

Zhikang Lai

Tel: (+86) 130-2207-2531 | E-mail: laizhikang@ciac.ac.cn | Address: Guangdong, China

EDUCATION

NanFang College of Sun Yat-Sen University, Electrical and Computer Engineering

Guangdong, China

Bachelor of Engineering

Sep 2017 - Jun 2021

- GPA 81.54/100 (3.15/5.0), Major in Electronic information science and technology.
- Core Courses: Advanced Mathematics, Complex Variable Function & Integral Transform, Linear Algebra, College Physics, Signal and System.

AWARDS AND PRIZES

- Third price Scholarship, awarded by NanFang College of Sun Yat-Sen University. 2019 - 2020
- National College Students' innovation and entrepreneurship training program, Project Leader. 2019 - 2020
- Provincial College Students' innovation and entrepreneurship training program, Main participants. 2019 - 2020
- Third price Scholarship, awarded by NanFang College of Sun Yat-Sen University. 2017 - 2018

PUBLICATIONS

Peer-reviewed Journal Articles

- Zhan C, Tse C K, **Lai Z**, Chen X, Mo M. General model for COVID-19 spreading with consideration of intercity migration, insufficient testing, and active intervention: Modeling study of pandemic progression in Japan and the United States[J]. JMIR public health and surveillance, 2020 (SCI Q1, 2022 IF: 14.56).
- Zhan C, Zheng Y, **Lai Z**, Hao T, Li B. Identifying epidemic spreading dynamics of COVID-19 by pseudocoevolutionary simulated annealing optimizers[J]. Neural Computing and Applications, 2021, (SCI Q2, 2022 IF: 5.606).
- Zhan C, Tse C K, **Lai Z**, et al. Prediction of COVID-19 spreading profiles in South Korea, Italy and Iran by data-driven coding[J]. PLoS One, 2020, (SCI Q2, 2022 IF: 3.24).
- Zhan C, Tse C K, Fu Y, **Lai Z**, Zhang H. Modeling and prediction of the 2019 coronavirus disease spreading in China incorporating human migration data[J]. PLoS One, 2020, (SCI Q2, 2022 IF: 3.24).

Conference Papers

- Wu S, Zheng Y, **Lai Z**, Wu F, Zhan C. Movie box office prediction based on ensemble learning. IEEE Symposium on Product Compliance Engineering-Asia (ISPCE-CN). IEEE, 2019 (EI).

RESEARCH EXPERIENCE AND ACADEMIC ACTIVITIES

1. Ongoing Researches

1) Infectious disease compartment model.

Supervisor: **Prof. Choujun Zhan**

Different epidemiological features have different effects on compartmental models in epidemiology. To explore the reliability and accuracy of compartmental models, I developed several compartmental models that describe the COVID-19 pandemic based on some previous studies, and derived and estimated the basic reproduction number in these models.

- Independently derived the basic reproduction number of epidemiological models based on 8 papers.
- Used the optimization algorithm to identify the parameters of these models based on 20 countries' the COVID-19 first wave data. Analyzed the estimated distribution of basic reproduction number for each model.
- The first draft of peer-reviewed journal paper is in preparation.

2. NanFang College of Sun Yat-Sen University, Research Institute of Big Data and Artificial Intelligence

Research Assistant, Supervisor: **Prof. Choujun Zhan**

Guangdong, China Mar 2019 - Mar 2022

I have two years of academic research experience studying with Prof. Zhan. Over this period, I have received some academic training, including literature survey, experimental design, and experiment report writing. I have been working on parameter identification, machine learning, data analysis, and computational modeling with applications in epidemiology and entertainment media. I have achieved several academic achievements in both directions.

1) Epidemiological modeling study.

The epidemiological model for the COVID-19 pandemic does not consider human inter-city activities. To address this issue and help humans better predict the COVID-19 pandemic in different countries and regions, we some improved epidemiological models based on the human migration network and the classical epidemiological models, and identified the parameters based on heuristic optimization algorithms.

- Led a team to collect COVID-19 pandemic, geographic and economic data from 192 countries and 1295 regions in the world, and independently cleaned, merged and reconstructed the dataset.
- Collected human activity data from six countries and established human migration networks.
- Participated in the establishment and modification of epidemiological models, and identified the parameters of these models with simulated annealing, MCMC, particle swarm, and Genetic algorithms.

- Third author paper published in JMIR PUBLIC HEALTH AND SURVEILLANCE: "General Model for COVID-19 Spreading With Consideration of Intercity Migration, Insufficient Testing, and Active Intervention: Modeling Study of Pandemic Progression in Japan and the United States".
- Third author paper published in Neural Computing and Applications: "Identifying epidemic spreading dynamics of COVID-19 by pseudo-co-evolutionary simulated annealing optimizers".
- Third author paper published in PLOS ONE: "Prediction of COVID-19 spreading profiles in South Korea, Italy and Iran by data-driven coding".
- Fourth author paper published in PLOS ONE: "Modeling and prediction of the 2019 coronavirus disease spreading in China incorporating human migration data".

2) Entertainment media study.

A cumulative movie box office prediction model was constructed based on ensemble learning combined with movie box office time series data. The experimental results found that the integrated learning model has a better prediction effect than the traditional machine learning model in building the movie box office model, and the prediction error decreased by 33.8% compared with the decision tree model. The prediction error decreased by 33.8% compared with the decision tree model.

- Participated in part of data collection and cleaning, visualization, part of programming modeling.
- Third author conference paper published in IEEE Symposium on Product Compliance Engineering-Asia, 2019: "Movie box office prediction based on ensemble learning".

PROFESSIONAL EXPERIENCE

1. Huangpu Institute of Materials, Center for Aircraft Tire Science

Algorithm Engineering

Guangdong, China Jan 2022 - Present

1) Solving Nonlinear Equations

The equilibrium equations of the aircraft tires complex structure are nonlinear equations, and the solution of nonlinear equations depends on the choice of initial values. I designed a nested optimization algorithm which is not affected by the initial value to obtain all numerical solutions of the nonlinear equations.

- Independently investigated literatures and completed the experimental design.
- Utilized heuristic algorithms nested with the Levenberg-Marquardt method to conduct randomized experiments, which optimized by maximizing accuracy and stable.
- Analyzed the feasibility and rationality of the equilibrium point for the establishment of the equilibrium equation.

2) Parameter Identification and Simulation of Tire Dynamics Model

The factors affecting the mechanical properties of tires are numerous and extremely complex. In order to accurately describe the tire mechanical characteristics, I analyzed the tire experimental data, established a dynamic model that can describe the tire movement, and designed an optimization algorithm to identify the parameters of the model.

- Independently investigated literatures, designed the experimental and programed modeling.
- Established the tire dynamic model under compound working, and proposed a new optimization algorithm which combined Interior Point Method and Trust-region Reflection to identify the parameters.
- Identified the parameters of the tire dynamics model. The results showed that the R-Squared between the output values and experimental values is up to 0.95, and the longitudinal force and lateral force are both above 0.99.

CONFERENCE ACTIVITIES

- Best volunteer at International Conference on Neural Computing for Advanced Applications 2021 held in Guangzhou, China. Aug 2021
- Participated in the 2019 IEEE International Symposium on Product Compliance Engineering-Asia held in Hong Kong, China. Oct 2019

ADDITIONAL INFORMATION

Research Interests

My main interest lies in parameter identification, heuristic algorithm, machine learning, and complex network, including:

- Algorithm design for parameter identification of dynamic model based on mathematical optimization method.
- Decision optimization of epidemic prevention measures based on epidemiological modeling.
- Application of complex network in epidemiology and power grid.

Language Skills

English (College English Test 4, CET4), Preparing for the IELTS test, Mandarin, Cantonese.

Computer Skills

MATLAB, R, Python (Scikit-learn, Numpy, Pandas, Matplotlib), LaTeX.