Dr. SHAWN LI ZENGXIANG (李增祥)

Nationality: Chinese
Identity: Singapore Permanent Resident
Gender: Male
Date of Birth: 19-Nov-1980
Mobile Phone: 65-93256108/86-18031693836
Email: zengxiang_li@outlook.com, lzxgale@gmail.com

EDUCATION

Ph.D **Nanyang Technological University (NTU)** Singapore 2012
Research Topic Efficient and Fault Tolerant HLA-based Simulations
Supervisor Professor Wengtong Cai, Professor Stephen John Turner

M.S. **Shanghai Jiao Tong University (SJTU)** Shanghai, China 2006
Research Topic Dynamic Binary Translation and Optimization
Supervisor Professor Haibing Guan

B.S. **Shanghai University of Electric Power (SUEP)** Shanghai, China 2003

EMPLOYMENT

08/2010-06/2012	**Research Associate**	Parallel and Distributed Computing Centre **NTU**
06/2012-08/2020	**Scientist**	Institute of High Performance Computing **A*STAR**
04/2018-08/2020	**Group Manager**	Institute of High Performance Computing **A*STAR**
08/2020-Present	**Executive Vice President**	Digital Research Institute ENN Group

Roles in Digital Research Institute ENN Group, Beijing, China (08/2020-Present)

Executive Vice President: Leading a team of 50 researchers and engineers. Focusing on Industrial IoT, Artificial Intelligence and Federate Learning research and development for smart energy and smart city application domains. Establishing collaborations among government agencies, companies and universities for Federated Learning platform development and interoperability, industry application deployment and use case demonstration, as well as technology standard releases.

Roles in Institute of High Performance Computing, A*STAR, Singapore (06/2012-08/2020)

Scientist and Group Manager: Led a team of 15 researchers and engineers, and supervised several Ph.D and internship students. Played the role as PI and Co-PI for several impactful research programmes and industry projects, establishing close relations with universities, government agencies and industrial companies, to work together as an avid collaborator on research problems and solutions towards improving society. Research interests include distributed system, data center, big data analytics and urban computing, blockchain, multi-party computation and federated learning. Published dozens of high-quality papers on ACM/IEEE Transactions, Journals, and Conferences, and also serves as track/workshop chair of several reputable international conferences.

SELECTED PROJECTS（Digital Research Institute ENN Group）

The **Collaborative Learning technology** developed by ENNEW (Xin'ao Xinzhi) Digital Research Institute enables a number of enterprises to create AI models in a collaborative approach for industrial internet applications. Consequently, they could discover the insights behind data across silos and devices without compromising data sovereignty and privacy. Incentive mechanisms are designed to encourage participants contributing high-quality data to promote AI models and establish a sustainable industrial intelligent ecosystem together.

- Federated Transfer Learning for Industry IoT
  - System and statistical heterogeneity challenges in federated learning for IIoT applications
  - Accurate and cost-saving gas boiler soft sensing across multiple stations
  - Knowledge-based ML and FL for equipment predictive maintenance
  - Heterogeneous model fusion mechanisms with Cloud-edge computing coordination
- Personalized Federated Learning for Gas and Electricity Demand Prediction
  - Privacy-preserving clustering for personalized and efficient prediction models
  - Self-supervised learning and transfer learning for large-scale energy load forecasting
  - Probability prediction based risk assessment for decision making
- Federated Learning and Optimization on CV Models for Safety Inspection in Energy Industry
  - Hazard detection in working and living environment via camera and special devices.
  - Model aggregation strategy for efficient federated learning over dynamic network
  - Self-supervised and novel DL network for multi-object and small-object detection
- Vertical Federated Learning for Data Feature Augmentation Across Multiple Data Sources
  - MPC and TEE for privacy-preserving ML training, ID matching and general computing
  - Collaborations among government agencies and various companies for secure residential community, energy saving and novel business model

SELECTED PROJECTS（Institute of High Performance Computing A*STAR）

- Industry project "Transparent HPC", Role: Key Member (Mar-2020 to Feb-2022)
  - Machine learning for adaptive resource provisioning for HPC applications
- Industry project "Scalable Analytics Platform (ModStore) for National Precision Medicine Research", Role: PI (Oct-2019 to Oct-2021)
  - Workflow pipelines for genomic and clinical data analytics on scalable platform
- Singapore-Germany Academic-Industry (2+2) International Collaboration Grant "SuppliedTrust: A Blockchain-based governance framework for transparent, efficient and trusted supply chain of unregulated consumer products", Role: PI (Jan-2020 to Dec-2022)
  - A distributed, Blockchain-based, end-to-end trust anchor for the governance, auditing and data insights of the supply chain of currently unregulated consumer products.
- A*STAR SERC Strategic Fund: "Trusted Data Vault Phase 1" Partners: I^2R, ACRC, BMRC, Role: Co-PI (Jan-2020 to Dec-2020)
  - Enable secure data sharing and privacy-preserving collaborative learning across organizations using blockchain, multiparty computation and federated learning.
  - Secure data storage service or maritime shipping companies using multiparty computation (MPC) technology
- A*STAR IAF-PP Programme "Industrial Internet-of-Things Innovation (I^3) Platform" "Secure Platform for Trusted Collaborations" work package, Role: Co-PI (Oct-2018 to Oct-2021)
  - Investigate IIoT platform interoperability and apply immutable distributed ledger for product life-cycle tracking across multiple organizations

- ❖ Smart Manufacturing Joint Lab: "Knowledge-based Manufacturing (KBM) Industrial Internet of Things (IIOT) Shared Services", Role: Co-PI (Feb-2018 to Dec-2020)
  - o Develop Cloud and on-premise industrial IOT solutions and implement microservices and manufacturing Apps based on machine learning predictive models
- ❖ Urban Computing and Engineering Centre of Excellence in Singapore (CoE): "The Large-scale Data Processing Research (LDP) Research", Role: PI (Jun-2015 to May-2018)
  - o Develop high-speed and scalable distributed data analytics platform and investigate graph analytics to explore relationship insights for city/transportation planning.
  - o Enable city-scale spatiotemporal data analytics for policy making, e.g., impact of ride sharing/hailing on-line services, transportation demand prediction and service evaluation.

RESEARCH INTEREST

Federated Learning，Blockchain, Privacy-Preserving Learning
Industrial IoT, Advanced Manufacturing, Machine Learning and Deep Learning
Data/Graph Analytics, Spatiotemporal Data Processing, Urban Computing
Parallel and Distributed Computing, Data Centre and Cloud Computing

RECENT AWARDS

Best Application Award in FL-AAAI'2022, Innovation Award in FL-IJCAI'2022, AAAI AI deployment award 2023.
Grab AI FOR S.E.A Challenge "Traffic Management: Demand Prediction", Top 10 solution out of 1200 participants, Jul-2019
Amazon Research Grant "Blockchain and IoT Data Analytics for Fine-grained Transportation Insurance" (US$20000), Jun-2019

AI COMMITTEE ACTIVITIES

Vice-President of Alliance of Federated Learning Industrial Ecosystem Development (http://flal.org/).
IEEE Std 3652.1™-2020, "IEEE Guide for Architectural Framework and Application of Federated Machine Learning" Published
IEEE Std 2894™, "IEEE Guide for an Architectural Framework for Explainable Artificial Intelligence" Approved

SELECTED PUBLICATION （Digital Research Institute ENN Group）

Journal Papers:

1. Chengyi Yang, Jia Liu, Hao Sun, Tongzhi Li and **Zengxiang Li,** "WTDP-Shapley: Efficient and Effective Incentive Mechanism in Federated Learning for Intelligent Safety Inspection", IEEE Transactions on Big Data, IF 4.271, 2022， Accepted
2. Chi Zhang, Sotthiwat Ekant, Liangli Zhen, **Zengxiang Li**,"Augmented Multi-Party Computation for Secure Federated Learning" IEEE Transactions on Big Data,IF 4.271, 2022， Accepted
3. Renuga Kanagavelu， Qingsong Wei; **Zengxiang Li**; Haibin Zhang; Juniarto Samsudin; Yechao Yang; Rick Siow Mong Goh; Shangguang Wang，"CE-Fed: Communication Efficient Multi-party Computation Enabled Federated Learning"ARRAY 2020 Open Access
4. Weishan Zhang，Fa Yu， Xiao Wang， Xingjie Zeng， Hongwei Zhao， Zenglin Tian， Fei-Yue Wang， Hongwei Qi， **Zengxiang Li**， "R2Fed: Resilient Reinforcement Federated Learning for Industrial Applications"， IEEE Transactions on Industrial Informatics, IF 10.215, 2022， Accepted

Conference Papers:

1. Chengyi Yang, Jia Liu, Hao Sun, Tongzhi Li and **Zengxiang Li,** "WT-Shapley: Efficient and Effective Incentive Mechanism in Federated Learning for Intelligent Safety Inspection", FL-AAAI 2022， **Best Application Award**
2. Sheng Guo, **Zengxiang Li**, Hui Liu, Shubao Zhao and Cheng Hao Jin, "Personalized Federated Learning for Multi-task Fault Diagnosis of Rotating Machinery" FL-AAAI 2022
3. Lianlian Jiang, YuexuanWang, Wenyi Zheng, Chao Jin, Zengxiang Li, Sin G. Teo,"LSTMSPLIT: Effective SPLIT Learning based LSTM on Sequential Time-Series Data", FL-AAAI 2022
4. Shubao Zhao, Jia Liu, Guoliang Ma, Jie Yang, Di Liu and **Zengxiang Li**,"Cluster-driven Personalized Federated Learning for Natural Gas Load Forecasting" FL-IJCAI 2022, **Innovation Award**
5. Yuanyuan Chen, Zichen Chen, Yansong Zhao, Zelei Liu, Pengcheng Wu, Sheng Guo, Chengyi Yang, **Zengxiang Li** and Han Yu, "Efficient Training of Large-scale Industrial Fault Diagnostic Models through Federated Opportunistic Block Dropout" The 35th Annual Conference on Innovative Applications of Artificial Intelligence (IAAI-23) AI deployment award
6. Hanchi Shen, Jun Li, Kang Wei, Pengcheng Xia, Sirui Tian, Ming Ding, **Zengxiang Li,** "CluFL: Cluster-driven Weighted FL Model Aggregation Strategy", The 28th IEEE International Conference on Parallel and Distributed Systems (ICPADS 2022), Accepted

SELECTED PUBLICATION （Institute of High Performance Computing A*STAR）

Journal Papers:

1. Tien-En Tan, Ayesha Anees, Cheng Chen, Shaohua Li, Xinxing Xu, **Zengxiang Li**, Tien Yin Wong, Yong Liu, Daniel Shu Wei Ting, et, al. "Retinal Photograph-Based Deep Learning Algorithms for Myopia and a Blockchain Platform to Facilitate Artificial Intelligence Medical Research: A Retrospective Multi-Cohort Study" The Lancet Digital Health, Mar, 2021 (Editor's Pick)
2. Palina Tolmach, Yi Li, Shang-Wei Lin, Yang Liu, **Zengxiang Li** "A Survey of Smart Contract Formal Specification and Verification" Accepted by ACM Computing Surveys, Mar, 2021
3. Kanagevelu, Renuga; Wei, Qingsong; **Zengxiang, Li**; Haibin, Zhang; Samsudin, Juniarto; Yang, Yechao; Feng, Yang; Goh, Rick Siow Mong, "Decentralized Federated Learning with Two-Phase Multi-Party Computation", Transactions on Services Computing, Under Review
4. Chi Zhang Sotthiwat Ekanut; Liangli Zhen; Joey Tianyi Zhou; **Zengxiang Li**, "Augmented Multi-Party Computation for Secure Federated Learning" Knowledge-Based Systems, Under Review
5. Yang Zhao, Jun Zhao, Linshan Jiang, Rui Tan, Dusit Niyato, **Zengxiang Li**, Lingjuan Lyu, and Yingbo Liu "Privacy-Preserving Blockchain-Based Federated Learning for IoT Devices" IEEE Internet of Things Journal, 2020
6. Zhe Xiao, **Zengxiang Li**, Yechao Yang, Yauheni Pyrloh, Ekanut Sotthiwat and Rick Siow Mong Goh, "Blockchain and IoT for Insurance: A Case Study and Cyberinfrastructure Solution on Fine-grained Transportation Insurance" Transactions on Computational Social System, 2020

7. Renuga Kanagavelu, **Zengxiang Li,** Juniarto Samsudin, Shaista Hussain, Yang Yechao, Yang Feng, Goh Siow Mong, Rick, Mervyn Cheah "Federated Learning for Advanced Manufacturing Based on Industrial IoT Data Analytics" Book chapter of "The Model Factory as the key enabler for the Future of Manufacturing". Part of Book Series "Intelligent Systems Reference Library", Springer-Verlag, 2020
8. Eda Koksal Ahmed, **Zengxiang Li**, Bharadwaj Veeravalli and Shen Ren, "Reinforcement Learning enabled Genetic Algorithm for Vehicle Fleet Scheduling" Accepted by Journal of Intelligent Transportation Systems, 2020
9. Bo Yang, Shen Ren, Erika Legara, **Zengxiang Li**, Edward Ong, Louis Lin and Christophe Monterola, "Phase Transition in Taxi Dynamics and Impact of Ridesharing" Transportation Science, 2019
10. Quanqing Xu, Zhaozheng He, **Zengxiang Li,** Mingzhong Xiao, Rick Siow Mong Goh, Yongjun Li "An Effective Blockchain-based Decentralized Application for Smart Building System Management", book chapter of "Real-Time Data Analytics for Large-Scale Sensor Data", Elsevier 2019
11. **Zengxiang Li**, Shen Ren, Nan Hu, Yong Liu, Zheng Qin, Rick Siow Mong Goh, Liwen Hou, Bharadwaj Veeravalli, "Equality of Public Transit Connectivity: The Influence of MRT Services on Individual Buildings for Singapore", Transportmetrica B: Transport Dynamics, 2018
12. Yulin Wu, Wentong Cai, **Zengxiang Li**, Xiangting Hou, Wen Jun Tan, "Efficient Parallel Simulation over Large-scale Social Contact Networks", ACM Trans. on Modeling and Computer Simulation, 2018

Conference Papers:

1. Ekanut Sotthiwat, Liangli Zhen, **Zengxiang Li**, Chi Zhang, "Partially Encrypted Multi-Party Computation for Federated Learning", NEAC workshop IEEE/ACM International Symposium on Cluster, Cloud and Internet Computing (CCGrid 2021)
2. Huafei Zhu, **Zengxiang Li,** Mervyn Cheah, Rick Siow Mong Goh, "Privacy-preserving Weighted Federated Learning within Oracle-Aided MPC Framework" arXiv:2003.07630
3. Qi Feng, Debiao He, **Zengxiang Li**, Li Li, Kim-Kwang Raymond Choo, "Practical Secure Two-Party EdDSA Signature Generation with Key Protection and Applications in Cryptocurrency" IEEE International Conference on Trust, Security and Privacy in Computing and Communications (TrustCom 2020)
4. Jun Zhao, Jing Tang, **Zengxiang Li**, Huaxiong Wang, Kwok-Yan Lam, Kaiping Xue, "An Analysis of Blockchain Consistency in Asynchronous Networks: Deriving a Neat Bound", IEEE International Conference on Distributed Computing Systems (ICDCS 2020),
5. Renuga Kanagavelu, **Zengxiang Li,** Juniarto Samsudin, Yechao Yang, Feng Yang, Rick Siow Mong Goh, Mervyn Cheah, Praewpiraya Wiwatphonthana, Khajonpong Akkarajitsakul and Shangguang Wang, "Two-Phase Multi-Party Computation Enabled Privacy-Preserving Federated Learning" IEEE/ACM International Symposium on Cluster, Cloud and Internet Computing (CCGrid 2020)
6. **Zengxiang Li**, Chutima Kitcharoenpaisan, Phond Phunchongharnb, Yechao Yang, Rick Siow Mong Goh, and Yusen Li, "Efficient Multi-Party Computation Algorithm Design For Real-World Applications", International Workshop on Emerging Topic in Computer Science (ETCS 2019)
7. Xi Lin, Yequan Wang, Xiaokui Xiao, **Zengxiang Li** and Sourav S. Bhowmick "Path Travel Time Estimation using Attribute-related Hybrid Trajectories Network", ACM International Conference on Information and Knowledge Management (CIKM'19)
8. **Zengxiang Li**, Zhe Xiao, Quanqing Xu, Ekanut Sotthiwat, Rick Siow Mong Goh and Xueping Liang, "Blockchain and IoT Data Analytics for Fine-grained Transportation Insurance", International Workshop on Blockchain Technologies and Systems (BCTS'18) 2018 Best Paper Runner Up
9. Zhe Xiao, **Zengxiang Li,** Yong Liu, Ling Feng, Weiwen Zhang, Thanarit Lertwuthikarn and Rick Siow Mong Goh, "EMRShare: A Cross-organizational Medical Data Sharing and Management Framework Using Permissioned Blockchain", International Workshop on Blockchain Technologies and Systems (BCTS'18) 2018
10. Quanqing Xu, Zhaozheng He, **Zengxiang Li** and Mingzhong Xiao, "Building an Ethereum-based Decentralized Smart Home System", International Workshop on Blockchain Technologies and Systems (BCTS'18) 2018
11. Weiwen Zhang, Yong Liu, Long Wang, **Zengxiang Li** and Rick Siow Mong Goh, "Cost-Efficient and Latency-Aware Workflow Scheduling Policy for Container-based Systems", IEEE International Conference on Parallel and Distributed Systems (ICPADS'18) 2018

12. **Zengxiang Li,** Shen Ren, Sifei Lu, Jiachun Guo, Wentong Cai, Zheng Qin and Rick Siow Mong Goh, "Concurrent Hybrid Breadth-First-Search on Distributed PowerGraph for Skewed Graphs", IEEE International Conference on Parallel and Distributed Systems (ICPADS'18) 2018
13. Shen Ren, Bo Yang, Liye Zhang and **Zengxiang Li**, "Traffic Speed Prediction with Convolutional Neural Network Adapted for Non-linear Spatio-temporal Dynamics" ACM SIGSPATIAL International Workshop on analytics for Big Geospatial Data (BigSpatial 2018)
14. Xi Lin, Xiaokui Xiao, **Zengxiang Li**, "A Scalable Approach to Inferring Travel Time in Singapore's Metro Network using Smart Card Data" IEEE International Smart Cities Conference (ISC2 2018)
15. Yuhong Feng, Meihong Guo, Kezhong Lu and Zhong Ming (Shenzhen University, China); Haoming Zhong (Webank, China); Wentong Cai (NTU, Singapore); **Zengxiang Li** (IHPC, Singapore), "Optimize the FP-tree based Graph Edge Weight Computation on Multi-core MapReduce Clusters", IEEE International Conference on Parallel and Distributed Systems (ICPADS'17) 2017
16. Shen Ren, Lin Han, **Zengxiang Li**, Bharadwaj Veeravalli, "Spatial-temporal Traffic Speed Bands Data Analysis and Prediction", IEEE International Conference on Industrial Engineering and Engineering Management (IEEM'17) 2017 (Honorable Mention Award)
17. Sifei Lu, **Zengxiang Li**, Zhen Qin, Xulei Yang, Rick Siow Mong GOH, "A Hybrid Regression Technique for House Prices Prediction", IEEE International Conference on Industrial Engineering and Engineering Management (IEEM'17) 2017
18. **Zengxiang Li**, Bowen Zhang, Shen Ren, Yong Liu, Zheng Qin, Rick Siow Mong Goh, Mohan Gurusamy, "Performance Modelling and Cost Effective Execution for Distributed Graph Processing on Configurable VMs", International Symposium on Cluster, Cloud and Grid Computing (CCGrid'17)
19. Yulin Wu, Xiangting Hou, Wen Jun Tan, **Zengxiang Li**, Wentong Cai, "Efficient Parallel Simulation over Social Contact Network with Skewed Degree Distribution", ACM SIGSIM Conference on Principles of Advanced Discrete Simulation (PADS'17) 2017 (Best Paper Award)
20. Sibo Wang, Youze Tang, Xiaokui Xiao, Yin Yang, **Zengxiang Li,** "HubPPR: Effective Indexing for Approximate Personalized PageRank", International Conference on Very Large Data Bases (VLDB'17)