Zhexu Jin

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EDUCATION

University of Illinois, Urbana Champaign   **08 2023 -**
Ph.D. in Statistics   *Champagne/Urbana, United States*

Duke Kunshan University   **08 2019 - 05 2023**
B.S. in Data Science   *Kunshan, China*

- Subjects Studied: Combinatorics and Graphs · Statistical Learning Theories · Numerical Analysis and Optimization · Statistical Divergences · Differential Geometry · Advanced Linear Algebra · Real Analysis
- Graduate with distinction in Signature Work Titled: *Unsupervised Optimal Transport Based Change Point Detection for Air Pollution Data*

Duke University (In person exchange semester)   **08 2022 - 12 2022**
B.S. in Interdisciplinary Studies (Subplan in Data Science)   *Durham, United States*

- Subjects Studied: Topological Data Analysis · Dimension Reduction · Spectral Graph Theory · Stochastic Petri Net

RESEARCH INTERESTS

I am interested in questions broadly associated with data science, statistics and discrete mathematics.
In particular, I am interested in **computational topology**, **optimal transport**, **optimizations** and **stochastic modeling**.
On the application side, I am interested in the application in health, medical imaging and computational medicine.

PUBLICATIONS

Zhexu Jin, Mario Andrés Velásquez Angel, Ivan Mura, and Juan Felipe Franco. Enriched spatial analysis of air pollution: Application to the city of Bogotá, Colombia . *Frontiers in Environmental Science*, page 1777, 2022a. doi: 10.3389/fenvs.2022.966560. URL https://doi.org/10.3389/fenvs.2022.966560.

Zhexu Jin, Gaoyang Li, Huansheng Cao, and Dongmian Zou. *Towards Geometry-Aware Cell Segmentation in Microscopy Images.* Medical Imaging meets NeurIPS. 36th Conference on Neural Information Processing Systems, 2022b. URL https://nips.cc/media/PosterPDFs/NeurIPS%202022/63451.png.

RESEARCH PROJECTS

Human Cell Segmentation ⇗

Mentored by Dr. Dongmian Zou   **12 2021 – Now**

- Developed a geometry perserving loss for **instance segmentation** based on **persistent homology** to segment microscopy cellular images which improved the segmentation robustness and accuracy.
- Implemented the **lower star filtration** on the distance function in morphological images which serve as the basis for loss computation.
- Presented the research as a poster at medical imaging meets Neurips workshop at Neurips 2022 conference in New Orleans

Bogotá Air Quality Disparity Analysis ⇗ </>

Mentored by Dr. Ivan Mura   **12 2021 – 9 2022**

- Performed **spatial-temporal interpolation** on the hourly $PM_{2.5}$ concentration for each neighbourhood & cross validated different spatial-temporal variogram models.
- Designed and implemented a effective visualization of the exposure disparity suffered by different groups of the population using **triangulation** on the surface.
- Wrote the methodology of the manuscript and reviewed and revised all of the manuscript produced.

Predictive Modeling of Health Care System (Duke Bass Connection) ⇗

Mentored by Dr. Ivan Mura   **8 2022 – Now**

- Model the health care system and the effect of health care intervention using **stochastic reward net**, a generalization of **stochastic petri net**.

- Map the **disease progression** and **intervention** for chronic disease into stochastic reward nets.
- Write documentations for people without technical background to use the tool and debug the model.

SIP Servers Defects Per Million (DPM) Modeling
Mentored by Dr. Ivan Mura *and* Dr. Kishor Trivedi   **5 2022 – Now**

- Model the client-oriented Defects Per Million during the call flow of **SoIP** telecommunication protocol using stochastic reward nets, which models the concurrency of the server failure.
- Design the **availability** and **reliability** model using formulations from stochastic rewards net
- Produce a reachability graph from the proposed stochastic reward net model and derive an analytical form of **DPM**

INVOLVEMENT

Duke Kunshan Mathematical Reading Seminar on Optimal Transport ↗   **06 2021 – 06 2022**
Organizer and Founder   *Kunshan*

- Organize weekly reading seminar on the book Computational Optimal Transport
- Implement some recently developed algorithm such as **Sinkhorn Iterations** and **Network Simplex**, which solves optimal transport

WORKING EXPERIENCE

Duke Kunshan University   **06 2021 – Now**
Research and Teaching Assistant   *Kunshan, China*
- Designed textbook material for the course Deep Learning STATS 403 at Duke Kunshan University.
- Organize weekly reading seminar on computational topological data analysis.

Santoni Shoes Company   **06 2021 – 09 2021**
Research Intern   *Kunshan, China*
- Predicted Machine Failures in Shoe-making production line and Conducted **Homogeneous tests** on data distribution produced by the machine operations over a series of time

New Ruipeng Pet Company   **09 2020 – 01 2021**
Research Intern   *Kunshan/Shanghai, China*
- Built statistical models for evaluating customer lifetime value and automating customer segregation using clustering techniques such as **Spectral Clustering** and **information value**.

Duke Pratt School of Engineering   **12 2019 – 05 2020**
Content Designer   *Kunshan, China*

- Design marketing materials for master recruitment and processing student grade.

TECHNICAL SKILLS

Languages: Python, Java, JavaScript, SQL, R, C, Markdown, HTML, LaTeX
Developer Tools: VS Code, Nivada, Anaconda, Miniconda, CUDA
Technologies/Frameworks: PyTorch, TensorFlow, Selenium, GitHub, Git

HORNORS AND CERTIFICATIONS

- Graduate with Distinction at Duke Kunshan University
- Undergraduate Conference Travel Grant at Duke Kunshan University Neurips 2022
- Student Experitial Learning Fellow at Duke Kunshan University
- Dean's List at Duke Kunshan University
- HTML, CSS and Javascipt John Hopkins University - Coursera
- Algorithm from University of Princeton - Coursera