# Li Wu

## University of Massachusetts Amherst 740 N Pleasant St, Amherst, MA 01003

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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 - 12/2021

*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

2023

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

Hanafy WA, Wu L, Abdelzaher T, Diggavi S, Shenoy P

2023 IEEE Military Communications Conference (MILCOM)

2022

**Failure identification from unstable log data using deep learning** *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 m (experience paper)  Battulga D, Farhadi M, Tamiru MA, Wu L, Pierre G (Contributed equally)  5th Conference on Innovation in Clouds, Internet, and Networks (ICIN)	anagement 2022
	Causal inference techniques for microservice performance diagnosis: Evaluation at recommendations  Wu L, Tordsson J, Elmroth E, Kao O  2021 IEEE International Conference on Autonomic Computing and Solf Organizing Systems (1)	2021
	2021 IEEE International Conference on Autonomic Computing and Self-Organizing Systems (A MicroRAS: Automatic recovery in the absence of historical failure data for microservice sy 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 Te Measurement Wu L, Chen Lijun Acoustic Technology	emperature 2018
	Experimental Evaluation of Sound Wave Propagation Characteristics in Waveguides Xu C, Wu L, Chen Lijun Acoustics and Electronic Engineering	2015
	Research on Matching Technology for Ultrasonic Fruit and Vegetable Washing Machines Wu L, Zhu Changping Acoustics and Electronic Engineering	2013
	Under Review	
	Failure-Resilient ML Inference at the Edge through Graceful Service Degradation Wu L, Hanafy WA, Souza A, Abdelzaher T, Verma G, Shenoy P 2024 IEEE Military Communications Conference (MILCOM)	2024
	In Preparation	
	<b>Leveraging Fine-grain Spatial Carbon-Intensity Variations for Edge Computing</b> <i>Wu L</i> , <i>Hanafy WA</i> , <i>Souza A</i> , <i>Shenoy P Sigmetrics</i> '25	2024
	Resilient Model Inference at Resource-Constrained Edge Wu L, Hanafy WA, Souza A, Shenoy P OSDI'25 / ATC'25	2024
	Enabling Device-to-device Collaboration in Dynamic IoT Environments Shastri H, Wu L,Shenoy P Mobisys'25	2024
PATENTS	Granted Patents	
	<b>Testing an online system for service oriented architecture (SOA) services</b> <i>L Cai, YM Yin, L Wu, XG Ding US Patent 11,169,905</i>	2021
	Pending Patents	
	5 Patents on reliable distributed systems for autonomous driving.	
HONORS & AWARDS	<ul> <li>Best of IBMer: Best new SRE of Cloud Foundation Services, IBM</li> <li>SEU Alumnus Scholarship for Outstanding Students</li> </ul>	2017 2013 – 2014

	■ The Third Prize in the National Graduate Student Mathematical Contest in Modeling	2013	
	■ Best Bachelor Thesis (Top 1%)	2012	
	<ul> <li>National Scholarship (Top 0.2% nationwide), The Chinese Ministry of Education</li> <li>2nd Prize in the Physical and Experimental Science Technology Innovation</li> </ul>	2011 2011	
	<ul> <li>Ist Prize in the TI Cup Electronic Design competition</li> </ul>	2011	
	<ul> <li>1st Prize in the Physics Contest of HHU</li> </ul>	2010	
	<ul> <li>1st Prize in the Mathematics Contest of HHU</li> </ul>	2009	
	■ HHU Academic Excellence Scholarship, Science and Technology Innovation Scholarship 20		
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	08/2021	
SERVICE TO	Conference Organization		
PROFESSION AND	Second International Workshop on Artificial Intelligence for IT Operations at ICSOC	2021	
UNIVERSITY	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	
	international World Wide Web Conference	2020	
	<ul><li>Hackathon Organization: Hack the fog</li><li>■ Organized and coordinated the event.</li></ul>	2021	
	Workshop Leadership: 15th Cloud Control Workshop	2019	
	<ul> <li>Led the discussion panel on "Anomaly detection in edge/fog computing".</li> </ul>		
	Outreach: UMass Turing Summer Program  Role: Organizer and Coordinator	2024	
	<ul> <li>Promoted and organized the program to attract high school participants in western Massachusetts.</li> <li>Coordinated with professors and lecturers to ensure the smooth execution of the three-week program.</li> </ul>		
TEACHING	University of Massachusetts Amherst	2024	
	UMass Turing Summer Program – https://none.cs.umass.edu/turing/		
	Coordinator and Teacher		
	<ul><li>Syllabus, class, and tutorial preparations.</li><li>Delivered lectures on "Introduction to Python Programming".</li></ul>		
	Capstone projects coordination and supervision.		
		2020-2021	
	Teaching Assistant: Distributed and Operating System Seminar		
	<ul> <li>Prepared and organized research topics for seminar students.</li> </ul>		
	<ul> <li>Guided students in developing research ideas, crafting their reports, and preparing presentation</li> <li>Managed grading and provided feedback on student work</li> </ul>	ons.	
	Managed grading and provided feedback on student work.      We have the feedback of student work.	0001	
	Hackathon: Hack the fog – http://www.fogguru.eu/living-lab/hackthefog/  Coordinator and Teacher	2021	
	<ul> <li>Delivered lectures on "Using Node-Red for the IoT and fog platform".</li> <li>Supervised and mentored participating teams</li> </ul>		
	<ul> <li>Supervised and mentored participating teams</li> </ul>		

Supervised and mentored participating teams.

 ADVISING &
 07/2023 - Present:
 Hetvi Shastri (Ph.D.)

 MENTORING
 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*.