Yuan Chen

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Education

M.S. in Statistics   **Expected 2021**
The George Washington University   *Washington, DC*

- **GPA**: 4.0/4.0
- **Course Work**: Mathematical Statistics I & II, Real Analysis, Regression Analysis, Measure Theory and Integration, Stochastic Process (Ph.D. level)

B.E. Environmental Science   **June 2019**
Hohai University   *Nanjing, China*

- **GPA**: 90.7/100; **Math-GPA**: 99.3/100; **Rank**: the 1st place
- **Course Work**: Calculus & Advanced Calculus, Linear Algebra, Probability Theory and Mathematical Statistics, Data Analysis, Machine Learning, Partial Differential Equations, Geographical Information System, Statistics and Life, Bayesian Statistics I & II (online), Practical Time Series Analysis (online)

Research Interests

- Numerical methods for Partial Differential Eq.s: Finite Element Method, Deep Galerkin Method
- Interface problems: Partial Differential Eq.s with discontinuities in coefficients across 'interfaces'
- Immersed finite element method (IFEM) for interface problems
- A-Prior error analysis for Immersed finite element method
- Applications of statistics and computational fluid dynamics on environmental problems

Publications & Presentations

Journal Articles

4. **Y. Chen**, X. Zhang, and S. Hou. *Error Estimates for a Partially Penalized Immersed Finite Element Method for Elastodynamics Interface Problems*, in preparation.

3. **Y. Chen**, S. Hou, and X. Zhang. *A Bilinear Partially Penalized Immersed Finite Element Method for Elliptic Interface Problems with Multi-domains and Triple Junction Points*, Results Appl. Math., under review.

2. **Y. Chen**, H. Wang, H. Yan, D. Liang, and R. Li. *Relation of Energy to Temporal and Spatial Variations of Nutrient Distribution in Binhu Network*, Environ. Sci. Pollut. R., under review.

1. **Y. Chen**, S. Hou, and X. Zhang. *An Immersed Finite Element Method for Elliptic Interface Problems with Multi-domain and Triple Junction Points*. Adv. Appl. Math. Mech., 11(2019), no. 5, 1005-1021.

Presentations and Posters

2. A Brief Picture: Immersed Finite Element Methods for Interface Problems with Multi-Domains and Triple-Junction Points. **GW Research Day**, The George Washington University, D.C. (April 2020).

1. Immersed Finite Element Methods for Interface Problems with Multi-Domains and Triple-Junction Points. **AMS Southeastern Sectional Meeting**, University of Virginia, VA (March 2020).

Research Experiences

Research on Time-dependent Elasticity Interface Problems · Washington, D.C.
Co-advised by Dr. Xu Zhang and Dr. Songming Hou · *Dec. 2019 – Present*

- Designed a fully discrete scheme for time-dependent elasticity interface problems based on Partially Penalized Immersed Finite Element Method (PPIFEM)
- Implemented multi-processing programs to verify the proposed scheme on numerical examples, showed optimal order convergence in $\mathbf{L}_2$ and semi-$\mathbf{H}_1$ norm using NumPy, SciPy package in Python
- Proved the unconditional stability for Symmetric Partially Penalized Immersed Finite Element scheme
- Completed a-prior error estimation for proposed scheme: proved the optimal convergence of numerical solution in energy norm and $\mathbf{L}^2$ norm under the standard piecewise H^2 regularity assumption of exact solution

Research on Multi-domain Elliptic Interface Problems · Washington, D.C.
Advised by Dr. Songming Hou · *July 2017 – Aug. 2018*

- Solved continuous elliptic interface problems with multi-domains and triple junction points by establishing a linear interpolation scheme based on Classical Immersed Finite Element Method (IFEM)
- Implemented proposed method on three numerical examples using NumPy package in Python to show the optimal order convergence of numerical results in L_2 and semi-H_1 norm
- Solved two-domain elliptic interface problems with discontinuous jump condition by extending Classic IFEM with an extra term and verified the optimal convergence in L_2 and semi-H_1 norm numerically

Improvement with Partially Penlaized Immersed Finite Element Method · *Feb. 2019 – Nov. 2019*

- Extended Partially Penalized Immersed Finite Element Method (PPIFEM) with an extra jump term to solve 2-domain continuous elliptic interface problems with non-homogeneous flux jump
- Implemented proposed method on numerical examples using NumPy and SciPy package in Python to show the optimal order convergence in L_2, semi-H_1 norm
- Established a new bilinear interpolation scheme and a corresponding weak formulation with additional penalty on triple elements to solve elliptic interface problems with multi-domains and triple junction points
- Proved trace inequalities and degeneracy property of local linear system and verified optimal order convergence in L_2, semi-H_1 norm without deterioration of the method numerically

Research on River Dynamic Measurement · Nanjing, China
Advised by Dr. Hua Wang · *Feb. 2019 – Aug. 2019*

- Developed an estimator to measure flowing river energy based on Gauss Quadrature. Combined field hydrology data with numerically simulated data to calculate total energy of Binhu network in China using Python
- Applied a curve fitting method coupled with least square method to identify negative exponential relationship between river mechanic energy and nutrient concentration
- Produced an algorithm to cleanse, manipulate and conduct visualization on 5 million rows of spatial hydraulic and water quality data in Python. This algorithm is now supporting colleagues to conduct further analysis

Projects

Project of House Price Prediction in King County, WA, Kaggle.com · Washington, D.C.
Project Leader · *Nov. 2019 – Dec. 2019*

- Cleansed approx. 4000 rows of house sales and city economic data in King county, Washington using Python (Pandas package). Produced a heat map to visualize average house price distribution using QGIS
- Established a linear model to examine relationship between house price and 15 independent variables. Evaluated and selected potential reduced models using Akaike information criterion (AIC) and Bayesian information criterion (BIC) in R
- Modified selected models to meet assumptions of linear regression in R: excluded outliers based on Cook's distance and Studentized Residual Rules; removed correlated variables according to Generalized Variance Inflation Factor (GVIF); transformed dependent variable to obtain constant residual variance; employed Durbin-Watson Test to examine autocorrelation of residuals; applied Shapiro-Wilk test to check residual normality
- Applied Cross Validation to determine final model with proper assumptions. R^2 of the final model is 0.7

Project of Statistical Analysis on Energy Policy, Key Shallow Lake Lab.　　　　　　　　**Nanjing, China**
Project Assistant　　　　　　　　　　　　　　　　　　　　　　　　　　　　　*Dec. 2017 – Dec. 2018*

- o Explored influence of social-economic and environmental factors to carbon emission evolution of Beijing's thermal power plants from 1997 to 2015. Applied a Logarithmic Mean Divisia Index (LMDI) model to decomposed CO_2 emission into five factors in Python, including economic growth, population growth, energy intensity, energy structure and emission coefficient factor
- o Visualized the evolution of five influence factors from 1997 to 2015 using Python. Identified drivers and resistances in mitigating CO_2 emission from Beijing's thermal plants and provided insights on future eco-friendly energy policy-making
- o Collected approx. 14 million rows of agricultural products trade data between 256 countries from 1986 to 2015. Cleansed and manipulated the trade dataset to quantify nitrogen pollution embodied in global trade using Python. Analyzed temporal variation of nitrogen pollution from different trade links and provide suggestions on future national nitrogen management.

Project of Shared Bicycle Management, IETP Program of Hohai University　　　**Nanjing, China**
Project Leader　　　　　　　　　　　　　　　　　　　　　　　　　　　　　*Mar. 2017 – June 2018*

- o Applied Seasonal ARIMA model in R to fit 2,000 pieces of field bicycle usage data. Applied the model to predict daily bicycle demand within each control area at given time of the day
- o Provided suggestions on meeting fluctuating demands of specific areas by adjusting number of available bicycles in each control area based on model forecasting results

Professional Experiences

Mobike Technology Co., Ltd. (Meituan.com)　　　　　　　　　　　　　　　**Beijing, China**
Product Manager Internship in Department of Data Analysis　　　　　　　　　　*June 2018 – Sept. 2018*

- o Retrieved and aggregated 1 million rows of raw data from mobile app to analyze different user behaviors for optimizing function design
- o Produced a user classification function on company's internal platform which supports other colleagues filtrating user data subject to constraints including users' personal backgrounds, physical & value characteristics and past orders, and also optimizing effects of targeted campaigns
- o Analyzed and visualized label data on malfunction of different bike types through Circos and Sankey diagrams produced in Echarts & D_3 to detect the association between specific bike types and causes of issues
- o Isolated the testing and formal data production environment to reduce risks from data production failure

Scholarships & Certificates

- o HOHAI UNIVERSITY Honored Student Scholarship　　　　　　　　　　　　　2016, 2018, 2019
- o HOHAI UNIVERSITY Science & Technology Innovation Scholarship　　　　　　　　　　　2019
- o Certificate of Honored Achievement in Bayesian Statistics I & II, Coursera online course by UCSC　　2018
- o Certificate of Achievement in Practical Time Series Analysis, Coursera online course by SUNY　　2018
- o 3rd Prize of China Undergraduate Mathematical Contest in Modeling　　　　　　　　2017

Skills

- o **Coding**　　　C, C++, Python, R, SQL, LaTeX, VB, MATLAB
- o **Data Analysis**　Python (pandas, matplotlib, geopy), R (ggplot), QGIS, ECHARTS, D_3, sas
- o **Algorithm**　　C, C++, Python (NumPy, SciPy, SymPy, multiprocessing compute), MATLAB
- o **Misc.**　　　　Academic Research, MS Office & VBA, Axure RP, Markdown
- o **Language**　　Mandarin Chinese, English