

Bipin Lekhak

📍 Rochester, NY ✉ bl1282@rit.edu 🌐 bipinlekhak.com.np
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Summary

PhD candidate working on **causal machine learning for time series**: latent-dynamics models that predict how a system—a patient, a tumour under therapy, a physical system observed through video—will respond to interventions. My models separate a system’s native dynamics from its response to treatment, are identifiable, and adapt to each individual from its own history through meta-learning. Before the PhD, four years as a machine learning engineer shipping medical imaging and forecasting systems.

Research interests: causal inference over time, treatment-effect estimation under time-varying confounding, latent dynamical systems and neural ODEs, identifiable representation learning, meta-learning, machine learning for healthcare.

Education

Rochester Institute of Technology, Rochester, NY Aug 2022 – Present
Ph.D. in Computing and Information Sciences Expected 2027

- Advisor: Prof. Linwei Wang, Computational Biomedicine Laboratory
- Dissertation proposal (defended July 2026): *Learning Dynamics for Forecasting Future Trajectories under External Interventions*

Pulchowk Campus, Institute of Engineering, Tribhuvan University, Nepal Nov 2014 – Sep 2018
B.E. in Electronics and Communication Engineering

Publications

Manuscripts under review

iASIDE: Identifiable, Adaptable, and Separable Interventional Dynamics 2026
Bipin Lekhak, Yubo Ye, Suraj Poudel, Ruby Shrestha, Linwei Wang

Peer-reviewed conference papers

ProReGen: Progressive Residual Generation under Attribute Correlations ICLR 2026
 Ruby Shrestha, Ajay Gopi, Casey Meisenzahl, *Bipin Lekhak*, Linwei Wang
 International Conference on Learning Representations. [OpenReview](#) 

Novel In-Home Cardiac Monitoring for Heart Failure Patients CinC 2023
Bipin Lekhak, Ryan Missel, Dillon Dzikowicz, Solomiya Rachynska, Wojciech Zareba, Linwei Wang
 Computing in Cardiology. [IEEE Xplore](#) 

Research Experience

Graduate Research Assistant Rochester, NY
Computational Biomedicine Laboratory, RIT (PI: Prof. Linwei Wang) Aug 2022 – Present

- **Interventional latent dynamics (ASIDE / iASIDE)**. Developed a latent neural-ODE framework for forecasting trajectories under time-varying treatments. It separates a system’s native dynamics from its intervention-response dynamics, adapts each to a subject’s history through amortized (feed-forward) meta-learning, and establishes identifiability of the latent interventional dynamics. Improves intervention-response prediction most at long horizons and under high data heterogeneity.
- **Benchmarking framework**. Built the evaluation suite behind the work: 10+ causal time-series baselines (Causal Transformer, CRN, RMSN, MSM, G-Net, SCIP, TE-CDE, TESAR-CDE, ACTIN) on tumour-growth simulation, MIMIC-III ICU data and high-dimensional pendulum video, with and without time-

varying confounding. Hydra, PyTorch Lightning and MLflow; SLURM sweeps across GPU clusters; regression tests that verified a migration from PyTorch 1.13 to 2.x against the old results.

- **Simulation.** Wrote a simulator of damped, forced pendulums under stochastic interventions, rendered as image sequences, as a benchmark for interventional dynamics from high-dimensional observations.
- **Treatment-effect estimation over time** (work in progress, with S. Poudel). Temporal X- and R-learners that build on the separable latent dynamics to identify causal treatment effects.
- **In-home cardiac monitoring.** Analysed multi-sensor data from a toilet-seat cardiac monitor in an NIH-funded (R01NR018301) study of heart-failure patients after hospital discharge, with the University of Rochester Medical Center. Measured adherence and deployment failures, built data dashboards, and predicted 21-day hospitalisation from 7-day windows (AUC 0.74).

Industry Experience

Machine Learning Engineer

Fusemachines

Kathmandu, Nepal

Sep 2018 – Jun 2022

- Built deep-learning semantic segmentation for medical images with U-Net, Mask R-CNN and Detectron.
- Reconstructed 3D anatomical structures from 2D images by gradient-free optimisation over statistical shape models.
- Forecast product sales from historical data with a multi-stage model, each stage encoding a different assumption about the sales pipeline (LSTMs, Prophet, gradient-boosted trees); designed and tested Bayesian variants in PyMC.

Teaching

Teaching Assistant, GCCIS-820 Quantitative Foundations, RIT

Fall 2025

PhD core course: linear algebra, optimisation and statistical inference

- Supervised and graded team projects and reports; built the tool used to form project teams.

Skills

Methods: causal inference over time (potential outcomes, time-varying confounding, IPW and marginal structural models, meta-learners), latent dynamics and state-space models, neural ODEs/CDEs, meta-learning, variational inference, identifiability, Bayesian modelling, time-series forecasting, medical image segmentation

ML stack: Python, PyTorch, PyTorch Lightning, torchdiffeq, Hydra, MLflow, Ray Tune, scikit-learn, PyMC, Prophet, pandas, NumPy

Infrastructure: SLURM and HPC clusters, Linux, Podman/containers, self-hosted MLflow, uv, pytest, Git

Other: R, MATLAB, SQL, LaTeX, Streamlit, Dash