CV

Dan Pei

June 2022

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Research Interests:

AIOps: AI-enhanced Operations for technology systems, such as IT, networking.
AI/ML for Networking, Software Engineering, and Distributed Systems

Education

2000-2005   **Ph.D.** in Computer Science   UCLA. Advisor: Dr. Lixia Zhang
Ph.D. Dissertation "On Resilient Internet Routing" studied the security, fault-tolerance, and performance improvement/evaluation of large-scale systems in the context of Internet routing.

1997-2000   **M.S.** in Computer Science   Tsinghua University, Beijing, China
Advisor: Dr. Dongsheng Wang. Master thesis "Design and Implementation of Process Migration and Checkpointing in Network of Workstations"

1992-1997   **B.E.** in Computer Science   Tsinghua University, Beijing, China

Working Experience

Dec.2012-Now Associate Professor, Computer Science Department, Tsinghua University, China. Leading the Network Management (NetMan) research group.

Sept.2005-Apr.2011 Senior (Principal) Member of Technical Staff - Research, Internet and Networking system, AT&T Labs - Research

Summer 2003 Summer Intern, AT&T Labs-Research. Worked with Dr. William Aiello, Dr. Anna Gilbert, Dr. Tim Griffin, and Dr. Patrick McDaniel on BGP measurements.

Summer 2002 Summer Intern, USC/Information Sciences Institute. Worked with Dr.Daniel Massey on packet delivery during routing convergence.

Summer 2001 Summer Intern, USC/Information Sciences Institute. Worked with Dr. Daniel Massey on formal specifications for BGP and RIP.

Teaching Experience

- Fall2013/Spring2015/Spring2016/Spring2017/Spring2018/Fall2018/Fall2019/Fall2020/Spring2021/Spring 2022: Advanced Network Management (also known as AIOps), a graduate course taught in English. It teaches students how to build practical systems that measure the real data from the networks and services, process the real data using big data techniques such as Machine Learning, and solve their real performance and security problems. Through case studies based

on recent research papers in top network conferences, this course covers the latest research progress in network management. This course also reviews the techniques that have broader applications more than just network management, such as time series analysis, association rule mining, machine learning, and big data systems. Course materials are updated by ~40% every year.

- Fall2017/Fall2018/Fall2019/Fall2020/Spring2021/Spring2022:   Software Engineering (undergraduate)
- Spring 2017/Spring 2018: Computer Networks (undergraduate)
- Spring 2002: Teaching assistant for Computer Network Fundamentals (CS118), UCLA CSD undergraduate course. Responsibilities include weekly recitation, office hours, design and grading of homework, exams and projects.

Selected Honors and Awards

2021	**Excellent Teacher Award,** China Teacher Development Foundation
2019	**Teaching Achievement Award of Tsinghua University**, Curriculum Design and Process Quality Management of Software Engineering Practice. Xiaoying Bai, Shanshan Li, Mingjie Li, **Dan Pei**, Yongwei Wu
2019	**IEEE ISSRE 2018 Best Paper**, Robust and Rapid Adaption for Concept Drift in Software System Anomaly Detection. Minghua Ma, Shenglin Zhang, **Dan Pei**, Xin Huang, Hongwei Dai
2017	**Okawa Foundation Research Grant,** Anomaly Detection through Deep Learning
2016	**IEEE/ACM IWQoS 2016 Best paper candidate**. "M3: Practical and Reliable Multi-Layer Video Multicast over Multi-Rate Wi-Fi Network" by Menghan Li, Dan Pei, Xiaoping Zhang, Beichuan Zhang, Zhi Wang, Hailiang Xu, Zihan Wang
2012	"**Global Talents Recruitment (Youth) Program**" by Chinese Government
2011	**ACM Senior Member** and **IEEE Senior Member**
2005	"**Outstanding Ph.D. Award**", UCLA Computer Science Department Annual award for best PhD thesis in UCLA Computer Science Department
2005	"**Best Paper Award**", **IEEE ICDCS** 2005. Beichuan Zhang, **Dan Pei**, Daniel Massey and Lixia Zhang. "Timer Interactions in Route Flap Damping."
2004	**IBM Ph.D. Fellowship** *"an annual, worldwide competitive program that honors exceptional PhD students in disciplines such as business, chemistry and computer science, as well as emerging technical fields."*
2003	**Dimitris N.Chorafas Foundation Award** *"awards scientific prizes worldwide for outstanding research in the engineering sciences, humanities and social sciences, medicine, and the natural sciences".*
1999	"**Outstanding Junior Researcher Award**". Based on research performance, awarded to top 9 students of all Ph.D. and M.S. students (more than 400 in total) in Computer Science Dept., Tsinghua University.
1992	Ranked 1$_{st}$ in Hebei Province in China's 1992 National College Entrance

Examination
(http://en.wikipedia.org/wiki/National_College_Entrance_Examination)

Professional Activities

- **Conference organizing committee:**
  IEEE **ICNP** 2022 TPC Co-Chair
  IEEE **ICNP** 2021 TPC Area Chair
  AIOps Challenge Algorithm Competition 2018/2019/2020/2021/2022 General Co-Chair
  AIOps Workshop 2018/2019/2020/2021/2022 General Co-Chair
  IEEE **ICNP HDR-Nets** Workshop 2020 General Co-chair
  IEEE **ICNP HDR-Nets** Workshop 2019 TPC Co-chair
  IEEE **ICNP** 2019/2020 Publicity Co-chair
  ACM SIGCOMM 2014 Judge for Student Research Competition (SRC)
  IEEE LANMAN 2014 Publication Chair
- **Conference Technical Committee Member:**
  ACM **CoNeXT** 2016/2022
  ACM **SIGMETRICS** 2021/2022
  USENIX **NSDI** 2021
  ACM AAAI 2021
  IEEE **ICNP** 2020
  IEEE/ACM IWQoS 2020/2021/2022
  ACM **IMC** 2016/2017
  SREcon Asia/Australia 2017
  ACM **ICN** 2016
  IEEE Workshop on Big Data and Machine Learning in Telecom 2016
  IEEE **LANMAN** 2015/2016
  IEEE **INFOCOM** 2010/2011/2012/2013/2014
  IEEE **ICC** 2011
  IEEE **ICDCS** 2008/2009
  WWW 2007
- **IETF Activity**:
  One of the acknowledged contributors to BGP standard **(RFC 4271)**
- **Other Activity**:
  Founder of "AIOps Challenge Algorithm Competition", an ImageNet-like algorithm competition for AIOps (AI for IT Operations). Obtained and published IT operations datasets from companies including Baidu, Alibaba, Tencent, eBay, Sogou, Suning, China Mobile, China Construction Bank, and China Minsheng Bank.
  Dataset published in these algorithm competitions were used by papers published in conferences/journals such as IEEE INFOCOM, IEEE ICSE, IEEE IWQoS, IEEE TNSM, IEEE ICCCN, etc.

  Chair of AIOps Challenge Algorithm Competition 2018/2019/2020/2021. 150220 teams participated every year. Number of audiences in the final conferences:150600 per year.

  Editor-in-Chief of AIOps Newsletter "AIOps Frontier" (Online, in Chinese) publishing articles explaining the latest AIOps papers. By February 2021,it has more than 13,000 subscribers□and more than 170,000 reads.

Graduated Students and Post-Docs

1. Haowen Xu, Ph.D. 2022, Dissertation: "Anomaly Detection for Web Applications through Variational Auto-encoder". First job: co-founder of a FinTech Startup.
2. Nengwen Zao, Ph.D. 2022, Dissertation: "Research on Key Technologies for Intelligent Failure Management in Software Services". First Job: Algorithm Engineer at Huawei, with "Young Genius (Tian Cai Shao Nian)" honor.
3. Wenxiao Chen, Ph.D. 2022, Dissertation: "Anomaly Detection and Root Cause Analysis for Microservice Based on Deep Learning". First Job: Algorithm Engineer at Huawei, with "Young Genius (Tian Cai Shao Nian)" honor.
4. Zhihan Li, Ph.D. 2022. Dissertation: "Hierarchical Anomaly Detection for Large-Scale Time Series Data in Web Services". Co-advised with Youjian Zhao. First job: Algorithm Engineer at Kuaishou, with "Kuai Star" honor.
5. Canhua Wu, M.S. 2022. Thesis: " Research on Failure Localization for Metrics in Software Services". First job: Engineer at Pony.ai.
6. Xiaohui Nie, Post-Doc 2021. First Job: Researcher at BizSeer.
7. Minghua Ma, Ph.D. 2021, Dissertation: "Anomaly Detection and Diagnosis for Metrics in Cloud Services". First job: Researcher at Microsoft Research Asia.
8. Yuan Meng, Ph.D. 2021, Dissertation: "Anomaly Root Cause Localization for Internet Application Performance". First job: Post-Doc at Tsinghua University.
9. Ya Su, Ph.D. 2021, Dissertation: "Anomaly Detection and Troubleshooting for Web Services in Data Centers".Co-advised with Youjian Zhao. First job: Algorithm Engineer at Kuaishou, with "Kuai Star" honor.
10. Weibin Meng, Ph.D. 2021, Dissertation: "Log Anomaly Detection for Data Center Infrastructure". Co-advised with Ying Liu. First Job: Algorithm Engineer at Huawei, with "Young Genius (Tian Cai Shao Nian)" honor.
11. Yao Wang , M.S., 2021, Thesis: "Anomaly Detection and Monitoring System Design for Key Performance Indicator", First job: Engineer at Pony.ai.
12. Ping Liu, Ph.D. 2021, Dissertation: "Failure Detection and Root Cause Localization for Web Service Operation". First job: Lecturer @ Institute of Artificial Intelligence in Sports, Capital University of Physical Education And Sports, China.
13. Changhua Pei, Post-Doc 2020, Dissertation: "Application Study of Machine Learning on E-commerce Platform". Co-advised with Youjian Zhao. First job: Algorithm Engineer @ Alibaba.
14. Jing Zhu, Post-Doc 2020, Dissertation: "Theoretical and Algorithm Research on AIOps". First job: Algorithm Engineer @ BizSeer.
15. Ruming Tang, Ph.D. 2020, Dissertation: "Research on Attack Threat Detection on the Boundaries of Enterprise Networks". First job: Researcher @ BizSeer.
16. Fede Zaiter, M.S. 2020, "Log Information Extraction for Anomalous Syslogs". Continued as my Ph.D. student.
17. Xiaohui Nie, Ph.D. 2019, Dissertation: "Research on Key Technologies for Improving Single Service Flow Latency in Web Service". Co-advised with Youjian Zhao. First job: Post-Doc in Tsinghua University.
18. Jiahao Bu, M.S. 2019. Thesis: "Anomaly Detection and Diagnosis for Key Performance Indicator of Internet Service". Co-advised with Ying Liu. First job: Algorithm Engineer @Meituan.
19. Lei Zou, M.S. 2019. Thesis: "Clustering-Based Hotspot Analysis and Alarm Compression for Mobile Internet". First Job: Entrepreneur.
20. Haibin Li, M.S. 2018. Dissertation: "Detection of User Behavior Anomaly and Masquerade

Attack Based on Unsupervised Learning". First job: Assistant Professor @ National University of Defense Technology

21. Yongqian Sun, Ph.D. 2018, Dissertation: "Anomaly Detection and Anomaly Localization for Key Performance Indicators in Web Application". Co-advised with Youjian Zhao. First job: Assistant Professor @ College of Software, Nankai University, China.

22. Shenglin Zhang, Ph.D. 2017, Dissertation: "Improving the Stability of the Datacenter of Web-based Services", co-advised with Ying Liu. First job: Assistant Professor @ College of Software, Nankai University, China.

23. Mengyu Zhou, Ph.D. 2017, Characterizing Campus Life in the Age of Mobile Internet, co-advised with Thomas Moscibroda. First job: Associate Researcher at MSRA.

24. Changhua Pei, Ph.D. 2017, Wi-Fi Performance Measurement and Optimization, co-advised with Youjian Zhao. First job: Algorithm Engineer, Alibaba.

25. Shiwen Cheng, M.S. 2017. Dissertation: "Error Log Clustering of Internet Software", First job: CTO @ BizSeer, Beijing, China.

26. Guo Chen, Ph.D. 2016. Dissertation: "Optimizing the Consistency of Flow Completion Time in Data Center Networks." Co-advised with Youjian Zhao. First job: Associate Researcher @ Microsoft Research Asia, Beijing, China.

27. Dapeng Liu, Ph.D. 2016. Dissertation: "Anomaly Detection and Bottleneck Identification for Performance of Web Applications." Co-advised with Youjian Zhao. First job: Engineer @ Operations Department of Baidu, Beijing, China. Now CEO @ BizSeer

28. Kaixin Sui, Ph.D. 2016. Dissertation: "Measuring Performance and Trajectory Privacy Risk for Large-scale Wi-Fi Network Management." Co-advised with Youjian Zhao. First job: Engineer @ Microsoft Azure Networking, Beijing, China. Now Director of Algorithms at BizSeer

29. Yaodong Zhang, Ph.D. 2016. Dissertation: "Key techniques of collaborative optimization in autonomous network." Co-advised with Jian Yuan and Yue Wang. First job: Researcher @ China Aerospace Research Institute II, Beijing, China.

30. Menghan Li, Ph.D. 2016. Dissertation: "Performance Optimization for Video Multicast over Deployed 802.11 Wireless LAN." Co-advised with Xiaoping Zhang and Ke Xu. First job: Researcher at a research institute in Beijing, China.

31. Jianxun Cao, Ph.D. 2016. Dissertation: "Research on Forwarding Strategy in Content-Centric Networking". Co-advised with Xiaoping Zhang and Youjian Zhao. First job: Researcher at a research institute in Beijing, China.

Current Students

1. Qingyang Yu, Ph.D. student, Alert Analysis,started 9/2017
2. Zeyan Li, Ph.D. student, Anomaly Detection and Localization, started 9/2018.
3. Mingjie Li, Ph.D. student, Failure Troubleshooting, started 9/2018
4. Qianyu Ouyang, Ph.D. student, Alert Aggregation and Summarization, started 9/2019.
5. Pinnong Li, Master student , Detection of System Out-of-Memory Failures, started 9/2019.
6. Fede Zaiter, Ph.D. student, Knowledge Graph for IT Operations, started 9/2020
7. Zhenhe Yao, Ph.D. student, Time Series Forecasting, started 9/2020.
8. Zhaoyang Yu, Ph.D. student, AutoML for Time Series Algorithms, started 9/2020.
9. Yiran Cheng, Master student, Multi-Attribute Time Series Anomaly Localization, started 9/2020.
10. Xianglin Lu, Master student, Time Series Anomaly Detection, started 9/2020.
11. Xuanrun Wang, Master student, Post-Change Time Series Analysis, started 9/2020.
12. Guanglei He, Master student, Chaos Engineering, starting 9/2021

Current Post-Docs

1. Xidao Wen
2. Mian Du (Jointly sponsored with China National Clearing Center)
3. Chen Yang (Jointly sponsored with China National Clearing Center)
4. Kanglin Yin

Interns at AT&T

1. Kai Chen, Northwestern, co-authored 2 papers, Ph.D. 2012. First job: Assistant Professor @ HKUST.
2. Amir Reza Khakpour, co-authored 1 paper, Michigan State University, Ph.D. 2012. First job: Engineer @ Verizon.
3. He Yan, Colorado State, co-authored 3 papers, Ph.D. 2011. First job: Researcher @ AT&T Research.
4. Sina farpour, Princeton, co-authored 2 papers, Ph.D. 2011. First job: Yahoo Research.
5. Tongqing Qiu, Georgia Tech, co-authored 4 papers, Ph.D.2011. First job: Senior Software Engineer @ Liaison Technologies.
6. Changxi Zheng, CMU, co-authored 1 paper, Ph.D. 2011. First job: Assistant Professor at Columbia University.
7. Patrick Verkaik, UCSD, co-authored 1 paper, Ph.D. 2010. First job: Cisco Meraki
8. Franck Le, CMU, co-authored 1 paper, Ph.D.2010. First job: Researcher @ IBM Research.
9. Changhoon Kim, Princeton, co-authored 1 paper, Ph.D.2010. First job: Dev Lead @ Microsoft.
10. Suk-Bok Lee, UCLA, co-authored 2 papers, Ph.D.2010. First job: Assistant Professor @ Hanyang University, Korea.
11. Yao Zhao, Northwestern, co-authored 2 papers, Ph.D.2009. First job: Bell Labs.
12. Elliott Karpilovsky, Princeton, co-authored 1 paper, Ph.D.2009. First job: Senior Software Engineer @ Google.
13. Ricardo Oliveria, UCLA, co-authored 4 papers, Ph.D. 2009. First job: Co-Founder & CTO @ Thousands Eyes.

Research Grants

- China Mobile, AIOps research for 5G networks, 2,125,200RMB=318,993USD. 2021/07/06-2022/07/06.
- Multi-purpose Anomaly Detection Framework, COLLABORATION AGREEMENT between EBAY INC and TSINGHUA UNIVERSITY, 845,000RMB = 130,000USD. 2021/07/01-2022/03/31
- Intelligent Detection of Operations Supervision Indicator Revulsion, Beijing Sogou technological development Ltd., 500,000RMB=75,050USD. 2021/05/07-2022/05/06.
- NSFC 61472214: A Study on Unsupervised Anomaly Detection and Localization for Microservices Based on Multimodal Monitoring Data. PI. 570,000RMB = 88,236USD. 2021/01/01-2024/12/31
- Shenzhen Securities Communication Co., Ltd., AIOps scientific research project cooperation agreement. 890,000RMB= 137,772USD. 2020/8/27-2021/4/30
- Classification of Project, Platform as Service Technologies for High-performance Blockchain-based Supply Chain. 325,000RMB=45915USD. 2020/7-2023/6
- ICBC Industrial and Commercial Bank of China, The applied research in network operation domain for the data center of ICBC Industrial and Commercial Bank of China. 469,200RMB= 66,299USD. 2020/3/2-2021/3/31

- Classification of Project, The core technology and theory platform of Multiplex Mode Wisdom Network. 7,520,000RMB= 1,062,597USD. 2020/1/1-2022/12/31
- Bank of China Limited, The research and preliminary practice of AIOPS in network operation and maintenance. 840,000RMB= 118,694USD. 2019/12/30-2020/12/30
- Beijing National Research Center for Information Science and Technology. 1050,000RMB= 162,645USD. 2018/11/12-2021/11/12
- Huawei Technologies Co., Ltd., The failure diagnosis technology of machine learning about ADOTP template combination anomaly detection and ADOTS template sequence anomaly detection. 1,800,000RMB=254,345USD. 2019/8-2020/8
- Huawei Technologies Co., Ltd., The failure delimitation and location technology of machine learning based on NLP massive log data multidimensional data feature analysis. 900,000RMB=127,173USD. 2018/7-2019/7
- VMWare Principle Engineer Grant, 20,000USD
- Tsinghua-Tencent Internet Innovative Technology United Laboratory, Analytical Model Of Game Users' Experience/ KPI Cluster/ Algorithm Selection of Anomaly Detection. 500,000RMB=76,081USD. 2017/07-2018/06.
- Beijing Taobao Science and Technology Ltd., Anomaly Detection of Operational Indicator （GOC）/Fault Detection of Database (CloudDBA). 450,000RMB=68,479USD. 2017/01-2018/01.
- Shenzhen Qianhai Weizhong Bank Corporation Ltd., AI for Operations of Weizhong Bank, 500,000RMB=76,081USD. 2017/11-2018/09.
- Intelligent Detection of Operations Supervision Indicator Revulsion, Beijing Sogou technological development Ltd., 56, 0000RMB=85,159USD. 2017/02-2018/01.
- • NSFC 61472214: OpsRobot (Network & Service Operations Robot). PI. 860,000RMB = 129,073USD. 01/01/2015 to 31/12/2018.
- NSFC 61472210: Cooperative Performance Improvement among Autonomous Wi-Fi Networks. PI. 860,000RMB = 129,073USD. 01/01/2015 to 31/12/2018.
- 973 Program 2013CB329105: Complex Network Behavior and Its Gaming Theory Perspective. PI 1,284,000RMB = 192,709USD. 01/01/2013 to 31/12/2016.
- NSFC Key Program 61233007: Networking Protocols for Smart Grid. Co-PI. 860,000RMB = 129,073USD. 01/01/2013 to 31/12/2017.
- Tsinghua National Laboratory for Information Science and Technology key projects: WiFi Union. PI. 500,000RMB = 75,042USD. 01/01/2015 to 31/12/2016.
- Global Talent Recruitment (Youth) Program. SmoothApp: App Performance Management through Big Data Analytics. PI. 2,000,000RMB = 300,170 USD. 01/07/2015 to 31/06/2018.
- The Research Institute of Petro China. Project: Key Technologies for Application Correlation and Robustness. PI. 1,170,000RMB = 175,599USD. 01/01/2015 to 31/12/2015.

Invited Talks
- Invited Talk, May 29th, 2021: Towards Autonomous IT Operations through Artificial Intelligence, ICSE21 Workshop on Cloud Intelligence In conjunction with the 43rd International Conference on Software Engineering (https://cloudintelligenceworkshop.org/2021/program.html)
- Keynote talk, Dec. 2020 "Towards Autonomous IT Operations through Artificial Intelligence" the International Workshop on Artificial Intelligence for IT Operations (AIOPS) 2020(https://aiopsworkshop.github.io/index.html)
- Colloquium talk at Computer Science and Engineering Department at UC Riverside, Oct. 2019. "Towards Autonomous IT Operations through Machine Learning".

Invited Papers

- "Intelligent Operations through Machine Learning" (基于机器学习的智能运维) in Chinese, in Communications of the CCF (China Computer Confederation), a monthly magazine (similar to IEEE communications Magazine), published by China Computer Confederation, the organization of 60000+ Chinese computer professionals and researchers.

Panels

- Panelist, May 29th, 2021: How to accelerate collaboration on Cloud Intelligence across academia and industry? ICSE21 Workshop on Cloud Intelligence, In conjunction with the 43rd International Conference on Software Engineering (https://cloudintelligenceworkshop.org/2021/program.html)
- Research Panelist, empower / PAWR Project Office / acm sigcomm the Networking Channel, May 19th 2021, Emerging Trends in AI/ML and Implications for Networking Research (https://networkingchannel.eu/emerging-trends-in-ai-ml-and-implications-for-networking-research/)
- Panelist, ML meets Networking, APNet 2019

Publication Summary

- 200+ papers in conferences/journals including IEEE/ACM TON, JSAC, IEEE TSC, ICSE, KDD, WWW, ACM SIGCOMM, IEEE INFOCOM, ATC, VLDB, FSE, USENIX Security, UbiComp, IJCAI, ACM SIGMETIRCS, IEEE ICNP, ACM CoNEXT, ACM MobiSys, ACM IMC, IEEE ISSRE, by June 2022.
- 24 US patents (issued).
- Google Scholar Citation count is 5308 by June 2022.
- SCI citation (excluding self-citations) count is 1271 by June 2022.
- ORCID: 0000-0002-5113-838X
- Scopus ID: 7102806576
- E-versions since 2014 (with slides) are available at: http://netman.aiops.org/publications/
- All E-versions are available at: http://scholar.google.com/citations?hl=en&user=i_zA1VsAAAAJ&view_op=list_works&sortby=pubdate

Journal, magazine, conference and workshop publications

2022

Causal Inference-Based Root Cause Analysis for Online Service Systems with Intervention Recognition. Mingjie Li, Zeyan Li, Kanglin Yin, Xiaohui Nie, Wenchi Zhang, Kaixin Sui, Dan Pei*. **KDD 2022**, Washington, DC, USA, Aug 14-18, 2022 (CCF A)

Shenglin Zhang, Zhenyu Zhong, Dongwen Li, Qiliang Fan, Yongqian Sun, Man Zhu, Yuzhi Zhang, Dan Pei, Jiyan Sun, Yinlong Liu, Hui Yang, Yongqiang Zou. Efficient KPI Anomaly Detection Through Transfer Learning for Large-Scale Web Services. **IEEE Journal on Selected Areas in Communications (JSAC),** Accepted (CCF A)

Yongqian Sun, Kunlin Jian, Liyue Cui, Guifei Jiang, Shenglin Zhang, Yuzhi Zhang, Dan Pei. Online Malicious Domain Name Detection with Partial Labels for Large-Scale Dependable Systems. **The Journal of Systems & Software**, 190: 1-12, 2022 (CCF B)

Mining Fluctuation Propagation Graph among Time Series with Active Learning. Mingjie Li, Minghua Ma, Xiaohui Nie, Kanglin Yin, Li Cao, Xidao Wen*, Zhiyun Yuan, Duogang Wu, Guoying Li, Wei Liu, Xin Yang, Dan Pei. **DEXA**

2022, Vienna, Austria, Aug 22-24, 2022 (CCF C)

Generic and Robust Performance Diagnosis via Causal Inference for OLTP Database systems. Xianglin Lu, Zhe Xie, Zeyan Li, Mingjie Li, Xiaohui Nie, Nengwen Zhao, Qingyang Yu, Shenglin Zhang, Kaixin Sui, Lin Zhu* and Dan Pei. **CCGrid 2022**, The 22nd IEEE/ACM International Symposium on Cluster, Cloud and Internet Computing. (CCF C, THU B)

Robust Anomaly Clue Localization of Multi-dimensional Derived Measure for Online Video Services. Yongqian Sun, Daguo Cheng, Pengxiang Jin, Quan Ding, Shenglin Zhang*, Xu Chen, Yuzhi Zhang, Minghan Liang, Dan Pei, Jianyan Zheng, Sen Luo, Xinyu Tang. **IEEE Transactions on Services Computing**. (CCF B)

Robust System Instance Clustering for Large-Scale Web Services. Shenglin Zhang, Dongwen Li, Zhenyu Zhong, Jun Zhu, Minghan Liang, Jiexi Luo, Yongqian Sun*, Ya Su, Sibo Xia, Zhongyou Hu, Yuzhi Zhang, Dan Pei, Jiyan Sun and Yinlong Liu. The Web Conference (**WWW**), Virtual Conference, April 25-29, 2022 (CCF A).

基于调用链控制流分析的大型微服务系统性能建模与异常定位；于庆洋，白晓颖*，李明杰，李奇原，刘涛，刘泽胤，裴丹；**软件学报**,2022,33(5):1849-1864 (THU B)

2021

Robust KPI Anomaly Detection for Large-Scale Software Services with Partial Labels. Shenglin Zhang, Chenyu Zhao, Yicheng Sui, Ya Su, Yongqian Sun, Yuzhi Zhang, Dan Pei, Yizhe Wang. **ISSRE 2021** , Wuhan, China, Oct 25, 2021.

Identifying Root-Cause Metrics for Incident Diagnosis in Online Service Systems. Canhua Wu, Nengwen Zhao, Lixin Wang, Xiaoqin Yang, Shining Li, Ming Zhang, Xing Jin, Xidao Wen, Xiaohui Nie, Wenchi Zhang, Kaixin Sui, Dan Pei. **ISSRE 2021** , Wuhan, China, Oct 25, 2021.

An Empirical Investigation of Practical Log Anomaly Detection for Online Service Systems. Nengwen Zhao, Honglin Wang, Zeyan Li, Xiao Peng, Gang Wang, Zhu Pan, Yong Wu, Zhen Feng, Xidao Wen ,Wenchi Zhang,Kaixin Sui ,Dan Pei. **ESEC/FSE 2021 (industry track)**, Athens, Greece, Aug 23, 2021.

Identifying Bad Software Changes via Multimodal Anomaly Detection for Online Service Systems. Nengwen Zhao, Junjie Chen, Zhaoyang Yu, Honglin Wang, Jiesong Li, Bin Qiu, Hongyu Xu, Wenchi Zhang, Kaixin Sui, Dan Pei. **ESEC/FSE 2021**, Athens, Greece, Aug 23, 2021.

Jump-Starting Multivariate Time Series Anomaly Detection for Online Service Systems. Minghua Ma, Shenglin Zhang, Junjie Chen, Jim Xu, Haozhe Li, Yongliang Lin, Xiaohui Nie, Bo Zhou, Yong Wang, Dan Pei. **ATC 2021**, virtual event, July 14, 2021.

Multivariate Time Series Anomaly Detection and Interpretation using Hierarchical Inter-Metric and Temporal Embedding. Zhihan Li, Youjian Zhao, Jiaqi Han, Ya Su, Rui Jiao, Xidao Wen, Dan Pei. **KDD 2021**, August 14-18, 2021, virtual conference

Practical Root Cause Localization for Microservice Systems via Trace Analysis. Zeyan Li, Junjie Chen, Rui Jiao, Nengwen Zhao, Zhijun Wang, Shuwei Zhang, Yanjun Wu, Long Jiang, Leiqin Yan, Zikai Wang, Zhekang Chen, Wenchi Zhang, Xiaohui Nie, Kaixin Sui, Dan Pei. **IWQoS 2021**, June 25-38, 2021, virtual

conference

Detecting Outlier Machine Instances through Gaussian Mixture Variational Autoencoder with One Dimensional CNN. Ya Su, Youjian Zhao, Ming Sun, Shenglin Zhang, Xidao Wen, Yongsu Zhang, Xian Liu, Xiaozhou Liu, Junliang Tang, Wenfei Wu, Dan Pei. IEEE **TC** (IEEE Transactions on Computers)，2021-03-10

CTF: Anomaly Detection in High-Dimensional Time Series with Coarse-to-Fine Model Transfer. Ming Sun, Ya Su, Shenglin Zhang, Yuanpu Cao, Yuqing Liu, Dan Pei, Wenfei Wu, Yongsu Zhang, Xiaozhou Liu, Junliang Tang. **INFOCOM 2021**, May 10 – 13, 2021, virtual conference

LogClass: Anomalous Log Identification and Classification with Partial Labels. Weibin Meng, Ying Liu, Shenglin Zhang, Federico Zaiter, Yuzhe Zhang, Yuheng Huang, Zhaoyang Yu, Yuzhi Zhang, Lei Song, Ming Zhang and Dan Pei. IEEE **TNSM** (IEEE Transactions on Network and Service Management) 2021

2020

FluxInfer: Automatic Diagnosis of Performance Anomaly for Online Database System. Ping Liu, Shenglin Zhang, Yongqian Sun, Yuan Meng, Jiahai Yang, Dan Pei. **IPCCC 2020**, November 6 – 8, 2020, virtual conference

VAEPP: Variational Autoencoder with a Pull-back Prior. Wenxiao Chen, Wenda Liu, Zhenting Cai, Haowen Xu, Dan Pei. **ICONIP 2020**, November 18 – 22, 2020, Online

Shallow VAEs with RealNVP Prior Can Perform as Well as Deep Hierarchical VAEs. Haowen Xu, Wenxiao Chen, Jinlni Lai, Zhihan Li, Youjian Zhao, Dan Pei. **ICONIP 2020**, November 18 – 22, 2020, Online

LogTransfer: Cross-System Log Anomaly Detection for Software Systems with Transfer Learning. Rui Chen, Shenglin Zhang, Dongwen Li, Yuzhe Zhang, Fangrui Guo, Weibin Meng, Dan Pei, Yuzhi Zhang, Xu Chen, Yuqing Liu. **ISSRE 2020**, Oct 12 – 15, 2020, Coimbra, Portugal

Unsupervised Detection of Microservice Trace Anomalies through Service-Level Deep Bayesian Networks. Ping Liu, Haowen Xu, Qianyu Ouyang, Rui Jiao, Zhekang Chen, Shenglin Zhang, Jiahai Yang, Linlin Mo, Jice Zeng, Wenman Xue, Dan Pei. **ISSRE 2020**, Oct 12 – 15, 2020, Coimbra, Portugal

Real-time Incident Prediction for Online Service Systems. Nengwen Zhao, Junjie Chen, Zhou Wang , Xiao Peng , Gang Wang, Yong Wu, Fang Zhou, Zhen Feng, Xiaohui Nie, Wenchi Zhang, Kaixin Sui, Dan Pei. **ESEC/FSE 2020**,Sacramento, California, United States, November 8, 2020

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