# Li Wu

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**RESEARCH INTEREST**

My research focuses on enhancing the resilience and sustainability of large-scale distributed systems, including cloud computing, edge computing, and cyber-physical systems, with a particular emphasis on machine learning workloads and microservices.

**EDUCATION**

**Technische Universität Berlin**, Germany 09/2018 – 11/2021

*Ph.D in Computer Science*

Advisor: Prof. Odej Kao, Prof. Johan Tordsson, Prof. Erik Elmroth

- Thesis: Automatic Performance Diagnosis and Recovery in Cloud Microservices (*Magna Cum Laude*)

**Southeast University**, China 09/2012 – 04/2015

*M.S. in Information and Communication Engineering*
Advisor: Prof. Lijun Chen

- Thesis: Research on Furnace Temperature Field Reconstruction Based on Acoustic Wave Theory

**Hohai University**, China 09/2008 – 06/2012

*B.S. in Telecommunication Engineering*
Advisor: Prof. Changping Zhu

- Honors: Top 1% of Class, Best Thesis Award

**GRANTS & FELLOWSHIPS**

**Marie Skłodowska-Curie Scholarship** 2018 – 2021
*European Commission*
*Budget: $ 115k*

**Huawei Research Grant (Indirect)** 2021 – 2023
*Huawei Munich*
*Budget: $ 300k*

**Huawei Research Grant (Indirect)** 2024 – 2026
*Huawei Munich*
*Budget: $ 300k*

**ACSOS Travel Grant** 2021
*Awarded for conference participation*

**ACADEMIC EXPERIENCE**

**University of Massachusetts Amherst**, United States 06/2023 – Present

*Postdoctoral Research Fellow*
Advisor: Prof. Prashant Shenoy

- Research on edge resiliency, security, and sustainability.

**Technische Universität Berlin**, Germany 09/2018 – 11/2021

*Research Associate*
Advisor: Prof. Odej Kao

- Research on root cause analysis and recovery for cloud microservices.

**Southeast University**, China 09/2012 – 04/2015

*Research Associate*
Advisor: Prof. Lijun Chen

- Research on algorithms for temperature distribution reconstruction (published 2 journal papers).

**Hohai University**, China 09/2009 – 06/2012

*Research Associate*
Advisor: Prof. Chenping Zhu

- Research on circuit design for ultrasonic washing machines (published 1 journal paper).

## INDUSTRY EXPERIENCE

**Bosch Research**, China 03/2022 – 06/2023

*Senior Research Scientist, Reliable Distributed System (5 patents)*

- Led research on reliable distributed systems for autonomous driving.
- Directed teams to integrate solutions into products, impacting industry standards.
- Developed 5 patents related to distributed systems.

**Elastisys**, Sweden 09/2018 – 11/2021

*System Scientist*, Advisors: Johan Tordson, Erik Elmorth (MicroX papers)

- Research on performance diagnosis and recovery in cloud microservices.
- Published MicroX papers.
- Developed and open-sourced the MicroRCA project.

**Las Naves**, Spain 09/2020 – 03/2021

*Researcher*, Advisors: Guillaume Pierre (LivingFog platform and hackathon)

- Design and implement the LivingFog platform for IoT devices.
- Organized and presented at a hackathon centered around the LivingFog platform.
- Authored a paper published in ICIN'22.

**IBM**, China 05/2015 – 09/2018

*Software Developer/Site Reliable Engineer, IBM Cloud (1 patent)*

- Developed and operated key cloud computing techniques, including Kubernetes and OpenStack.
- Issued 1 US patent.

## PUBLICATIONS

### Highly Cited Papers

**MicroRCA: Root cause localization of performance issues in microservices** 2020
***Wu L**, Tordsson J, Elmroth E, Kao O*
*2020 IEEE/IFIP Network Operations and Management Symposium (NOMS)*
*Citations: 190+*

**Fog computing applications: Taxonomy and requirements** 2019
*Ahmed, A., Arkian, H., Battulga, D., Fahs, A. J., Farhadi, M., Giouroukis, D., ... & **Wu, L** (Contributed equally)*
*arXiv:1907.11621*
*Citations: 70+*

**MicroDiag: Fine-grained performance diagnosis for microservice systems** 2021
***Wu L**, Tordsson J, Bogatinovski J, Elmroth E, Kao O*
*IEEE/ACM International Workshop on Cloud Intelligence (CloudIntelligence)*
*Citations: 50+*

**Performance diagnosis in cloud microservices using deep learning** 2020
***Wu L**, Bogatinovski J, Nedelkoski S, Tordsson J, Kao O*
*Service-Oriented Computing – ICSOC 2020 Workshops: AIOPS*
*Citations: 40+*

### Other Notable Publications

**Acies-OS: A Content-Centric Platform for Edge AI Twinning and Orchestration** 2024
*Li J, Chen Y, Kimura T, Wang T, Wang R, Kara D, Hu Y, **Wu L**, Hanafy WA, Souza A, Shenoy P*
*33rd International Conference on Computer Communications and Networks (ICCCN)*

**SLO-Power: SLO and Power-aware Elastic Scaling for Web Services** 2024
*Savasci M, Souza A, **Wu L**, Irwin D, Ali-Eldin A, Shenoy P*
*24th IEEE International Symposium on Cluster, Cloud and Internet Computing (CCGrid)*

**Failure-Resilient ML Inference at the Edge through Graceful Service Degradation** 2023
*Hanafy WA, **Wu L**, Abdelzaher T, Diggavi S, Shenoy P*
*2023 IEEE Military Communications Conference (MILCOM)*

**Failure identification from unstable log data using deep learning** 2022
*Bogatinovski J, Nedelkoski S, **Wu L**, Cardoso J, Kao O.*
*22nd IEEE International Symposium on Cluster, Cloud and Internet Computing (CCGrid)*

**LivingFog: Leveraging fog computing and LoRaWAN technologies for smart marina management (experience paper)** 2022
*Battulga D, Farhadi M, Tamiru MA, **Wu L**, Pierre G (Contributed equally)*
*5th Conference on Innovation in Clouds, Internet, and Networks (ICIN)*

**Causal inference techniques for microservice performance diagnosis: Evaluation and guiding recommendations** 2021
***Wu L**, Tordsson J, Elmroth E, Kao O*
*2021 IEEE International Conference on Autonomic Computing and Self-Organizing Systems (ACSOS)*

**MicroRAS: Automatic recovery in the absence of historical failure data for microservice systems** 2021
***Wu L**, Tordsson J, Acker A, Kao O*
*13th International Conference on Utility and Cloud Computing (UCC)*

## Journal Papers

**Experimental Study on Sound Wave Transit Time Measurement in Furnace Acoustic Temperature Measurement** 2018
***Wu L**, Chen Lijun*
*Acoustic Technology*

**Experimental Evaluation of Sound Wave Propagation Characteristics in Waveguides** 2015
*Xu C, **Wu L**, Chen Lijun*
*Acoustics and Electronic Engineering*

**Research on Matching Technology for Ultrasonic Fruit and Vegetable Washing Machines** 2013
***Wu L**, Zhu Changping*
*Acoustics and Electronic Engineering*

## Under Review

**Failure-Resilient ML Inference at the Edge through Graceful Service Degradation** 2024
***Wu L**, Hanafy WA, Souza A, Abdelzaher T, Verma G, Shenoy P*
*2024 IEEE Military Communications Conference (MILCOM)*

## In Preparation

**Leveraging Fine-grain Spatial Carbon-Intensity Variations for Edge Computing** 2024
***Wu L**, Hanafy WA, Souza A, Shenoy P*
*Sigmetrics'25*

**Resilient Model Inference at Resource-Constrained Edge** 2024
***Wu L**, Hanafy WA, Souza A, Shenoy P*
*OSDI'25 / ATC'25*

**Enabling Device-to-device Collaboration in Dynamic IoT Environments** 2024
*Shastri H, **Wu L**,Shenoy P*
*Mobisys'25*

**PATENTS**

## Granted Patents

**Testing an online system for service oriented architecture (SOA) services** 2021
*L Cai, YM Yin, **L Wu**, XG Ding*
*US Patent 11,169,905*

## Pending Patents

5 Patents on reliable distributed systems for autonomous driving.

**HONORS & AWARDS**

- Best of IBMer: Best new SRE of Cloud Foundation Services, IBM 2017
- SEU Alumnus Scholarship for Outstanding Students, 2013 – 2014

- The Third Prize in the National Graduate Student Mathematical Contest in Modeling 2013
- Best Bachelor Thesis (Top 1%) 2012
- **National Scholarship** (Top 0.2% nationwide), The Chinese Ministry of Education 2011
- 2nd Prize in the Physical and Experimental Science Technology Innovation 2011
- 1st Prize in the TI Cup Electronic Design competition 2010
- 1st Prize in the Physics Contest of HHU 2010
- 1st Prize in the Mathematics Contest of HHU 2009
- HHU Academic Excellence Scholarship, Science and Technology Innovation Scholarship 2008 – 2012

**INVITED TALKS**

**Automatic Performance Diagnosis and Recovery in Cloud Microservices**
*Zscaler, US* 08/2024

**MicroRCA: Root Cause Localization of Performance Issues in Microservices**
*Ericsson, Sweden* 11/2021

**SERVICE TO PROFESSION AND UNIVERSITY**

**Conference Organization**

Second International Workshop on Artificial Intelligence for IT Operations at ICSOC 2021

The 16th IEEE International Conference on Autonomic Computing (ICAC) 2019

**Reviewer**

IEEE Transactions on Services Computing 2024

Sustainable Computing: Informatics and Systems 2024

Journal of Parallel and Distributed Computing 2024

Performance Evaluation 2024

International World Wide Web Conference 2020

**Hackathon Organization: Hack the fog** 2021
- Organized and coordinated the event.

**Workshop Leadership: 15th Cloud Control Workshop** 2019
- Led the discussion panel on ”Anomaly detection in edge/fog computing”.

**Outreach: UMass Turing Summer Program** 2024
- Role: Organizer and Coordinator
- Promoted and organized the program to attract high school participants in western Massachusetts.
- Coordinated with professors and lecturers to ensure the smooth execution of the three-week program.

**TEACHING**

**University of Massachusetts Amherst** 2023, 2024
UMass Turing Summer Program – https://none.cs.umass.edu/turing/
- Coordinator and Teacher
- Syllabus, class, and tutorial preparations.
- Delivered lectures on ”Introduction to Python Programming”.
- Capstone projects coordination and supervision.

**Technische Universität Berlin** 2020-2021
Teaching Assistant : Distributed and Operating System Seminar
- Prepared and organized research topics for seminar students.
- Guided students in developing research ideas, crafting their reports, and preparing presentations.
- Managed grading and provided feedback on student work.

Hackathon: Hack the fog – http://www.fogguru.eu/living-lab/hackthefog/ 2021
- Coordinator and Teacher
- Delivered lectures on ”Using Node-Red for the IoT and fog platform”.
- Supervised and mentored participating teams.

**ADVISING & MENTORING**

**07/2023 - Present:** Hetvi Shastri (Ph.D.)
**09/2023 - 05/2024:** Khai Nguyen (MSc)
**08/2022 - 06/2023:** Xiangyu Wu (MSc, University of Science and Technology of China)
**06/2024 - Present:** Riley Kim Connell (BSc., REU)
**Summer, 2024:** Akshay Prabhu (MSc., Summer Intern)
**09/2020 - 11/2021:** +4 BSc./MSc. students in research seminar (Technische Universität Berlin)
**09/2023 - Present:** +3 MSc. students in *Independent studies*.