interests

❏ **Robotics** - I have an active interest in robotics, be it writing image processing or SLAM algorithms or designing a robot that can climb stairs. I have also 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.
❏ Also interested in DIY-ing, gardening, 3D printing, electronics, etc.
