

Zhongwei Luke Li

POSTDOC · ALGORITHM DEVELOPER · SOFTWARE ENGINEER

Theory Lab, 2012 Labs, Huawei Technologies, 611731, China

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Education

Bachelor of Science in Mathematics and Applied Math

DALIAN UNIVERSITY OF TECHNOLOGY

Dalian, China

Sep. 2006 - Jul. 2010

- Mathematical Analysis, Linear Algebra, Abstract Algebra, Functional Analysis, Probability and Statistics, Stochastic Processes, etc.

Master of Science in Computer Science

SOUTHERN UNIVERSITY AND A&M COLLEGE

Baton Rouge, U.S.

Aug. 2010 - Dec. 2012

- Algorithms and Data Structures, Computer Architecture, Network Communication, Object-Oriented Programming, Assembly Language, Design Patterns, etc.

Ph.D in Computer Science

THE UNIVERSITY OF TEXAS AT ARLINGTON

Arlington, U.S.

Jan. 2013 - Dec. 2019

- Data Modeling, Distributed System Design, Advanced Software Development, etc.

Skills

Programming C/C++, Python, Java, Go

DevOps Kubernetes, K3S, Kubeedge

Data Analytics Hadoop, Spark, PyTorch, Mathematica, MatLab, Excel

Kernals Shell Script, Docker, Vagrant, Virtual Box

Work Efficiency Git, LaTeX

IDE CLion, PyCharm, Visual Studio, VS Code, IntelliJ, GoLand, XCode

Others Vue, JavaScripts, sql, hexo, Android SDK, iOS, Objective C

Communication English(Professional)

Experience

Bioinformatics Lab - Southern University and A&M College

RESEARCH ASSISTANT

Baton Rouge, U.S.

Aug. 2010 - Dec. 2012

- Conducted molecular dynamics simulations of biomolecules on the LONI (Louisiana Optical Network Infrastructure) supercomputer system. This involved executing tasks such as developing parallel instruction scripts, designing experiments, integrating data, and performing thorough analysis.

SERC Lab - University of Texas at Arlington

RESEARCH/TEACHING ASSISTANT

Arlington, U.S.

Jan. 2013 - Dec. 2019

- Proposed a solution to resource allocation challenges in high-performance computing centers and validated it through experiments on large-scale cluster.
- Conducted performance analysis of big data analytics platforms, including Hadoop and Spark, and derived concise and practical mathematical rules to guide relevant engineering practices. Completed the open-source project IPSO and publicly shared all experimental data.
- Played a key role in designing Pigeon, a hierarchical task scheduler for distributed data centers. Led the development, testing, and experimental design of the project. Achieved over 30-fold performance improvement compared to UC Berkeley's open-source project Sparrow.

Ilumi Solutions

INTERN SOFTWARE DEVELOPER

Plano, U.S.

May. 2016 - Sep. 2016

- Participated in the development and implementation of the Ilumi smart home product app, encompassing Android and iOS client development and testing for intelligent lighting fixtures and smart light strips.

ABACUS Lab - University of Texas at Arlington

PostDoc

Arlington, U.S.

Feb. 2020 - Aug. 2020

- Led a research team in designing and implementing the JADE scheduler prototype, a high-performance task scheduler for cloud-native Kubernetes systems.
- Participated in the design of TailGuard, a task scheduler for big data platforms aimed at meeting Service Level Objectives (SLOs). Collaborated with team members to conduct large-scale experiments on the Amazon Web Services (AWS) cloud computing platform.
- Took charge of maintaining the research team's open-source code repository and documentation.

- Invited to deliver undergraduate-level university courses on the following subjects:
- Java Object-Oriented Programming (Data Structures and Algorithms): Instructed students in the principles of Java programming with a focus on object-oriented design, data structures, and algorithms.
- Introduction to Machine Language and Digital Logic: Provided an overview of machine language and digital logic, covering topics such as binary representation, logic gates, Boolean algebra, and introductory computer architecture.
- Digital Forensics: Taught a course on digital forensics, encompassing techniques and methodologies for acquiring, analyzing, and preserving digital evidence in legal investigations.

Theory Lab - Huawei 2012 Labs

Chengdu, China

PostDoc

Aug. 2021 - Present

- Participated in the design of algorithms and development of high-performance function libraries for Reed-Solomon encoding and decoding using the Lin-Chung-Han Fast Fourier Transform (FFT) method.
- Applied the LCH-RS technology to real-time media communication, resulting in the development of a high-speed, low-latency, and robust error-correcting code library. Achieved a tenfold increase in throughput compared to existing technologies. Leveraged modern algebraic techniques to achieve performance enhancements of several orders of magnitude.
- Optimized the Reed-Solomon encoding and decoding algorithms for both high and low bit rates, leading to a twofold performance improvement over the original technical solution. These new encoding and decoding algorithms can be extended to cutting-edge technologies such as sliding window Reed-Solomon codes.

Publications

DISSERTATION

Zhongwei Li. "Performance Modeling and Resource Provisioning for Data-intensive Applications". PhD thesis. 2019.

CONFERENCE PROCEEDINGS

Reduced-Complexity Erasure Decoding of Low-Rate Reed-Solomon Codes Based on LCH-FFT

Chao Chen, Sian-Jheng Lin, Zhongwei Li, Suihua Cai, Yunghsiang Sam Han, Bo Bai

Proceedings of the IEEE International Symposium on Information Theory (ISIT), 2023

An Efficient Reed-Solomon Erasure Code over Cantor-constructed Binary Extension Finite Fields

Zhongwei Li, Sian-Jheng Lin, Yunghsiang Sam Han, Chao Chen

Proceedings of the IEEE International Symposium on Information Theory (ISIT), 2023

JADE: Tail-Latency-SLO-Aware Job Scheduling for Sensing-as-a-Service

Stoddard Rosenkrantz, Huiyang Li, Prathyusha Enganti, Zhongwei Li, Lin Sun, Zhijun Wang, Hao Che, Hong Jiang

Proceedings of the IEEE/ACM 13th International Conference on Utility and Cloud Computing (UCC), 2020

A Unified Scaling Model in the Era of Big Data Analytics

Zhongwei Li, Feng Duan, Hao Che

Proceedings of the 3rd International Conference on High Performance Compilation, Computing and Communications (HP3C), 2019

IPSO: A Scaling Model for Data-intensive Applications

Zhongwei Li, Feng Duan, Minh Nguyen, Hao Che, Yu Lei, Hong Jiang

Proceedings of the IEEE 39th International Conference on Distributed Computing Systems (ICDCS), 2019

Pigeon: An Effective Distributed, Hierarchical Datacenter Job Scheduler

Zhijun Wang, Huiyang Li, Zhongwei Li, Xiaocui Sun, Jia Rao, Hao Che, Hong Jiang

Proceedings of the ACM Symposium on Cloud Computing (SOCC), 2019

The Tail at Scale: How to Predict It?

Minh Nguyen, Zhongwei Li, Feng Duan, Hao Che, Hong Jiang

Proceedings of the 8th USENIX Workshop on Hot Topics in Cloud Computing (HotCloud), 2016

Interaction Simulation of Lipoxigenase with Arachidonate Acid Using NAMD

Zhongwei Li, Ebrahim Khosravi, Shuju Bai

Proceedings of the IEEE International Conference on Bioinformatics and Biomedicine Workshops (BIBMW), 2011

Projects

IPSO [\[LINK\]](#)

UTA - SERC Lab

PROJECT LEADER & MAIN CONTRIBUTOR

- The IPSO open-source project encompasses mathematical modeling and corresponding open-source code implementations derived from our analysis of performance data for data-intensive applications. This model not only extends the applicability of the traditional Amdahl's Law to modern cloud computing and big data scenarios but also provides a comprehensive mathematical coverage of known scalable system performance evaluation models, including Gustafson's Law, Sun-Ni Law, and others. As such, it can be regarded as a superset of these models.

Pigeon [\[LINK\]](#)

UTA - SERC Lab

PROJECT LEADER & MAIN CONTRIBUTOR

- The Pigeon open-source project is an efficient hierarchical scheduler for big data centers, inspired by the renowned distributed scheduler Sparrow from UC Berkeley. The core of this scheduler employs hierarchical task dispatching and message queue mechanisms, designed to mitigate head-of-line blocking for short-duration tasks and starvation for long-duration tasks. As a result, Pigeon exhibits significant improvements in task scheduling performance compared to its competitors Sparrow and Eagle. The project's GitHub repository includes the Pigeon core code (engine module + AWS cloud deployment module) as well as the Apache Spark Plugin (extender).

JADE

UTA - ABACUS Lab

PROJECT INITIATOR & EARLY CONTRIBUTOR

- The JADE project is an extension of the Pigeon project in a cloud-native application environment. It includes the core logic code implemented in Go language, as well as a series of resource definition files, image files, and other components designed for the Kubernetes container orchestrator. The project is currently in progress, and the source code has not been publicly released yet.

SecPro

Huawei - Theory Lab

MAIN CONTRIBUTOR

- The SecPro project was initiated by Central Media Technology Institute of Huawei's 2012 Laboratory. It is based on the independent research and development of the LCH-RS erasure code algorithm and SIMD instruction set by the Theory Lab. This project aims to enhance the efficiency of RS encoding and decoding, reduce system resource consumption, and support high-throughput, low-latency, and robust HD media transmission services by applying a series of self-developed technologies. The project has been integrated into the key project in the Media Institute's "Ultra HD Real-time Communication Technology." It has been successfully deployed on Huawei Cloud Desktop and is planned for deployment in other product lines.

Honors & Awards

PERSONAL

- 2022 **Star of Knowledge** (Central Research Institute - Huawei 2012 Labs)
- 2022 **Star of Quality** (Huawei Technologies Co., Ltd)
- 2023 **Innovation Vanguard** (Central Research Institute - Huawei 2012 Labs)

Chengdu, China

Chengdu, China

Chengdu, China

TEAM

- 2023 **Excellence in Practice Incentives** (Huawei 2012 Labs)

Chengdu, China

Presentation

HP3C'19

Xi'an, China

ACADEMIC PRESENTATION

Mar. 2019

- A unified scaling model in the era of big data analytics

ICDCS'19

Dallas, U.S.

ACADEMIC PRESENTATION

Jul. 2019

- IPSO: A scaling model for data-intensive applications

ISIT'23

Taipei, Taiwan

ACADEMIC PRESENTATION

Jul. 2023

- An Efficient Reed-Solomon Erasure Code over Cantor-constructed Binary Extension Finite Fields