

AHMET FARUK SAZ

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Objective

Faruk is a sixth-year Machine Learning Ph.D. candidate at Georgia Tech, working at the intersection of information theory, formal logic, and machine learning. His research develops the theory and practice of semantic communication, which shifts the focus away from faithful signal reconstruction and asks instead what a receiver needs to reason and act correctly, and why a given selection of information is the right one. Grounding these questions in first-order logic, he has built quantitative foundations for semantic information and communication, with applications to collaborative neuro-symbolic autonomous driving, intelligent infrastructure, and next-generation wireless networks, where bandwidth is constrained and decisions must remain interpretable and verifiable. His earlier research in federated learning introduced attribute-based privacy, extending differential privacy to individual input features to give finer control over the accuracy-privacy trade-off. He is recognized for a results-driven focus; leadership developed through fellowship, mentoring, and teaching roles; and a willingness to take calculated risks on ambitious problems.

Education

Georgia Institute of Technology Atlanta, GA <i>Ph.D. in Machine Learning, GPA: 3.80</i>	2021 – 2027 (Expected)
Georgia Institute of Technology Atlanta, GA <i>M.S. in Electrical and Computer Engineering, GPA: 3.80</i>	2021 – 2024
Bilkent University Ankara, TURKEY <i>B.S. in Electrical and Electronics Engineering, GPA: 3.83</i>	2016 – 2021

Skills

Programming (Advanced): Python

Programming (Intermediate): Java, C++, Matlab

Software: TensorFlow, PyTorch, Keras, Anaconda, Numpy, Pandas, Scikit-learn, $\text{\LaTeX}$

Language: Turkish (native), English (TOEFL: Total: 112/120, Read.: 30, List.: 26, Speak.: 27, Writ.: 29, GRE: Verbal Reasoning: 154/170, Quantitative Reasoning: 170/170, Analytical Writing: 4/6)

Theory & Relevant Coursework

Signal Processing and Communications: Digital Signal Processing, Information Theory, Telecommunications, Computer Networks, Random Processes.

ML and Optimization: Statistical Machine Learning and Data Analytics, Mathematical Foundations of Machine Learning, Probabilistic Graphical Models, Convex Optimization, Online Decision Making.

Programming and Entrepreneurship: Advanced Programming Techniques, Tech Entrepreneur.

Publications

1. **A. F. Saz**, D. Xu, F. Fekri, “Goal-Oriented Logic-based Semantic Communication for Neuro-Symbolic Reasoning with Applications onto Autonomous Driving”, *IEEE INFOCOM* (Under Review), 2026.
2. **A. F. Saz**, F. Fekri, “Goal-Oriented Semantic Communication for Logical Decision Making”, *IEEE GLOBECOM* (Accepted), 2026.
3. **A. F. Saz**, S. Xiong, F. Fekri, “On The Theory of Semantic Information and Communication for Logical Inference”, *IEEE WCNC* (Accepted), 2026.
4. Y. M. Saidutta, **A. F. Saz**, A. Abdi, F. Fekri, “A Machine Learning Framework for Task-Oriented Distributed Semantic Communication over Wireless Channels in IoT”, *IEEE OJSP* (Under Review), 2025.
5. **A. F. Saz**, S. Xiong, F. Fekri, “Analysis of Semantic Communication for Logic-based Hypothesis Deduction”, *IEEE GLOBECOM* (Accepted), 2025.
6. A. M. Alamoudi, **A. F. Saz**, Y. M. Saidutta, F. Fekri, “SemTexIB: Semantic Text Communication with Information Bottleneck: Integrating Rate and Semantic Similarity into Training Objectives”, *IEEE GLOBECOM* (Accepted), 2025.
7. **A. F. Saz**, S. Xiong, F. Fekri, “DISCD: Distributed Lossy Semantic Communication for Logical Deduction of Hypothesis”, *IEEE ICMLCN* (Accepted), 2025.

8. **A. F. Saz**, S. Xiong, F. Fekri, “Lossy Semantic Communication for the Logical Deduction of the State of the World”, *IEEE WCNC* (Accepted), 2025.
9. **A. F. Saz**, Y. M. Saidutta, F. Fekri, M. R. Akdeniz, B. Edwards, N. Himayat, “Attri-Fed: A GIB Framework for Attribute-Based Privacy and Communication-Efficient Federated Learning”, *IEEE SPAWC* (Accepted), 2023.
10. **A. F. Saz**, S. Gezici, “Database Assisted Nonlinear Least Squares Algorithm for Visible Light Positioning in NLOS Environments”, Research Report (ArXiv), 2020.

Experience

Georgia Institute of Technology | Atlanta, GA

2021 – Present

Graduate Research Assistant

Sensing, Learning, Communication and Decision Intelligence (SENTINEL) Lab (<https://fekri.ece.gatech.edu>)

- Designed an FOL-based semantic communication system for LLM-guided neuro-symbolic decision-making in collaborative autonomous driving, with budget-constrained uplink/downlink data selection and roadside deduction of safety and right-of-way conclusions over FOL-encoded California Driver Handbook rules. Introduced a random-support Dirichlet–Categorical model of inductive logical probability, a modern statistical reinterpretation of Carnap’s and Hintikka’s work on semantic information. Evaluated on the MDrive benchmark in CARLA. [INFOCOM ’26]
- Formulated goal-oriented semantic communication over goal states, the logical equivalence classes of world states induced by task rules, defining semantic content entropy, relative entropy, and mutual information over them and expressing the objective equivalently through semantic rate–distortion theory and the semantic information bottleneck. Devised a polynomial-time lexicographic sorting algorithm that bypasses the doubly-exponential state space. Evaluated in the LogiCity urban simulator. [GLOBECOM ’26]
- Developed a mathematical theory of semantic information and communication for logical inference, separating the physical entropy of transmitted symbols from the content they signify. Derived a content measure calibrated to language granularity, making content-informativeness comparable across systems built on different FOL ontologies, and made the world state space tractable through dynamically constructed evidential sub-languages. [WCNC ’26]
- Framed message selection for hypothesis deduction as posterior alignment between transmitter and receiver over the world state space, reducing it to a constrained resource allocation problem solved by truncated water-filling, with global optimality established through permutation invariance and convergence rates derived for the multi-round setting. [GLOBECOM ’25]
- Extended lossy semantic communication to distributed networks whose nodes hold partial, overlapping views of the world and exchange content-informative FOL sentences through a central server. Proved convergence of node posteriors toward the true distribution over the state space and derived a PAC bound on the sample complexity on the convergence. [ICMLCN ’25]
- Designed the point-to-point lossy semantic communication scheme for deducing the state of the world when the transmitter has no knowledge of the receiver’s downstream task. Made the exponentially large state space tractable by recasting inductive logical probability as Boolean model counting over a tree-decomposition SAT model counter. Validated on the FOLIO dataset. [WCNC ’25]
- Introduced attribute-based privacy to the federated learning literature under an NSF and Intel-funded project, formulating a lightweight framework that provides a more granular accuracy–privacy trade-off than differential privacy. [SPAWC ’23]

Intel Corporation | Atlanta, GA (Remote)

May – August 2022

Graduate Technical Intern

- Developed a Generalized Information Bottleneck privacy framework for NSF & Intel’s MLWiNS project, using generative adversarial minimax optimization to produce informative yet private transformations of input data in federated learning. Transferred the technology to Intel.
- Formulated attribute-based Differential Privacy (AB-DP), relaxing DP’s assumptions so that guarantees hold over a chosen subset of input attributes and shifting the privacy–accuracy trade-off toward accuracy, and established its compatibility with standard DP.
- Implemented in TensorFlow and PyTorch, integrated with the Intel OpenFL federated learning platform, and benchmarked against Meta Opacus on Colored MNIST.

Bilkent University | Ankara, TURKEY

May – August 2021

Undergraduate Research Assistant

- Designed a novel visible light-based positioning algorithm for indoor non-line-of-sight environments by fusing two existing frameworks in the literature, fingerprinting and non-linear least squares, to improve localization

performance.

- Showcased algorithms superiority through MATLAB experimentation. Summarized findings in the form of a technical report and published on arXiv.
- Practical use cases: self-guided museum tours, indoor infant tracking.

METEKSAN Defence | Ankara, TURKEY

July – August 2018

Summer Intern

Turkish defense corporation that produces tactical military radios and electronic warfare systems

- Designed a printed log-periodic dipole antenna that can operate in the frequency range 1.5-2.5 GHz using CST software. Tested antenna with a network analyzer and presented the results to entire department.
- Received a return offer for a full-time position upon successful completion of internship.

TUBITAK Bilgem Iltaren | Ankara, TURKEY

June – July 2017

Summer Intern

The Scientific and Technological Research Council of Turkey, a government funded research institution

- Created a simulation program in Matlab to geolocate a moving object using TDOA and AOA-based geometric localization techniques under various levels of noise and conducts error analysis to determine estimate reliability. Showcased the results to entire R&D department and intern cohort.
- Received a return offer for a full-time position upon successful completion of internship.

Selected Projects

Advanced Programming Techniques Course Projects

Fall 2022

- Implemented projects in C++, gaining proficiency in common graduate-level algorithms, libraries, templates, and applications.
- These projects include:
 - Finding number of unique paths in a maze through dynamic programming.
 - Solving a large number of Sudoku's concurrently through multithreading.
 - Multiplying large matrices efficiently with OpenMP.
 - Creating a 2D Pacman game via SFML graphics library.
 - Computing temperature of a plate in a HPC cluster GPU with CUDA and Open MPI.
 - Creating a multi-client error log server via SFML networking tools.
 - Rendering a 3D sonic game map model from multiple meshes using OpenGL.

Statistical Learning and Data Analytics Course Project

Fall 2020

- Created a Suicide Number Predictor to approximate number of suicides to be committed over the next year in a target country.
- Preprocessed Kaggle World Statistics Dataset to interpolate missing values. Ridge / Lasso Regression with PCA, Neural Networks and Random Forests are implemented from scratch (sans any machine learning tools). Achieved ~93% accuracy.
- Prepared a poster and presented the results in an exhibition.

Computer Networks Course Project

Spring 2019

- Coded a web client via Java Socket API that can send and receive images to/from a web server implementing TCP protocol and providing authentication service.
- Coded a reliable data transfer protocol (Selective Repeat Protocol) over UDP via Java Socket API and threading to ensure reliable data transfer over UDP.

Microprocessors and Digital Design Course Projects

Spring – Fall 2018

- Developed an ATM using a mbed-enabled FRDM-KL25Z and Arduino Mega. OLED display, Bluetooth and force resistive sensors, and a touchpad are interfaced to Arduino and mbed. A colorful UX, opening and closing multiple accounts, depositing & withdrawing cash and coins, and overdraft alerts were among the functionalities.
- Designed a responsible parking system allowing only drivers who obey the speed limits (as estimated by ultrasonic sensors) and know the password to enter to a parking garage. An FPGA (programmed via VHDL), servo motors and ultrasonic sensors were utilized.

Amateur Radio for Analog Electronics Course Project

Fall 2017

- Soldered and tested an analog transceiver circuit that can transmit & receive audio signals at two different frequencies (28 KHz and 28.8 KHz).

Quiz Game for Programming Course Project

Spring 2017

- Contributed to a location-based android game where players need to be at certain coordinates to unlock & answer questions, collect points (developed with a group of 5).

Honors and Awards

GT LEAD Leadership Fellowship

2022 – present

Endowed to exemplary students within GT community to bolster their leadership development.

Qualcomm Fellowship

2022

Awarded to students specializing in Wireless Communications to support advancements in the field.

Outstanding Success Scholarship

2016 – 2021

Granted by Turkish Education Assn. to students with distinct vision, character, and success to reinforce their education.

Comprehensive Scholarship

2016 – 2021

Given to successful students. Covers tuition, housing, and includes a stipend.

High Honor Roll (Undergraduate)

2016 – 2021

All semesters.

298th in University Placement Exam

2016

In a cohort of 2+ million students.

Trainings and Certificates

QPR Gatekeeper Certificate

2025

Question, Persuade, Refer framework-based suicide prevention training.

Engaging with Different Personalities

2019

Turkish Education Association-led seminars to establish successful professional relationships with different personalities.

Ericsson Professional Foundation Program

2019

Series of educations on computer networks, 5G, AI, Machine Learning, Data Science, Cloud, Automation, Blockchain, IoT, Communications.

Rotary Foundation (Turkish Branch)

2018

Attended Leadership Development camp.

Teaching

Georgia Institute of Technology | Atlanta, GA

2021 – 2023

Teaching Assistant, "ECE3005: Professional and Technical Communications for ECE"

- Assisted students to help them improve their resumes, presentation and technical writing skills.

Community Involvement

Resident Assistant, GT Graduate Housing (2023–2025) — first point of contact for residents; integrated out-of-state and international students; ran biweekly community events.

LEAD @ GT (2022–present) — coach undergraduates on academic, professional, and leadership development.

Mentor'ink (2021–present) — mentor Turkish students on Ph.D. applications and careers abroad.

Turkish Education Association (2016–present) — statutory member.

Personal Interests

Coursework: Introduction to Computer Graphics (Basics on Adobe Photoshop and Illustrator); Introduction to Psychology; Introduction to Social Psychology; Cultures, Civilizations, and Ideas I & II; Science, Technology and Society; Introductory Astronomy, FujiFilm (Ankara) Basics of Photography and Composition.

Readings and Essays: International Relations, Military, Intelligence and Political History and Security Studies, Philosophy, Psychology, Political Economy, Theology.

Extracurriculars: Regular workouts at gym. Occasional hiker. Aspiring adventurer. Lover of fine food. Hater of cooking. Humanities, letters, and social sciences enthusiast. Firm believer of lifelong learning. Amateur explorer in writing, photography, poetry, dancing, and parasailing.