Sai Ashish Somayajula

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Research Interests

My research centers on developing ***Multi-Modal Foundational Models*** for specialized domains, such as healthcare and biology, by addressing associated challenges:

- **Data Synthesis:** Using ***LLMs*** to generate synthetic data, with meta-learning-based feedback to optimize data generation for specialized tasks.
- **Continual Learning:** Enabling ***LLMs*** to adapt to new data streams while retaining prior knowledge, ensuring reliable performance in dynamic environments.
- **Security and Reliability:** Developing watermarking techniques for ***LLMs*** to reliably distinguish between human-written and machine-generated content, crucial for ensuring data integrity in specialized domains.

Education

2020 - Present **University of California San Diego (UC San Diego)**, *CA*.
PhD, Electrical and Computer Engineering, *GPA: 3.96*
Advisor: Prof. Pengtao Xie

2016 - 2020 **Indian Institute of Technology Hyderabad (IIT H)**, *India*.
Bachelor of Technology; Major: Electrical Engineering, Minor: Computer Science and Engineering, *GPA: 9.68 (out of 10)*

- ***Academic Excellence Awardee*** *in academic terms 2016-2017, 2018-2019.*
- ***Second Highest*** *CGPA in B.Tech Program across all departments (240 students).*

Work Experience

June–Sept 2023 **Research Intern**, ***Apple***, Cupertino, CA, USA.

- Explored ***multi-modal LLMs***, developing innovative methods to enhance user interactions and optimize user experience on iPhones.

June–Sept 2022 **Research Intern**, ***Tencent AI Lab***, Bellevue, WA, USA.

- Enhanced ***BERT*** model performance by ∼10% on extremely low-resource datasets through data augmentation, employing a task-dependent similarity matrix, with both this matrix and model weights optimized via a *meta-learning-based* approach.

May–Aug 2019 **Research Intern**, ***Texas A&M University***, College Station, TX, USA.
Halliburton Engineering Global Program Scholar

- Developed a control algorithm for self-driving cars to navigate crowded environments by leveraging a pedestrian behavior model built with *Inverse Reinforcement Learning*.

May–Aug 2018 **Research Intern**, ***L.V Prasad Eye Institute*** **-** ***Research Center***, Hyderabad, Telangana, India.

- Developed deep learning models for segmenting the optic disc and hard exudates in fundus images, and the choroid layer in OCT images. Built a web portal for doctors to access and utilize these tools.

Foundational Model Initiatives

GeneChat: Foundational Model for Gene Function Prediction.
Leading an ongoing project to develop a ***multi-modal LLM*** for predicting gene functions, enabling natural language interaction for querying gene functions, and improving the accuracy and efficiency of genomic research.

Drug-Drug Interaction Foundational Model.
Developing a ***multi-modal LLM*** to predict drug interactions by analyzing their chemical structures, providing outputs on interaction likelihood, severity (high, moderate, low), and a natural language explanation of the interaction mechanism.

Foundational Model for DNA 3-D Structure Prediction.
Developing a ***foundational model*** to predict missing gene coordinates, improving the accuracy of reconstructing the 3-D structure of DNA by analyzing both sequence data and folding patterns.

Skills

- **Machine Learning:** Hugging Face, PyTorch, TensorFlow, spaCy, NLTK, Scikit-Learn, pre-training and fine-tuning *LLMs*, Proximal Policy Optimization (PPO).
- **Programming Languages:** Python, C++, MATLAB, Java, SQL, Bash/Unix, Git.
- **Software Packages:** OpenCV, Jupyter, Pandas, Keras, Numpy, Matplotlib, seaborn.

Selected Publications

ICML, 2024 Token-Specific Watermarking with Enhanced Detectability and Semantic Coherence for Large Language Models
Sai Ashish Somayajula*, Mingjia Huo*, Youwei Liang, Ruisi Zhang, Farinaz Koushanfar, and Pengtao Xie

NAACL, 2024 Generalizable and Stable Finetuning of Pretrained Language Models on Low-Resource Texts
Sai Ashish Somayajula, Youwei Liang, Abhishek Singh, Li Zhang, and Pengtao Xie

NAACL, 2024 AutoLoRA: Automatically Tuning Matrix Ranks in Low-Rank Adaptation Based on Meta Learning
Ruiyi Zhang*, Rushi Qiang*, **Sai Ashish Somayajula**, and Pengtao Xie

Scientific Reports, Nature, 2024 Improving Long COVID-Related Text Classification: A Novel End-to-End Domain-Adaptive Paraphrasing Framework
Sai Ashish Somayajula, Onkar Litake, Youwei Liang, Ramtin Hosseini, Shamim Nemati, David O. Wilson, Robert N. Weinreb, Atul Malhotra, and Pengtao Xie

Scientific Reports, Nature, 2024 Improving Image Classification of Gastrointestinal Endoscopy Using Curriculum Self-Supervised Learning
Han Guo, **Sai Ashish Somayajula**, Ramtin Hosseini, and Pengtao Xie

ACL, 2023 Bi-level Finetuning with Task-dependent Similarity Structure for Low-resource Training
Sai Ashish Somayajula, Lifeng Jin, Linfeng Song, Haitao Mi, and Dong Yu

TACL, 2022 A Multi-Level Optimization Framework for End-to-End Text Augmentation
Sai Ashish Somayajula, Linfeng Song, and Pengtao Xie

Awards and Honors

- Travel grant for ICML 2024, NAACL 2024.
- Best ***TA rating 10/10*** for ECE 208, Computational Evolutionary Biology, Spring 2023.
- Awarded the *Jacob School of Engineering Departmental Fellowship* for PhD studies at UC San Diego 2020.
- Microsoft Azure Award winner at the *Engineering the Eye-2018 Hackathon* 2018.
- Runners-up in the PwC Challenge on "Smart Cities" at *Megathon* 2017.
- Bronze Medal in the National Science Olympiad 2012.
- Secured a rank in the top 0.1% among 0.5 million students in the IIT-Joint Entrance Exam 2016.
- Diploma in Indian Carnatic Music, 2016.

Leadership

2021 **ENLACE program**, *UC San Diego*.
Led a team of college and high school students on the project '*Deep Learning Algorithms for Disease Segmentation in Chest X-rays*'; managed data preprocessing, model development, and evaluation, while fostering collaboration and technical skills.

2020 **First-Year PhD Representative**, *ECE Graduate Student Council, UC San Diego*.
Elected to represent and advocate for the needs and concerns of first-year PhD students in the department.

2018 **Elektronica Club**, *Head, IIT H*.
Led the Electronics and Signal Processing Club, fostering innovation and critical thinking in electronics and signal processing among students.

2017 **College Counsel**, *Co-Founder*.
Launched a startup that guided top-ranking students from India's prestigious IIT entrance exam in selecting academic branches, using a personalized approach based on exam rank and personal career aspirations.

2018 **Marketing Team**, *Head, IIT H*.
Led efforts to engage investors in supporting student-led startup initiatives and entrepreneurial ventures.

Teaching, Mentoring, and Reviewer Experience

Teaching Assistant.

Graduate courses: Random Processes, Linear Algebra and Applications, Computational Evolutionary Biology (Best TA, 10/10 rating), Statistical Learning I, Deep Generative Models; **Undergraduate course**: Linear Electronic Systems

Mentorship Experience, During my PhD, I mentored historically underrepresented and underprivileged students, guiding them to excel in research projects with a strong emphasis on skill development and professional growth.

Reviewer Experience.

NeurIPS (2022–2024), ACL-ARR (2023–2024), ICLR (2023–2024), ICML (2023–2024), AAAI (2022), ICASSP (2022)