Rishav Sen

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I am currently a Ph.D. candidate in Electrical and Computer Engineering (ECE) at Vanderbilt University, Nashville, TN, USA. My research focuses on optimization theory, data analysis, reinforcement learning, and decision-making under uncertainty, with applications in cyber-physical systems such as electric vehicles (EVs).

Education

- **Vanderbilt University** — Nashville, TN
  Pursuing PhD — *Fall 2021 - Present*
  Graduate Research Assistant (2022 - Present)
  Graduate Teaching Assistant (2021 - 2022)

- **Heritage Institute of Technology** — Kolkata, India
  Bachelor of Technology - Electronics and Communications — *August 2016 - June 2020*

Skills Summary

- **Languages**: Python, C++, JavaScript, SQL, Java
- **Frameworks**: CPLEX, Scikit, PySpark, PyTorch,, D3.js
- **Tools**: Docker, GIT, MySQL, SQLite, Spark
- **Platforms**: Linux, Web, AWS
- **Soft Skills**: Leadership, Writing, Public Speaking, Event Management

Experience

- **ScopeLab** — Vanderbilt University, Nashville, TN, USA
  Graduate Research Assistant — *Jan 2022 - Present*
  - Vehicle-to-Building (V2B) optimization with integrated negotiation strategies to minimize energy costs and mitigate power grid impact.
  - Optimization of electric bus assignments and charging schedules, incorporating power grid impacts, and accommodating driver preferences.
  - Transit simulation focused on modeling bus movements and optimizing their deployment for improved efficiency.
  - Locating Emergency response centers in and around Nashville

- **Nissan North America Inc.** — Santa Clara, CA, USA
  Research Intern — *Jun 2023 - Sep 2023*
  - Worked on developing vehicle-to-building (V2B) solutions
  - Data analysis and building generative models to predict user behavior. Building optimization models for minimizing operational cost of buildings supporting V2B.

- **TATA Consultancy Limited** — Kolkata, WB, India
  Assistant Systems Engineer — *Sep 2020 - Aug 2021*
  - Carried out web development using Angular based on JavaScript; worked on Adobe Experience Manager
  - Salesforce Customer Relationship Management - for designing the delivery pipelines and maintaining schedules for Emirates Catering Services.

Publications

- **Online Decision-Making Under Uncertainty for Vehicle-to-Building Systems (under review)**: Vehicle-to-Building (V2B) systems optimize EV charging and discharging to cut costs, but complexity arises from pricing, planning, and user constraints; we model it as an MDP and use online search with heuristics, achieving state-of-the-art results in real-world tests using data from an EV manufacturer.
- **Reinforcement Learning-based Approach for Vehicle-to-Building Charging with Heterogeneous Agents and Long Term Rewards** (Best paper finalist at AAMAS 2025): This study introduces a novel RL framework combining Deep Deterministic Policy Gradient (DDPG) with MILP-driven guidance, enabling scalable and efficient V2B energy management, achieving significant cost savings and meeting all charging demands in dynamic, real-world scenarios.
- **OPTIMUS: Discrete Event Simulator for Vehicle-to-Building Charging Optimization**: The rise of EVs has increased demand for charging infrastructure, raising grid concerns while offering building owners a way to use EV batteries for energy resilience; we propose a discrete event simulator V2B optimization, enabling owners and EV manufacturers to train, evaluate, and benchmark charging policies for cost savings and grid stability. IEEE Xplore

- **Grid-Aware Charging and Operational Optimization for Mixed-Fleet Public Transit**: This study presents a robust hierarchical MILP model that optimizes charging and trip assignments for mixed bus fleets (electric and internal combustion engine buses), cutting costs and enhancing sustainability using real-world data from Chattanooga, Tennessee. Link
- **BTE-Sim: Fast simulation environment for public transportation**: Public transit is vital for cities but often stagnates due to static design. BTE-Sim, a fast, multi-layered transit simulation, analyzes population demand, traffic, and road networks to optimize routes, evaluate changes, and improve efficiency with low computation time. IEEE Xplore
- **E-Transit-Bench: Simulation Platform for Analyzing Electric Public Transit Bus Fleet Operations**: A framework of transportation-grid co-simulation, analyzing the spatiotemporal interaction between the transit operations with electric buses and the power distribution grid. ACM Digital Library
- **Low-Cost Air Pollution Monitoring Device Based on Air Quality Index** (Best paper award at I3SET2K19): This paper uses a portable battery-powered hub on an 8-bit microcontroller, equipped with several Metal Oxide Semiconductor (MOS) based gas sensors and Particulate matter (PM) sensors to record air quality. SSRN
- **Microcontroller Based Sensor-Array Data Acquisition System for Electronic Nose**: The development of microcontroller-based data acquisition for the processing of the real-time data of a QCM Sensor array-based E-Nose system and its output on a graphical user interface (GUI) has been discussed. It also shows a light and easy-to-move working prototype. IEEE Xplore
- **Development of an android platform for monitoring QCM sensor-array based Electronic Nose**: The objective is to develop a microcontroller-based, real-time data acquisition, and remotely operated system, also called the Remote Sensing System for a Standalone E-Nose System (IEEE Xplore
- **Development of the Data Acquisition System and GUI for QCM Sensor-Based System**: The development of a Quartz crystal Microbalance (QCM) sensor-based data acquisition system along with a Graphical user interface (GUI) for proper sensing functionality has been described in this work. SSRN

Projects

- **Inducing Self-Supervised Learning in GANs**: Focuses on exploring two potential self-supervised tasks, rotational and contrastive learning on images. We mainly test the quality of the generated image samples using FID-based scores. We show that our method was able to improve upon Vanilla GANs, with the Contrastive Learning GAN performing the best (May '22)
- **Predicting Location of Emergency Response Centers**: provide a framework to address this issue by spatiotemporally aggregating the traffic and the accident data over the area of interest and make optimal predictions for locating the emergency response hubs (April '21)
- **Investigating Nashville's Traffic Incidents**: give a comprehensive visualization of Nashville's traffic incidents, revealing their spatial and temporal patterns and conveying how different conditions such as weather, location, collision type, and time of day have impact traffic incidents rates in Nashville. (May '21)
- **Optimizing electric bus charging with cost and grid load considerations**: The project aims to use a game theoretic approach to find the optimum time for the EVs to charge, minimizing grid load, and in turn reducing the electricity cost of the Transit Agency. This is done by setting up a Stackelberg game between the EVs and the Charging station. (November '21)
- **Automating Games and live browser tasks**: Using pattern recognition in live video feeds to track and then act on them to play games and perform browser automation. (Feb '21)
- **Automated nearby warning for COVID-19**: Produces warning messages if any infected person with who has been detected to have COVID-19 sets their system accordingly and approaches an uninfected person. (May '20)
- **Tic-Tac-Toe and ConnectFour playing bots**: This project used the minimax algorithm to automate the logic behind the two games, allowing for interactive and auto-play options. (September '20)
- **UI based Automatic folder sorter**: Sorts all files in a folder according to their extensions (April '20)
- **IEEE HITK website**: Developed and maintained the website - adding in SEO and built on HTML and Javascript IEEE HIT Student Branch(Sep '19)
- **4-bit micro-controller**: Using Xilinx FPGA board to design a micro-controller to perform fundamental mat operations - outputs displayed using onbaord LEDs and time graphs (Jan '19)

Volunteer Experience

Vanderbilt University
ECE Student Association (ECESA) *September 2022 – September 2023*
- Founding member (Treasurer)
- Organized workshops and collaborative activities across the ECE department

Google
Developer Student Club *June 2019 – March 2020*
- Organized workshops on advancements in Machine learning, and spread interest in automation.

IEEE
IEEE Heritage Institue of Technology Student Branch *April 2018 – June 2020*
Branch chair from Jun '19 to Jun '20
- Organized technical seminars, trainings and workshops.
- Conducted technical fests in and around the city with more than 1000 students participating.
- Seminar on drone building. Propagated interests in RC drones and airplanes.