

# NAIBO WANG

Innovation 4.0, #04-06, Institute of Data Science, NUS, Singapore, 117602

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Research Interests: Model-Centric Collaborative Machine Learning, Federated Learning, Cloud Computing, Big Data, Distributed System, Database

## EDUCATION

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- National University of Singapore (NUS)** • Singapore Aug 2020 – Present  
*Ph.D. Candidate* • Data Science • CAP: 5.0/5.0
- Zhejiang University (ZJU)** • Hangzhou, China Sept 2017 – June 2020  
*Master of Engineering* • Computer Science and Technology • GPA: 4.0/4.0
- Xidian University (XDU)** • Xi'an, China Aug 2013 – June 2017  
*Bachelor of Science* • Computer Science and Technology • GPA: 3.6/4.0

## RESEARCH EXPERIENCE

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- Machine Learning Model Market** – Institute of Data Science Dec 2020 – Present  
Advisor: Professor Ng See-Kiong, National University of Singapore, Singapore
- Building a platform which enables users to share, trade, and operate machine learning models.
  - Provide a vision for the future work of Machine Learning and Artificial Intelligence.
  - Concentrating on finding the relationship among different models.
- Federated Learning System Design** – System & Networking Research Lab 1 Aug 2019 – Dec 2020  
Advisor: Professor Bingsheng He, National University of Singapore, Singapore
- Identified two important features for the applying federated learning on real cases, heterogeneity and autonomy, that are rarely considered in the existing federated learning systems.
  - Compared and contradicted the current frameworks that support federated learning.
  - Concentrated on the design of model, definitions of terminologies.
  - Concentrated on standard pipeline to benchmark distinctive FL frameworks to evaluate the efficiency and accuracy.
- Service Wrapper: A System for Converting Web Data into Web Services** – CCNT Lab Sept 2018 – Jun 2020  
Advisors: Professor Jianwei Yin and Professor Zhiling Luo, Zhejiang University, Zhejiang, China
- Constructed a *Service Wrapper* system to convert available data on web pages into web services. A user can convert web data into web services with easy operations and invoke these services through one simple step.
  - With *Service Wrapper*, a rookie user can design and generate a web crawler in just a few minutes without any prior knowledge of web/network spider.
  - Outstripped the traditional crawler program on the efficiency of data collection. The *Service Wrapper* can either automatically analyze the page, generate crawler rules, and return the corresponding structured data; or a user can design its own crawl rules with a user-friendly GUI.
  - Responsible for all parts of the system, including system design, frontend/backend/chrome extension/Graphic User Interface, patent application, etc.
  - Still Improving the functions of the system.
- Feelings-aware RNN Model for User Churn Prediction** – CCNT Lab Dec 2017 – Oct 2018  
Advisor: Professor Zhiling Luo, Zhejiang University, Zhejiang, China
- Proposed an RNN model, LaFee, in order to generate latent feelings while predicting user churn, which mitigates the challenge of lacking users' real feelings.
  - Introduced BMM-UCP method to help models predict user churn when it needs to be completed with only behavioral data.
  - Evaluated the model's performance on UNO dataset from NetEase.com. Proposed method outperforms baselines by applying the BMM-UCP and LaFee model on them, showing that LaFee is more suitable for long-term sequential learning.
  - Contributed to the implementation of the model, training and evaluation with TensorFlow.
- Parallel acceleration for Convolution Neural Network based on OpenCL** Oct 2016 – Jan 2017  
System-on-a-chip design & research laboratory Advisor: Jianxian Zhang, Xidian University, Xi'an, China
- Completed the parallelization design of Convolutional Neural Network (CNN) based on OpenCL and verified the feasibility and correctness of the designed algorithm on heterogeneous parallel platforms.
  - Proposed optimizations in OpenCL such as parallelism for a single convolution and multiple convolutions, data parallelism and batch processing.
  - Benchmarked proposed parallel computation on Intel CPU, AMD GPU, and NVIDIA GPU. The proposed algorithm is 375 times faster than serial execution conditioned on similar training accuracy.
  - Contributed to the implementation of the model, training and evaluation with C++. Submitted the work in form of undergraduate thesis for publication.

## PUBLICATIONS

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### Published

- Qinbin Li, Zeyi Wen, Zhaomin Wu, Sixu Hu, **Naibo Wang**, Yuan Li, Xu Liu, Bingsheng He (2021) *A survey on federated learning systems: vision, hype and reality for data privacy and protection* [T] IEEE Transactions on Knowledge and Data Engineering (TKDE)

- Meng Xi, Zhiling Luo, **Naibo Wang**, Jianrong Tao, Ying Li, Jianwei Yin (2020) *A Latent Feelings-aware RNN Model for User Churn Prediction with only Behaviour data*. [C] 2020 IEEE International Conference on Smart Data Services (SMDS), 26-35, **[Best Paper Award]**
- Meng Xi, Ying Li, Yongna Wei, **Naibo Wang**, Yuyu Yiny, Zhiling Luo, Shuiguang Deng, Yihua Mao, Jianwei Yin (2019) *A Scenario-based Requirement Model for Crossover Healthcare Service*. [C] The 2019 IEEE World Congress on Services (SERVICES)

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#### PATENTS

- **Wang, N.**, Xiya, L.V., Yang, Z., Wang, T. and Yin, J., Zhejiang University ZJU, 2022. A service packaging method based on web page segmentation and search algorithm. U.S. Patent Application 17/614,978. (Published)
- **Naibo Wang**, Jianwei Yin, Zitong Yang, Tao Wang, Zhaohui Wu (2022), CN111797340B, ZL 2020 1 0526593.0, A service wrapper system for customizing extraction processes (Granted)
- Zhiling Luo, **Naibo Wang**, Xiya Lv, Zitong Yang, Jianwei Yin (2022), CN110222251B, ZL 2019 1 0447448.0, A service wrapper method based on web page segmentation and searching algorithms (Granted)

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#### REVIEW EXPERIENCE

- Invited to serve as a reviewer for TKDE 2022.

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#### WORK EXPERIENCE

**Server Administrator** Institute of Data Science, National University of Singapore, Singapore Oct 2022 - Now  
*Supervised by: Prof. Ng See-Kiong and Sam Yeong*

- Worked as part-time server administrator to manage and maintain GPU servers at IDS, NUS.
- To monitor usage of servers, identify unused processes that occupy GPU memories, contact users to clear unused processes, manually clear unused processes periodically in servers, and all other actions to keep the servers in good health.
- Designed a very useful tool for all users to check the status of GPU and who is using it with their email addresses with just "ids" command; automatically check the zombie processes and kill them; make users to send anonymous emails to users who is overusing GPUs, etc.

**Research Assistant (GAP)** National University of Singapore, Singapore Dec 2021  
*Project: Cryptocurrency Trade Market/Platform • Coworker: Yuan Li, Supervised by Shengliang Lu and He Bingsheng*

- Worked as full-time software engineer to build a Cryptocurrency Trade Market/Platform.
- Responsible for building the full frontend and part of the backend of the system with multiple languages and frameworks.
- Designed the database structure, participated in requirement design and deployed the platform on secure and stable servers.

**Research Assistant** National University of Singapore, Singapore Sep 2019 - Dec 2019  
*Project: Development of Federated Learning (FL) Systems (Benchmark)*

- Worked as full-time researcher for the School of Computing, National University of Singapore.
- Composed literature review, system building, evaluation and implementation.
- Composed paper on Federated Learning Systems, which enable the collaborative training of machine learning models among different organizations under the privacy restrictions.

**Software Development Engineer** Xidian University, Xi'an, China Jan 2016 - May 2018  
*Project: Development of Three-Thinking Website*

- Worked as part-time software engineer for the School of Computer Science, Xidian University
- Developed an information hub *Three-Thinking* for students in Xidian University to allow them to access academic information. The website provides information including GPA, ranking, grade certificates, appointment of official transcript, enrollment statements, etc.
- Assisted professors with online grading for students' graduation projects, and teachers to recruit good students by posting announcements on the website.
- Individually responsible for all development on back-end system, front-end design, UI design and testing.
- Other example projects including the *Crab Verification Code Service System, International Student Information Management System, High Resolution Ground-to-ground Observation Service Grid System (In ZJU)*, etc.

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#### HONORS AND AWARDS

- **Graduate Star (2017)**  
 Awarded along with 10 students from the whole grade (about 5000 students)
- **National Scholarship (2016)**  
 Top 1% among competitors, awarded by the Ministry of Education of PRC
- **Graduate of Merit (2018)**  
 Top 15% among competitors, Awarded by Zhejiang University
- **Honor for Graduate Student (2018)**  
 Top 30% among competitors, Awarded by Zhejiang University
- **Outstanding Graduate Student Leader (2018)**  
 Top 2% among competitors, Awarded by Zhejiang University

- **Excellent Student and First-class Scholarship (2014, 2015)**  
Top 10% among competitors, Awarded by Xidian University
- **Excellent Student Leader (2015)**  
Top 1% among competitors, Awarded by Xidian University
- **Recognition Award in the CCSP contest (2016)**  
Top 10% among competitors, Awarded by China Computer Federation (CCF)
- **First prize in the ACM contest (2015)**  
Top 10% among competitors, Awarded by Xidian University
- **Internet Plus Contest Second Prize (2016)**  
Top 30% among competitors, Awarded by Xidian University
- **Excellent team and leader in summer social practice (2015)**  
Top 5% among competitors, Awarded by Xidian University

#### TECHNICAL SKILLS

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- Programming languages: Python, C, C++, Java, Android, PHP, HTML, CSS, JavaScript, C#, .net Framework, VHDL, MATLAB, ActionScript, Linux Shell, R
- Frameworks: Machine Learning Related (PyTorch, TensorFlow, Keras/Scikit-Learn, etc), Frontend Related(Vue.js, ESLint, Webpack,etc), Backend Related (MySQL, MongoDB, ElectronJS, Django, etc), OPS related (Linux, Docker, Nginx, etc), etc.
- Language: Mandarin (Native Speaker), English (Proficient, TOEFL 103, GRE 327+4.0), Henan Dialect (Native Speaker)