Garvit Banga

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Education

New York University, New York City, NY, USA — Fall 2023 – Present
Master of Science in Computer Science — Anticipated Graduation: May 2025
GPA: 3.889/4.0

Indian Institute of Technology (BHU), Varanasi, UP, India — August 2017 – May 2021
Bachelor of Technology in Metallurgical Engineering
GPA: 8.26/10

Relevant Coursework

Computer Vision, Foundations of Machine Learning, Parallel Computing, Natural Language Understanding and Computational Semantics, Operating Systems, Fundamental Algorithms, Programming Languages, Fuzzy Set Theory.

Research Experience

Research Intern at **UCF** under Dr. Aritra Dutta — Summer 2024-Present

Project: *Communication Compression for Multimodal Federated Learning (Work under submission for ICML 2025)*

- Investigated gradient update dynamics in FL to design more efficient knowledge transfer strategies across vision-language modalities.
- Implemented a **cross-modal diversity metric** to optimize collaboration between multi-modal and uni-modal clients in federated learning environments.
- Developed an **adaptive layer-wise threshold sparsification technique** for Multimodal Federated Learning, reducing communication costs by **10x-20x** while maintaining performance.
- Enhanced the FedCola framework to improve communication efficiency in bandwidth-constrained scenarios using gradient sparsification methods.

Master's Thesis at **NYU** under Dr. Qi Lei — September 2023 – Present

Project: *Unsupervised Federated Domain Adaptation (UFDA)*

- Proposed a **confident data approach** for UFDA, leveraging high-confidence pseudo-labels to train a global target model.
- Integrated **FixMatch to reduce domain shifts** by aligning predictions on weak and strong augmentations of unlabeled target data, enhancing generalization.
- Formulated UFDA as a multi-objective optimization problem and applied the **Multiple Gradient Descent Algorithm (MGDA)** to balance performance across domains in large-scale federated networks.
- Addressed scalability challenges in existing UFDA methods, enabling efficient adaptation to heterogeneous domains in privacy-preserving federated environments.

Undergraduate Researcher at **IIT BHU** under Dr. Hari Prabhat Gupta and Dr. Rahul Mishra
January 2021 – August 2023

Projects: *Fed-RAC*, *FL Based Patient Monitoring System* and *Inertial Measurement Units for Handwritten English Alphabets Dataset*

- Designed Fed-RAC, an adaptive Federated Learning (FL) framework using **Dunn Indices for resource-aware clustering and Knowledge Distillation** to address client heterogeneity, published in TPDS 2024.
- Developed lightweight model training strategies for **low-resource clients**, achieving superior performance benchmarks with reduced communication costs.
- Adapted Fed-RAC for Internet of Medical Things (IoMT) applications, incorporating **data freshness** to prioritize recent sensory data for patient activity monitoring, published in TCSS 2023.
- Contributed to creating an **IMU-based public dataset for handwritten English alphabets**, leading pre-processing efforts to ensure quality for FL research applications.

Publications

R. Mishra, H. P. Gupta, **G. Banga** and S. K. Das, *Fed-RAC: Resource-Aware Clustering for Tackling Heterogeneity of Participants in Federated Learning* in IEEE Transactions on Parallel and Distributed Systems(TPDS), 2024, https://doi.org/10.1109/TPDS.2024.3379933

C. Singh, R. Mishra, H. P. Gupta and **G. Banga**, *A Federated Learning-Based Patient Monitoring System in Internet of Medical Things* in IEEE Transactions on Computational Social Systems(TCSS), 2023, https://doi.org/10.1109/TCSS.2022.3228965

Public Dataset

Hari Prabhat Gupta, Tanima Dutta, Rahul Mishra, **Garvit Banga**, Shubham Pandey, Krishna Sharma, Himanshu Sahu, *A Dataset of Inertial Measurement Units for Handwritten English Alphabets: Leveraging Diversity in Indian Context* , IEEE Dataport, 2023, https://dx.doi.org/10.21227/av6q-jj17

Grad Course Projects

CSCI-GA 2271 Computer Vision at **NYU** under Dr. Saining Xie — Fall 2024

Project: *RoboSignature: Robust Signature and Watermarking on Diverse Image Attacks*

- Developing a **robust watermarking framework for generative AI models**, improving watermark extraction resilience against diverse adversarial image attacks using Latent Diffusion Models.
- Implementing an innovative **fine-tuning approach for stable diffusion model decoders** to embed imperceptible watermarks while maintaining image generation quality.

DS-GA 1012 Natural Language Understanding and Computational Semantics at **NYU** under Dr. Sophie Hao — Spring 2024

Project: *DENIAHL: Data-centric Evaluation of Needle-In-A-Haystack for LLM's*

- Designed the DENIAHL benchmark to evaluate the **influence of data size, patterns, and type**s on the long-context modeling capabilities of language models.
- Evaluated LLaMA-2 7B and GPT-3.5 on DENIAHL, **analyzing recall trends** and uncovering phenomena like **lost-in-the-middle** and **lost-in-the-end** that impact performance across varying data patterns and types.

Industry Experience

Standard Chartered Bank — July 2021 – July 2023

Software Developer

- Led **migration of on-premise banking services to AWS Cloud**, enhancing scalability and performance for core banking operations.
- Implemented infrastructure-as-code using **Terraform to provision and manage AWS resources**, including load balancers and security groups for efficient HTTPS routing.
- **Administered JBOSS application servers** on AWS to ensure high availability and optimal performance for retail banking products like E-Branch and eBBS.

Other Experience

NYU CSCI-UA 0480 Parallel Computing , *Tutor/Grader* — September 2023 – Present

NYU CSCI-UA 0310 Basic Algorithms, *Tutor/Grader* — Summer 2024

Extra-Curricular

IIT BHU Anveshan *Technical Secretary* — July 2020 – May 2021