Zexuan LIU

Address: 213, School of Mathematics and Statistics, Wuhan University, Wuhan, China, 430072
Phone: +86-132-6065-6335
Email: zexuanliu.math@gmail.com
Website: https://ocf.io/zexuanliu

EDUCATION

Wuhan University   September 2017 - June 2021 (expected)
B.S. in Mathematics, School of Mathematics and Statistics & Hongyi **Honor** College   Hubei, CHN
GPA: 3.92/4.00; Averaged Grade: 92.5/100; Rank:1/38

University of California, Berkeley   January 2020 – May 2020
Visiting Undergraduate Student   CA, USA
GPA: 4.00/4.00
Graduate Courses: Nonlinear Programming: A, Matrix Computations (Prof. James Demmel): A

PUBLICATION

[1] Zexuan Liu, Zhiyuan Sun, and Jerry Zhijian Yang. "A NUMERICAL STUDY OF SUPERCONVERGENCE OF THE DISCONTINUOUS GALERKIN METHOD BY PATCH RECONSTRUCTION". In: *Electronic Research Archive* vol. 28 (2020), pp. 1487–1501.

RESEARCH EXPERIENCE

Non-convex Parametric Optimization via Differential Equations   May 2020 - Present
Research assistant to Prof. Paul Grigas
INDUSTRIAL ENGINEERING & OPERATIONS RESEARCH DEPARTMENT
UNIVERSITY OF CALIFORNIA, BERKELEY
Overview: Used ordinary differential equation to develop different second order algorithms for computing an approximately optimal solution path of a parameterized non-convex problem.

- Derived approximate solution path by Euler discretization method
- Developed the error bound of the algorithm
- Modified the algorithm by solving a sub-problem to minimize the upper bound (MINIUPPER)
- Implemented MINIUPPER algorithm and proved it has the optimal convergence rate

Keywords: Parametric Optimization, Ordinary Differential Equation (ODE), Interpolation, Non-convex.

Superconvergence of Discontinuous Galerkin Method   August 2019 - May 2020
Research Assistant to Prof. Jerry Zhijian Yang
SCHOOL OF MATHEMATICS AND STATISTICS
WUHAN UNIVERSITY
Overview: Developed a new Galerkin method by patch reconstruction requiring much less free order than the traditional methods and explored the superconvergence property.

- Developed symmetry element patch picking rule and defined only one degree of freedom (DOF) per element
- Constructed the global stiffness matrix with fix size regardless of various approximation orders
- Implemented the discontinuous Galerkin method by patch reconstruction (DGPR) in MATLAB and C++
- Extended the DGPR method in MATLAB into the 6th polynomials while traditional method only use 1st order or 2nd order polynomials
- Found three different patterns of superconvergence from 1 to 3 dimensions with our DGPR method in elliptic problem when the mesh is geometrically symmetric

Keywords: Superconvergence, Discontinuous Galerkin method, Patch Reconstruction, Partial Differential Equation (PDE).

Professional Experience

TIANYUAN MATHEMATICAL CENTER   August 2019 - March 2020
Algorithm Specialist
Wuhan University & Huawei Ascend Lab
Overview: Built a high efficient C++ Machine Learning library for an ARMv8-a architecture server and implemented a *scikit-learn* like C++ machine learning toolkit.

- Developed linear regression models (Ridge regression, Lasso regression and Elastic Net methods) based on OpenBLAS, which are 140% times faster than *scikit-learn* functions on the ARMv8 sever
- Implemented the Word2Vec function whose training is 171% times faster than *scikit-learn* functions on the ARMv8 sever
- Modified the algorithms to parallel system and distributed system (the performance is state-of-the-art)

Keywords: High Efficient Computing, Regression, ARMv8, Machine Learning Library, C++

Teaching Experience

Teaching Assistant of Numerical Analysis   September 2019 - January 2020
School of Mathematics and Statistics, Wuhan University
- Developed an online-judge system with Docker and Ruby to automatically evaluate codes submitted by students, when maximum number of concurrent users exceeds 30
- Taught regression methods, iteration methods and eigen problems with convergence analysis, perturbing theory and implementation
- Delivered the bonus content about the Frank-Wolfe method in Matrix Completion

Talks and Seminar

Hongyi Tournament   November 2019
Hongyi College
Wuhan University
Topic: A new efficient discontinuous Galerkin method in Elliptic equations

Host of Advanced Analysis Seminar   September 2018 - April 2019
School of Mathematics and Statistics
Wuhan University

- Conducted this seminar for students of Honor Science Program
- Prepared and delivered abundant content including topics from Real Analysis to Fourier Analysis which refers to the chapters in Princeton Lectures in Analysis written by Elias M. Stein and Rami Shakarchi

Honors and Activities

Honors:
Scholarship in Honor Program (0.5%), *Hongyi Honor college*   October 2018 & 2019

Merit-Based First Class Scholarship (2.5%), *Hongyi Honor College*   October 2018 & 2019

Second Prize in The Chinese Mathematics Competitions (1.5%), *Chinese Mathematical Society*   November 2018

Outstanding Freshman Scholarship (5%), *Hongyi Honor College*   September 2017

Activities:
Vice President of the Student Union, *Hongyi Honor College*   September 2018 - June 2019

Volunteer of the Barred Goose Guardian Operation, *Green River program*   June 2018 - Present

Skills and Languages

Programming: C++, Julia, Python and Ruby
Softwares and Packages: Matlab, Docker, Singularity, CMake, TVM and LaTeX
Operating Systems: Linux/Unix/macOS
Language: Mandarin (native), English (professional)