Curriculum Vitae

Name: Mainak Biswas
University: Indian Institute of Science, Bangalore.
Department: Brain and Artificial Intelligence
Date of Birth: 12th January, 1999.
Course: PhD
Nationality: Indian

CONTACT DETAILS

Phone Number: +918902186059
Email ID: mainak.biswas.dbl@gmail.com
Permanent Address: Flat no. 406, Dasarathi Apartment; 64, Amarendra Sarani, Uttarpara, Hooghly – 712258, West Bengal, India

ACADEMIC DETAILS

Examination	*Duration*	*Institute*	*Grade*
PhD (Engg.) in BAI	2021 -	Indian Institute of Science, Bangalore	10.00
B.E. in IT	2017 - 21	Jadavpur University, Kolkata	9.51
ISC (XII)	2015 - 17	Don Bosco School, Liluah	97.25%
ICSE (X)	2004 - 15	Don Bosco School, Liluah	96.00%

Academic Achievements

- GATE 2021: AIR: 111, Score: 846/1000.
- B.E. IT, Jadavpur University: Department rank: 2.
- Region topper in ISC 2017 (class 12).
- JEE Mains 2017: AIR-7698, score: 205/360.
- WBJEE 2017: Rank-643.
- Cleared National Talent Search Examination (NTSE - 1st round) in 2014-15 (District Rank: 1, qualified from West Bengal).
- Top 10% in NSEJS 2013.
- Ranked within top 20 (State rank) multiple times in NSTSE.

Publication details

1. ***Authors:*** Mainak Biswas; Saif Rahaman; Ali Ahmadian, Ph.D.; Kamalularifin Subari, Ph.D.; Pawan Kumar Singh, PhD
   Title: Automatic Spoken Language Identification Using MFCC based Time Series Features
   Journal: Multimedia Tools and Applications (2022)
   Link: https://link.springer.com/article/10.1007/s11042-021-11439-1 (published)
2. ***Authors:*** Mainak Biswas, Saif Rahaman, Abhishek Kumar Jha, Kshitij Kumar Singh, Sruti Gan Chaudhuri
   Title: Uniform Distribution of Fat Robots on a Circle Under Limited Visibility
   Conference: 2nd International Conference on Advanced Computing and Applications (ICACA 2021), organized by the Computer Society of India (CSI), Kolkata.
   Published in: Proceedings of International Conference on Advanced Computing Applications (2022)
   Link: https://link.springer.com/chapter/10.1007/978-981-16-5207-3_54 (presented and published)
3. ***Authors:*** Mainak Biswas, Saif Rahaman, Satwik Kundu, Pawan Kumar Singh, Ram Sarkar
   Title: Spoken Language Identification of Indian Languages Using MFCC Features
   Book: Machine Learning for Intelligent Multimedia Analytics (2021)
   Link: https://link.springer.com/chapter/10.1007/978-981-15-9492-2_12 (published)

Industry Experience

1. Student Trainee at *Samsung Research Institute, Bangalore (SRIB):* Summer internship from 18th May, 2020 to 13th July, 2020. Text Normalization using WFSTs was the project I worked on.

Research Projects and Experience

1. *Decoding Attention from EEG-data using deep learning:* We receive huge amount of information from our sensory organs. Attentions helps us to devote our brain's vital resources to the most important stimulus around us. This study aims to find neural signatures for attention using deep CNNs aided by embeddings. This study also shows that embeddings help us improve the classification ability of the model, by capturing variability in neural data amongst subjects. EEG recording of subjects performing a 2-AFC change detection tasks is used for this study. It also aims to understand the relationship between cues in an AFC and Posner task.
2. *Spoken Language Identification:* (i) Classification of Indian languages using MFCC features and machine learning (SVM) techniques. We also saw the effects of removing silent frames and how it ameliorated the performance of the classifier. (published)

   (ii) As the SVM model did not do very well (not scalable), I built a deep learning model (trained an ANN) that could perform any arbitrary Spoken language identification task. The model was trained on features that were obtained through analysis of multidimensional time series (MFCC) of audio clips. The relevant features were selected, and the model outperformed any state-of-the-art model. It obtained accuracies of over 99% in IITM and IIIT-H audio datasets and 98.5% on the Vox-Forge dataset. (published)

3. *Detection of emotion from speech data using Spectrograms:* Log-frequency spectrograms were extracted (with the goal of extracting overall attitude of the speaker), and deep CNN was trained. 98% accuracy was obtained on the RAVDESS dataset.

4. *Text Normalization and Composite Word Separation using WFSTs:* Developed a text normalization model (for several domains) using weighted finite state transducers. Also developed a composite word separator using WFST. This was done during my internship at Samsung (in Summer 2020).

5. *Algorithms for fat swarm robots to form geometric shapes:* (i) Developed an algorithm to move randomly initialized, independent, decentralized swarm robots to the circumference of a circular region. They know what is happening only within their limited visibility and in turn reposition themselves to form a uniform circle. (presented and published)

   (ii) Multiple uniform Circle formation by fat robots: The previous algorithm was enhanced so that robots randomly distributed could form multiple uniform circles without collision. The identical robots with limited visibility would run a totally distributed algorithm to reposition themselves on the circumference of arbitrary circles, uniformly. (Paper submitted, reviews awaited)

S/W Development Projects

1. *Social Networking Site for Sports Lovers:* Developed a java-based web application that allows user to follow their favourite teams/players and predict results of future matches. Based on the predictions the users are given rankings. It has a win predictor. There is full-fledged web-socket based chat feature that allows users to make groups, chat with other users, and even participate in public chatrooms pertaining to current sports events.

TECHNICAL SKILLS

1. *Mathematics:* In-depth understanding of Linear Algebra, Probability & Statistics, random processes, calculus, numerical methods, and group theory.
2. *Programming Languages:* C, C++, Java, Python, javascript, Web Development related technologies, Assembly, SQL, Matlab, R.
3. *Optimization Algorithms:* In-depth understanding of mathematics in optimization problems (like strongly convex, Lipschitz smoothness) and how they help us prove theoretical guarantees of speed of convergence of iterative algorithms like Gradient descent. Understands algorithms like proximal GD, SVRG, projected GD, and mirror descent.
4. *Machine Learning and Data Mining*: Good knowledge of supervised learning, unsupervised learning algorithms, and techniques for finding patterns in data.
5. *Deep Learning:* In-depth knowledge of state-of-the-art DL algorithms and architectures. Have used tensorflow, keras and pytorch in deep learning.
6. *Natural Language Processing:* Knowledge of Text Normalization, language identification, feature extraction from speech signal, language models. Worked on problems like natural language inference.
7. *Reinforcement Learning:* Good understanding of wide range of RL algorithms ranging from Bandits to Q-learning, actor critic models, safe-RL, etc. Have worked on safe RL via curriculum learning.
8. *Neuroscience & Detection theory:* Good understanding of SDT, drift diffusion model, and other statistical neural models. Basic understanding of neural mechanisms for vision, and attention.
9. Digital Signal Processing: Understanding of signal, systems, and operations on them like various transforms, convolutions etc. FFTand DFT has been extensively used in the task of Language Identification.

10. *Image Processing:* Understanding of basic algorithms like segmentation, filtering, edge detection.
11. *CS Fundamentals:* Strong understanding of data structures, algorithms, Object Oriented Programming, and relational database management systems.
12. *Operating Systems:* Sound knowledge about linux shell scripting *(BASH)* and other operating system concepts and basic distributed algorithms.
13. *Theory of Computation:* Good Understanding of Automata and Transducer Theory. Strong background in weighted automata too.

CO-CURRICULARS & EXTRA-CURRICULARS

- *Teaching Experience: (i)* Performed TA duties (helped in an NLP class) at Department of IT, Jadavpur University (Spring 22). *(ii)* Instructor at Unacademy (Physics), and has taught students from class 9-12 (Mathematics, Physics, Coding and Chemistry).

- *Chess:* Trained at Alekhine Chess Club (Gorky Sadan, Kolkata). Captained the school chess team. Won several interschool tournaments. Competed several times at DBCA tournaments, and tournaments organized by Alekhine chess club. Current Lichess Rating (online): 1550.

DECLARATION: I hereby declare that the information stated above are correct and up to the best of my knowledge.

Date: 12/06/2022