Yan Zhang

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Education Background

09/2016 — 06/2020: BSc, Information and Computing Science, Harbin Institute of Technology
09/2019 — 05/2020: Exchange, Signal Control and Robotics, Centrale Nantes (English program)
09/2020 — Present: PhD, Statistics and Actuarial Science, Hong Kong University
(Undergraduate) GPA: 92.97/100 (3.77/4) **Major GPA:** 94.68/100 (3.90/4)
(Undergraduate) Rank in the Major of Information and Computing Science: 2/53
English Level: IELTS: 7 (Reading: 8.5, Writing: 6, Listening: 7, Speaking: 6) **Date: 05/08/2020**

Publication

- **01/2018 - 07/2018 "*Recurrence and strong stochastic persistence of a stochastic single-species model*" - Jingliang Lv, Yan Zhang, Xiaoling Zou, published in "*Applied Mathematics Letter (JCR 1)*" (a SCI journal on Applied Mathematics, SSN: 0893-9659, Impact Factor of 2018: 3.487) - Second author (as the only undergraduate student)**

● A stochastic generalized logistic model is considered in this paper.
● The condition of the existence of its stationary distribution is generalized.
● Recurrence and strong stochastic persistence are obtained.
● Some numerical simulations are carried out to support our results.

- **12/2018 - 07/2019 "*Dynamics of stochastic single-species models*" - Yan Zhang, Jingliang Lv, Xiaoling Zou, published in "Mathematical Methods in the Applied Sciences (JCR 1)" (a SCI journal on Applied Mathematics, SSN: 1099-1476, Impact Factor of 2018: 1.533) - *First author***

● A type of stochastic single-species model is proposed and studied.
● The sufficient conditions of the existence of its stationary distribution and stochastic permanence are obtained.
● The threshold conditions for its strong stochastic persistence and extinction are found.
● Some examples and numerical simulations are introduced to support our main results.

Academic Experiences

- **09/2020 - Present Asymptotically Zero-Variance Importance Sampling Estimators based on Kernel Density Estimation**

● Adopted kernels in KDE as control variates in the regression or MLE based estimators, achieving faster MSE convergence rate than normal IS, even experimentally faster than NIS ('Nonparametric Importance Sampling' by Ping Zhang).
● Improved the performance of the regression or MLE based estimators with SIR-based (Sampling Importance Resampling) kernel position adjustment.
● Improved the algorithm performance with clustering-based kernel shape adjustment.
● Built an algorithm to systematically construct KDE for IS estimation purpose. Experiments were carried out to test the properties of parameters in the new algorithm and a corresponding parameter tunning procedure were carefully established.

- **03/2021 – 04/2021 Visualization for Dichotomous Variables, the Independence and Markov chains (a self-motivated mini-project, https://arxiv.org/abs/2107.09850)**

● Found a novel way to visualize dichotomous variables and the independence relationships amount them, like the common cause/effect relationships.

● Instead of drawing the transition graph, I visualize the Markov chains by drawing all events of the Markov process in a single plot by simple plane geometries, where some sort of fractal pattern can be observed, which is just the reflection of the Markov memoryless property.

- **10/2017 Calibration and Imaging of CT System Parameters (as the team leader)**

● ***Wrote a paper which won the first prize of "The China Undergraduate Mathematical Contest in Modeling" in Shandong Province, Top 5% in Shandong Province.***

● Used MATLAB to solve questions about ***"CT system parameter calibration and imaging"*** and drew the result images.

● Built a regression model about a calibration template consisting of a large ellipse and a small circle used to calibrate the system parameters and fit the model to the existing data to get the required parameters using Gradient Descent method.

● Implemented the direct back projection reconstruction method with MATLAB. From the received information of an unknown medium obtained by the CT system, the position, geometry and absorption rate of the medium in the tray were obtained.

● Introduced a filtered back projection reconstruction method based on Fourier transform, which weakened the noise and obtained better result images.

- **02/2019 Scientific and Eco-friendly Dragon Breeding (as the team leader)**

● ***Wrote a paper which won the "Meritorious Winner of the Mathematical Contest in Modeling, USA", Top 5% in the world.***

● Constructed a difference equation system inspired by the Cellular Automaton, which consisting of three modules: environment, community and dragon.

● Set a total of 32 main parameters, using existing data to estimate some of the parameters, and obtained functional relationships between the parameters.

● Used MATLAB to visualize the model and then draw qualitative diagrams to get some qualitative results, such as the impact of dragons on the ecological environment, the regulation of community on dragon growth, and the impact of migration to different environments on dragons and communities.

- **07/2018 - 12/2018 The General Analysis of the Dynamics of Stochastic Single-species Models**

● Constructed a series of Lyapunov equations and tested their properties after applying Itô' s Lemma.

● Tried to find a model-free Lyapunov to prove the existence, stationary distribution and stability of solutions of stochastic differential equations.

● Improved and simplified the proof of strong stochastic persistence in "Coexistence and Extinction for Stochastic Kolmogorov Systems" written by *Alexandru Hening* and *Hguyen Hai Dangh*.

- **11/2016 - 10/2017 The Seminar Mathematical Research Project**

● Study methods to solve optimization problems with linear constraints by recurrent neural networks.

● Used MATLAB to do numerical simulation on transient behaviors of the optimization object function based on neural network.

● Learned LaTeX and used it to wrote the project report about how to impose penalty terms to let its solution to reach the feasible domain in finite time.

- **07/2018 - 08/2018 Mathematical Laboratory and Modeling (Course Title) - HKU Summer Institute**

● Achieved an excellent grade of A+ and received an Award of Excellence with Scholarship.
● Studied mathematical models and SCILAB-based model solving, especially with the discrete deterministic modeling, including its application and characteristics.
● learned how to solve moderately complicated numerical problems by writing Scilab programs.

- **09/2019 - 05/2020 Signal Control and Robotics (Foundation Master) - Centrale Nantes**

● Enhance computer programming skills, especially in algorithm.
● Study basics of signal processing and imaging methods.
● Do basic research about ML particularly in the deep learning and data mining fields.
● Learn to utilize Python, R to collect and analyze data, and achieve optimization in coding.

- **01/2017 The First Prize of the First Stage of the TZMCM (as the team leader, Top 5%)**
- **02/2017 The First Prize of the Second Stage of the TZMCM (as the team leader, Top 5%)**
- **11/2017 The Third Prize in National College Student Mathematics Contest (Top 10%)**
- **11/2018 The Second Prize in National College Student Mathematics Contest (Top 5%)**

Teaching Experiences

- **01/2020 – 05/2020 Tutor - STAT8019 Marketing Analytics**

● A course for the master project students, providing an overview and practical application methodology used in marketing research.
● Contents included cluster analysis, factor analysis, multidimensional scaling, conjoint analysis, choice models, market response models and discriminant analysis in market segmentation, positioning and new product design.
● R coding and practical examples were introduced in 12 tutorials based on English, each of which was 1 hour.

- **05/2019 – 06/2019 Student lecturer - Paper writing and MATLAB using in Mathematical Contest in Modeling**

● A short-term training mainly for the first and second year students to get familiar about the modeling, coding and writing skills in mathematical modeling contests. Conducted by three student lecturers who were experienced in the contests.
● Literature searching, literature citation, writing structure and problem-oriented writing were elaborated; MATLAB coding including array calculation, symbolic calculation and drawing techniques were introduced.
● Lingo was introduced as a complementary software for Linear, Nonlinear, and Integer Programming.

Professional Skills

- **Proficiency in Language:** Python, R, C/C++, SQL, Java
- **Proficiency in Software:** MATLAB, SPSS, LaTeX, Lingo, SCILAB, LabVIEW
- **Expertise in:** Mathematical Modeling and Computer Programming in Solving Actual Problems
- **Competence in:** Self-study and Studying Papers in Specialized Fields
- **Good Command of:** Researching with Unique Improvement and Expansion Ideas

Honors

- 11/2018 The first prize of People's Scholarship in China (Top 3%)
- 11/2019 The first prize of People's Scholarship in China (Top 3%)
- 06/2017 The second prize of People's Scholarship in China (Top 10%)
- 11/2017 The second prize of People's Scholarship in China (Top 10%)
- 06/2018 The second prize of People's Scholarship in China (Top 10%)
- 06/2019 The second prize of People's Scholarship in China (Top 10%)
- 11/2017 Honorary title of "Merit Student" (Top 10%)
- 04/2018 Outstanding Individual in Winter Social Practice (Top 10%)
- 08/2018 Award of Excellence in the 2018 Summer School of the University of Hong Kong (Top 5%)

Internship Experience

- **07/2019 - 09/2019 Network Operation Assistant - China Mobile Communications Group Co., Ltd.**

● Data collection and analysis of network communication systems in R, SPSS.
● Assisted in the design of satellite network resource distribution packages.
● Assisted in the development of the recommender system based on Low Rank Matrix Factorization and Deep Neural Network.
● Worked with satellite communication database systems in SQL.
● Computer and network information security management and undertook customer service job.

- **01/2019 - 02/2019 Assistant Java Engineer - Jin Modern Information Industry Co., Ltd.**

● Using Java to solve human resource management problems after systematic learning and training.
● Completed the interface design of the "supermarket customer management system" using Navicat.
● Designed the web front-end using Dreamweaver.

- **07/2017 - 09/2017 Data Analyst - Statistics Bureau of Luliang.**

● Agricultural data collection of suburb areas through Excel.
● Revised reports of population data and found the statistical error by building an anomaly detection system based on Multivariate Gaussian Distribution.
● Assisted in developing data uploading system of the layered type.

Courses taken

- **Undergraduate major courses in HIT:**

● Mathematical Analysis, Advanced Algebra, Analytic Geometry, Discrete Mathematics, Modern Algebra, Ordinary Differential Equations, Differential Geometry, Real Function, Complex Function, Numerical Analysis, Introduction to Functional Analysis, Probability Theory and Mathematical Statistics, Mathematical Physics Equation, Operations Research, Point Set Topology, Numerical Method of Partial Differential Equation
● C Language Program Design, Data Structure, Database System and Application, Computer Network Technology and Application, Information Science Foundation

- **Postgraduate major courses in HKU:**

● Advanced Statistical Inference, Research Methods in Statistics, Computational Statistics, Modern Causal Inference, Computational Methods for Bayesian Inference