

个人简介

我于 2011 年、2016 年取得浙江大学计算机本科、博士学位。读博期间从事人工智能领域研究工作，因学术成果突出，获得百度奖学金、微软学者奖学金、教育部学术新人奖。在 2016 至 2018 年期间任美国加州大学伯克利分校统计系博士后，在 2018 至 2021 年期间任美国史蒂文斯理工学院计算机系助理教授、博导。从 2021 年底至今在小红书（上海）任算法工程师、基础模型团队负责人。

我精通搜索引擎、机器学习、强化学习、数值计算，熟悉 NLP、推荐系统。在学术界期间，在人工智能相关的国际顶级期刊、国际顶级会议上发表超过 30 篇论文，并担任多个国际期刊、国际会议的评审、组委会成员。在工业界期间，个人和团队在搜索排序、搜索召回等方向落地多项基础技术和创新技术，推全十多个实验，均显著提升大盘业务指标、或降低机器成本。我在业余时间著书《深度强化学习》，开设公开课《工业界的推荐系统》。

教育经历

- 2011 – 2016 浙江大学计算机学院，博士
- 2007 – 2011 浙江大学计算机学院、竺可桢学院，本科

工作经历

- 2021 – 现在 小红书（中国上海），算法工程师、团队负责人
- 2018 – 2021 史蒂文斯理工学院（美国新泽西州），助理教授、博导
- 2016 – 2018 加州大学伯克利分校（美国加州），博士后
- 2014 – 2015 百度研究院（中国北京），实习
- 2012 – 2012 谷歌研究院（中国北京），实习
- 2011 – 2012 微软亚洲研究院（中国北京），实习

工业界项目

- 2022 搜索排序的 CTR 模型
 - 我的团队推全多个模型结构、特征工程实验，均显著提升 query 有点比。
 - 我的团队将 CPU 推理切换成 GPU 推理，降低成本和 RT。
- 2022 本地内容搜索
 - 背景：我发现小红书上有一定比例的 query 的意图是寻找本地生活内容，但是搜索引擎没有相应的承接，这类 query 的有点比等指标很差。
 - 我提出了本地内容搜索项目，设计了独立的链路（包括意图理解、召回、排序策略），作为项目 PL 推进项目从零到一落地。对于几类本地意图的 query，有点比有巨大提升。
 - 项目获得公司 2022 Q3 ExtraMile 奖（公司共有 5 个项目，其中 2 个为技术项目）。
- 2022-2023 NLP 预训练技术
 - 我们团队利用小红书数据与公开数据，用多机多卡预训练 12 层和 48 层 BERT 模型。
 - 将模型在搜索、电商等业务中落地，比公开中文 BERT 有大幅提升。
- 2022-2023 NLP 技术在搜索召回的应用
 - 我设计了“反向召回”技术，用文档生成高相关性查询词，建立 query → List (doc) 的 KV 索引。我的团队落地该技术，小幅提升有点比，大幅提升大盘 DAU 和留存指标。
 - 我们团队将反向召回技术用于新文档召回，在文档发布之后，近线生成 query，接入 query → List (doc) 实时流 KV 索引。该技术小幅提升有点比，大幅提升 24 小时新文档占比。
 - 我设计了一种 query 改写与召回的联合建模方法，利用曝光日志和已有的相关性模型自动生成训练数据，训练改写召回和改写判别模型，模型仍在优化中，初步实现结果显著正向。
- 2022-2023 离线搜索链路
 - 我的团队设计并实现了“缓存召回通道”，原理是圈定头部 query，离线统计每条 query 的曝光、点击、交互，并融合相关性、内容质量、时效性分数，根据融合分数做离线排序，作为一条召回通道。项目大幅提升了有点比等业务指标。

- 我提出了离线搜索链路，即圈定头部 query，在夜间发起主动的非个性化召回和排序，建立 query → List (doc) 的 KV 索引。在线上，用离线计算结果代替非个性化召回通道。策略仍在优化中，初步实验结果显著正向。

著书

- 深度强化学习（中文）。
王树森，黎彧君，张志华。
人民邮电出版社，2022。
初稿下载地址：https://github.com/wangshusen/DRL/tree/master/Notes_CN

期刊论文

- Fast Randomized-MUSIC for Mm-Wave Massive MIMO Radars.
Bin Li, **Shusen Wang**, Jun Zhang, Xianbin Cao, and Chenglin Zhao.
IEEE Transactions on Vehicular Technology, 70(2):1952-1956, 2021.
- Fast Pseudo-spectrum Estimation for Automotive Massive MIMO Radar.
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IEEE Internet of Things Journal, 2021.
- Randomized Approximate Channel Estimator in Massive-MIMO Communication.
Bin Li, **Shusen Wang**, Xianbin Cao, Jun Zhang, and Chenglin Zhao.
IEEE Communications Letters, 24(10):2314 - 2318, 2020.
- A Bootstrap Method for Error Estimation in Randomized Matrix Multiplication.
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Journal of Machine Learning Research (JMLR), 20(39):1-40, 2019.
- Scalable Kernel K-Means Clustering with Nystrom Approximation: Relative-Error Bounds.
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Geophysical Journal International, ggy385, 2018.
- Alchemist: An Apache Spark \rightleftharpoons MPI Interface.
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会议论文

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In *Artificial Intelligence and Statistics (AISTATS)*, 2022.
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In *International Joint Conference on Artificial Intelligence (IJCAI)*, 2022.
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In *International Conference on Artificial Intelligence and Statistics*, (**AISTATS**), 2014.
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In *the 28th AAAI Conference on Artificial Intelligence (AAAI)*, 2014.
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Shusen Wang and Zhihua Zhang.
In *Advances in Neural Information Processing Systems (NIPS)*, 2012.
- Colorization by Matrix Completion.
Shusen Wang and Zhihua Zhang.
In *AAAI Conference on Artificial Intelligence (AAAI)*, 2012.
- Efficient Subspace Segmentation via Quadratic Programming.
Shusen Wang, Xiaotong Yuan, Tiansheng Yao, Shuicheng Yan, and Jialie Shen.
In *AAAI Conference on Artificial Intelligence (AAAI)*, 2011.

教学

- 2021 秋 CS600: Advanced Algorithms
- 2021 春 CS583: Deep Learning (网课)
- 2020 秋 CS600: Advanced Algorithms (网课)
- 2020 春 CS583: Deep Learning
- 2019 秋 CS583: Deep Learning
- 2021 春 CS583: Deep Learning
- 公开课 YouTube 中文频道: <https://www.youtube.com/c/ShusenWang>
YouTube 英文频道: <https://www.youtube.com/c/ShusenWangEng>
Bilibili 中文频道: <https://space.bilibili.com/1369507485>

获奖

- 2014 百度奖学金, 全球 8 人获奖, 奖金 20 万人民币
- 2013 微软学者奖学金, 亚太地区 10 人获奖, 奖金 1 万美元
- 2012 教育部学术新人奖学金, 奖金 3 万人民币
- 2012 – 2014 三次获得国家奖学金, 每次奖金 3 万人民币

期刊、会议评审

期刊审稿

- Journal of Machine Learning Research, 2015 – 2021
- SIAM Journal on Scientific Computing, 2017

- ACM Transactions on Mathematical Software, 2017
- Journal of Econometrics, 2017
- SIAM Journal on Matrix Analysis and Applications, 2017, 2019
- International Journal of Data Science and Analytics, 2018
- IEEE Transactions on Signal Processing, 2018
- IEEE Transactions on Information Theory, 2019
- IEEE Transactions on Pattern Analysis and Machine Intelligence, 2019, 2020

会议 Committe Member

- NIPS 2014, 2015, 2017, 2018, 2020
- ICML 2017, 2018, 2019
- IJCAI 2015, 2017, 2018, 2019, 2020
- AAAI 2017, 2018, 2020
- AISTATS 2019, 2020
- UAI 2019, 2020
- Supercomputing 2019
- KDD 2020
- ICLR 2021

会议 Senior Committe Member

- AAAI 2021, 2022
- IJCAI 2021

About Me

I obtained my bachelor's and doctoral degrees in computer science from Zhejiang University in 2011 and 2016. During my doctoral study, I was supported by "Microsoft Research Asia Fellowship" and "Baidu Scholarship", which were the highest fellowships/scholarships in China. From 2016 to 2018, I was a postdoc scholar at the Department of Statistics, UC Berkeley. From 2018 to 2021, I was a tenure-track assistant professor at the Department of Computer Science, Stevens Institute of Technology. In late 2021, I joined Xiaohongshu (Shanghai) as an ML engineer and manager.

My expertise includes search engines, machine learning, reinforcement learning, and numerical algorithms. I also have experience in NLP and recommender systems. When I was in academia, I did research on machine learning, numerical optimization, parallel computing, etc. In the industry, I lead a team working on search ranking, search retrieval, and NLP techniques. We have launched over 10 projects that significantly improved key indicators such as DAU, retention, CTR, etc. In my spare time, I published a book *Deep Reinforcement Learning (in Chinese)* and taught an open course *Industrial Recommender System (in Chinese)*.

Work Experience

- 2021 – now Xiaohongshu (Shanghai, China), machine learning engineer & manager
- 2018 – 2021 Stevens Institute of Technology (NJ, USA), Assistant Professor in Computer Science
- 2016 – 2018 UC Berkeley (CA, USA), Postdoc
- 2014 – 2015 Baidu Big Data Lab (Beijing, China), intern
- 2012 – 2012 Google (Beijing, China), intern
- 2011 – 2012 Microsoft Research Asia (Beijing, China), intern

Education

- 2011 – 2016 Zhejiang University (Hangzhou, China), Ph.D. in Computer Science
- 2007 – 2011 Zhejiang University (Hangzhou, China), B.Eng. in Computer Science

Industry Projects

- 2022 Improving CTR model for search ranking
 - My team launched multiple improvements over neural network architecture and features. We much increased query CTR, document CTR, engagements, etc.
 - My team replace CPU training/inference with GPU training/inference to reduce cost and response time.
- 2022 Locality-sensitive search intents
 - Background: Over 1% queries on Xiaohongshu have the intent of finding nearby POIs. I found such queries overlooked by our search engine.
 - I proposed the project, designed the pipeline (including query understanding, retrieval, and ranking), and lead this project.
 - For those queries with nearby intent, our project hugely increased query CTR.
 - This project was selected as 2022 Q3 ExtraMile Prize (one of five projects in the company.)
- 2022-2023 Pretrained NLP models
 - My team pretrained 12-layer and 48-layer BERT models on a mixture of public data and Xiaohongshu's data.
 - The pretrained models have been used by search relevance, search query, and other applications and demonstrated substantial improvements.
- 2022-2023 NLP techniques for search retrieval
 - I designed the *inverse retrieval* method that offline generates highly relevant queries to build an index of query \rightarrow List \langle doc \rangle . My team implemented and launched the inverse retrieval. APP DAU and APP retention increased by 0.1%.

- My team applied the inverse retrieval to new document retrieval. Upon the publication of a new document, our nearline pipeline generates its relevant queries and adds the $\langle query, doc \rangle$ pair to the index of query \rightarrow List $\langle doc \rangle$. The project much increased 24h new document impression ratio and slightly increased query CTR and document CTR.
- I propose to jointly model query rewrite and document retrieval. It uses the search log and our in-house relevance model to generate billion-scale training data, on which we train a rewrite retrieval model and a rewrite discriminative model. A/B test results are very positive. We are still optimizing the data and models.

2022-2023 Offline search retrieval pipelines

- My team designed and implemented a *cached retrieval* method. We maintain a table of the top 5 million queries. For those queries, we offline analyze the search log to extract documents with high relevance, high content quality, freshness, and high click number. We daily update an index of query \rightarrow List $\langle doc \rangle$ and use it as a retrieval channel. This project much improved query CTR and document CTR.

Book

- Deep Reinforcement Learning (in Chinese).
Shusen Wang, Yujun Li, and Zhihua Zhang.
Posts & Telecom Press Co.,Ltd, 2022.

Journal Papers

- Fast Randomized-MUSIC for Mm-Wave Massive MIMO Radars.
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Conference Papers

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Teaching

2021 Fall	CS600: Advanced Algorithms
2021 Spring	CS583: Deep Learning (remote)
2020 Fall	CS600: Advanced Algorithms (remote), with students' rating of 3.90/4.0
2020 Spring	CS583: Deep Learning, with students' rating of 3.89/4.0
2019 Fall	CS583: Deep Learning, with students' rating of 3.83/4.0
2021 Spring	CS583: Deep Learning, with students' rating of 3.71/4.0
Open Course	YouTube Chinese Channel: https://www.youtube.com/c/ShusenWang
	YouTube English Channel: https://www.youtube.com/c/ShusenWangEng

Honors & Awards

- 2014 Baidu Scholarship, awarded to 8 Chinese students in the world, US\$30,000
- 2013 Microsoft Research Asia Fellow, awarded to 10 students in Asia Pacific, US\$10,000
- 2012 Scholarship Award for Excellent Doctoral Student Granted by Ministry of Education, US\$5,000
- 2012 – 2014 National Scholarship for Graduate Students, 3 times, each time US\$5,000

Academic Service

Journal Reviewer

- Journal of Machine Learning Research, 2015 – 2021
- SIAM Journal on Scientific Computing, 2017
- ACM Transactions on Mathematical Software, 2017
- Journal of Econometrics, 2017
- SIAM Journal on Matrix Analysis and Applications, 2017, 2019
- International Journal of Data Science and Analytics, 2018
- IEEE Transactions on Signal Processing, 2018
- IEEE Transactions on Information Theory, 2019
- IEEE Transactions on Pattern Analysis and Machine Intelligence, 2019, 2020

Conference Committee Member

- NIPS 2014, 2015, 2017, 2018, 2020
- ICML 2017, 2018, 2019
- IJCAI 2015, 2017, 2018, 2019, 2020
- AAAI 2017, 2018, 2020
- AISTATS 2019, 2020
- UAI 2019, 2020
- Supercomputing 2019
- KDD 2020
- ICLR 2021

Conference Senior Committee Member

- AAAI 2021
- IJCAI 2021