Tanjeem Azwad Zaman

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Research Interest

Computational Biology, Machine Learning, Algorithms

Education

BSc in Computer Science and Engineering (CSE) 2019 - 2024

Bangladesh University of Engineering and Technology (BUET)
CGPA: 4.00/4.00, Position: 1/113

Publications

Under Revision

A. Rafi, A. M. S. Rumi, S. A. Hakim, Sohaib, M. T. Tahmid, R. J. I. Momin, **T. A. Zaman**, R. Reaz, and M. S. Bayzid. "wQFM-TREE: highly accurate and scalable quartet-based species tree inference from gene trees," *bioRxiv*, 2024, under revision in *Bioinformatics Advances*. DOI: 10.1101/2024.07.30.605630

Preprints

T. A. Zaman, R. J. I. Momin, and M. S. Bayzid, "On the robustness to gene tree rooting (or lack thereof) of triplet-based species tree estimation methods," *bioRxiv*, 2024. DOI: 10.1101/2024.11.22.624944

M. T. Tahmid, **T. A. Zaman**, and M. S. Rahman, "GraFusionNet: Integrating Node, Edge, and Semantic Features for Enhanced Graph Representations," *bioRxiv*, 2024. DOI: 10.1101/2024.11.22.624875

H. A. Z. Sameen Shahgir, K. S. Sayeed, **T. A. Zaman**, M. A. Haider, S. S. R. Jony, and M. S. Rahman, "Ophthalmic Biomarker Detection Using Ensembled Vision Transformers and Knowledge Distillation," DOI: 10.48550/arXiv.2310.14005

Research Experience

Robustness to Gene Tree Rooting of Triplet-based Species Tree Estimation Methods
Supervised by Dr. Md Shamsuzzoha Bayzid August 2023 - present
(Computational Biology, Phylogenetics)

– Conducted rigorous empirical testing with different phylogenetic rooting techniques on input gene trees to evaluate its effect on the species trees estimated by triplet-based estimation methods like STELAR.

– Evaluated key parameters like RF Distance, Triplet and Quartet Scores for simulated datasets with varying ILS, gene counts, and base pairs. Considered correctness of inter-clade relationships for biological datasets.

– Identified and explained conditions where STELAR with algorithmic rootings yielded better performances than with Outgroup rooting, even outperforming the state-of-the-art species tree estimation method ASTRAL.

– Suggested an avenue for the underrated triplet-based methods to excel even when the true root is unknown.

Highly Accurate and Scalable Quartet-Based Species Tree Inference from Gene Trees
Supervised by Dr. Md Shamsuzzoha Bayzid August 2023 - July 2024
(Computational Biology, Phylogenetics, Algorithms)

– Addressed the scalability issues of the quartet-based species tree estimation method wQFM.

– Introduced wQFM-TREE, which uses graph theory, combinatorics, and data structures efficiently to avoid explicitly enumerating all possible quartets, as done in wQFM.

– Benchmarked against other state-of-the-art (SOTA) methods on simulated datasets (up to 2000 taxa), and empirical datasets (the One Thousand Plant Transcriptomes Initiative dataset).

– Showed that wQFM-TREE consistently outperformed or matched the accuracy of SOTA methods, ASTRAL and TREE-QMC - especially in cases with higher taxa; showcasing its competitiveness in large-scale phylogenetic analyses.

Ophthalmic Biomarker Detection using Ensembled Vision Transformers
Supervised by Dr. M. Sohel Rahman October 2023 - present
(Medical Imaging, Machine Learning)

– Used extensive data augmentations and meticulous ensembling of vision transformers to detect ophthalmic biomarkers from OCT scans, placing 1^{st} at the IEEE SPS VIP Cup 2023.

– Consulted an ophthalmologist to learn about local and global features. Ensembled MaxViT (utilizing its strided attention to focus on the former) and EVA-02 (that excels at detecting global features) for the winning idea.

– Used data augmentation strategies including random greyscale transformation, color jitter, random resized cropping, horizontal flipping, and random perspective shifts to enhance model robustness during training.
– Post-competition, utilized unlabelled data by adopting pseudolabeling and knowledge distillation to train a single MaxViT that matched our winning solution, while significantly reducing inference time and computational cost.

GraFusionNet: Dual Graph Autoencoders for Enhanced Graph Representations
Supervised by Dr. Mohammad Saifur Rahman November 2023 - present
(Cheminformatics, Machine Learning, Graph Neural Networks)

– Developed a Dual-Graph Autoencoder framework that effectively utilizes both node features and the traditionally overlooked edge features in graph-structured data.
– Made graphs using node and edge features from RDkit. Final features were composed of latent layers of separate Autoencoders trained on the graphs and their line-graphs, and the Embeddings extracted by ChemBERT from SMILES.
– Benchmarked on the Tox-21 dataset (a multi-label binary classification task) and the HIV dataset from MoleculeNet. Our approach was more accurate than other GNN-based methods using edge features (like Graph Transformers)
– Conducted ablation studies with different feature combinations, gaining insights into the efficiency of structural vs. semantic features in each classification task.

Work Experience

Adjunct Lecturer - Department of CSE, BUET August 2024 - present
Courses:
– [CSE211] Theory of Computation (Theory)
– [CSE326] Information Systems Development and Management (Lab)
– [CSE322] Computer Networks (Lab)
– [CSE210] Computer Architecture (Lab)
– [CSE200] Technical Writing and Presentation (Lab)

Machine Learning Intern - North-West Power Generation Company Limited, BD April 2023 - June 2023
– Part of an internship program organized by the Department of CSE, BUET
– Collected data from several sensors installed around the NWPGCL plant, and used ML models to predict the operational state of machinery

Software Development and Data Analytics Intern - Infolytx May 2023 - June 2023
– I was part of a team in charge of developing an app with real-time data analysis and visualization for a foreign client.
– Built a full-stack module from scratch: Data-Analysis (pandas), Backend (FastAPI), and Frontend development. (Javascript)

Projects

Implementing Paging and Copy-on-Write Techniques in xv6 - Operating System Sessional [Link]
Building a Subset C - Compiler - Compiler Sessional [Link]
Implementing Ray-Tracing - Computer Graphics Sessional [Link]
Brainlytic: an Interactive Problem Solving App in Bengali - Head of Content Team - under Dr. Anindya Iqbal [Link]
DoctorAid: organized EHRs for Doctors - using NodeJS, React, PostgreSQL - Software Development Sessional [Link]

Grants, Awards & Honors

***IEEE Upsilon Pi Epsilon Award 2023* - Winner** - by IEEE Computer Society [Link] 2023
***IEEE SPS Video and Image Processing Cup 2023* - Champion** - by IEEE SPS [Link] 2023
University Gold Medal* - *awarded to the highest CGPA holder in a graduating batch - by BUET 2024
Prime Minister's Gold Medal* - *awarded to highest CGPA holder in each faculty of grad. batch 2024
University Merit Scholarship and ***Dean's List Award*** - by BUET Authority 2020 to 2023
***Robi Datathon 3.0* - Runner-up** - by Robi, Axiata 2024
***International Physics Brawl* - 36^{th}, Category O** - by Charles University, Prague, Czechia 2022
***AI for Bangla 2.0* - Honorable Mention** - by the Govt. of Bangladesh (BD) 2023
***Inter University AI Contest* - 1^{st} Place** - by BUET CSE Dept. 2022
***Bangladesh Mathematical Olympiad (BdMO)* - National Champion and Camper** 2011 to 2018
***Bangladesh Physics Olympiad (BdPhO)* - National Winner and Camper** 2014 to 2018
***Bangladesh Biology Olympiad (BdBO)* - National Champion and Camper** 2017
***Bangladesh Olympiad in Informatics (BdOI)* - 3rd Place, Nationals** 2016
***Creative Talent Hunt* - National Winner, Math and ICT, Class 9-10** - by Govt. of BD 2015
Board Talentpool Scholarship (HSC and SSC) - by the Education Ministry of Bangladesh 2018, 2017
***International Assessment for Schools* - Gold in Math, Science and English** - by UNSW 2016, 2015, 2008

Affiliations and Volunteering

IEEE Computer Society Student Branch Chapter, BUET

Technical Committee, Chair 2022-2023
Treasurer 2021-2022
Technical Committee, Executive 2020-2021

Class Representative for 7 semesters - CSE, BUET 2019-2024

Content Team Head at Brainlytic [Link] 2020-2024
In charge of organizing and setting problems for an interactive math and logic-based problem-solving app.

Test Scores

GRE
Verbal: 165 (95%) | Quant: 170 (92%) | AWA: 4.5 (83%)
November 7, 2024

TOEFL (iBT)
Score: 120/120
August 24, 2024

Selected Programming Language Literacy

Python (PyTorch, Pandas, NumPy, Scikit-learn, Seaborn, Matplotlib), **C/C++, Bash, Java, JavaScript**

Hobbies

Playing the violin, competitive football (soccer)

References

Dr. Md. Shamsuzzoha Bayzid
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