Priyanka Sinha

Optimization, Machine Learning, Decision Sciences, Signal Processing
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Education

- **North Carolina State University** — Raleigh, NC
  Ph.D. in Electrical Engineering; Minor in Mathematics; — *January 2018 - October 2022*
- **University of Florida** — Gainesville, FL
  Master of Science in Electrical Engineering; — *August 2011 - May 2013*
- **National Institute of Technology** — Durgapur, West Bengal, India
  Bachelor of Technology in Electrical Engineering; — *July 2006 - September 2010*

Work Experience

- **Virginia Tech, Math Department** — Blacksburg, VA
  Departmental Postdoctoral Fellow — *Current*
  - Research on Large-Scale Inverse Problems, Multi-distribution Learning and Adversarial Learning.
- **Virginia Tech, ECE Dept** — Arlington, VA
  Presidential Postdoctoral Fellow — *November 2022 - December 2023*
  - Research on application of game dynamics on Multi-distribution Learning, Adversarial Learning and Watermarking.
- **NCSU, ECE Dept** — Raleigh, NC
  Research Assistant, MPACT Lab — *January 2018 - October 2022*
  - Research on application of signal processing, machine learning, and probability theory for the detection, localization, and tracking of aerial vehicles.
- **CableLabs** — Santa Clara, CA
  Research Intern — *May 2022 - August 2022*
  - Developed adaptive end-to-end meta-learning models for communication chains from modulator through channel encoder to receiver and demodulator.
- **Qualcomm Inc** — San Jose, CA
  Senior WLAN Systems Engineer — *June 2013 - November 2017*
  - Developed beamforming and dynamic frequency selection (DFS) algorithms for IEEE 802.11ac WiFi chips.

Projects

- **Distributed dynamic inverse problems:**: Our goal is to reconstruct a stream of piecewise constant tomographic images of test objects composed of randomly moving parts from partial sinograms in a distributed manner. This allows us to take advantage of the dynamic information by solving a large-scale inverse problem in a distributed manner, without running into the issue of prohibitive computational load at a single machine.
- **Retention, Fairness and Optimality in Federated Learning (FL) at Correlated Equilibrium (CE)**: Framing FL as a *repeated convex sender-receiver game*, we develop a multistage FL mechanism where different embedded probability measures are identified, and datasets belonging to each measure are clustered. The *aggregation* process is framed as a *polytope learning* problem, where mixture models from the clusters construct the hyperplanes of a maximum margin polytope learner. This is achieved by repeated alternating steps of simplexical decomposition of the convex hull of the local models from the clients, followed by convex combinations of local models within each cluster, followed by a polytope learning across the clusters. The actions of the *dual reduced game* define a *Markov Decision Process* over the convex combination coefficients of each cluster, and the *left eigenvectors* of the transition matrices when updated through a *no-regret* algorithm converges to a ϵ-*Correlated Equilibrium* with approximately optimal aggregation-communication trade-off, indicating enhanced *retention* due to improved *fairness* in each cluster.
- **Generating Persistent Watermarking Triggers and an Exhaustive Collection of Adversarial Samples for Deep Neural Networks**: We pose the training method as an online non-convex game where each agent i.e. the distribution of the watermarking/adversarial samples and the original distribution of the pure data wants to minimize their *conditional value at risk (CVaR)* i.e. a combination of the probability of error and the confidence along the adversarial direction. We then design a no-regret algorithm and construct a feasibility set such that the game converges to a *unique approximate correlated equilibrium* indicating persistence and exhaustiveness.
- **Meta Trained Autoencoder Model for Adaptive End-to-End Communication System**: Developed a Meta-learning algorithm for an autoencoder where the encoder is a Meta-trained transmitter that generates symbols from data stream in an adaptive manner, based on the current channel condition and the decoder is a Meta-trained receiver that decodes the symbols to retrieve the original message.

- **Neural Network-based Non-Linear Adaptive Filtering**: Developed an adaptive filtering algorithm for tracking maneuvering unmanned aerial vehicles (UAVs), that first learns the *time-varying non-linear state space model* for the vehicle dynamics by training a recurrent neural network (RNN) on observed *time series data* and then retrains the pre-trained RNN in conjunction with a *change point detection* and a *data fusion algorithm* for fast online adaption to unknown UAV dynamics by combining current measurements with the prediction by the RNN, for enhanced tracking accuracy.
- **Detection and Localization of Aerial Vehicles in a Sensor Network**: Developed a *stochastic geometry*-based framework that characterizes the impact of mixed Line-of-Sight/Non-Line-of-Sight propagation and 3D directional antenna patterns on detection performance of a sensor network; Derived *Cramer-Rao Lower Bound* on the localization error of a Time-Difference-of-Arrival-based positioning scheme for aerial vehicles in a ground sensor network to characterize the impact of the 3D antenna patterns and the probabilistic propagation of the Air-to-Ground links on the localization performance for single and multiple receive antennas.

Publications

- Conference Publications
  - **P. Sinha**, J. Kibilda and W. Saad, "On the Tradeoff Between Heterogeneity and Communication Complexity in Federated Learning," in *Proc. Asilomar (ACSSC)*, Pacific Grove, CA, USA, Oct. 29, 2023, 115-121, doi: 10.1109/IEEECONF59524.2023.10476887
  - **P. Sinha**, M. Kang, "Persistent Backdoor Watermarking Triggers for Deep Neural Networks," in preparation for *JMLR*, Oct. 2025.
  - **P. Sinha**, H. Krim and I. Güvenç, "Neural Network Based Tracking of Maneuvering Unmanned Aerial Vehicles," in *Proc. Asilomar (ACSSC)*, Pacific Grove, CA, USA, Nov. 3, 2022.
  - M. M. U. Chowdhury, **P. Sinha** and I. Güvenç, "Handover-Count based Velocity Estimation of Cellular-Connected UAVs," in *Proc. Int. Wrkshp. Signal. Proc. Adv. Wirel. Commun. (SPAWC)*, Atlanta, GA, USA, May. 2020.
  - **P. Sinha**, Y. Yapici, I. Guvenc, E. Turgut, and M. C. Gursoy, "RSS-Based Detection of Drones in the Presence of RF Interferers," in *Proc. IEEE Consumer Communications Networking Conference (CCNC)*, Las Vegas, USA, Jan. 10-13, 2020, pp. 1–6.
  - **P. Sinha**, Y. Yapici, and I. Guvenc, "Impact of 3D Antenna Radiation Patterns on TDOA-Based Wireless Localization of UAVs," in *Proc. IEEE INFOCOM Workshops*, Paris, France, Apr. 29-May. 02, 2019, pp. 1–6.
  - J. Chen, Y. Zhou, D. Raye, W. Khawaja, **P. Sinha**, and I. Guvenc, "Impact of 3D UWB Antenna Radiation Pattern on Air-to-Ground Drone Connectivity," in *Proc. IEEE Veh. Technol. Conf. (VTC)*, Chicago, IL, USA, Aug. 2018.
- Journal Publications
  - **P. Sinha**, M. Kang "Correlated Equilibrium for Enhanced Retention in Federated Learning with Optimal Aggregation-Communication Trade-off," in preparation for *Jrnl. Machine. Learn. Res. (JMLR)*, August. 2025.
  - **P. Sinha**, M. Kang, "A Dedicated Neural Network Architecture for Provable Convergence of Robust Adversarial Training," in preparation for *Jrnl. Machine. Learn. Res. (JMLR)*, October. 2025.
  - **P. Sinha**, and I. Guvenc, "Impact of Antenna Pattern on TOA Based 3D UAV Localization Using a Terrestrial Sensor Network," accepted to appear in *IEEE Trans. Veh. Technol.*, Feb. 2022.
  - **P. Sinha**, M. M. U. Chowdhury and I. Güvenç, David W. Matolak, and Kamesh Namuduri "Wireless Connectivity and Localization for Advanced Air Mobility Services," accepted to appear in *IEEE Aerosp. Electron. Syst. Magz.*, Feb. 2022.
  - **P. Sinha**, I. Guvenc and M. C. Gursoy, "Fundamental Limits on Detection of UAVs by Existing Terrestrial RF Networks," *IEEE Open J. Commun.* Soc., vol. 2, Sep. 2021, pp. 2111 - 2130.

Graduate Coursework

- **Mathematics**: Real Analysis, Convex Analysis, Optimization in Vector Spaces, Probability Theory, Stochastic Processes, Stochastic Differential Equations
- **Signal Processing**: Digital Signal Processing, Noise in Linear Systems, Detection and Estimation Theory
- **Machine Learning**: Pattern Recognition, Neural Networks

Skills

- **Programming Languages**: MATLAB, Simulink, Python, Pytorch, Numpy, Scikit
- **Standards**: IEEE 802.11a,g,n,ac,ax, LTE, 3GPP.

Honors, Awards, and Outreach

- Presidential Postdoctoral Fellowship Award, Virginia Tech, 2022.
- Carried out NASA funded research under the grant number NX17AJ94A from 2018 to 2022. Presented research outcomes to NASA program managers, external reviewers, and project partners.
- Outstanding Achievement Award at University of Florida for the years 2011-12.
- Selected for Summer Internship in the Global Internship Program in Engineering Design and Innovation (GIPEDI), Airtel IIT Delhi Centre of Excellence in Telecommunication (AICET), Bharti School of Telecommunication Technology and Management, July, IIT Delhi, 2009.
- Graduated with distinction in Bachelors of Technology, at National Institute of Technology, Durgapur - September, 2010

Service

* Reviewer: IEEE Transactions of Wireless Communications, IEEE Wireless Communications Letters, IEEE International Conference on Communications, Physical Communication, Computer Communications.
* Conference Travel Grant Chair at IEEE Dynamic Spectrum Access Networks (DySPAN) 2024.

References

* Eric De Sturler, Professor (Email: sturler@vt.edu)
  Department of Mathematics, Virginia Tech, VA, Blacksburg, USA
* Gretchen Matthews, Professor (Email: gmatthews@vt.edu)
  Department of Mathematics, Virginia Tech, VA, Blacksburg, USA
* Ismail Guvenc, Associate Professor (Email: iguvenc@ncsu.edu)
  Electrical and Computer Engineering, North Carolina State University, NC, Raleigh, USA
* Mustafa Cenk Gursoy, Professor (Email: mcgursoy@syr.edu)
  Electrical and Computer Science, Syracuse University, Syracuse, NY, USA Electrical and Computer Engineering, North Carolina State University, NC, Raleigh, USA
* Hamid Krim, Professor (Email: ahk@ncsu.edu)
  Electrical and Computer Engineering, North Carolina State University, NC, Raleigh, USA
* Sayandev Mukherjee, Distinguished Technologist (Email: s.mukherjee@cablelabs.com)
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* Susinder Rajan Gulasekaran, Director of Engineering (Email: susinder.gulasekaran@commscope.com)
  Senior IEEE Member, Ruckus Wireless, Sunnyvale, CA, USA
* Qinfang Sun, Senior Director (Email: qinfang@qti.qualcomm.com)
  Qualcomm, Inc., San Jose, CA, USA