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RESEARCH & COLLABORATION PROFILE

KEY WORDS: Stochastic Differential Equations, Stochastic Optimization & Control, Data-Driven Modeling, Numerical PDEs, Scientific Machine Learning



Research Snapshot. Prof. Jeon develops mathematical and data-driven methods for modeling and optimizing dynamic systems under uncertainty. His research combines stochastic differential equations, PDE-based computational methods, machine learning, and stochastic optimization. His recent work focuses on constrained stochastic control, data-driven prediction, and computational analysis of stochastic dynamics, with applications to financial systems and sequential decision-making problems.

RESEARCH EXPERTISE

- **Stochastic modeling:** mathematical modeling of uncertain dynamic systems using stochastic differential equations, including stochastic volatility, mean-reverting dynamics, and state-dependent stochastic processes.
- **Stochastic optimization & control:** development of optimization and learning methods for sequential decision-making problems under uncertainty, including constrained stochastic control and policy-gradient methods.
- **Numerical & computational methods:** PDE/SDE-based computation, Monte Carlo simulation, asymptotic methods, and numerical analysis for stochastic dynamic systems.
- **Data-driven modeling & machine learning:** statistical and machine-learning methods for forecasting, uncertainty-aware prediction, and learning complex relationships from time-series and tabular data.

RECENT RESEARCH HIGHLIGHTS

- **Constrained stochastic optimization:** developed policy-gradient-based methods for solving dynamic stochastic optimization problems with state and control constraints.
- **Stochastic dynamics and numerical solvers:** investigated how numerical solvers affect predictive distributions in conditional diffusion models and analyzed solver-induced variance distortion.
- **Data-driven risk modeling:** developed a type-aware neural architecture for imbalanced tabular credit-default prediction, integrating heterogeneous feature structures within a unified predictive framework.

POTENTIAL COLLABORATION RESEARCH

Best-fit collaborator areas: Stochastic dynamics | optimization & control | scientific machine learning | uncertainty quantification | dynamic decision systems

- **1. Data-driven stochastic dynamics:** development of hybrid models that combine observed data with SDE-based dynamics, including estimation or learning of drift, diffusion, and latent stochastic states.
- **2. Stochastic optimization and sequential decision making:** development of constrained optimization and control methods for dynamic decision problems under uncertainty.
- **3. Scientific machine learning:** integration of neural networks and learning-based methods with stochastic differential equations, PDEs, and numerical simulation.
- **4. Prediction-to-decision modeling:** integration of forecasting and uncertainty quantification with downstream optimization and decision-making.

SELECTED RECENT PUBLICATIONS

- **Journal of Industrial and Management Optimization** 2025, 21(9), 5687–5715 — *Pontryagin-Guided Direct Policy Optimization for Continuous-time Portfolio Problem.*
- **AIMS Mathematics** 2025, 10(8), 18997–19017 — *Analytic Approximations for Foreign Equity Options under a Stochastic Volatility with Fast Mean Reversion.*
- **PLoS One** 2025, 20(9), e0331391 — *Deep Momentum Networks with Market Trend Dynamics.*
- **IEEE Access** 2026 — *CSA-Net: A Type-Aware Dual-Tower Neural Model for Imbalanced Tabular Credit Default Prediction.*

CONTACT

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REPRESENTATIVE RESEARCH FIGURES / SCHEMES

