

Ting Gao

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EDUCATION

- **Illinois Institute of Technology** Ph.D., Applied Math Aug. 2010 – May. 2015
- **Southwest University** M.S., Applied Math Sep. 2007 – Jul. 2010
- **Southwest University** B.S., Mathematics Sep. 2003 – Jul. 2007

WORK EXPERIENCE

Associate Professor, Huazhong University of Science and Technology

Wuhan, Hubei

Dec. 2020 – present

- Learning governing laws for stochastic dynamical systems under non-Gaussian Levy noise
 - Time evolutionary latent dynamics
 - Interaction kernels in particle systems
- Learning effective dynamics in stochastic dynamical systems under non-Gaussian Levy noise
 - Transition phenomena
 - Effective reduced order dynamics
- Explainable deep learning modelling through dynamical systems' point of view
 - Reinforcement learning
 - Reservoir Computing
- Applications on high-dimensional complex data analysis & Research Labs
 - MIMO 5G communication
 - Brain Science
 - Quantitative Finance

Machine Learning Engineer II, Revenue Science R&D

Twitter, San Francisco

Dec. 2018 – Dec. 2020

- Learning-period ads optimization
 - Improved PCTR prediction via attention mechanism on deep neural network
 - Designed multiple boosting mechanisms for enhancing new campaigns' survival rate during/after learning period as well as better long-term ads budget utilization
 - Designed experiments and analyzed new campaigns' performance to help make business decisions
- Launched a new large scale deep learning model for real time video ads engagement prediction
- Designed and implemented an innovative reinforcement learning framework for real time bidding in ads auction Presented state-of-the-art research papers from premier conferences
- Led two summer interns: PCTR exploration through contextual bandit, CPE optimization via reinforcement learning

Senior Data Scientist/Tech Lead, R&D

Machine Zone, Palo Alto

Sep. 2017 – Nov. 2018

- Refactored sales recommendation system to OOP modules and generalized ML tools
 - Scale up personalized sales recommendation system to players at all levels and all price points.
 - Build map-reduce data pipeline to improve data quality with PySpark.
- Developed cohort inflation optimization model and tool to improve total ROI for new game release
 - Automate cohort sales inflation strategies with Multi-arm bandit UCB.
- Built MZ's first sales recommendation system to improve revenue lift and purchase conversion
 - Data pipeline from various data sources: Hive, Vertica, MySQL, Hbase, Redis.
 - Models using DDPG, LSTM, GBT, Clustering & robust Softmax, Sequential Pattern Mining.
 - AB testing experiments framework for model iterations and automatic performance report.

Data Scientist, R&D

Machine Zone, Palo Alto

Mar. 2016 – Sep. 2017

- Created a data product to track the healthiness of long term user engagement and optimize strategies on critical

targets

- o Markov chain modeling for cohort flow/churn prediction.
- o Created a tree based generic bucketing framework for time series anomaly detection.
- Long term revenue prediction
 - o Created revenue targeting and prediction model/UI to help sales reach monthly revenue goal and game feature release.
 - o Built random probability matching algorithms for real time creative optimization.
 - o Budget planning and allocation for product release using linear programming and portfolio optimization algorithms.

Data Analyst, R&D

Machine Zone, Palo Alto

Feb. 2015 – Mar. 2016

- Built automatic reports for Game KPI and ROI summary to support game design and live operations.
- Designed statistical analysis and Machine learning methods to help make business decision
 - o Game: kingdom open/close control, kingdom war pairing, inflation analysis, etc.
 - o Marketing TV ads campaign management, ROI prediction.

Graduate Research & Teaching Assistant

Illinois Institute of Technology, Chicago

Aug. 2010 – Dec. 2014

- Created numerical algorithms for computing first passage time and escape probability of Non-Gaussian process.
- Quantifying model uncertainty under Non-Gaussian noise.
- Taught courses: Computational Mathematics, Probability and Statistics, Calculus, hand-on Mathematica lab.

Institute for Pure and Applied Mathematics (IPAM), Los Angeles

Jan. 2012 – Jul. 2013

- Created numerical algorithms for computing Fokker-Planck equations of Non-Gaussian process.
- Data assimilation under Non-Gaussian noise.

TECHNICAL SKILLS

- Programming Languages: Python, R, Scala, C++, Matlab, Tensorflow, Pytorch
- Database & Big Data Ecosystem: MySQL, Vertica, HIVE, Hbase, Redis, Druid, Hadoop, Spark
- Stochastic Analysis; Stochastic Dynamical Systems; Advanced Probability and Statistics; Stochastic Optimal Control; Statistical Learning; Deep Learning; Deep Reinforcement Learning

PUBLICATIONS & PATENTS

- [1] C. Fang, Y. Lu*, **T. Gao**, J. Duan, Reservoir Computing with Error Correction: Long-term Behaviors of Stochastic Dynamical Systems, arXiv:2305.00669, 2023. submitted.
- [2] J. Guo, **T. Gao***, P. Zhang, J. Duan, Deep Reinforcement Learning in Finite-Horizon to Explore the Most Probable Transition Pathway, arXiv:2304.12994, 2023. submitted.
- [3] J. Chen, **T. Gao***, Y. Li and J. Duan, Detecting the Most Probable High Dimensional Transition Pathway Based on Optimal Control Theory, arXiv:2303.00385, 2023. submitted.
- [4] L. Yang, **T. Gao***, W. Wei, M. Dai, Y. Lu, C. Fang, J. Duan, Meta label correction for time series, arXiv:2303.08103, 2023. submitted.
- [5] L. Feng, **T. Gao***, M. Dai, J. Duan, Learning reduced effective dynamics from data-driven stochastic dynamical systems, Chaos 33 (4), 043131, 2023.
- [6] H. Huang, **T. Gao***, P. Li, J. Guo, P. Zhang, N. Du, J. Duan, Model Based Reinforcement Learning with Non-Gaussian Environment Dynamics and its Application to Portfolio Optimization, arXiv:2301.09297. submitted. 2023.

- [7] L. Feng, **T. Gao**, T. Li*, Z. Lin, X. Liu, Approximations of Levy processes by integrated fast oscillating Ornstein-Uhlenbeck processes, submitted to Stochastics and Dynamics. 2023.
- [8] L. Yang, **T. Gao***, Y. Lu, J. Duan, T. Liu, Neural network stochastic differential equation models with applications to financial data forecasting, *Applied Mathematical Modelling* 115, 279-299, 2023.
- [9] W. Wei, **T. Gao**, X. Chen*, J. Duan, An Optimal Control Method to Compute the Most Likely Transition Path for Stochastic Dynamical Systems with Jumps, *Chaos*, 32, 051102, 2022.
- [10] C. Fang, Y. Lu, **T. Gao*** and J. Duan, An end-to-end deep learning approach for extracting stochastic dynamical systems with α -stable Levy noise, *Chaos*, 32, 063112, 2022.
- [11] Y. Lu, R. Maulik*, **T. Gao**, F. Dietrich, I. Kevrekidis, J. Duan, Learning the temporal evolution of multivariate densities via normalizing flows, *Chaos* 32, 033121, 2022.
- [12] Min Dai, **Ting Gao***, Yubin Lu, Yayun Zheng, Jinqiao Duan, Detecting the maximum likelihood transition path from data of stochastic dynamical systems, *Chaos*, 30, 113124, 2020.
- [13] **Ting Gao**, C. Lam, etc. Sales inflation recommendation based on DDPG. *Application number 62/856,536*. 2019.6.3.
- [14] **Ting Gao**, J. Duan, X. Li*, Fokker-Planck Equations for Stochastic Dynamical Systems with Symmetric Levy motions. *Appl. Math Comput.* Vol.278, (2016) 1-20.
- [15] **Ting Gao**, J. Duan*, Quantifying model uncertainty in dynamical systems driven by non-Gaussian Levy stable noise with observations on mean exit time or escape probability. *Commun Nonlinear Sci Numer Simulat.* 39 (2016) 1-6.
- [16] **Ting Gao**, J. Duan*, X. Kan, Z.Cheng, Dynamical inference for transitions in stochastic systems with alpha-stable Levy noise. *J Phys A-Math Theor.* Vol.49(29), December, 2015.
- [17] **Ting Gao**, J. Duan, X. Li*, R. Song, Mean exit time and escape probability for dynamical systems driven by Levy noise. *SIAM J. Sci. Computing. SIAM J. Sci. Computing.* Vol. 36, No. 3, pp. A887-A906, 2014.
- [18] M. Hao, **Ting Gao**, J. Duan*, W. Wu, Non-Gaussian dynamics of a tumor growth system with immunization. *Inverse Problems & Imaging*, Vol. 7 Issue 3, August, 2013.
- [19] J. Duan, **T. Gao**, G. He, Quantifying Model Uncertainties in the Space of Probability Measures. *Interdisciplinary Mathematical Sciences*. Volume 13, p.99-110, 2012.
- [20] J. Ren, C. Li, **Ting Gao**, X. Kan and J. Duan, Mean Exit Time and Escape Probability for a Tumor Growth System under Non-Gaussian noise. *International J. Bifurcation and Chaos*, Vol. 22, No. 4, 2012.
- [21] **Ting Gao**, Wendi Wang*, Xianning Liu, Mathematical analysis of an HIV model with impulsive antiretroviral drug doses. *Mathematics and Computers in Simulation*. Vol. 82, Issue 4, p.653-665, 2011.
- [22] **Ting Gao**, Wendi Wang, Global analysis of a viral model with delayed intracellular immune response. *Journal of Southwest University (Natural Science)*, April, 2009.
- [23] Ruida Wang; Junbao Zhou; Zhuan Cheng; Jinqiao Duan; **Ting Gao**; Yan Jiao; Yang Liu; Biyun Zeng; Pengbo Li ; Homomorphic Ciphertext-PC, 2022-10-06, PCT/SE2022/050900 .
- [24] Zhuan Cheng; Shuyu Jin; Ruida Wang; **Ting Gao**; Jinqiao Duan; Yan Jiao; Yang Liu; Biyun, Zeng; Pengbo Li ; Homomorphic recommendation-PC, 2022-10-06, PCT/SE2022/050898.

FUNDING

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GUEST EDITOR

Special Issue, “Data Science and Stochastic Dynamics” in Journal “Stochastic and Dynamics”, JCR, Q3.

Special Issue, “Recent Advances in Fractional Differential Equations and Their Applications” in Journal “Fractal and Fractional”, JCR Q1.

INVITED TALKS

“Neural network stochastic differential equation models and applications”, ICIAM 2023, Japan, 2023.08.20 - 2023.08.25

“Identification, Prediction and Control in Non-Gaussian Stochastic Dynamical Systems”, National Tianyuan Math Northwestern Center “Stochastic Analysis and Applications in Special Areas Workshop” 2022.10.23 - 2022.10.24

“Data Driven Problems in Stochastic Dynamical Systems: Identification, Forecasting and Optimal Control”, HUST-UPSaclay Joint Workshop on "Math for Data Science", 2022.09.22 - 2022.09.23

“Identifying and learning effective reduced dynamics in stochastic dynamical system”, The 7th International Conference on Random Dynamical Systems, Hanoi, 2022.06.23

“Data assimilation with non-Gaussian Lévy noise”, 9th International Congress on Industrial and Applied Mathematics - ICIAM 2019, Valencia, 2019.07.15 - 2019.07.19