

# AZAL AHMAD KHAN

Guwahati, Assam 781039

☎ +91-8957776840 ✉ azalahmadkhan@gmail.com ✉ k.azal@iitg.ac.in 🌐 azalahmadkhan.github.io

## Research Interests

Alignment in LLMs, Reasoning Capabilities in LLMs, LLM Inference, Prompting Techniques in LLMs

## Education

**Indian Institute of Technology Guwahati**

11/2020 – 05/2024(Expd.)

*Bachelor of Technology in Chemical Science and Technology*

*Guwahati, Assam*

**Thesis Advisor:** [Dr. Debanga Raj Neog](#), School of Data Science and Artificial Intelligence

**Thesis Title:** Trustworthy Language Models and Optimized Text-to-Image Synthesis via Direct Preference Optimization [[Thesis Part-1](#)] [[PPT](#)]

## Publications & Pre-prints

- [1] **Direct Preference Optimization for Prompt Engineering in Text-to-Image Synthesis**  
[Azal Ahmad Khan](#), Xinran Wang, Ahmad Faraz Khan, Ali Anwar, Debanga Raj Neog  
*Conference on Language Modeling 2024 (under review)* [ COLM 2024 ]
- [2] **Mitigating Sycophancy in Large Language Models via Direct Preference Optimization**  
[Azal Ahmad Khan](#), Sayan Alam, Xinran Wang, Ahmad Faraz Khan, Ali Anwar, Debanga Raj Neog  
*Conference on Language Modeling 2024 (under review)* [ COLM 2024 ]
- [3] **FLOAT: Federated Learning Optimizations with Automated Tunnings** 📄  
Ahmad Faraz Khan, [Azal Ahmad Khan](#), Samuel Fountain, Ahmed M. Abdelmoniem, Ali Butt, Ali Anwar  
*Association for Computing Machinery EuroSys 2024* [ ACM EuroSys 2024 ]
- [4] **PI-FL: Personalized and Incentivized Federated Learning** 📄  
Ahmad Faraz Khan, Xinran Wang, Qi Le, [Azal Ahmad Khan](#), Haider Ali, Jie Ding, Ali Anwar, Ali Butt  
*International Conference on Machine Learning (ICML) 2024 (under review)* [ ICML 2024 ]
- [5] **A quantum-inspired predator-prey algorithm for discrete optimization** 📄  
[Azal Ahmad Khan](#), Salman Hussain, Rohitash Chandra  
*Recent Advances in Algorithms for Swarm Systems 2024* [ RAASS 2024 ]
- [6] **Personalized Federated Learning Techniques: Empirical Analysis**  
[Azal Ahmad Khan](#), Ahmad Faraz Khan, Ali Anwar  
*IEEE Transactions on Parallel and Distributed Systems 2024 (under review)* [ IEEE TPDS 2024 ]
- [7] **A review of ensemble learning and data augmentation models for class imbalanced problems: combination, implementation and evaluation.** 📄  
[Azal Ahmad Khan](#), Omkar Chaudhari, Rohitash Chandra  
*Expert Systems With Applications 2024* [ Elsevier ESWA 2024 ]

## Experience

**Research Intern, University of Minnesota**

01/2022 – Present

Advisor: [Dr. Ali Anwar](#), Computer Science and Engineering, University of Minnesota

*Remote*

- Conducted empirical analysis on 10 personalized PFL across heterogeneous settings, providing valuable insights.
- Developed an incentivization approach in PFL, outperforming other algorithms in performance in non-IID settings.
- Improved federated learning efficiency by employing reinforcement learning to minimize staleness for non-IID clients.
- Leading research project at the intersection of parallelization and LLM to enhance inference speed and scalability.

## Research Intern, University of New South Wales

01/2022 – 12/2023

Advisor: [Dr. Rohitash Chandra](#), School of Mathematics and Statistics, University of New South Wales

Remote

- Co-authored 3 research papers and worked on quantum chemistry, computer optimization, and deep learning
- Developed a metaheuristic optimization algorithm that outperformed 8 SOTA methods in best solution and speed.
- Conducted computational analysis of data augmentation and ensemble learning to address class imbalance challenges.

## Research Intern, Yale University

06/2022 – 08/2022

Advisor: [Dr. David Van Dijk](#), Computer Science, Yale University

Remote

- Applied Deep Learning to model mesoscopic calcium imaging data, illuminating cognitive processes in brain dynamics.
- Applied Vision Transformers, Neural Ordinary Differential Equations, and Continuous Transformers on mice brain data.

## Other Research Projects

### QCMBO: Quantum Cat and Mouse Based Optimization Algorithm

08/2022 – 11/2022

Instructor: [Dr. Prakash Kotecha](#), Department of Chemical Engineering



- Developed a novel optimization algorithm inspired by quantum chemistry and natural laws.
- Evaluated the algorithm on 14 objective functions and applied it to production planning problems.
- QCMBO outperformed famous pre-developed algorithms like PSO, s-TLBO, and real-coded GA.
- Performed statistical analysis(t-test) and sensitivity analysis to show algorithms performance.

### DynamicNet: LC Detection with BiLSTM for Dynamic Environments in VSLAM 08/2023 – 11/2023

Instructor: [Dr. Arijit Sur](#), Department of Computer Science and Engineering



- Developed DL model using CNN and BiLSTM methods for Visual SLAM to improve accuracy in loop closure detection.
- Employed novel framework with ResNet-50 and Cosine Similarity Metric on New College and City Center Dataset.
- Outperformed SOTA methods by incorporating Dynamic Object Handling and Adaptive Thresholding Strategies.

## Grants

**Research Week with Google 2024** Received a travel grant to attend Research Week 2024 at Google Research, India.

## Services

**2024: Reviewer** Set-LLM workshop - ICLR 2024, Tiny Papers - ICLR 2024

**2023: Reviewer** GenBio workshop - NeurIPS 2023

## Positions and Volunteer Works

**Coordinator, Coding Club IITG:** Participated in conducting various events, courses, and projects. 06/2021-04/2022

**Associate, Consulting and Analytics Club:** Contributed to organizing various club events. 06/2021-04/2022

**Volunteer, NSS(National Service Scheme):** Participated in campaigns for student awareness. 08/2022-11/2022

**City Representative, Technothlon:** Represented Technothlon IIT G in multiple schools in the city. 06/2021-08/2021

## Technical Skills

**Programming:** Python, C/C++

**ML Tools:** Pandas, Numpy, Scipy, Matplotlib, Seaborn, Scikit-learn, Keras, Tensorflow, Pytorch, OpenCV, Hugging Face

**Miscellaneous:** Jupyter Notebook, Google Colab, Git, GitHub, SQL, L<sup>A</sup>T<sub>E</sub>X

**Web Technologies:** HTML, CSS, Bootstrap, Django

**Operating Systems:** MacOS, Windows

## References

[Dr. Ali Anwar](#)

Assistant Professor

University of Minnesota

aanwar@umn.edu

[Dr. Debanga Raj Neog](#)

Assistant Professor

IIT Guwahati

dneog@iitg.ac.in

[Dr. Rohitash Chandra](#)

Senior Lecturer

University of New South Wales

rohitash.chandra@unsw.edu.au