Sheikh Shams Azam azam1@purdue.edu
https://sshamsazam.com/ +1-765-775-9420

Education

- **Purdue University** West Lafayette, IN
  M.S in Electrical and Computer Engineering (3.83/4.0) *August 2019 – Present*
- **National Institute of Technology Karnataka (NITK)** Surathkal, India
  B.Tech in Electrical and Electronics Engineering (8.28/10) *July 2011 – May 2015*

Publications

- Azam, S.S., Hosseinalipour, S., Qiu, Q. and Brinton, C. 2021. **Recycling Model Updates in Federated Learning: A Gradient-space Odyssey** *Under Review, ICLR 2022.*
  - **TLDR:** We explore the rank characteristics of centralized SGD, and design an algorithm `LBGM` for Federated Learning that requires to transmit merely a few scalars instead of millions of parameters, i.e., actual gradients to the server.
- Azam, S.S., Kim, T., Hosseinalipour, S., Brinton, C., Joe-Wong, C. and Bagchi, S., 2020. **Towards Generalized and Distributed Privacy-Preserving Representation Learning.** *Accepted, NeurIPS Workshop 2021.*
  - **TLDR:** We use generative modeling to learn a representation of data in a latent space that obfuscates (non-invertibly) multiple sensitive attributes in the data, while maintaining its utility w.r.t other non-sensitive attributes.
- Lin, F.P.C., Hosseinalipour, S., Azam, S.S., Brinton, C. and Michelusi N. 2021. **Two Timescale Hybrid Federated Learning with Cooperative D2D Local Model Aggregations** *Accepted, IEEE JSAC 2021.*
- Hosseinalipour, S., Azam, S.S., Brinton, C.G., Michelusi, N., Aggarwal, V., Love, D.J. and Dai, H., 2020. **Multi-Stage Hybrid Federated Learning over Large-Scale Wireless Fog Networks.** *Under Review, IEEE/ACM TON.*
- Azam, S.S., Raju, M., Pagidimarri, V. and Kasivajjala, V.C., 2019. **CASCADENET: An LSTM-Based Deep Learning Model for Automated ICD-10 Coding** *In Future of Information and Communication Conference, 2019.*
  - **TLDR:** We use the hierarchical structure of massively categorical ICD-10 code (over 90,000 unique classes) to develop a LSTM based model with a cascading architecture for automated annotation of clinical documents in a CDSS.
- Azam, S.S., Raju, M., Pagidimarri, V. and Kasivajjala, V., 2018. **Q-Map: Clinical Concept Mining from Clinical Documents** *In International Journal of Computer and Information Engineering, 12(9).*
  - **TLDR:** We use the finite-state machine based Aho-corasick algorithm, NegEx and the UMLS Metathesaurus Knowledge base to develop one of the fastest fault-tolerant clinical concept retrieval system.

Research Experience

- **Graduate Research Assistant @ Purdue University, West Lafayette, IN**
  Project: Learning from Partially-observed Multimodal Data Fall 2021
  - **Abstract:** Developing unsupervised techniques to learn from partially observed multimodal datasets. The aim is to learn a high quality latent representation of observed (with missing modalities) datasets using self-supervised, unsupervised techniques. We specifically focus on solutions in the domain of energy-based generative modeling, including but not limited to variational inference, flow-based models, etc.
- **Applied Scientist - Intern @ Zillow Group, Seattle, WA**
  Project: Unsupervised Multimodal Representation Learning Summer 2021
  - **Abstract:** Developed an unsupervised multimodal representation learning framework that leverages the unlabeled raw documents (e.g. property documents) and weakly labeled image dataset (e.g. zillow listings) to learn representations that boost downstream few-shot learning performance on tasks such as sequence classification, token classification, image attribute detection and localization etc.
- **Graduate Research Assistant @ Purdue University, West Lafayette, IN**
  Project: Exploiting the Rank Deficiency of Gradient Subspaces in Federated Learning Spring 2021
  - **Abstract:** Optimization using gradient descent is intrinsically low-rank. This work gives a fresh perspective into understanding the structure of optimization in terms of first-order optimization and leverages these observation to propose a novel algorithm for gradient compression called "Look-back Gradient Multiplier".

- **Graduate Research Assistant @ Purdue University, West Lafayette, IN**
  Project: Efficient Clustering of Document in Clustered Vector Spaces Fall 2020
  - **Abstract:** Developed a novel (patent-pending) technique for document clustering by utilizing several explainable techniques including TF-IDF, clustering, and cosine similarity metrics. This module helps curate data that is used for several downstream applications such as personalization of marketing campaigns for focus groups.
- **Graduate Research Assistant @ Purdue University, West Lafayette, IN**
  Project: Two Time-scale Hybrid Federated Learning Spring 2020
  - **Abstract:** Asynchronous communication is ubiquitous in edge networks. We analyze the effect of incorporating device-to-device communication on federated learning systems and propose several algorithms that leverage these asynchronous communication for fault-tolerant distributed/federated learning.
- **Graduate Research Assistant @ Purdue University, West Lafayette, IN**
  Project: Link Prediction in Social Learning Networks Fall 2019
  - **Abstract:** Graph neural network based link prediction in social learning networks for recommendations.
- **Research Scientist @ Foundation AI, Los Angeles, CA**
  Project: Computer Vision (CV) for Document Analysis Sept 2018 - Aug 2019
  - Development of novel CV methods for document analysis and OCR using GANs, CNNs and Graph convolutions.
  - Developed key-value pair extraction NLP model leveraging link prediction techniques on unstructured documents.
- **Software Engineer, Senior Software Engineer, Data Scientist @ Practo, Bangalore, India**
  Project: Computer Vision for Medical AI June 2015 - Aug 2018
  - Developed novel CV models for diagnosing lung-cancer, brain tumor, and diabetic retinopathy using radiology images.
  - Developed NLP solutions using LSTM and attention based deep learning methods for 90,000-class classification.
  - Developed semi-supervised text classifier for highlighting important phrases in clinical documents.

Software Engineering Experience

- **Research Scientist @ Foundation AI, Los Angeles, CA**
  Project: Secure Containerization September 2018 - August 2019
  - **Abstract:** Containerization and distribution of services using micro-service architecture with dynamic SSL layer.
- **Senior Software Engineer @ Practo, Bangalore, India**
  Project: Optimizing Index Searches and Secure URL Discoveries June 2015 - August 2018
  - Scalable system for *faster search and intelligent suggestions* reliant on data driven adaptive ranking.

Relevant Courses

- **Machine Learning & Algorithms:** Generative Models (ECE695); Computer Vision (ECE595CV); Machine Learning I (ECE595); Artificial Intelligence (ECE570); Computational Methods and Models (ECE608);
- **Mathematics:** Linear Algebra & Its Applications (MA511); Real Analysis (MA504);
- **Optimization:** Introduction to Convex Optimization (AAE561); Optimization Methods (ECE508)

Programming Skills

- **Advanced:** Over 7 years of experience in Python (including ML/Deep Learning using PyTorch, Tensorflow).
- **Intermediate:** Over 2 years of experience in JavaScript, PHP, C, C++, MATLAB.
- **Beginner:** Over 6 months of experience in Java, Scala, Lua.

Projects & Achievements

- **Machine Learning Medium:** Author of the educational website (https://machinelearningmedium.com).
- **Medical Contextual Highlighter, Winner Practo Hackathon 2017:** Developed a semi-supervised deep learning based contextual highlighter using open-source PubMed dataset.
- **Kaggle, Data Science Bowl 2017:** Developed a 3D convolutional classifier for detecting malignant lung nodules.
- **HackerEarth, IndiaHacks 2017:** Ranked 18. Built ML solutions for HERE maps and Hotstar.
- **Reviewer:** AAAI, AISTATS, IEEE Transactions on Signal Processing, IEEE INFOCOM.
- **Young Leader, ISB:** 1 of 2 students selected as ISB Young Leader (ISB-YLP) in Senior Year during B.Tech.
- **Academic Scholarships:** Received scholarships for Academic Excellence for Undergraduate and High-school Studies including Indian Air Force-BA Scholarship and KVS Scholarship for AISSE and AISSCE Certificate Examinations