RAHUL GULIA

AI/ML Researcher and Systems Architect specializing in **Smart Manufacturing Systems** (Industry 4.0/5.0), **Digital Twins for Automation, and Real-Time Control**. Expertise lies in R&D, system-level simulation, and cross-functional optimization of complex industrial environments. Deep technical knowledge in **Reinforcement Learning (RL), Interpretable AI (XAI), and low-latency control protocols**. Proven ability to translate advanced AI theory into computationally efficient, high-impact industrial solutions.

CONTACT

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EDUCATION

- **PhD in Electrical & Computer Engineering** | Sep 2020 – Present
  Rochester Institute of Technology,
  Advisor: Dr. Amlan Ganguly
- **M.S. in Electrical Engineering** | Sep 2018 – Aug 2020,
  Rochester Institute of Technology
  Master's Thesis: Path Loss Model for 2.4 GHz Indoor Wireless Networks with Application to Drones
- **B.E. in Electronics & Communication Engineering** | Sep 2010 – May 2014
  Visvesvaraya Technological University

SKILLS

- **AI/ML & Data Science: Reinforcement Learning (RL) for Control,** Generative AI (VAEs), Deep Learning, **Interpretable AI (XAI), Goal-Oriented Control, Optimization,** Data-Driven Decision Systems.
- **Industrial Systems & Concepts: Digital Twins for Automation,** Industry 4.0/5.0 Technologies, **Intelligent Material Handling,** Multi-Agent Systems, **Industrial IoT/Sensing, Optimization.**
- **Modeling & Simulation: System-Level Simulation, Discrete-Event Modeling, MATLAB, Python** (NumPy, SciPy), C/C++, **High-Performance Computing.**
- **Sensor Signal Processing:** Core proficiency in data acquisition, feature extraction, filtering, and **AI-Aided Performance Monitoring** and fault diagnosis.

PUBLICATIONS

- R. Gulia et al., **"Memory-Augmented Generative AI for Real-time Wireless Prediction in Dynamic Industrial Environments,"** *IEEE Transactions on Industrial Informatics* (Under Review).
- R. Gulia et al., **"AI-Driven Radio Propagation Prediction in Automated Warehouses using Variational Autoencoders,"** *IEEE Transactions on Industrial Informatics* (Under Review).
- R. Gulia et al., **"White-Box Modeling of V2X Link Performance Using Stabilized Symbolic Regression,"** *IEEE Transactions on Vehicular Technology* (Under Review).
- R. Gulia et al., "Evaluation of 60 GHz Wireless Connectivity for an Automated Warehouse," *Information, 2023*.
- R. Gulia et al., "Automated Warehouse 5G Infrastructure Modeling Using VAEs," *ISNCC, 2024*.

EXPERIENCE

Research Assistant | RIT Sep 2020 – Present

- **Accelerated network simulations by 108x**, reducing prediction time for large-scale systems from **37.9 hours to 21 minutes**, enabling real-time network performance tuning.
- Pioneered a physics-informed deep learning framework (WISVA) for accurate **predictive modeling of resource conditions** and **real-time spatial sensing** in complex, dynamic industrial environments.

- Developed a dynamic digital twin framework (**Evo-WISVA**) to model and predict spatiotemporal changes in wireless channels, achieving high accuracy (**MAE: 0.329 dB**).
- Led development of a novel, stabilized Symbolic Regression (SR) framework in collaboration with a researcher, for interpretable BLER modeling in V2X systems.
- Provided a transparent, deployable "white-box" alternative to black-box ML, enabling efficient real-time link adaptation and foundational physical insight.

ns3 Wireless Intern | AIRA TECHNOLOGIES, INC. Jun 2023 – Aug 2023

- Conducted in-depth **performance analysis of an Open RAN deployment** using the ns-3 simulator, focusing on system-level performance.
- Collaborated on developing and enhancing **rApp functionalities** to improve network intelligence and scalability.

Teaching Assistant | RIT August 2019 – May 2020

Course: EEEE 484 – Introduction to Communication Systems |

- Assisted Dr. Panos Markopoulos in delivering core concepts of communication systems to ~30 students.
- Provided direct guidance and support on assignments, quizzes, and lab experiments, fostering active learning and problem-solving skills.

PROJECTS

Evo-WISVA: Dynamic Channel Digital Twin for Smart Warehouses

- Developed an AI/ML digital twin framework (**Evo-WISVA**) that predicts wireless channel conditions in dynamic warehouse environments achieving high accuracy (MAE=0.329 dB); achieved high accuracy and an average prediction speed of **0.5 msec per frame**.

Stabilized Symbolic Regression for Interpretable BLER Modeling in V2X Systems (Collaboration with F. Papoola and Ashish Sheikh)

- Designed and implemented a physics-informed **Symbolic Regression** framework to discover explicit analytical expressions for V2X BLER, addressing the interpretability gap of black-box ML models.
- Utilized an **aggressive Genetic Programming** configuration (20,000 population, 300 generations) to derive a 253-node analytical expression with $\boldsymbol{R^2}$**of 0.86 and MSE of** $\boldsymbol{2.08x10^{-2}}$ on unseen BLER data.

BC-TAS MD-OFDM: Backscatter-Constrained Antenna Selection for Ambient-Powered Wi-Fi (IEEE 802.11bp)

- Designed and mathematically formulated a **Backscatter-Constrained Transmit Antenna Selection (BC-TAS)** scheme to co-optimize signal strength, PAPR, and backscattered interference in MIMO-OFDM for 802.11bp systems.
- Demonstrated significant performance gains, including projected **5 dB PAPR reduction** (reducing PA back-off) and effective **control over backscatter power variance**, which is critical for interference management in ultra-low power **PHY** layers.

TECHNICAL PRESENTATION

- **Evaluation of wireless connectivity in an automated warehouse at 60Ghz,** 2022 IEEE International Conference on Consumer Electronics (ICCE) 2022, Rochester, NY, 2022
- **Automated Warehouse 5G Infrastructure Modeling Using Variational Autoencoders**, 2024 International Symposium on Networks, Computers and Communications (ISNCC), Washington, DC, 2024

SERVICES

- **Active Technical Committee Member:** IEEE Consumer Technology Society (CTSoc) – Consumer Communications Networks and Connectivity (CCN).
- **Peer Reviewer:** IEEE Internet of Things Journal, IEEE ICCE-Taiwan (2025), and other leading conferences/journals in wireless communications and AI/ML.
- **Research Showcase Leader:** Led team in presenting innovative wireless AI research at Imagine RIT: Creativity and Innovation Festival.

CERTIFICATIONS

- IBM Deep Learning & Reinforcement Learning (Coursera, May 2024)
- Generative Deep Learning with TensorFlow (Coursera, Mar 2024)
- VAEs for Image Compression (Coursera, Jan 2024)
- Neural Networks & Deep Learning (Coursera, Aug 2022)