WENQIAN (WENDY) DONG

5200N Lake Road ⋄ SE2 Room 213C , Merced, CA 95348

(+1) 209 349 2589 ⋄ wdong5@ucmerced.edu

BIOGRAPHY

I am a Ph.D. candidate in Computer Science at the University of California, Merced. My research area is High-Performance Computing (HPC) systems with a focus on the interaction among high performance applications, numerical methods, PDE equations, algorithms, automatic performance tuning. I am eager to pursue scientific machine learning for the acceleration of high performance applications.

EDUCATION

University of California, Merced, CA, USA *Aug 2017 - Present*
Ph.D. candidate, in Computer Science and Engineering
Advisor: Dong Li

Hunan University, Changsha, Hunan, China *Sep 2015- Aug 2017*
Master of Science, in College of Computer Science and Electronic Engineering
Advisor: Keqin Li

Hunan Agricultural University, Changsha, Hunan, China *Sep 2011-June 2015*
Bachelor of Science, in College of Computer Science and Electronic Engineering

RESEARCH INTERESTS

High-performance computing (large-scale parallel/distributed systems). I am working on (i) **Scientific machine learning**: accelerating HPC applications using machine learning-based approximation, (ii)**Automatic Machine Learning**: automatically machine learning model construction for HPC applications, and (iii) **Automatic Performance Tuning**: performance optimization and quality control on accelerating HPC applications using machine learning-based approximation.

RESEARCH EXPERIENCE

Pacific Northwest National Laboratory May - August. 2019; March - August. 2020
Student researcher *Work in PNNL[1]*

· Studying neural network based approximation to accelerate power grid system simulation.

University of California, Merced Aug 2017 - Now
Research Assistant *Work in PASA Lab[2]*

· Modeling application error resilience in large scale parallel execution (Aug. 2017 Nov. 2017)
· Using machine learning-based approximation to accelerate LAMMPS (Molecular Dynamic) simulation and psi4 (an ab initio computational chemistry package) (Feb. 2018 - Present).

Hunan University, Changsha Sep 2015- Aug 2017
Research Assistant

· Porting MD (Molecular Dynamics, LAMMPS) simulation to the Intel Xeon Phi processor. The National High-tech R&D Program of China (Grant No. 2015AA015303). (Jan. Dec. 2016)
· Implementing the PETSc numerical library and MD on the Sunway TaihuLight supercomputer. (Nov. 2015 Oct. 2016)

---

[1]https://www.pnnl.gov/
[2]http://pasa.ucmerced.edu/

PUBLICATIONS

[SC'20] **Wenqian Dong**, Zhen Xie, Gokcen Kestor and Dong Li. "Smart-PGSim: Using Neural Network to Accelerate AC-OPF Power Grid Simulation." In 32th ACM/IEEE International Conference for High Performance Computing.

[SC'19] **Wenqian Dong**, Jie Liu, Zhen Xie and Dong Li. "Adaptive Neural Network-Based Approximation to Accelerate Eulerian Fluid Simulation." In 31th ACM/IEEE International Conference for High Performance Computing.

[ICPP'18] Kai Wu, **Wenqian Dong**, Qiang Guan, Nathan Debardeleben and Dong Li. "Modeling Application Resilience in Large Scale Parallel Execution". In the 47th International Conference on Parallel Processing.

[Journal of CCPE] **Wenqian Dong**, Kenli Li, Letian Kang, Zhe Quan, Keqin Li. "Implementing molecular dynamics simulation on the Sunway TaihuLight system with heterogeneous many-core processors." Concurrency and Computation: Practice and Experience 30(16) (2018).

[HPCC'16] **Wenqian Dong**, Letian Kang, Zhe Quan, Kenli Li, Keqin Li, Zi-Yu Hao, Xiang-Hui Xie. "Implementing Molecular Dynamics Simulation on Sunway TaihuLight System". In 19th IEEE International Conference on High Performance Computing and Communications.

PROJECT EXPERIENCE

Smart-PGsim: Using Neural Network to Accelerate AC-OPF Power Grid Simulation
May 2019- June 2020

- **Task:** Accelerate power grid application using neural networks; Identify the replaced code and extract features for neural network construction; Reformulate the solving method the for the AC-OPF problem; Design a interactive learning model for multitask prediction; Enable physics-informed learning Through domain knowledge; Implement neural network models with frameworks PyTorch.

- **Outcome:** Reduces simulation time by an average of $2.60\times$ (up to $3.28\times$) without losing the optimality of the solution; This work is published in SC'20.

Smart-fluidnet: Adaptive Neural Network-Based Approximation to Accelerate Eulerian Fluid Simulation
Sep 2018- Apr 2019

- **Task:** Adaptively accelerate Eulerian fluid simulation to meet the execution time and simulation quality requirement; Model morphsim: construct multiple neural network models for online different requirement; Dynamically switches these neural networks to make best efforts to reach the users requirement on simulation quality; Implement neural network models with frameworks Keras.

- **Outcome:** Smart-fluidnet is $1.46\times$ and $590\times$ faster than a state-of-the-art neural network model and the original fluid simulation respectively; This work is published in SC'19.

A Preliminary Study of Neural Network-based Approximation for HPC Applications
Jan 2018- Dec 2019

- **Task:** Using neural networks for accelerating the Newton-Raphson method and L-J potential in LAMMPS(a molecular dynamics simulation code); Use gprof to identify the most time-consuming functions for replacement; Characterize application information to chose the type of neural networks; Design different neural networks for different applications according to feature characterise; Implement neural network models with frameworks Tensorflow.

- **Outcome:** Results show a 2.7× and 2.46× speedup for the Newton-Raphson method and L-J potential in LAMMPS, respectively; This work is available on ArXiv[3].

Modeling Application Resilience in Large Scale Parallel Execution
Sep 2017- Aug 2018

- **Task:** Evaluate the resilience of the application running in large scales; Inject errors into the serial code to model the situation in parallel code with tool F-SEFI; Evaluate the efficiency of our modeling accuracy on four benchmarks(CG, FT, MG and LU) from NAS parallel benchmark suite;

- **Outcome** Introduce a new methodology to study the resilience of applications in large-scale parallel execution without injecting errors into the application in large-scale execution; This work is published in ICPP'19.

COMMUNITY SERVICES

UAW student leader, UC Merced, 2020

Student Volunteer at SC'17 and SC'18

Assistant of managing HPDC'18 and HPDC'19 travel grants

AWARDS

Bobcat Fellowship at UC Merced, 2018, 2020

ASPLOS'19 Student Travel Grant, 2019

China National Scholarship for graduate students (Master student), 2016

The First Class Academic Scholarship of Hunan University, 2015-2016

Second prize, "The Mathematical Modeling Competition of Hunan province", 2016

The Excellent Graduation Thesis, 2015

The Outstanding Graduates of Hunan Agricultural University, 2015

Recommended as an excellent fresh graduate to study for master degree with exam waived, 2014

China National Scholarship for undergraduate students, 2014

Third prize, "The LanQiao Cup National Software and Information Technology Professional Talents Competition", 2014

Third prize, "The Qiuzhen Cup Undergraduate Students Extracurricular Academic Science and Technology Works Competition", 2013

Merit Student of the School, 2013 and 2012

China National Encouragement Scholarship for undergraduate students, 2012

INVITED TALKS AND PRESENTATIONS

[SC'20] **Smart-PGSim: Using Neural Network to Accelerate AC-OPF Power Grid Simulation.**(Paper) In 31th ACM/IEEE International Conference for High Performance Computing, Atlanta, GA, November, 2020.

---

[3]https://arxiv.org/abs/1812.07561

[ARRIA Meeting] **Using Neural Network to Accelerate AC-OPF Power Grid Simulation..** High Performance group, PNNL, June, 2020

[SC'19] **Adaptive Neural Network-Based Approximation to Accelerate Eulerian Fluid Simulation.**(Paper) In 31th ACM/IEEE International Conference for High Performance Computing, Denver, CO, 2019.

[HPCC'16] **Implementing Molecular Dynamics Simulation on Sunway TaihuLight System.** (Paper) In 19th IEEE International Conference on High Performance Computing and Communications, Sydney, Australia, December, 2016.

PEER REVIEW ACTIVITIES

Reviwer for ICPP'20, Edmonton, AB, Canada

Reviewer for HPDC'19 travel grant program, Phoenix, Arizona, USA

Reviewer for HPDC'18 travel grant program, Tempe, Arizona, USA

Reviwer for IPDPS'19 Rio de Janeiro, Brazil

Reviwer for NAS'19, Enshi, China

Reviwer for IEEE Cluster'19, Albuquerque, New Mexico USA.

Reviwer for NPC'19, Hohhot, Inner Mongolia, China.

Reviwer for CCGrid'18, Washington, DC, USA.

TEACHING EXPERIENCE

Introducing to Computing (CSE 020 01)   Fall 2019
Teaching Assistant   *UC Merced*

· In charge of the assignment, exam, and lab session; involve in the assignment design; grade assignments, labs, and exams; host office hours; collect feedback from students and communicate with the course lecturer.
· Overall course evaluation score 5.9/7.0 by students

PROFESSIONAL MEMBERSHIPS

Member of the Association of Computing Machinery (ACM)

Member of the Association of Computing Machinery (ACM-Women)

Member of the Institute of Electrical and Electronics Engineers (IEEE)

REFERENCE

Dr. Dong Li, Professor, School of Electronic Engineering and Computational Science, UC Merced, CA, USA, Email: dli35@ucmerced.edu

Dr. Gokcen Kestor, Scientist, Pacific Northwest National Laboratory (PNNL), Richland, WA, USA, Email:gokcen.kestor@pnnl.gov