Amit Sarker

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Education

University of Massachusetts Amherst, Amherst, MA *Sep. 2022 - Aug. 2027*
Ms/PhD in Computer Science; CGPA 3.93/4.00; Advised by Dr. Ali Sarvghad and Dr. Narges Mahyar
Courses: NLP, Neural Networks, Information Retrieval, Advanced Algorithms, Information Assurance

University of Dhaka, Dhaka, Bangladesh *Jan. 2016 - Dec. 2019*
B.Sc. in Computer Science and Engineering; CGPA 3.77/4.00; Advised by Dr. Md. Mosaddek Khan
Courses: Data Mining, AI, Data Structures, Algorithms, OOP, C/C++, Linear Algebra, Statistics

Experience

University of Massachusetts Amherst, *Graduate Research Assistant* *Sep. 2022 - Present*

- Exploring fairness implications within Differential Privacy (DP) algorithms to ensure fair and equitable treatment across all demographic groups.
- Working on designing and building a fair visual data exploration platform for DP data.
- Conducted interviews with DP practitioners to identify real-world challenges in deploying privacy-preserving systems and how data visualization can be utilized to make DP widely adopted.

University of Massachusetts Amherst, *Graduate Teaching Assistant*

- Introduction to HCI (Fall 2024); Foundations of Programming (Fall 2023)

University of Dhaka, *Research Assistant* *Jan. 2020 - Dec. 2020*

- Applied local search and particle swarm optimization algorithms to solve Continuous Distributed Constraint Optimization Problems (C-DCOPs) in large-scale multi-agent systems.
- Mentored two undergraduate students and contributed to their senior year thesis projects on multi-agent planning and scheduling.

TigerIT Bangladesh Limited, *Software Engineer (QA)* *Apr. 2020 - Jul. 2021*

- Enhanced system reliability and performance by identifying system requirements.
- Analyzed and tested methodologies for a COVID-19 contact tracing module to mitigate the spread.
- Created and executed well-structured test plans, and implemented automation scripts.

Publications (* - Equal Contribution)

- L. Panavas*, **A. Sarker***, A. Sarvghad, C. Dunne, N. Mahyar. "Illuminating the Landscape of Differential Privacy: An Interview Study on the Use of Visualization in Real-World Deployments." IEEE Transactions on Visualization and Computer Graphics (TVCG), July 2024. (Paper Link)
- M. Choudhury, **A. Sarker**, S. Yaser, MAA. Khan, W. Yeoh, M. M. Khan. "A Particle Swarm Inspired Approach for Continuous Distributed Constraint Optimization Problems." Engineering Applications of Artificial Intelligence (EAAI) Volume 123, Part B, August 2023, 106280. (Paper Link)
- **A. Sarker**, M. Choudhury, and M. M. Khan. "A Local Search Based Approach to Solve Continuous DCOPs." In Proceedings of the 20th International Conference on Autonomous Agents and Multiagent Systems (AAMAS), pages 1127–1135, 2021. (Paper Link)
- **A. Sarker**, A. B. Arif, M. Choudhury, and M. M. Khan. "C-CoCoA: A Continuous Cooperative Approximation Algorithm to Solve Functional DCOPs." In Proceedings of the 19th International Conference on Autonomous Agents and Multiagent Systems (AAMAS), pages 1990–1992, 2020, IFAAMAS. (Extended Abstract) (Paper Link)
- **A. Sarker**, A. B. Arif, M. Choudhury, and M. M. Khan. "C-CoCoA: A Continuous Cooperative Approximation Algorithm to Solve Functional DCOPs." 11th International Workshop on Optimization and Learning in Multiagent Systems (OptLearnMAS) @ AAMAS, 2020.

Projects

Occlusion Aware Vehicle Detection *(NN, YOLO, Localization)* *Oct. 2024 - Dec. 2024*

- Designed a two-stage object detection system integrating ResNet-18 with YOLOv5m, improving localization accuracy and reducing false positives (improving mAP by 24.7%) in occluded scenarios.
- Fine-tuned YOLOv5m with occlusion-aware modules, achieving a 44.5% improvement in small-object detection in coco vehicle dataset.

ICL Capabilities of LLMs *(NLP, In-Context Learning, Chain-of-Thought)* *Mar. 2024 - May. 2024*

- Conducted evaluations of pre-trained language models on arithmetic tasks and sentiment analysis using synthetic datasets, employing zero-shot, few-shot, and chain-of-thought prompting strategies.
- Designed and implemented "Jumbled Arithmetic" tasks to test if models learn from prompts or rely on pre-trained knowledge, enhancing the understanding of model adaptability to altered symbols.

LLM Personalization *(Scikit Learn, Probabilistic and Neural Retrievers)* *Oct. 2023 - Dec. 2023*

- Developed advanced retrieval strategies, including clustering and reranking, to enhance the personalization of LLMs by optimizing user-specific outputs from large data.
- Used multiple retrieval models such as the baseline BM25, topic-model-based retrieval, and Contriever reranking to refine personalization, culminating in integration with the Flan-T5 base model to assess the effectiveness of the output.

Privacy Risk of ML Models *(RNN,Adversarial Regularization,MemGuard)* *Oct. 2022 - Dec. 2022*

- Evaluated neural network-based models' vulnerability to membership inference attacks, developed and tested various defense mechanisms, including adversarial regularization and MemGuard.
- Assessed their effectiveness in protecting sensitive training data against attacks, introduced a novel privacy risk score that quantifies the privacy risks of individual data samples based on their likelihood of being part of the model's training set.

Technical Skills

- **Libraries & Tools:** PyTorch, scikit-learn, LLM, Huggingface, In-Context Learning, Prompt Engineering, Pandas, NumPy, OpenDP, Diffprivlib, D3, Matplotlib, Plotly
- **Languages:** Python, Java, C/C++, Javascript
- **Web Development:** React, Node.js, Flask, MySQL, Oracle, MongoDB, Firebase, Django
- **Research:** Differential Privacy, HCI, Data Visualization, Quantitative & Qualitative Data Analysis, Multi-Agent Systems, DCOPs

Honors and Awards

- Dr. Phil Bernstein Graduate Scholarship in Computer Science, UMass Amherst, 2025.
- James Kurose Scholarship in Computer Science, UMass Amherst, 2023.
- Conference Scholarship (AAMAS 2021, AAMAS 2020)
- 1st Runner-Up in Code Samurai 2019 *Nov. 2019*
  - The objective of the hackathon was to find efficient transportation routes in Dhaka city by considering several constraints, including transportation method, traffic situation, time, distance, etc.

Voluntary Activities & Services

Conference Student Volunteer

- IEEE VIS 2023, AAMAS 2021, AAMAS 2020.

Shabab-Murshid Development Foundation (SMDF) *Feb. 2016 - Jan. 2020*
Volunteer Teacher & Coach

- Took mathematics classes for underprivileged high school children.
- Motivated and prepared them to participate in the National Mathematical Olympiad, Bangladesh.