Soumadeep Saha

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Education

2020 –

Senior Research Fellow at
Indian Statistical Institute, Kolkata

My current research is focused on trying to inculcate key features of **symbolic AI** techniques, like **domain knowledge augmentation, 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.

2015–2020

Integrated BS-MS from
Indian Institute of Science Education and Research, Kolkata

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 keeping these considerations in mind.

GPA : 7.8/10; **GRE** : 330/340

2013–2015

High School
Bhavan's G.K. Vidyamandir, Kolkata

I was awarded the prestigious national level **N.T.S.E.** scholarship in class X in addition to scoring **91.2%**. I was also a recipient of the esteemed **K.V.P.Y. Fellowship.** I passed my senior secondary examinations with a **92%** score. I also trained for olympiads and competitive programming and was selected for INOI.

Publications and Patents

Plos One	*MedTric : A clinically applicable metric for evaluation of multi-label computational diagnostic systems* S. Saha, U. Garain, A. Ukil, A. Pal, S. Khandelwal **Accepted** March 24, 2023, In press.
Computational Linguistics (submitted)	*Analyzing Semantic Faithfulness of Language Models via Input Intervention on Question Answering* A. Chaturvedi, S. Bhar, S. Saha, U. Garain, N. Ascher `https://arxiv.org/abs/2212.10696`
IEEE TNNLS (submitted)	*DOST : Domain Obedient Self-supervised Training for Multi Label Classification with Noisy Labels* S. Saha, U. Garain, A. Ukil, A. Pal, S. Khandelwal
TCS Research	Worked on improving metrics used for evaluation of computational diagnostic systems and making them more aligned to clinical practice. Patent filing is under processing at TCS.
TCS Research	Worked on improving algorithms for cardiovascular disease detection by domain knowledge augmentation. Patent filing is under processing at TCS.

Experience

2021–2022	**Worked with TCS Research** 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 (pending) and publications (ongoing).
2019–2020	**Worked on *Adversarially robust deep learning systems* under the supervision of Dr. Utpal Garain, CVPR, ISI Kolkata.** As part of my master's dissertation I explored the issue of **adversarial robustness** using several approaches like transfer learning, cryptography, and tried to construct a mathematical model for our understanding of adversarial examples. Developed key insights into training and deploying deep learning models, experience with tensorflow, ImageNet models, and language models.
Summer 2020	**Worked on *Deep Analysis of Pain Management* as a project student at CVPR, ISI Kolkata.** Collaborated with medical professionals in the field of radio diagnosis 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
Summer 2018, 2019	**Worked on *Pure SU(3) Lattice Gauge Simulations* under the supervision of Dr. Pushan Majumdar, IACS Kolkata.** I worked on parallelising simulation programs for lattice gauge theory problems using OpenMP, meant to run on cutting edge massively parallel super computers.

Skills

Deep Learning	I am intimately familiar with the state of the art vision and language models like **ViT, ResNets, BERT, RoBERTa, XLNet** and techniques like **adversarial training, fine-tuning, transfer learning** in addition to a solid grasp of the foundations. Well versed in time series modelling.
Programming	I am familiar with both Tensorflow and Torch down to a very granular level, and routinely implement complex problems end to end from scratch. High level proficiency in Python, and well versed in several languages.

Hobbies and 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.

- **Music** - Classically trained pianist and enjoy listening to and performing works by Chopin, Beethoven, etc