RUBY SHRESTHA

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RESEARCH INTERESTS

Reliable Deep Generative Modeling; Causal Modeling and Reasoning; Interventional and Counterfactual Generation; Robustness to Distribution Shift; Trustworthy ML

EDUCATION

PhD in Computing and Information Sciences *Aug 2022 – Present*
Rochester Institute of Technology (RIT) *Rochester, NY, USA*
Expected graduation: 2027
Advisor: Prof. Linwei Wang | Research group: Computational Biomedicine Lab
Relevant coursework: Deep Learning, Statistical Machine Learning, Non-convex Optimization, Quantitative Foundations, Data Science & Analytics, Visual Analytics

B.Sc. in Computer Science and Information Technology *Oct 2013 – Apr 2018*
Tribhuvan University *Nepal*

RESEARCH EXPERIENCE

Computational Biomedicine Lab, RIT Rochester, NY, USA
Graduate Research Assistant *Aug 2022 – Present*

Robustness analysis of generative models under feature correlation *(first author, manuscript under review)*

- *Led a large-scale evaluation of 13+ generative models and mitigation strategies* from explainable AI, causal modeling, and data augmentation, assessing how well they generalize to minority images across synthetic, natural, and medical datasets under increasing feature correlations.
- *Built a new benchmark dataset (Co-occurrence MNIST) and a multi-metric evaluation framework*, identifying root causes of failure: covariate shift, scarce minority samples, mismatched inductive bias, and biased classifier supervision.
- *Developed a theoretical perspective on observed failures* by drawing an analogy between minority image generation and potential outcome estimation in causal inference.

Robust deep generative framework, ProReGen *(first author, ICLR 2026)*

- *Developed a model-agnostic generative framework* that combines input orthogonalization inspired by Robinson's partialling-out method in causal inference with progressive residual learning to generate underrepresented attribute combinations.
- *Improved minority generation accuracy over baselines* across diffusion models, VAEs, and GANs, without degrading majority generations.

Controllable and counterfactual generation *(work in progress)*

- *Developing a robust causal generative model* for controllable and counterfactual image generation under varying strengths of causal relationships between attributes.

Scientific ML for noisy real-world signals *(manuscript under review; RIT and Argentine Institute of Radioastronomy collaboration)*

- *Developed an unsupervised ML pipeline* combining Isolation Forest outlier rejection, β-VAE denoising, and Self-Organizing Map clustering to analyze approximately 10^6 noisy radio-telescope pulses.
- *Introduced a peak-dominance score* to select pulses with distinct peaks, doubling the signal-to-noise ratio for a faint millisecond pulsar; *linked pulse clusters to pulsar emission physics*, suggesting a potential $\sim 3.5\times$ improvement in timing precision for a pulsar used in pulsar timing arrays.

PUBLICATIONS

- **R. Shrestha**, A. Gopi, C. Meisenzahl, B. Lekhak, and L. Wang. "ProReGen: Progressive Residual Generation under Attribute Correlations." **ICLR**, 2026.
- C. O. Lousto, **R. Shrestha**, E. Zubieta, S. B. Araujo Furlan, G. Gancio, F. García, S. del Palacio, R. Missel, and L. Wang. "Single-pulse reanalysis of the 2024 Vela glitch and new observations of PSR J0437–4715 and PSR J1644–4559." arXiv:2609.03056 (preprint), 2026.

- M. Toloubidokhti, Y. Ye, R. Missel, X. Jiang, N. Kumar, **R. Shrestha**, and L. Wang. "DATS: Difficulty-Aware Task Sampler for Meta-Learning Physics-Informed Neural Networks." **ICLR**, 2024.
- N. Kumar*, **R. Shrestha***, Z. Li, and L. Wang. "Distributionally Robust Optimization and Invariant Representation Learning for Addressing Subgroup Underrepresentation: Mechanisms and Limitations." **FAIMI @ MICCAI**, 2023. (*Equal contribution.)
- **R. Shrestha**. "Maze Solving with Anomaly Tolerant Dead End Filling and A*: Implementation and Analysis." **Deerwalk Journal of Computer Science and Information Technology**, 2019.

INDUSTRY EXPERIENCE

Saugal Trading Company Pvt. Ltd. Nepal
Software Consultant *Apr 2021 – Jul 2022*

Deerwalk Inc. (now Cedar Gate Technologies) Nepal
Software Engineer / Team Lead / Development Manager *Sep 2015 – Mar 2021*
Progression: Software Engineering Intern (Sep 2015 – Apr 2018); Software Engineer (May 2018 – Mar 2019); Software Engineer & Team Lead (Apr 2019 – Jan 2021); Senior Software Engineer & Development Manager (Jan – Mar 2021).

- Led projects to optimize Elasticsearch queries and build healthcare-data extraction frameworks supporting descriptive, prescriptive, and trend-based reporting and visualization.

SKILLS

Generative & Trustworthy ML	Diffusion models, VAEs, GANs, distribution shift, spurious correlations, explainable AI, data augmentation, anomaly detection
Causal ML	Structural causal models, potential outcome framework, confounding, interventions, counterfactual generation
ML Stack	Python, PyTorch, scikit-learn, NumPy, Pandas, Weights & Biases, MLflow, MATLAB
Tools & Platforms	Linux, SLURM, Git, SQL, Elasticsearch, LaTeX

HONORS AND AWARDS

Dr. Russell & Melissa Bessette Award for Doctoral Student Excellence, RIT *2023*

National Female Education Award, Government of Nepal *2019*

Winner, International Girls in ICT Day Hackathon *2016*

Outstanding Cambridge Learners Award – Top in Country *2013*

CONFERENCE PRESENTATIONS

Poster: ProReGen: Progressive Residual Generation under Attribute Correlations, ICLR *Apr 2026*

Oral: Maze Solving with Anomaly Tolerant Dead End Filling and A*, IT4D *Aug 2018*

TEACHING EXPERIENCE

Guest Lecturer, CISC-865 Deep Learning (PhD-level course), RIT *Nov 2025*

Guest lecture on robustness of deep learning models to observed attribute correlations.

Workshop Instructor, Deerwalk Institute of Technology *Jan – Mar 2019*

Taught data management and analysis with Elasticsearch.

Guest Trainer, Local Development Training Academy *Jul 2018*

Delivered hands-on training on cloud services, content management, and project management tools.