

Career Transition: Natural Language Processing (NLP) to Formal Methods

I have been working on NLP space for 3+ years. I am currently trying to move into Formal Methods space. I love to model complex social relationships, real world scenarios (specification) in Math. The opportunity to bridge the gap between abstract mathematical concepts and practical applications motivates me greatly to pursue Formal Method.

EDUCATION

University of Dhaka - Institute of Information Technology, Bachelors of Science in Software Engineering(BSSE) 3.93/4.00

Organizations: DU Band Society (DUBS), DSSE Research Group, IITSEC, Bangla AI Research, Technologies & Application (BARTA)

Accomplishment: Secured the 70th position out of 86,000+ students in the admission examination for University of Dhaka.

GRANTS

Advanced Research Fund | Samsung 2024

During my academic internship in Samsung R&D Institute, Bangladesh, I submitted a proposal for the Advanced Research Fund (ARF). After many verification and discussions, it was finally approved by headquarters. A grant of 3 man-months for 1 year was approved for my team against the project proposal, which is equivalent to ~2700000 Taka. Further details are classified.

Seed Funding for project “DU Bus Tracking System” | Dr. Naushin Nauer, University of Dhaka, Bangladesh 2024

I lead a startup on the project of “DU Bus Tracking System”. A preliminary funding sufficient for the first quarter of R&D was provided to the team by Dr. Naushin Nower, University of Dhaka. Our team includes 10 self-motivated members from the business and software engineering domain.

RESEARCH EXPERIENCE

NSF Funded Project “ACOSUS” | State University of New York, Old Westbury, USA Mar 2024 - Present

It's a joint project between 5 universities from the USA, namely Northeastern Illinois University, University of Houston - Victoria, California State Polytechnic University, Humboldt, State University of New York at Old Westbury and University of Texas at El Paso. I worked on the NLP technical part of this project.

Samsung R&D Institute, Bangladesh (SRBD) | Academic Internship Jan 2024 - June 2024

- o Submitted 2 SBPA extended abstracts and 1 Advanced Research Fund (ARF) proposal during my brief 6 months academic internship.
- o HQ Approved 1 SBPA extended abstract, the only one to receive HQ approval in the last 5 years at SRBD. I also secured the ARF.
- o Contributed to R&D in tasks involving LLM, Formal Methods, Fuzz, Smart Home, Testing, and deployment practices.

IIT, University of Dhaka | NLP Research & BARTA under Dr. Ahmedul Kabir May 2021 – Present

- o **Founding member** of the research group Bangla AI Research, Technology and Application (BARTA) under Dr. Ahmedul Kabir's supervision. With our efforts, the group now has grown to 13+ members, with external collaborators from Canada, USA and industry collaborators (SoftBD Ltd).
- o Established 7+ NLP and HCI projects under Dr. Kabir's supervision to onboard new undergraduates. Managed discussions with the Center for Disability Development, Bangladesh Deaf School and Chakma indigenous group for our survey tasks.
- o Researched topics in NLP, including Bayesian language models, normalization, word embeddings, Bangla Sign Language, spelling correction, topic modeling, information retrieval, stemmers, POS tagging, and more. Long experience with LLM based research tasks.
- o Organized dissemination sessions to promote BARTA's research philosophy, leading to a marked increase in undergrad research engagement.
- o **Publications:** Two manuscripts in progress:
 - *"Representation Discrimination of Ethnic People in Bangladesh"* (Target: CSCW(A), Abstract submission: October 28, 2024)
 - *"Stemming - The Evolution and Current State with a Focus on Bangla"* (Target: TALLIP (Q2))
- o **Supervision:** Oversee junior undergraduates in Bangla Sign Language, Chakma Language, and Knowledge Graph projects, for which I created initial prototypes to help them get started and currently guide them in writing papers.

Team Odyssey, University of Dhaka | Blockchain R&D Feb 2023 - Dec 2023

Under the supervision of Tahlil, an Web3 engineer, I developed 4 Web3 solutions that include both research and development tasks. Our efforts resulted in two awards (Finalist of National Blockchain Olympiad & 2nd Runners Up of ITVerse2.0). I learnt to work on Ethereum, Solana chains and did R&D on Zero Knowledge Proofs, AMM, Design patterns for Web3 etc.

IIT, University of Dhaka | Computer Vision Research under Dr. Mohammad Shoyaib Jan 01 - Jun 31, 2023

Opportunity to work on a government funded project for the first time in the Remittance Garments Industry. To better manage congestion in the assembly line, we built an “Assembly Line Management System” with a built-in congestion detection model. Dr. Shoyaib guided us through mathematical foundations of computer vision, specifically Nonnegative Matrix Factorization and how to work with noisy industry vision data.

PROFESSIONAL EXPERIENCE

Samsung R&D Institute, Bangladesh | Academic Internship Jan 2024 - June 2024

Worked on improving the testing process by introducing tools for Fuzzy Stress testing in the team and theoretical frameworks necessary for CMMI5. Opportunity to work on Smart Things, Samsung Fits, Smart Watch, Samsung Notes, Samsung Health and closely collaborated across teams.

An open platform for talented individuals to work together and develop new ideas. I worked on an AI driven distributed Food Crowdfunding Solution for 4 days with food business owners and chefs. It felt similar to workin on HCI discipline where you just use any tool to solve a problem.

Softanbees Technologies Limited, Kolkata, India | Data science Intern

Nov 2021 – Dec 2021

- o Creating models like Early Prediction of Birth Weight Based on Maternal Factors.
- o Constructing documentation for research and technical content.

DEVELOPMENT SKILLSET

Languages:	Python, JS, Solidity, E-Lisp, TS, Java, R, C, C++, SQL, Bash, Php, Rust, NuSMV, LTSA, TLA+, Alloy
Libraries and Frameworks:	Angular, NodeJS, OpenCV, Hardhat, Scikit-Learn, Actix Framework(Rust), BNLTk, Solana, Metaplex
Development Tools:	Git, Docker, Azure Cloud, Linux/UNIX, Emacs, Jupyter Notebook, Emacs, Wireshark, nmap
Others:	Software Requirements Specification, Database Administration, Linux System Administration

PROJECTS

Robustify Design Python, LTSA, Java	Formal Methods
o Implemented a layer of UML to LTL translation on top of a tool called Fortis for robustification of behavioral design against environmental deviation. I learnt to design simple systems using the LTSA tool for the task. It is my first work on FM.	
Assembly Line Management System Versatile Garments Ltd NodeJS, TypeScript, Angular, FastAPI, MySQL	Machine Learning
o Conducting experimentation to find a NMF-based approach at detecting congestion in the assembly line.	
o Performing Software Requirements Specification after communicating with Versatile Garments Ltd to design our system.	
Automated-Static-Control-Flow-Testing React, TypeScript, FastAPI, Python	Testing
o Parsing C code to generate static control flow graphs from scratch and then hoisting variables to test using heuristics.	
o Identifying independent paths and generating test cases for each of the independent paths discovered.	
DAOist Solidity, Hardhat, Design Patterns, IPFS	Blockchain
o A decentralized platform for DAO entities to communicate, vote NFTs and auction them using native DAO currency.	
o A liquidity pool to automatically adjust exchange rates between DAO currencies based on liquidity availability.	
o For each NFT exchange, Royalty is automatically transferred to the original owner of the NFT. Weighted voting scheme to select NFT.	
o Creational pattern to simplify the process of creating DAO currency with the Royalty system, along with the DAO community.	
Dhaka University Bus Tracking System Collaborative Project Azure, React, JavaScript, LeafletJS, MySQL	Startup
o Under the guidance of Dr. Naushin Nowar, leading a team of six towards creating a fast and scalable bus tracking system.	
o Designed a distributed, anonymous implementation of Bus Tracking System. along with their business model.	
NLP Library C++, Gprof, gdb, Cmake	SPL1
o Implemented language model and a wide variety of smoothing and segmentation techniques to preprocess and post-process the data.	
o Showed an application of the NLP library with a noisy channel model for spelling correction tasks and optimized existing research work.	
More on Github: abj-paul	

PUBLICATIONS

Stemming - The Evolution and Current State with a Focus on Bangla - On Review, EACL Conference September, 2023

With the advent of LLM and generative agents, the need for a good stemmer is at an all time high. Bangla, being a low-resource high-inflectional language, has a natural need for good stemmers. In this research, we look at existing progress and provide future directions.

AWARDS

- Team “Software Project Lab” received “ Best innovator team ” for 1st quarter during my academic internship in Samsung.	Jul, 2024
- Secured the 1st Runners-Up position in Blockchain Segment, ITVerse2.0, Bangladesh.	Nov, 2023
- Secured the 2nd Runners-Up position in Notre Dame Inter-University Ideathon Contest, Bangladesh.	Oct, 2023
- Secured 1st Runners-up position in Deep Learning Sprint, BUET, Bangladesh.	Jun, 2023
- Secured the 2nd Runners-up position in “MLBB Gaming Contest”, University of Dhaka, Bangladesh	Apr, 2023
- Finalist of National Blockchain Hackathon, Bangladesh	Dec, 2022
- Finalist of Bengali.AI contest, Bangladesh	Mar, 2022
- Champion of Datathon, Coding Object Private Limited, India.	Dec, 2020
- Received “Rising Star” award in Intra-sport Competition, IIT, University of, Bangladesh	Jan, 2020

SCHOLARSHIP

- Received Mitsubishi UFJ Foundation Scholarship Program FY 2024, Japan	Sep, 2024
- Received 2 Govt. Scholarship for Higher Secondary & Junior School Certification Examination, Bangladesh.	2015-2017, 2019-2023

CERTIFICATES

“Industrial Data Science in Python”, Coding Objects Private Limited, Kolkata, India.

2020