NJIT New Jersey Institute of Technology

The Elisha Yegal Bar-Ness Center for Machine Intelligence, Signal Processing, and Communications (MICS) Activity Report

December 2025

From the Director

Dear Colleagues, Students, and Friends of MICS,

I am writing to you today as the new Director of The Elisha Yegal Bar-Ness Center for Machine Intelligence, Signal Processing, and Communications (MICS). It is an honor to lead a center with such a distinguished history. I would like to thank the outgoing director, Prof. Alexander Haimovich, for his leadership and contributions over the past years, which have been essential to the center's success. I look forward to building on this strong foundation.

The 2022-2025 period has been a productive one for our center. Our faculty and students have been engaged in a wide range of research projects, from foundational theory to applied systems. This work has attracted over $2.4 million in research funding from federal and industry partners. In this period, we have published over 50 papers in leading journals and conferences. We are also pleased to welcome our new junior faculty members, Dr. Arnob Ghosh and Dr. Anirudh Sridhar, whose expertise in reinforcement learning and network science will be invaluable as we move forward.

As we look to the future, we will be guided by our new strategic vision, which focuses on the growing importance of machine learning and AI. Our vision is to be a nationally recognized center of excellence, and our research will be focused on three synergistic pillars:

1. Trustworthy AI and Machine Learning
2. Intelligent Communication and Networking (6G & Beyond)
3. Information, Learning, and System Dynamics

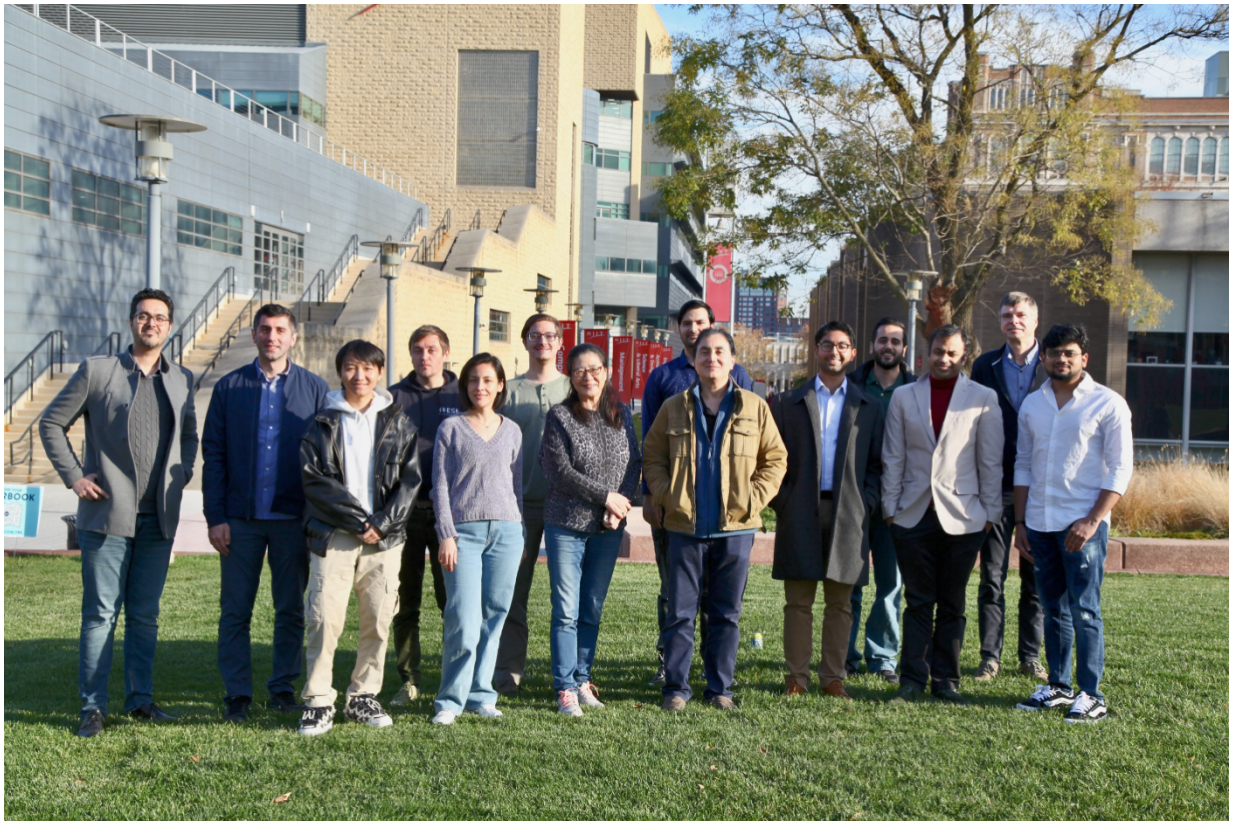
I am confident that by working together, we can continue to produce high-quality research, provide an excellent educational experience for our students, and make a lasting impact on our field.

I look forward to working with all of you.

Sincerely,

Dr. Joerg Kliewer
Director, The Elisha Yegal Bar-Ness Center for Machine Intelligence, Signal Processing, and Communications (MICS)

The MICS Team, Fall 2025



Our vision is to become a nationally recognized center of excellence that contributes to the theoretical foundations and practical applications of next-generation intelligent systems.

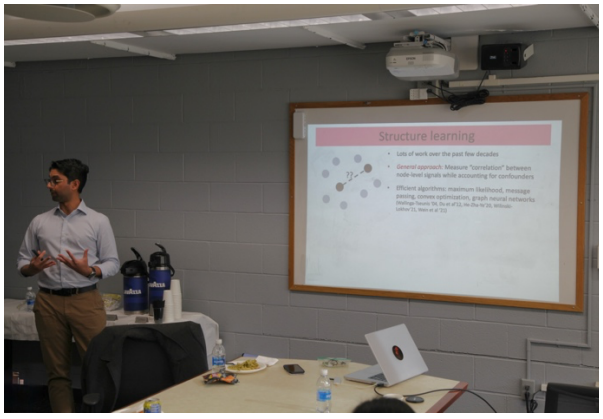
About MICS

The Elisha Yegal Bar-Ness Center for Machine Intelligence, Signal Processing, and Communications (MICS) is a research center within the Electrical and Computer Engineering Department at the New Jersey Institute of Technology (NJIT). As the successor to the long-standing Center for Wireless Information Processing (CWiP), MICS is strategically repositioned to address the growing importance of artificial intelligence and machine learning in modern information and communication systems.

The activities of the MICS center are broad and designed to foster a vibrant research and educational environment. Our faculty and students are actively engaged in initiating and pursuing cutting-edge research in machine learning, communications, and signal processing, while also seeking financial support from federal agencies and industry partners to sustain our work.

In addition to research, the center plays a key role in the educational mission of the university. Our members are responsible for teaching graduate courses in our core areas, and we are committed to recruiting top graduate students and research associates. Our faculty also contribute to the university's continuing education program by offering short courses on specialized topics, and they are actively involved in teaching and developing new graduate courses in communications, signal processing, and machine learning. To foster a collaborative environment, the center hosts bi-weekly presentations where students can share their research with their peers and faculty.





Faculty

	**Joerg Kliewer, Center Director, Professor** **Research Interests**: Secure and private machine learning, information and coding theory, generative models, secure and private communication.
	**Ali Abdi, Professor** **Research Interests:** Digital communication and propagation modeling in wireless channels, channel and parameter estimation techniques, space-time processing and interference cancellation, blind modulation recognition, systems biology and molecular networks.
	**Hongya Ge, Associate Professor** **Research Interests:** Statistical and Array Signal Processing. Wireless Communications. Space-Time Multiuser Detection. MIMO for Broadband Wireless Access.
	**Arnob Ghosh, Assistant Professor** **Research Interests:** Reinforcement Learning, Stochastic Optimization, Multi-agent Learning
	**Alexander Haimovich, Ying Wu Endowed Chair and Distinguished Professor** **Research Interests:** multi-sensor radar systems, localization, MIMO communications, blind signal processing.
	**Anirudh Sridhar, Assistant Professor** **Research Interests**: Information theory, network science, statistical inference, stochastic processes, spreading processes

Center Staff

Destiny Adeleye	Administrative Assistant (until October 2025)

Postdoctoral Research Assistants

Kyle Wensell	Professor Haimovich
Yauhen Yakimenka	Professor Kliewer

Center Ph.D. Students

Behrooz Mosallaei	Professor Abdi
Yuan Zhao	Professor Abdi
Siamak Beikzadeh	Professor Ghosh
Kartik Pandit	Professor Ghosh
Sourav Ganguly	Professor Ghosh
Amir Ziaeddini	Professor Kliewer
Yusuf Ozkan	Professor Kliewer
Amirarsalan Moatazedian	Professor Kliewer
Sara Ghasvarianjahrom	Professor Kliewer

Masters & Undergrad Students

Joshua Barr	Professor Kliewer

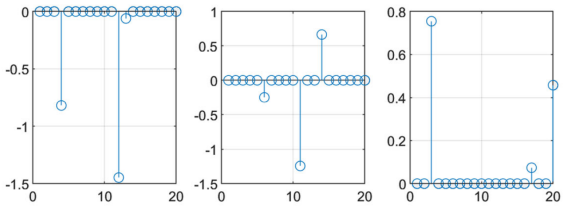




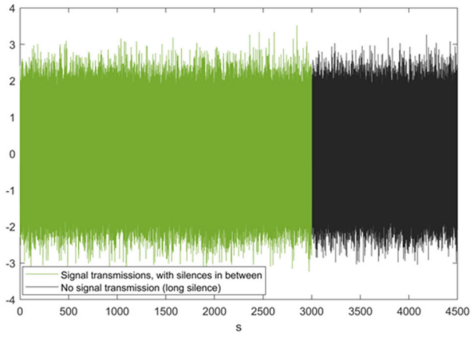
Learning-Based Blind Detection and Localization

Faculty: Ali Abdi

Graduate Student: Behrooz Mosallaei



Three realizations of a random multipath channel



Weak unknown signal buried in strong noise

A multipath wireless channel exposes a transmitted signal to time-spreading distortion (TSD), which means that multiple copies of the transmitted signal are received at different time delays. Compared to single-path channels, weak signal detection in multipath TSD channels is more complicated, as the signal energy is spread over multiple paths, which need to be properly incorporated into the detector structure, in order to achieve good detection performance. In fact, it is shown that, under certain conditions, the optimal detector in TSD channels is a collection of correlators that correlate the received TSD signal with the original as well as with the time-shifted copies of the transmitted signal.

In the context of signal detection, where the transmitted signal is known to the receiver, the above-mentioned transmitted signal-based detectors are viable options in TSD channels. However, in detection applications where the receiver has no knowledge of the transmitted signal, the performance of such transmitted signal-based detectors can degrade significantly. Therefore, it is of high interest to develop blind detectors for TSD channels that do not need to know the transmitted source signal.

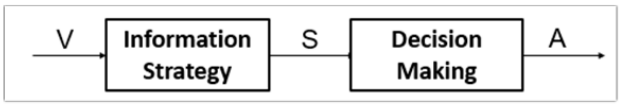
In this research, we aim to utilize a dictionary learning (DL) method for sparse representations, to perform blind signal detection in TSD channels. The sparse representation is suitable for those TSD channels where many propagation paths convey a very small amount of energy, resulting in sparse channel impulse responses that have many near-zero taps or coefficients. In the DL method, a training data matrix is ultimately decomposed into a product of a dictionary matrix and a sparse coefficient matrix. The columns of the dictionary matrix are called atoms, which we propose to use for blind detection.

We use collected experimental data to form a training data matrix, from which we learn a dictionary matrix that contains an estimate of the unknown source signal. This estimated signal can be used to implement a correlator in the developed blind detector. The simulations and the experimental results show the effectiveness of the developed blind signal detector when the source signal is not known in advance in unknown multipath TSD channels.

Noise Mitigation with Rational Inattention to Noisy Information and Data

Faculty: Ali Abdi

Graduate Student: Yuan Zhao

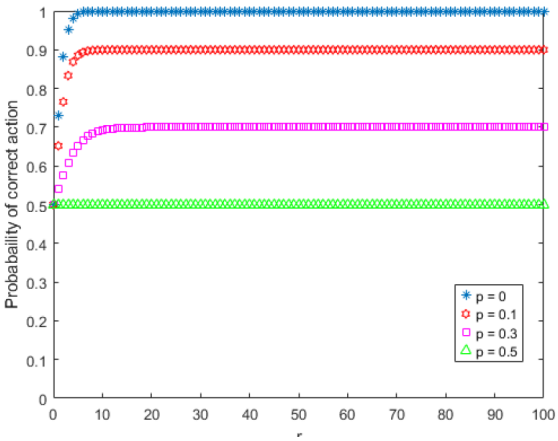


Rationally inattentive decision-making steps

V = Underlying state

S = Signal (observed information)

A = Action (decision)



Probability of correct action of a rationally inattentive decision maker versus the reward level *r* and for different noise probabilities *p*.

Since usually it is costly to sense signals and collect information, and to balance performance and cost, some data can be deliberately ignored in decision making problems, a concept known as rational inattention (RI). The state that a rationally inattentive decision maker observes can be a noisy version of the true underlying state. Examples include intentionally distorted data to protect privacy and private information, or information sources that are not entirely trustworthy due to some inaccuracies and pitfalls in their data collection methods and processes, or data collected by aggregation or quantization of raw information. In this research we introduce a new RI framework for noisy data and present/analyze methods to mitigate noise.

The research presents new methods for noise mitigation when there is a signal sensing cost. The significance is that our developed methods allow utilizing noisy costly signals by being rationally inattentive, hence overcoming noise while balancing performance and information cost. A fundamental limit on maximum tolerable noise is also derived. Results can be used in many contexts such as image classification, smart decision making using human-machine networks, cognitive radios, etc.

In this research we introduce methods for noise mitigation while being rationally inattentive to parts of costly signals. Using mathematical analysis, synthetic and empirical data, we show how to improve correct decision probability and payoff as noise level varies. Other new findings are a formula for optimal number of noisy signals to balance accuracy and cost, and a fundamental rational inattention limit on maximum tolerable noise.

Statistical Signal Processing and Multi-Channel Adaptive Data Analysis

Faculty: Hongya Ge

Graduate Students: Enlong Hu (PhD awarded in May 2023)

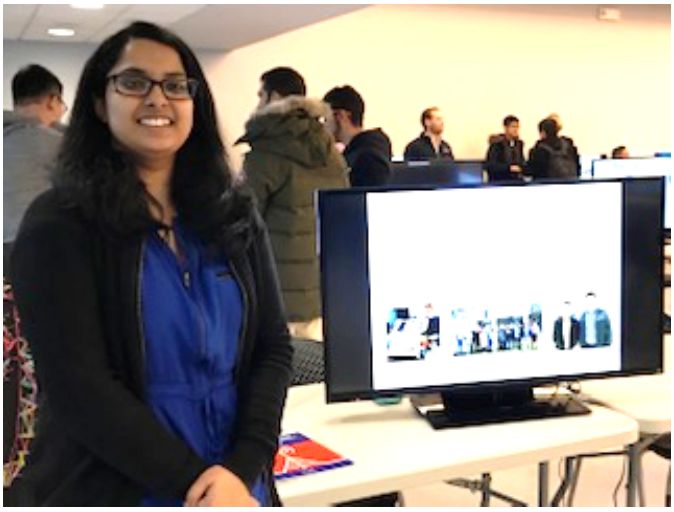
Collaborators: Dr. I. P. Kirsteins (NUWC-NPT); Dr. L. L. Scharf (CSU)

Sponsors: ONR, NUWC, NSF

Adaptive analysis and processing of multi-channel array data for beamforming, estimating and tracking signal-of-interest's dynamic position and moving direction, subject to propagation environment's spatial coherence variation and loss and interferences (Sponsored by ONR, NUWC-NPT)

Broadband Wireless Access (BWA) transceiver systems, and reduced-rank data-driven subspace transceiver design for wireless communications (Sponsored by: DARPA, SAIC-Telcordia, NSF)

Challenge: Our multi-channel data set used for extracting signal-of-interest's information is subject to the propagation environment's spatial coherence variation and loss and interferences. Impact: The research provides important insights to adaptive signal processing techniques to various applications in defense and communications.





Safe Reinforcement Learning Based Decision Making

Faculty: Arnob Ghosh

Graduate Students: Sourav Ganguly, Kartik Pandit, Siamak Beikzadeh, Brandon Knight (MS)

Collaborators: Ness Shroff (OSU), Kaushik Chowdhury (UT Austin), Toshinori Kitamura (University of Alberta, University of Tokyo), Tadashi Kozuno (Omron Sinic X), Honghao Wei (Washington State University), Mehrdad Moharrami (University of Iowa), Chih-Chun Wang (Purdue University), Debashri Roy (UT Arlington), Lei Ying (University of Michigan), Shaahin Angizi (NJIT), Adam Wiermann (Caltech)

Project 1: Provably Efficient Safe RL Algorithm Development

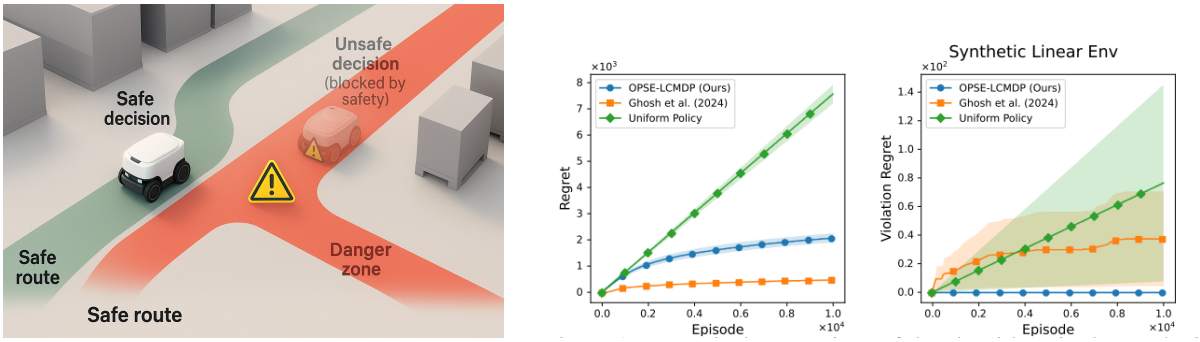


Figure: The left-hand figure shows the safe robot navigation problem. Right-hand figure shows that our approach (OPSE-LCMDP) does not violate (lower violation regret is better) during exploration while reducing the regret (see central figure, lower is better).

Research Description.
Reinforcement Learning (RL) is a key enabling technology in many domains, including large language model training, 6G networks, healthcare, wireless communications, and robotics. However, most RL algorithms lack the formal safety guarantees needed for deployment in safety-critical cyber-physical systems. My research focuses on designing RL algorithms with *provable* safety guarantees, including during the learning phase itself. Our methods ensure that constraints are respected not only at convergence, but throughout the exploration process. Further, we develop the first provably efficient approach with sub-linear regret guarantee for linear function approximation while maintaining safety throughout. We also developed the first computationally efficient RL algorithm to solve robust Constrained MDP with a provable performance guarantee.

Challenges.
The core difficulty is to balance reward maximization and constraint satisfaction in a principled way. One must ensure that constraints are satisfied even while the agent is still learning and exploring, which calls for fundamentally new algorithmic designs. A further challenge arises when learning is done primarily in simulators or from offline data: the resulting policies must remain safe even when the real-world environment deviates from the simulated one.

Impact.
These developments have a broad impact across cyber-physical systems, where safety constraints are non-negotiable. Our algorithms provide formal guarantees that safety constraints are satisfied during learning and remain robust when the real-world data distribution differs from the simulated environment, thereby enabling safer deployment of RL in practice.

Project 2: AI-Driven Wireless Connectivity for Mobile Service Robots

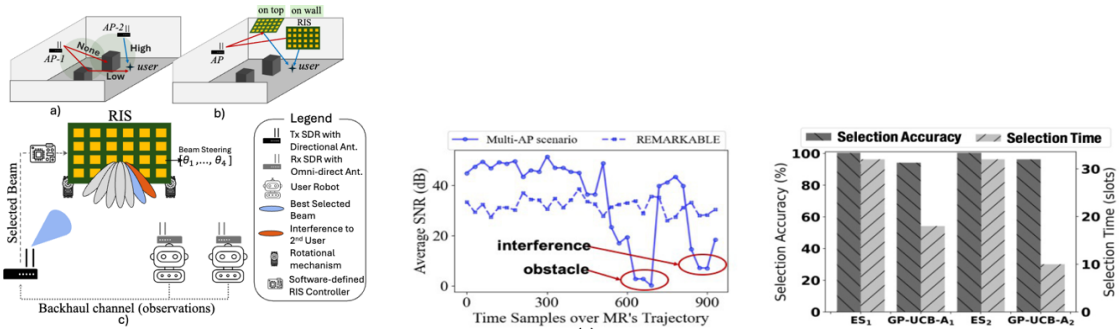


Figure: Left figure illustrates mobile robot connectivity in a factory floor when a) multiple APs are deployed to mitigate the issue of blockages, but creating interference among APs, b) a solution to the issue in via RIS deployment on the ceiling/wall, and c) our system architecture presents beam selection for MRs through RIS. Central and right-hand side figures show the advantage of our setting (REMARKABLE) over the state-of-the-art approaches.

Research Description.
As industrial environments become increasingly automated, mobile service robots are emerging as critical infrastructure. To operate reliably, these robots must maintain robust connectivity with a central controller, even in cluttered indoor environments with obstacles, blockages, and frequent non-line-of-sight conditions. We propose an AI-driven control framework for reconfigurable (reflective) intelligent surfaces (RIS) that can sense the environment and adapt their reflection patterns in real time as robots move. Our kernelized bandit–based solution quickly identifies near-optimal reflection angles while satisfying interference constraints in real time. In particular, our approach reduces the time taken to find an optimal angle by 46% while maintaining 94% accuracy compared to the state-of-the-art approach.

Challenges.
Determining the optimal reflection configuration while maintaining interference constraints is challenging because the best angles change dynamically as robots move and the channel conditions evolve. The algorithm must therefore adapt rapidly to non-stationary conditions while simultaneously enforcing strict interference constraints during learning.

Impact.
This research enables data-driven, low-latency control of beam directions and reflection angles using historical and online measurements. A key strength of our approach is its low computational complexity, which makes it suitable for real-time deployment in indoor factory and warehouse settings, where the environment and robot trajectories change frequently.

Video Demo: Please see the code below for a live video demo on how this works in real-time.

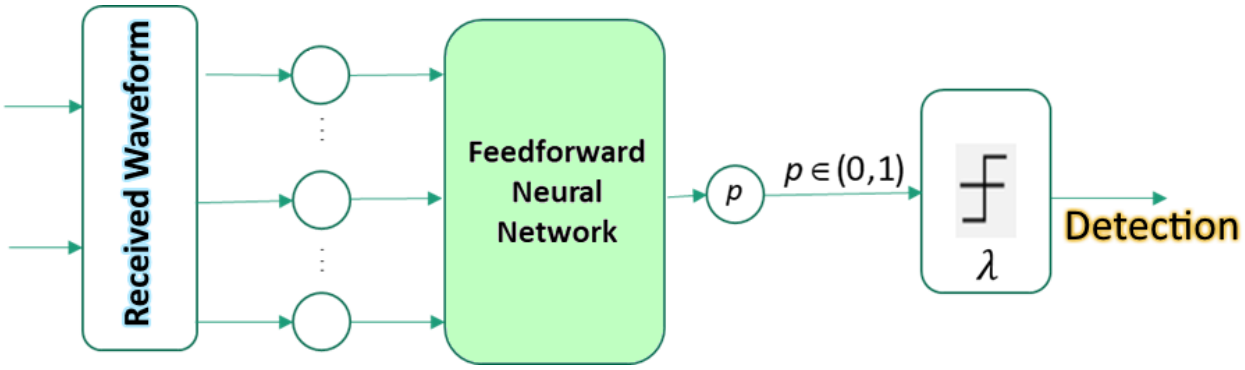
End-to-End Machine Learning (E2EML) Fuze Radar

Faculty: Alexander Haimovich

Graduate Student: Kyle Wensell (graduated 2024)

Collaborator: Abdallah Khreishah

Sponsor: Department of Defense



Traditional radar systems must be designed to handle many different operation environments. These environments are comprised of performance-reducing situations involving interference, clutter, and Doppler considerations. Generally, adverse situations such as these are handled by designing the receiver using some a priori knowledge of the environment. However, in some cases, the ideal receiver is non-trivial to find mathematically and therefore too difficult or complicated to use in real world scenarios.

Using deep learning techniques, a neural network (NN) may be trained to perform waveform detection in all of these adverse environments, yielding improved detection performance and allowing for a more robust radar system. Because of this, NN-based detectors are a hot topic in the field of radar and communications. Our research involves making further improvements to these systems, including quantization of the data to one bit (which relaxes hardware requirements and computation time), and simultaneous training of the receiver and transmitter (which allows the radar system to show adaptive resistance against clutter and interference). The network is designed and trained using theoretical data generated from statistical target and environment models. After the network is trained, the NN performance is tested using software-defined radio (SDR) devices to analyze waveform propagation and real-time processing capabilities. Successful real-time operation of the network then allows transmitter optimization depending on the statistics of the received data.

Private and Robust Decentralized Computing

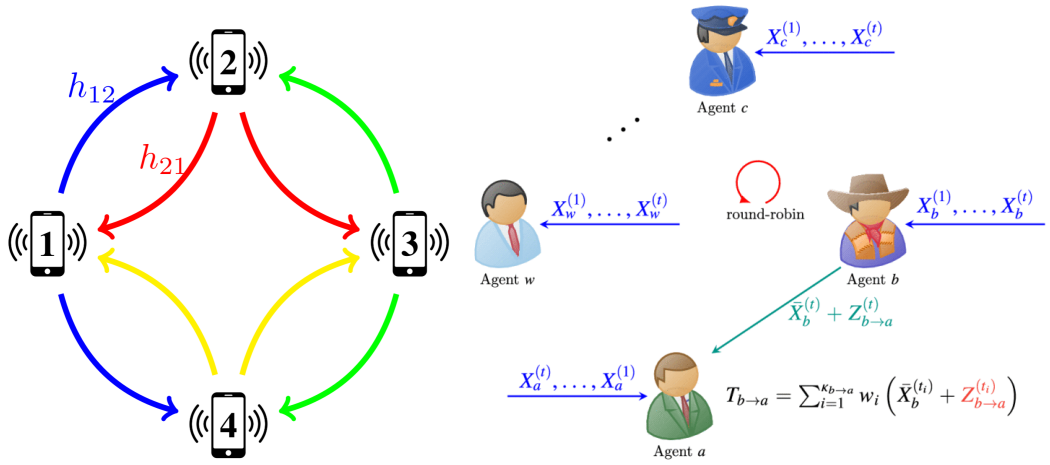
Faculty: Joerg Kliewer

Postdoc: Yauhen Yakimenka

Graduate Students: Sara Ghasvarianjahromi, Amir Ziaeddini

Collaborators: Eirik Rosnes (Simula UiB), Hsuan-Yin Lin (Simula UiB), Eimear Byrne (University College Dublin), Oliver W. Gnilke (Aalborg University), Allison Beemer (University of Wisconsin-Eau Claire), Oliver Kosut (Arizona State University)

Sponsor: National Science Foundation



Challenge: Training AI models across a network of devices is difficult when some devices are slow ("stragglers") or malicious ("Byzantine"). The challenge is to aggregate results accurately and efficiently without exposing sensitive user data to central servers or other participants.

Impact: This enables secure and reliable Federated/Decentralized Learning on edge devices (like smartphones or IoT). It ensures AI systems can continue learning and functioning correctly even when parts of the network fail or are under active attack, which is critical for resilient autonomous systems.

Research Description: This research focuses on developing coding-theoretic frameworks that simultaneously provide differential privacy, straggler resilience, and robustness against adversarial attacks. We designed schemes for decentralized sparse matrix multiplication that remain accurate even under Byzantine attacks. Additionally, we developed differentially private algorithms for decentralized learning that utilize polynomial codes to mitigate the impact of slow nodes while maintaining strict privacy guarantees in heterogeneous networks.

Semantic Communication and Generative Reconstruction

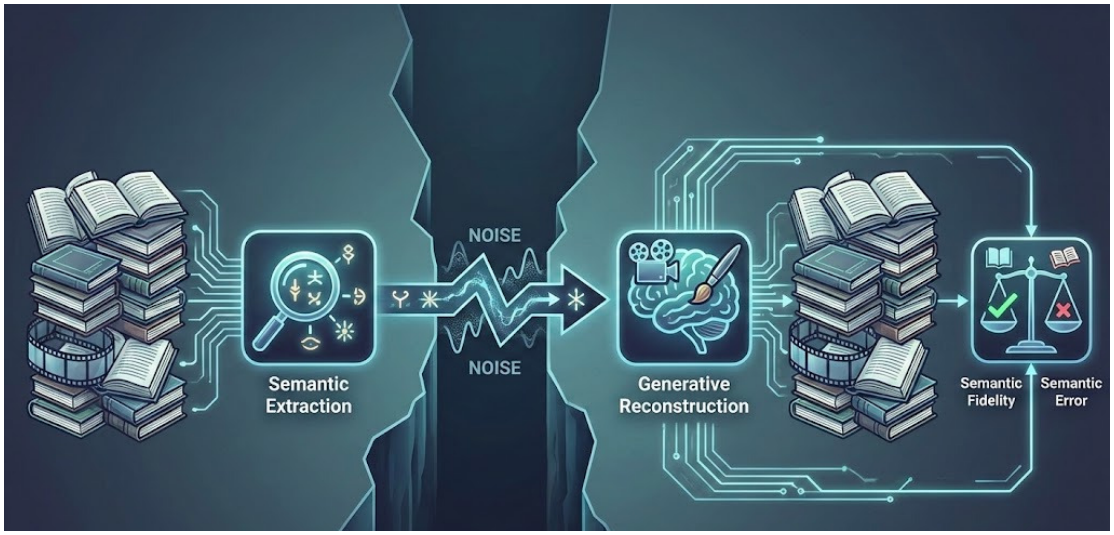
Faculty: Joerg Kliewer

Postdoc: Yauhen Yakimenka

Graduate Student: Sara Ghasvarianjahromi

Collaborator: Asaf Cohen (Ben-Gurion University)

Sponsor: NJIT, National Science Foundation



Challenge: Traditional communication systems optimize for transmitting exact bits, which is inefficient for media where "meaning" matters more than precision. The challenge is to transmit only the semantic core of text or video over noisy channels and successfully reconstruct the full content at the receiver using generative AI, while rigorously quantifying the probability of semantic error.

Impact: This shifts communication from "bit-fidelity" to "semantic-fidelity," drastically reducing bandwidth usage. It enables high-quality video streaming and accurate information retrieval over poor connections by allowing the receiver to "regenerate" missing content using context, rather than requesting re-transmission.

Research Description: This direction investigates semantic communication systems for both text and video. For text, we analyze Natural Question (NQ) datasets and Zipfian distributions to optimize retrieval over erasure channels. We utilize BERT embeddings to determine token importance, applying repetition codes to critical semantic units. Theoretically, we are deriving tight error bounds (Berry-Esseen, Sidak, Bonferroni) for high-dimensional semantic retrieval. For video, we are exploring the use of generative models (such as the Wan model and Stable Diffusion) to reconstruct video content at the receiver based on transmitted captions or single reference frames. This involves evaluating performance using video embeddings like VideoPrism and ViVit to measure the cosine similarity between the original and the semantically reconstructed video streams.

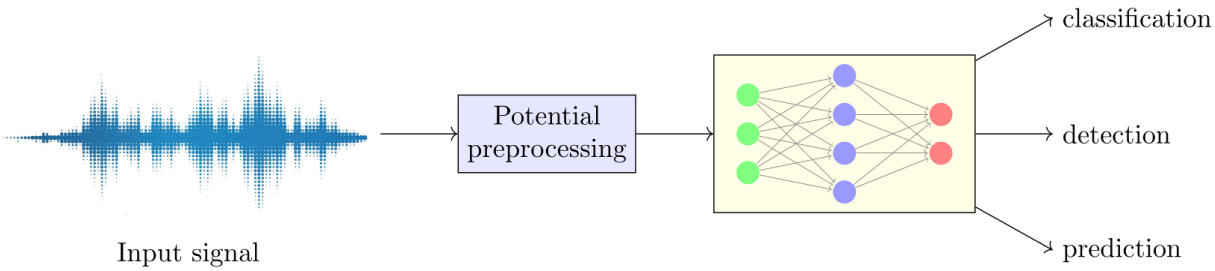
Machine Learning for Specific Emitter Identification

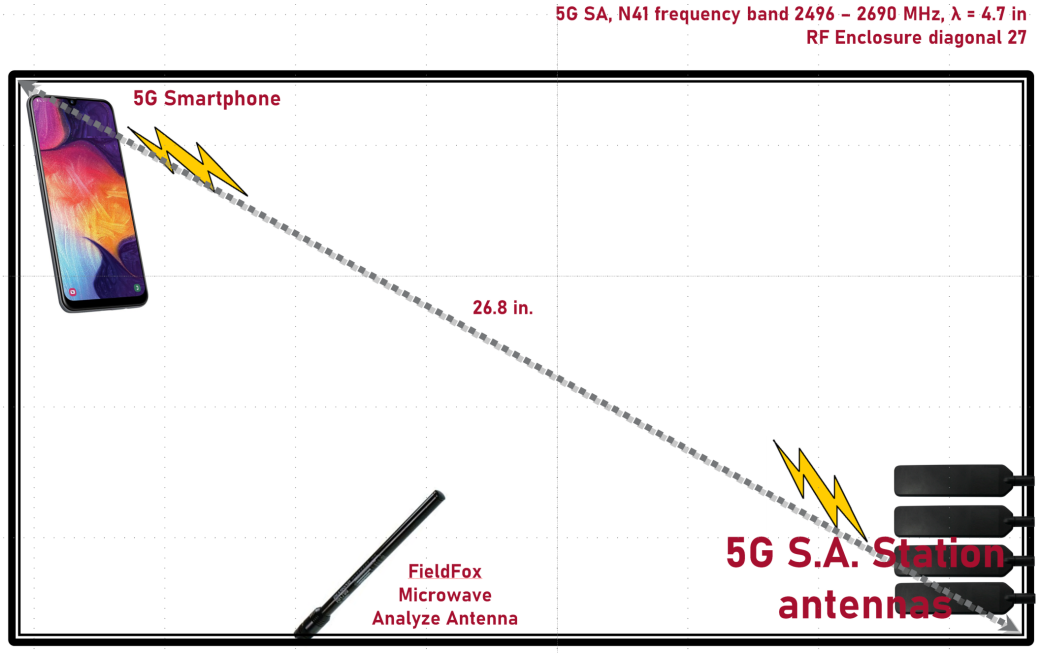
Faculty: Joerg Kliewer

Postdoc: Yauhen Yakimenka

Collaborators: Alex Haimovich, Jason Dabin (Naval Information Warfare Center Pacific, US Navy)

Sponsor: US Navy





Challenge: Securing wireless networks against device spoofing is difficult because digital keys can be stolen or cloned. The challenge is to authenticate devices based on the unique, unintentional physical imperfections of their hardware (RF fingerprinting) which are nearly impossible to replicate.

Impact: This provides a physical-layer security anchor for 5G and military communications. By treating the hardware itself as the identity, it prevents sophisticated adversaries from masquerading as legitimate devices, significantly enhancing authentication beyond standard cryptography.

Research Description: Supported by the US Navy, this project develops advanced machine-learning techniques to extract stable, device-intrinsic signatures directly from raw 5G uplink signals. Our team has shown that modern neural architectures can reliably learn these hardware fingerprints even under realistic channel variations. A major outcome of the work is a foundational SEI model trained on a diverse synthetic 5G corpus that transfers effectively to real laboratory data, enabling rapid onboarding of new devices with only a handful of examples. The project also investigates early open-set detection strategies, laying the groundwork for identifying previously unseen emitters and strengthening physical-layer authentication in future wireless systems.

Information-Theoretic Privacy in Retrieval and Estimation

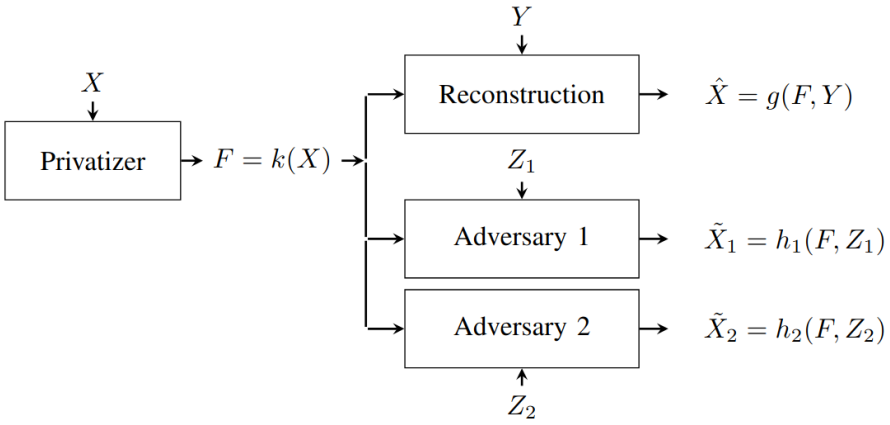
Faculty: Joerg Kliewer

Postdoc: Yauhen Yakimenka

PhD student: Amirarsalan Moatazedian

Collaborator: Remi A. Chou (University of Texas at Arlington)

Sponsor: National Science Foundation



Challenge: Modern data-sharing systems often involve multiple parties who each hold different pieces of correlated information. When sensitive data must be released for legitimate use, a key challenge is to preserve utility for authorized users while simultaneously preventing unauthorized parties—who may possess partial side information—from reconstructing the original data. Existing approaches to privacy typically assume a single adversary or rely on information-theoretic metrics that may not align with real-world estimation tasks.

Impact: This research contributes a rigorous foundation for privacy-preserving data release in multi-user environments. The framework enables fine-grained control over who can reconstruct the data and how accurately, even when users have correlated external information. Potential applications include secure distributed learning, collaborative analytics, privacy-aware data

publishing, and next-generation access-control systems in which different classes of users are guaranteed different levels of inference capability.

Research Description: This project develops a general framework for minimax data sanitization, in which a privatizer releases a sanitized version of sensitive data while balancing two goals:

- Utility: an authorized reconstructor must be able to recover the data within a specified distortion level;
- Privacy: two unauthorized adversaries—each with different side information—should incur high estimation error.

The work formalizes this as a constrained minimax optimization problem, where the privatizer maximizes the minimum adversarial loss while maintaining a distortion constraint for the reconstructor. We derive optimal solutions for both Gaussian and binary data models, providing clear theoretical characterizations of the privacy–utility tradeoff. Building on these insights, the project introduces a data-driven training procedure that jointly learns the privatizer, reconstructor, and adversaries using neural networks. Experiments demonstrate that this learned system closely matches the theoretical optima across a wide range of distortion levels. Together, these contributions establish a flexible and practical strategy for releasing sanitized data in multi-user settings where side information plays a crucial role.

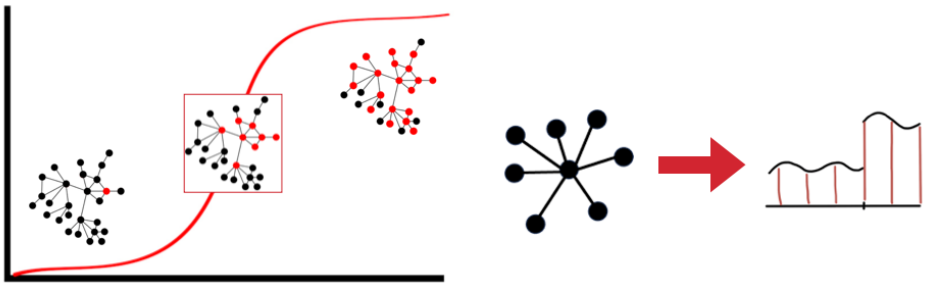




Learning Networks from the Dynamics of Social Agents

Faculty: Anirudh Sridhar

Collaborators: Anna Brandenberger (MIT), Elchanan Mossel (MIT), Arnob Ghosh (NJIT)



Challenge: Uncovering who influences whom in fast-moving, data-limited systems is extremely difficult because traditional methods require long, stable observations.
Impact: New algorithms for *structure learning* will let us identify key actors and patterns in real time, enabling timely prediction and control in complex social and engineered systems.

The goal of this project is to estimate the causal interactions that drive large-scale dynamical systems. That is, given a collection of time series corresponding to the behaviors or signals of different agents in a population, we wish to estimate the (direct) interactions between agents that lead to the observed dynamics. This task, known as *structure learning* or *causal graph discovery* in the literature, has been of significant interest for decades in engineering disciplines and the sciences. Though the details of structure learning methods vary significantly across contexts, many methods share the same high-level idea: interactions between agents can be measured by examining "correlations" in their time series, while accounting for potential confounding effects. Unfortunately, such approaches may require extremely long observation periods to learn all interactions. This framework is therefore unsuitable for dynamical systems driven by *social agents*, who are often mobile and interact with others in an ad-hoc manner.

Motivated by this gap, we have been developing a new theory of structure learning that can extract meaningful insights from systems of social agents. Preliminary results have already been acquired for learning aspects of the network underlying spreading processes such as epidemics. In a series of recent works, the fundamental limits of detecting and estimating high-degree vertices were established **[1,2,3]**, and its efficacy for detecting super-spreading events in COVID-19 was demonstrated **[2]**. Ongoing work concerns the estimation of further network properties, such as degree distributions and community structure.

References:
1. E. Mossel and A. Sridhar. *Finding Super-Spreaders in Network Cascades.* In the Proceedings of the Thirty-Seventh Conference on Learning Theory, 2024.
2. A. Brandenberger, E. Mossel and A. Sridhar. *Detecting Abrupt Changes in Point Processes: Fundamental Limits and Applications.* Preprint, 2025.
3. A. Sridhar and A. Ghosh. *Finding Super-Spreaders in SIS Epidemics.* Under review at the American Control Conference, 2025.

PROJECTS AND FUNDING

A. Abdi, CoPI, Detection Theory, Simulations, and Experiments in Time-Dispersive Underwater Environments with a Multi-Sensor Architecture, NJIT Faculty Seed Grant, $10,000. 07/1/23 - 6/30/24.

A. Abdi, PI, An Emergency Electro-Mechanical Communication System for Underground Tunnels and Mines, NSF, $50,000. 03/15/21 - 08/31/23.

A. Abdi, PI, Research in 5G/6G Technology, NEC Labs America, $30,000. 10/22.

A. Abdi, PI, Intern Proposal - A Novel Vector Acoustic Communication Technology for High Speed Underwater Modems, NSF, $49,370. 11/01/20 - 04/30/22.

A. Abdi, PI, Supplemental Request Proposal - A Novel Vector Acoustic Communication Technology for High Speed Underwater Modems, NSF, $39,965. 08/15/2019 - 04/30/22.

A. Haimovich, PI, End-to-End Machine Learning (E2EML) Fuze Radar, DoD, $1.32M, 2021-2026

J. Kliewer, PI, Collaborative Research: CIF: Medium: Do You Trust Me? Practical Approaches and Fundamental Limits for Keyless Authentication, NSF, $450,000, 2021–2026

J. Kliewer, PI, Collaborative Research: CIF: Small: Not All Eggs in One Basket: Authority Distribution for Resilience Against Compromised Nodes in Communication Networks, NSF, $299,839, 2022–2026

J. Kliewer, PI, Specific Emitter Identification for 5G Device Authentication, US Navy, $215,177, 2024-2025

Total center funding: $2,465,000

Peer-reviewed Journal Articles Published

2022

M. Ozen, E. S. Emamian, and A. Abdi, “Exploring extreme signaling failures in intracellular molecular networks,” Computers in Biology and Medicine, vol. 148, 105692, 2022.

A. Emadi, M. Ozen and A. Abdi, “A hybrid model to study how late long term potentiation is affected by faulty molecules in an intraneuronal signaling network regulating transcription factor CREB,” Integrative Biology, vol. 14, pp. 111-125, 2022.

M. Ozen, E. S. Emamian, and A. Abdi, “Learning feedback molecular network models using integer linear programming,” Phys. Biol., vol. 19, 066004, 2022

J. M. Romero-Jerez, F. J. Lopez-Martinez, J. P. Pena-Martin and A. Abdi, “Stochastic fading channel models with multiple dominant specular components,” IEEE Trans. Vehic. Technol., vol. 71, pp. 2229-2239, 2022

W. Jiang, A. M. Haimovich and O. Simeone, "Joint Design of Radar Waveform and Detector via End-to-End Learning With Waveform Constraints," in IEEE Transactions on Aerospace and Electronic Systems, vol. 58, no. 1, pp. 552-567, Feb. 2022.

Y. Yakimenka, H.-Y. Lin, E. Rosnes, and J. Kliewer, "Optimal Rate-Distortion-Leakage Tradeoff for Single-Server Information Retrieval," IEEE J. Sel. Areas Commun., vol. 40, no. 3, pp. 832-846, 2022.

S. A. Obead, H.-Y. Lin, E. Rosnes, and J. Kliewer, "Private Linear Computation for Noncolluding Coded Databases," IEEE J. Sel. Areas Commun., vol. 40, no. 3, pp. 847-861, 2022.

Y. Liu, L. Ong, P. Sadeghi, S. Johnson, J. Kliewer, and P. L. Yeoh, "Information Leakage in Index Coding With Sensitive and Nonsensitive Messages," IEEE J. Sel. Areas Inf. Theory, vol. 3, no. 4, pp. 803-814, 2022.

O. Günlü, J. Kliewer, R. F. Schaefer, and V. Sidorenko, "Code Constructions and Bounds for Identification via Channels," IEEE Trans. Commun., vol. 70, no. 3, pp. 1486-1496, 2022.

S. A. Obead, H.-Y. Lin, E. Rosnes, and J. Kliewer, "Private Polynomial Function Computation for Noncolluding Coded Databases," IEEE Trans. Inf. Forensics Secur., vol. 17, pp. 1800-1813, 2022.

E. Ekenstedt, L. Ong, Y. Liu, S. Johnson, P. L. Yeoh, and J. Kliewer, "When Differential Privacy Implies Syntactic Privacy," IEEE Trans. Inf. Forensics Secur., vol. 17, pp. 2110-2124, 2022.

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A. Emadi, T. Lipniacki, A. Levchenko, and A. Abdi, “Single cell measurements and modeling and computation of decision making errors in a molecular signaling system with two output molecules,” Biology (Machine Learning Applications in Biology Special Issue), vol. 12, 1461, 2023.

M. Ozen, E. S. Emamian, and A. Abdi, “From data to knowledge: A mini-review on molecular network modeling and analysis for therapeutic target discovery,” Arch. Pharmacol. Ther., vol. 5, pp. 36-43, 2023.

A. Haimovich, "Information Theoretic Signal Processing and Its Applications [Bookshelf]," in IEEE Control Systems Magazine, vol. 43, no. 2, pp. 97-109, April 2023.

E. Byrne, O. W. Gnilke, and J. Kliewer, "Straggler- and Adversary-Tolerant Secure Distributed Matrix Multiplication Using Polynomial Codes," Entropy, vol. 25, no. 2, p. 266, 2023.

S. Habib, A. Beemer, and J. Kliewer, "RELDEC: Reinforcement Learning-Based Decoding of Moderate Length LDPC Codes," IEEE Trans. Commun., vol. 71, no. 10, pp. 5661-5674, 2023.

E. Graves, A. Beemer, J. Kliewer, O. Kosut, and P. L. Yu, "Keyless Authentication for AWGN Channels," IEEE Trans. Inf. Theory, vol. 69, no. 1, pp. 496-519, 2023.

2024

R. Rashid, E. Zhang, A. Abdi and Z. H. Michalopoulou, “Multichannel signal detection in time-spreading distortion underwater channels using vector and scalar sensors: Theory and experiments,” IEEE J. Oceanic Eng., vol. 49, pp. 1151-1159, 2024.

R. Rashid, E. Zhang and A. Abdi, “On the performance of a new wireless communication compact multichannel underwater receiver using a sphere vector sensor,” IEEE Trans. Vehic. Technol., vol. 73, pp. 1458-1461, 2024.

U. Qureshi, A. Ghosh and B. K. Panigrahi, "Menu-Based Pricing for Electric Vehicle Charging in a Mobile Charging Service for Maximizing Charging Station's Profit and Social Welfare: A Stackelberg Game," in IEEE Transactions on Industry Applications, Vol. 61, no. 2, pp. 3447-3456 doi: 10.1109/TIA.2024.3522902.

U. Qureshi, A. Ghosh and B. K. Panigrahi, "Multiobjective Pareto-Optimal Intelligent Electric Vehicle Charging Schedule in a Commercial Charging Station: A Stochastic Convex

Optimization Approach," in IEEE Transactions on Industrial Informatics, vol. 20, no. 11, pp. 12620-12632, Nov. 2024, doi: 10.1109/TII.2024.3423373

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R. A. Chou and J. Kliewer, "Secure Distributed Storage: Optimal Trade-Off Between Storage Rate and Privacy Leakage," IEEE Trans. Inf. Theory, vol. 70, no. 5, pp. 3658-3668, 2024.

2025

R. Rashid, A. Abdi and Z. H. Michalopoulou, “Blind weak signal detection via dictionary learning in time-spreading distortion channels using vector sensors,” JASA Express Lett., vol. 5, 064803, 2025.

Wensell, Kyle P., et al. "Machine Learning Doppler-Tolerant One-Bit Radar Detectors." IET Radar, Sonar & Navigation 19.1 (2025)

S. Ghasvarianjahromi, Y. Yakimenka, and J. Kliewer, "Decentralized Sparse Matrix Multiplication Under Byzantine Attacks," IEEE Trans. Inf. Forensics Secur., vol. 20, pp. 7333-7346, 2025.

R. A. Chou and J. Kliewer, "Function Computation Without Secure Links: Information and Leakage Rates," IEEE Trans. Inf. Theory, vol. 71, no. 11, pp. 9004-9018, 2025.

J. Gaudio, M. Z. Rácz and A. Sridhar. Average-case and Smoothed Analysis of Graph Isomorphism. Annals of Applied Probability 35(2): 1373 – 1406, April 2025.

Peer-reviewed Conference Papers Published

2022

R. Rashid, E. Zhang, A. Abdi and Z. H. Michalopoulou, “Theoretical and experimental multi-sensor signal detection in time spreading distortion underwater channels,” in Proc. MTS/IEEE Oceans, Hampton Roads, VA, 2022, pp. 1-4.

A. Emadi and A. Abdi, “A study of how abnormalities of the CREB protein affect a neuronal system and its signals: Modeling and analysis using experimental data,” in Proc. IEEE Signal Processing in Medicine and Biology Symp., Philadelphia, PA, 2022, pp. 1-6.

Z. Khan, W. Jiang, A. Haimovich, M. Govoni, T. Garner and O. Simeone, "Fast Adaptation of Radar Detection via Online Meta-learning," 2022 56th Asilomar Conference on Signals, Systems, and Computers, Pacific Grove, CA, USA, 2022, pp. 580-585.

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Y. Liu, L. Ong, P. L. Yeoh, P. Sadeghi, J. Kliewer, and S. Johnson, "Information Leakage in Index Coding With Sensitive and Non-Sensitive Messages," in Proc. IEEE Int. Symp. Inf. Theory (ISIT), 2022, pp. 3256-3261.

Y. Yakimenka, C.-W. Weng, H.-Y. Lin, E. Rosnes, and J. Kliewer, "Straggler-Resilient Differentially-Private Decentralized Learning," in Proc. IEEE Inf. Theory Workshop (ITW), 2022, pp. 708-713.

S. A. Obead and J. Kliewer, "Multi-Message Pliable Private Information Retrieval," in Proc. IEEE Inf. Theory Workshop (ITW), 2022, pp. 714-719.

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E. Zhang, R. Rashid and A. Abdi, “Underwater communication experiments for transmitting multiple data streams using a vector acoustic MIMO system: OFDM and FSK modulations,” in Proc. MTS/IEEE Oceans, Biloxi, MS, 2023, pp. 1-5.

E. Zhang, R. Rashid and A. Abdi, “Experiments on a compact multichannel vector sensor receiver for signal acquisition in underwater communication systems,” in Proc. MTS/IEEE Oceans, Biloxi, MS, 2023, pp. 1-4.

Y. Zhao, A. Abdi, M. Dean and A. Abdi, “Optimal decision making with rational inattention using noisy data,” in Proc. Conf. Inform. Sci. Syst., Johns Hopkins University, Baltimore, MD, 2023, pp. 1-5.

A. Emadi, T. Lipniacki, A. Levchenko and A. Abdi, “A cellular decision making model where the cell exhibits maximum signal detection probability,” in Proc. Conf. Inform. Sci. Syst., Johns Hopkins University, Baltimore, MD, 2023, pp. 1-4.

A. Ghosh, A. M. Haimovich and J. A. Dabin, "Interference Mitigation in Blind Source Separation by Hidden State Filtering," 2023 57th Annual Conference on Information Sciences and Systems (CISS), Baltimore, MD, USA, 2023, pp. 1-6.

K. P. Wensell, J. Zhou, A. M. Haimovich, E. A. Young and L. T. Vo, "Learning of Doppler Tolerant Radar Detectors for Noise Waveforms," 2023 57th Annual Conference on Information Sciences and Systems (CISS), Baltimore, MD, USA, 2023, pp. 1-5.

S. Ghasvarianjahromi, Y. Yakimenka, and J. Kliewer, "Decentralized Sparse Matrix Multiplication Under Byzantine Attacks," in Proc. IEEE Global Commun. Conf. (GLOBECOM), 2023, pp. 1723-1728.

X. Zhong, J. Kliewer, and M. Ji, "Matrix Multiplication with Straggler Tolerance in Coded Elastic Computing via Lagrange Code," in Proc. IEEE Int. Conf. Commun. (ICC), 2023, pp. 136-141.

Y. Yakimenka, C.-W. Weng, H.-Y. Lin, E. Rosnes, and J. Kliewer, "Differentially-Private Collaborative Online Personalized Mean Estimation," in Proc. IEEE Int. Symp. Inf. Theory (ISIT), 2023, pp. 737-742.

R. A. Chou and J. Kliewer, "Secure Distributed Storage: Optimal Trade-Off Between Storage Rate and Privacy Leakage," in Proc. IEEE Int. Symp. Inf. Theory (ISIT), 2023, pp. 1324-1329.

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Emadi, A. Abdi, M. Migliore and C. Mazzara, “A hybrid model to explore how a hippocampal CA1 neuronal network is affected by faulty molecules of an intraneuronal CREB signaling network,” in Proc. IEEE Signal Processing in Medicine and Biology Symp., Philadelphia, PA, 2024, pp. 1-6.

X. Zhong, J. Kliewer, and M. Ji, "Uncoded Storage Coded Transmission Elastic Computing with Straggler Tolerance in Heterogeneous Systems," in Proc. IEEE Int. Conf. Commun. (ICC), 2024, pp. 4730-4735.

R. A. Chou, J. Kliewer, and A. Yener, "Private Sum Computation: Trade-Off Between Shared Randomness and Privacy," in Proc. IEEE Int. Symp. Inf. Theory (ISIT), 2024, pp. 927-932.

M. Bakshi, S. Ghasvarianjahromi, Y. Yakimenka, A. Beemer, O. Kosut, and J. Kliewer, "Valid: a Validated Algorithm for Learning in Decentralized Networks with Possible Adversarial Presence," in Proc. IEEE Int. Symp. Inf. Theory (ISIT), 2024, pp. 2502-2507.

2025

Z. Qi, R. Rashid, A. Abdi and D. Pompili, “Carrier frequency offset compensation for OSDM in underwater acoustic communications: Theory and experiments using a vector MIMO modem,” in Proc. Conf. Inform. Sci. Syst., Johns Hopkins University, Baltimore, MD, 2025, pp. 1-6.

A. Roknimalouki, A.Ghosh, M.Shi, and N. Shroff, ``Provably Efficient RL for Linear MDPs under Instantaneous Safety Constraints in Non-Convex Feature Spaces", in International Conference on Machine Learning (ICML), 2025.

A.Ghosh, and M. Moharremi, ``Online Learning in Risk Sensitive constrained MDP", in International Conference on Machine Learning (ICML)'25.

Y. Ahmad, A.Ghosh, Chih-Chun Wang, N. Shroff, ``Communication Efficient Asynchronous Stochastic Gradient Descent'', accepted in IEEE INFOCOM'2025

T. Koshinori, A.Ghosh, T. Kozuno,``Provably Efficient RL under Episode-Wise Safety for Constrained MDPs with Linear Function Approximation", to appear in Advanced Neural Information Processing (Spotlight), 2025.

S. Ganguly, K. Panaganti, A. Ghosh, and A. Wierman., Efficient Policy Optimization in Robust Constrained MDPs with Iteration Complexity Guarantees, to appear in Advanced Neural Information Processing, 2025.

K. Alemdar, A. Ghosh, V. Chaudhary, N. Shroff, & K. Chowdhury, (2025, October). REMARKABLE: RIS-Enabled Mobile Beamforming through Kernalized Bandit Learning. In Proceedings of the Twenty-sixth International Symposium on Theory, Algorithmic Foundations, and Protocol Design for Mobile Networks and Mobile Computing (pp. 101-110).

X. Zhong, S. Lu, J. Kliewer, and M. Ji, "Uncoded Download in Lagrange-Coded Elastic Computing with Straggler Tolerance," in Proc. IEEE Int. Symp. Inf. Theory (ISIT), 2025, pp. 1-6.

X. Zhong, S. Lu, J. Kliewer, and M. Ji, "Dual-Lagrange Encoding for Storage and Download in Elastic Computing for Resilience," in Proc. IEEE Int. Symp. Inf. Theory (ISIT), 2025, pp. 1-6.

A. Ziaeddini, Y. Yakimenka, and J. Kliewer, "Differentially-Private Decentralized Learning in Heterogeneous Multicast Networks," in Proc. IEEE Int. Symp. Inf. Theory (ISIT), 2025, pp. 1-6.

PATENTS AWARDED

J. Kliewer, S. Habib, A. Beemer: Systems and Methods for Decoding of Graph-Based Channel Codes via Reinforcement Learning, US Patent 12,166,504 B2, Dec. 2024

POSTDOCS UNDER SUPERVISION

Erjian Zhang, 2019-2022

Allison Beemer, 2020-2022

Yauhen Yakimenka, 2022-current

Kyle Wensell, 2025

STUDENTS GRADUATED

Kyle Wensell, 2024, PhD

Rami Rashid, 2024, PhD

Salman Hoque, 2024, MS

Ali Emadi, 2023, PhD

Enlong Hu, 2023, PhD

Sarah Obead, 2022, PhD

CLASSES TAUGHT BY CENTER FACULTY

ECE 232: Circuits and Systems II

ECE 291: ECE Lab for Analog Circuits

ECE 294: ECE Lab for Analog and Digital Circuits

ECE 333: Signals and Systems

ECE 425/644: Wireless Communications

ECE 601: Linear Systems

ECE 673: Random Signal Analysis

ECE 698-ST: Reinforcement Learning for Engineers

ECE 754: Statistical Signal Processing

AWARDS AND RECOGNITION

IEEE Fellow

In 2024, Dr. Joerg Kliewer was elevated to the grade of IEEE Fellow for his contributions to coding for communications and networks.

Best Paper and NeurIPS Spotlight Award

Dr. Arnob Ghosh received a Best Paper award at the ACM MobiHoc 2025 conference (among 165 papers) and a NeurIPS 2025 spotlight award (top 3.2% of accepted papers), recognizing his work in reinforcement learning.

NeurIPS 2025 Spotlight Paper

Provably Efficient RL under Episode-Wise Safety in Constrained MDPs with Linear Function Approximation

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Kenta Hoshino*
Kyoto University
Kyoto, Japan

Yohei Hosoe
Kyoto University
Kyoto, Japan

Yutaka Matsuo
The University of Tokyo
Tokyo, Japan

MobiHoc 2025 Best Paper

REMARKABLE: RIS-Enabled Mobile Beamforming through Kernalized Bandit Learning

Kubra Alemdar*, Arnob Ghosh†, Vini Chaudhary‡, Ness Shroff†, Kaushik R. Chowdhury+
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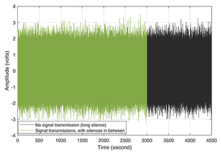
Editor's Pick

A paper by Dr. Ali Abdi's PhD student, Rami Rashid, was selected as an "Editor's Pick" in JASA Express Letters.

(Editor's Pick) R. Rashid, A. Abdi and Z. H. Michalopoulou, "Blind weak signal detection via dictionary learning in time-spreading distortion channels using vector sensors," *JASA Express Lett.*, vol. 5, 064803, 2025.

Editor's Picks

JUNE 24 2025



Blind weak signal detection via dictionary learning in time-spreading distortion channels using vector sensors

Rami Rashid, Ali Abdi et al.

This paper presents a blind passive signal detection method for underwater sparse time-spreading distortion (TSD) channels, employing a dictionary learning (DL) algorithm. This approach estimates and ...

Graduate Student Spotlight: Dr. Rami Rashid

Dr. Rami Rashid, a 2024 graduate advised by Prof. Ali Abdi, is now a Sensor Engineer at The MITRE Corporation and had an impressive record of achievements at the center. During his doctoral research, he developed new methods for data communication and signal detection in complex and challenging channels, involving both theoretical studies and field tests.

His work has been recognized with numerous awards, including:

- The Newark College of Engineering (NCE) Outstanding Graduate Student Award (2024)
- A travel award from the National Council of Acoustical Consultants (2024)
- A prize in the ECE Department PhD Stories Contest (2023)
- An NSF internship (2021)



