Jinlai Xu

Curriculum Vitae

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Education

Aug. 2015– 2021 **PhD in Information Science (expected)**, *University of Pittsburgh*.
Advisor: Balaji Palanisamy
Thesis: Geo-distributed Edge and Cloud Resource Management for Low-latency Stream Processing

Sep. 2012– Jun. 2015 **M.E in Software Engineering**, *China University of Geosciences*.
Advisor: Zhongwen Luo
GPA – 89.9/100, *Major GPA – 91.9/100*,
Thesis: MapReduce Performance Acceleration and Analytic with Intermediate Results Reusing.

Sep. 2008–Jun. 2012 **B.E. in Software Engineering**, *China University of Geosciences*.
GPA – 88.6/100, *Major GPA – 92.9/100*, ranked 1st/96,
Thesis: Design and Implementation of the Quadrotor Autopilot and 3-D Point Cloud Generation and Processing System.

Research Interests

I am broadly interested in Distributed Systems, Edge Computing, and Cloud Computing with specific focuses on Resource Management, Stream Processing, Reinforcement Learning on Systems, and Intensive Design for Resource Sharing

Research Experience

2015–Present **PhD Researcher**, The Laboratory for Education and Research on Security Assured Information Systems (LERSAIS), University of Pittsburgh, Pittsburgh.

- Designed and implemented a novel contract-based framework to support resource sharing between different entities (e.g., cloud service providers, edge infrastructure providers) in geo-distributed cloud and edge computing environment
  - Based on the theory of mechanism design, designed the auction framework to support contract-based resource sharing among different entities
  - Based on the utility of different participates, designed the bidding strategies, e.g., for idle cloud providers, they place sell bids with their operation cost.
  - Proposed a decentralized version of the above mechanism based on blockchain techniques
- Designed, developed and deployed a configurable edge stream processing testbed based on OpenStack toolchain
  - Designed a configurable three-tier edge computing testbed
  - Based on real edge devices (smart gateways, micro datacenter servers) to design the specification of each node
  - Developed a configurable network architecture (e.g., latency, and bandwidth) using OpenStack toolchain.
- Proposed and implemented a sort of novel mechanisms to deal with resource management, fault tolerance, and elastic requirements of stream processing applications in edge computing environment based on Apache Storm
  - Proposed a three phase optimization for stream processing applications (physical plan generation, operator placement, runtime optimization)
  - Considering data locality, load balancing, and coflow completion rate to optimize the end-to-end latency of stream processing applications in edge computing environment
  - Considering both the heterogeneous recovery cost and resource usage cost to selectively replicate operators to achieve both low latency during fails and overall low fault tolerance cost
  - Proposed a model-based reinforcement learning method to automatically configure the parallelism of the operators by considering the heterogeneous nature of the operators and physical nodes in edge computing environment

2012–2015 **Research Assistant**, Robotics and Artificial Intelligence Laboratory, China University of Geosciences, Wuhan.

- Reviewed related literature (mainly in Cloud Computing)
- Constructed the cloud computing platform for our faculty:
  - Designed the virtualization solution for the cluster. (based on Xen)
  - Deployed Hadoop and related application(Hive, Spark, Solr ...) on the cluster.
- Studied MapReduce programming model and did research on it:
  - Read the source code of MapReduce in Hadoop project.
  - Proposed a new method to reuse the intermediate results automatically and data-awarenessly and implemented the prototype system by modifying the core code of MapReduce.
  - the paper is published on Concurrency and Computation: Practice and Experience (CCPE) (Title: ***MEMoMR: Accelerate MapReduce via Reuse of Intermediate Results***)
- Managed the cluster in our faculty:
  - Allocated the virtual machines and network resource.
  - Supported a mirror site on the cluster (http://mirrors.cug.edu.cn).

2009–2012 **Undergraduate Research Assistant**, Robotics and Artificial Intelligence Laboratory, China University of Geosciences, Wuhan.

- Reviewed related literature (mainly in Computer Vision and Robotics).
- Participated in The 9th Robot Soccer Tournament of China and The Tryouts for FIRA in Changchun in freshmen year.
- Studied the architecture and implementation of ROS(The Robot Operating System) and preliminarily deployed it on the robots control panel (Version: RB100 by RoBoard).
- Successfully applied for The National College Students Innovation Experiment Program:
  - **Topic: Small Model Aircraft Autopilot System and Aerial Photo Research**
  - Chose Quadrotor(an aircraft with four rotors) as the carrier platform of the research.
  - Studied the theory of balancing the Quadrotor with MikroKopter(one of the most famous open source UAV projects).
  - Studied and implemented the point clouds registration algorithm ICP and RANSAC on ROS.
  - Used ASUS Xtion PRO (a device like Kinect) to get the point cloud data and evaluated the algorithm.
  - Wrote graduation thesis based on this topic.(Title: the Design and Implementation of the Quadrotor Autopilot and 3-D Point Cloud Generation and Processing System)

Work Experience

2019 May.–Jul. **Software Engineer Intern**, *Facebook*.

- Software Engineer Intern in Stream Processing Team
- Implemented mechanisms (in C++) to automatically control the resource usage (CPU and memory) for thousands of stream processing applications deployed on Facebook's stream processing backbone to decrease manually tuning efforts
- For memory management, implemented and evaluated a mechanism to adjust the data volume between barriers to meet the memory utilization requirement
- For CPU management, implemented and evaluated a mechanism to use a multi-thread pool to control the number of threads allocated to one operator and control the en-queue and de-queue priorities to improve the utilization for each thread

Publications

Journal Publications

[JPDC] **Jinlai Xu**, Balaji Palanisamy, Qingyang Wang, Heiko Ludwig, and Sandeep Gopisetty. Amnis: Optimized stream processing for edge computing. *Journal of Parallel and Distributed Computing****(under review after major revision)***, 2021.

[TSC] **Jinlai Xu**, and Balaji Palanisamy. Optimized contract-based model for resource allocation in federated geo-distributed clouds. *IEEE Transactions on Services Computing (TSC)*, 2018.

[CCPE] Hong Yao, **Jinlai Xu**, Zhongwen Luo, and Deze Zeng. MEMoMR: Accelerate mapreduce via reuse of intermediate results. *Concurrency and Computation: Practice and Experience (Special Issue)*, 28(14):3814-3829, 2016.

Conference Publications

[CCGrid 21'] **Jinlai Xu**, Balaji Palanisamy, and Qingyang Wang. Resilient stream processing in edge computing. In 2021 *IEEE/ACM International Symposium on Cluster, Cloud and Internet Computing (CCGrid)**(accepted)***. IEEE, 2021.

[CODASPY 21'] Chao Li, Balaji Palanisamy, Runhua Xu, **Jinlai Xu** and Jingzhe Wang. SteemOps: Extracting and Analyzing Key Operations in Steemit Blockchain-based Social Media Platform. In *2021 ACM Conference on Data and Application Security and Privacy **(Dataset/Tool Paper)***. ACM, 2021.

[IEEE CIC 20'] Jingzhe Wang, Balaji Palanisamy, and **Jinlai Xu**. Sustainability-aware resource provisioning in data centers. In *2020 IEEE International Conference on Collaboration and Internet Computing (CIC)*. IEEE, 2020.

[IEEE Edge 17'] **Jinlai Xu**, Balaji Palanisamy, Heiko Ludwig, and Qingyang Wang. Zenith: Utility-aware resource allocation for edge computing.In *2017 IEEE international conference on edge computing (EDGE)*, pages 47-54. IEEE, 2017.

[IEEE Cloud 17'] **Jinlai Xu** and Balaji Palanisamy. Cost-aware resource management for federated clouds using resource sharing contracts. In *2017 IEEE 10th International Conference on Cloud Computing (CLOUD)*, pages 238-245. IEEE, 2017.

[IEEE CIC 17'] **Jinlai Xu**, Balaji Palanisamy, Yuzhe Tang, and SD Madhu Kumar. PADS: Privacy-preserving auction design for allocating dynamically priced cloud resources. In *2017 IEEE 3rd International Conference on Collaboration and Internet Computing(CIC)*, pages 87-96. IEEE, 2017.

Teaching Experience

2017–2020 **Teaching Assistant**, University of Pittsburgh
- Cloud Computing (2017 Spring, 2018 Spring, 2019 Spring, 2020 Spring)
  - Instructor: Prof. Balaji Palanisamy
- Information Security and Privacy (2017 Fall), Information Security and Privacy (Online Course) (2018 Fall)
  - Instructor: Prof. Balaji Palanisamy
- Algorithm Design (2018 Fall)
  - Instructor: Prof. Hassan Karimi

2013 Fall **Teaching Assistant**, China University of Geosciences
- Advanced Programming Language (JAVA)
  - Instructor: Prof. Shengwen Li

Skills

Programming Languages : Java, C++ , Python, R

Libraries and Frameworks : Hadoop, Storm, Spark, PyTorch, RLlib, Ray , Pandas, Numpy, OpenStack

Version Control : git Git, Github

Writing : LaTeX, Markdown, Office, Vim

Honors & Awards

2019 **ICOMITEE 2019 outstanding reviewer**, ICOMITEE 2019

2017 **ICDCS 2017 student travel grant**, ICDCS 2017, Atlanta, GA, USA

2013–2014 **Outstanding Student Award**, China University of Geosciences, China

2010–2011 **Fellows Scholarship**, China University of Geosciences, China

2009–2010 **National Scholarship**, Ministry of Education, China

2009 **The Second Place of AndroSot(Full-autonomous 3vs3 Humanoid Robot Soccer)**, The 9th Robot Soccer Tournament of China and The Tryouts for FIRA, Changchun, China

2009 **The First Prize of AndroSot(Semi-autonomous 3vs3 Humanoid Robot Soccer)**, The 9th Robot Soccer Tournament of China and The Tryouts for FIRA, Changchun, China

Professional Services

Journal Review
- IEEE Transactions on Services Computing (TSC)
- Concurrency and Computation: Practice and Experience (CCPE)
- International Journal of Cooperative Information Systems (IJCIS)
- Information Systems Frontiers (ISFI) : IRI - Special Issue on Foundations of Reuse
- PLOS ONE
- TELKOMNIKA (Telecommunication, Computing, Electronics and Control)

Conference Review
- IEEE INTERNATIONAL CONGRESS ON INTERNET OF THINGS (ICIOT)
- International Conference on Electrical Engineering, Computer Science and Informatics (EECSI)
- International Workshop on Internet-scale Clouds and Big Data (ISCBD)
- IEEE International Conference on Communications (ICC)

Conference External Review
- IEEE World Wide Web (WWW)
- International Conference on Distributed Computing Systems (ICDCS)
- IEEE International Conference on Big Data (Big Data)
- ACM International Conference on Information and Knowledge Management (CIKM)

Conference Volunteer
- IEEE 18th International Conference on Information Reuse and Integration (IRI 2017), San Diego, CA, USA. Aug 4 - 6, 2017
- The 37th International Conference on Distributed Computing Systems (ICDCS 2017), Atlanta, GA, USA. June 5 - 8, 2017
- IEEE 17th International Conference on Information Reuse and Integration (IRI 2016), Pittsburgh, PA, USA. Jul 28 - 30,2016
- IEEE 2ed International Conference on Collaboration and Internet Computing (CIC 2016), Pittsburgh, PA, USA. Nov 1 - 3,2016

Conference Web Chair
- The 7th IEEE International Conference on Collaboration and Internet Computing (IEEE CIC 2021)
- The Third IEEE International Conference on Trust, Privacy and Security in Intelligent Systems, and Applications (IEEE TPS 2021)
- The Third IEEE International Conference on Cognitive Machine Intelligence (IEEE CogMI 2021)

Conference Webmaster
- 7th IEEE International Conference on Collaboration and Internet Computing (CIC 2021)
- Third IEEE International Conference on Trust, Privacy and Security in Intelligent Systems, and Applications (TPS 2021)
- Third IEEE International Conference on Cognitive Machine Intelligence (CogMI 2021)
- IEEE 19th International Conference on Information Reuse and Integration (IEEE IRI 2018)
- IEEE 18th International Conference on Information Reuse and Integration (IEEE IRI 2017)
- International Workshop on Internet-scale Clouds and Big Data (ISCBD 2018)
- International Workshop on Internet-scale Clouds and Big Data (ISCBD 2017)
- International Workshop on Internet-scale Clouds and Big Data (ISCBD 2016)