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*
- ❏ Majored in **Physics** and a minor in **Mathematics**.
- ❏ Master's dissertation - **Adversarial Robustness in 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
Arxiv preprint, 10.48550/arXiv.2406.09043

❏ 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 - W3PHIAI 2024, 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*

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*

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)

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.
