De-Quan Zhu(朱德权)

PERSONAL INFORMATION

Gender: Male
Date of Birth: September 16, 2003
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EDUCATION

South China Normal University September 2021 –June 2025(expected)
Major in Data Science and Big Data Technology (School of Data Science and Engineering)
GPA: 4.06/5(Overall Score: 90.6/100) Rank: 1/30 IELTS 6.5(6)
Supervisor: Prof. Jin-Hua Zhao (homepage: http://ds.scnu.edu.cn/a/20221109/116.html)

Dongguan Experimental High School September 2018 –June 2021
Courses: Chinese, Mathematics, English, Physics, Chemistry, Geography

INTERNSHIP

Geological Inversion Project in AI for Science Collaboration with Baidu July 2024 –September 2024
Institute of Automation, Chinese Academy of Sciences
PaddleScience-Docs link: https://paddlescience-docs.readthedocs.io/zh-cn/latest/zh/examples/velocity_gan/
· Migrated a GAN model from PyTorch to PaddlePaddle.
· Identified precision errors in PaddlePaddle operators and submitted issues on GitHub.
· Developed a model using the PaddleScience framework and contributed to the official code repository.

RESEARCH INTERESTS

- **Neural Network Structure and Dynamics**
- **Neural Computational Modeling**
- **Geometrical Probabilistic Approaches to Stochastic Processes in Physical Problems**
- **Combinatorial Optimization Problems on Graphs**
- **Complex Network Structure and Dynamics**

PUBLICATIONS AND PREPRINTS

A full list can be found in: https://arxiv.org/a/zhu_d_2.html
[*: co-first author; #: corresponding author]

1. Yan-Jie Min*, **De-Quan Zhu***, Jin-Hua Zhao#. Buffon-Laplace Needle Problem as a Geometric Probabilistic Approach to Filtration Process, ***Physica A: Statistical Mechanics and its Applications***. (in press)
2. **De-Quan Zhu***, Yan-Jie Min*, Jin-Hua Zhao#. Node reinforcement in interdependent networks. (in preparation)

RESEARCH EXPERIENCE

Percolation Phenomena in Complex Networks January 2023 –May 2023
Theoretical Derivation | Numerical Computation | Programming Simulation
· Constructed random graph models (Erdős-Rényi, Random Regular) and scale-free network models (Barabási-Albert, static, configurational) using C++, and simulated their percolation phenomena (Giant Component(GC), K-core, core).
· learned percolation theory and derived percolation formulas (GC, K-core, core).
· Solved fixed points of self-consistent equations using numerical methods (bisection/iterative) and performed fixed-point analysis.

Combinatorial Optimization Problems in Graph Theory June 2024 –July 2024

Theoretical Derivation | Numerical Computation | Programming Simulation

- Implemented greedy leaf-removal and message-passing algorithms in C++ to approximately solve the Minimum Vertex Cover (MVC) problem.
- Constructed an analytical framework using percolation theory to estimate the size of MVC.

The Impact of Randomly Reinforced Nodes on The Robustness of Interdependent Networks September 2023 –January 2024

Theoretical Derivation | Numerical Computation | Programming Simulation

- Implemented dynamic processes on interdependent networks with randomly reinforced nodes, including random node removal, K-core pruning, and searching for GC.
- Derived coupled self-consistent equations to calculate the sizes of the K-core and GC within the network.
- Utilized the bisection method to find stable fixed points of the coupled self-consistent equations for precise numerical solutions.
- Applied cost-benefit analysis framework to quantify the relationship between node reinforcement costs and network robustness gains.

Extended Study on the Buffon-Laplace Needle Problem March 2024 –June 2024

Theoretical Derivation | Numerical Computation | Programming Simulation

- Implemented Monte Carlo simulations of the needle-throwing experiment using C++.
- Derived collision probability formulas for needles and spherocylinders in two- and three-dimensional cases under arbitrary parameter ranges.

ACADEMIC ACTIVITIES

First Training Course on Neural Modeling and Programming (Online) August 2023 –September 2023

Supplementary Material: Practical Neural Modeling: Based on BrainPy (神经计算建模实战：基于 BrainPy)

GitHub link: https://github.com/brainpy/1st-neural-modeling-and-programming-course

- Studied neuron models (Hodgkin-Huxley model, Leaky Integrate-and-Fire model) and synapse models (Exponential Decay model, AMPA model, Short-Term Plasticity model); learned relevant biological background; understood modeling methods of neural structures and dynamical differential equations; programmed simulations of dynamical processes using the BrainPy framework.

SKILLS

- **Programming Languages**: C++, Python
- **Platforms**: LaTeX, Linux, Git
- **Languages**: Mandarin (Native Speaker), English (Fluent)