GURU KALYAN JAYASINGH

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SUMMARY

Quantitative researcher skilled in Python, C++, and machine learning, with expertise in large-scale data analysis and algorithm development. Passionate about quantitative trading and financial markets, with a strong foundation in statistical modeling and real-time data processing.

EDUCATION

University of California San Diego 2022-2027
PhD in Theoretical Physics and Fluid Turbulence

Indian Institute of Technology Bombay, India 2017-2022
Dual Degree (B.Tech + M.Tech) in Engineering Physics (Nanoscience Specialization) (GPA = 3.78)
Awarded Institute Silver Medal (Top of class in Physics Department) and Best Master's Thesis Award

SKILLS & CERTIFICATIONS

Languages & Platforms: Python (7+ years), C/C++, Mathematica (1+ year)
Python Libraries: PyTorch, TensorFlow, NumPy, Pandas, SciPy, scikit-learn, Matplotlib, Seaborn
Machine Learning: Supervised Learning (regression), XGBoost, Decision Trees, Neural networks (RNNs, LSTM)
Quantitative: Quantitative stochastic processes, Data Analysis, Numerical Methods, Monte Carlo methods, Time-series analysis

MACHINE LEARNING EXPERIENCE

Structural Health Monitoring and Fault Detection from Time Series — Course Project
Tools: Python, PyTorch (LSTM), scikit-learn, NumPy, Pandas, SciPy (Welch PSD/FFT), Matplotlib
- Built an end-to-end structural health monitoring pipeline on a 34.8M-entry sensor dataset to detect building structural damage.
- Trained a multivariate sequence model (LSTM) to predict 4-floor acceleration responses from excitation input.
- Achieved test MSE ≈ 0.00278; on a heavily damaged state, error rose to MSE ≈ 0.0347 (~12.5× increase), enabling clean anomaly separation using prediction residuals.
- Engineered PSD/FFT-based features (Welch spectrum, band integrals, peak structure) and trained a multinomial classifier achieving 85.29% accuracy across 17 structural states.

Neural Forecasting Competition: Graph-RNN for High-Dimensional Time Series
Tools: Python, PyTorch (GRU, Graph Convolutions), NumPy, Pandas, Matplotlib
- Developed Graph-RNN architecture for forecasting ECG signals given multi-channel neural activity data in NSF HDR hackathon ($4k prize pool).
- Implemented 3-layer GRU with scheduled sampling and graph convolutions; addressed out-of-distribution generalization challenges from distribution shifts across recording sessions.
- Achieved MSE of 32,925 with 0.80 R^2 on in-distribution data; outperformed statistical baselines (ARIMA, ETS) and currently 17th in the global leaderboard.

Fukushima–Daiichi Nuclear Disaster: Spatiotemporal Spread Modeling
Tools: Python, NumPy, Pandas, Matplotlib
- Built and validated a diffusion-based spatiotemporal model of radioactive spread following the Fukushima disaster.
- Established distance-dose scaling, and recovered a secondary peak in activity signals consistent with dual explosions and I-131 decay times.

RELEVANT RESEARCH EXPERIENCE

Statistical Mechanics and Stochastic Modeling of Transition to Fluid Turbulence
- Developed a new stochastic model explaining the laminar-turbulent transition in externally forced pipe flows.
- Established the connection to certain classes of ecological models, allowing use of theoretical ecology results to investigate fluid dynamics for the first time.
- Demonstrated universal statistical features across different flows and resolved a key inconsistency in prior numerical studies. Results published in Physical Review Letters. [Paper Link] [News Coverage]
- **Topology Driven Stability in Quantum Matter:** Recast the interacting quantum system governed by self-consistency as a nonlinear eigenvalue problem, linearizing near criticality to extract observable thermodynamics and characterize how boundary-induced scattering reshapes the spectrum.
- **Nonequilibrium Dynamics Of Electron-Phonons In Solids:** Developed a high-performance real-time quantum many-body dynamics solver implementing Kadanoff-Baym equations for electron-phonon systems on a 1D lattice.

AWARDS AND PUBLICATIONS

- **G.K. Jayasingh** and N. Goldenfeld, "Tricritical directed percolation controls the laminar–turbulent transition in pipes with body forces," Phys. Rev. Lett. 135, 104001 (2025).
- Selected among the top 50 nationwide for the 10-day Indian National Maths Olympiad Training Camp (KVS).
- Ranked 3rd all-India in the Indian Young Physicists League (IYPL), a national theoretical physics competition.
- Achieved 99.62 percentile in JEE Advanced (2017) among 200,000 applicants.
- Ranked in the Top 1% in NSEC/NSEP, the national qualifiers for INPhO/INChO, and advanced to the INChO.
- Served as Teaching Assistant in over 16 courses, spread between undergraduate math, physics and graduate level courses.