ZHANG, ZIHAN

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RESEARCH INTERESTS

I am currently interested in collaboratively training deep learning models in context of edge computing and cloud computing. Current collaborative machine learning (CML) techniques, e.g. federated learning and split learning, suffer from low resource utilisation during training. During my PhD study, I am dedicated to build an efficient CML framework that accelerates CML in edge/cloud computing by exploring parallelisation techniques.

EDUCATION

Doctor of Philosophy @ University of St Andrews (UK) Oct. 2021 - Now
Computer Science @ Edge Computing Hub **Supervisor: Dr. Blesson Varghese**

- Research title: Efficient and adaptive parallelisation of distributed machine learning in edge computing.
- Studied in Queen's University Belfast until Feb. 2022, and transferred to University of St Andrews.

Master of Science with Distinction @ University of Edinburgh (UK) Sep. 2017 - Nov. 2018
Data Science @ School of Informatics **GPA: 78/100, 4.0/4.0**

- Core Courses with Grades: Machine Learning Practical (84), Probabilistic Modelling and Reasoning (90), Data Mining and Exploration (80), Extreme Computing (72), etc.
- The grades of the majority of courses and the dissertation are at level A (≥ 70).

Bachelor of Science @ Shandong University (985 & 211 project, China) Sep. 2013 - Jun. 2017
Mathematics and Applied Mathematics @ School of Mathematics **GPA: 85/100**

- Core Courses with Grades: Probability Theory (89), Mathematical Statistics (95), Applied Statistics (88), C language (95), C++ (92), Java (92), Data Structure (85), Database (95), Linux Operating System (84), etc.
- Graduated from *Hua Luogeng Class*, a National Mathematical Training Base, **TOP 3** in China by specialization.

WORK EXPERIENCE

Algorithm Engineer @ Noah's Ark Lab (AI Lab), Huawei Dec. 2018 - Now
Skill set: Java, Scala, Python, Spark, Hadoop, Linux, Docker, etc.

Responsible for optimizing Huawei's logistics by tackling vehicle routing problems and bin packing problems with exact algorithms (mixed-integer programming, tree search, etc.) and heuristics (machine learning, simulated annealing, etc.), and visualising the 3D packing results.

1. Develop an industry-leading distributed system for truck packing and routing with Prof. Zhixing Luo from Nanjing University, which has reduced millions of USD of the logistics cost per year.
2. Develop an industry-leading bin-packing service on Huawei Cloud, and the cooperation with many customers are being negotiated.
3. Participate in organizing EMO 2021 Competition as the main developer, providing the auxiliary code and Docker images.

PUBLICATIONS

1. Qianwen Zhu, Xihan Li, Zihan Zhang, Zhixing Luo, Xialiang Tong, Mingxuan Yuan, and Jia Zeng. 2021. "Learning to Pack: A Data-Driven Tree Search Algorithm for Large-Scale 3D Bin Packing Problem." *Proceedings of the 30th ACM International Conference on Information & Knowledge Management.* Association for Computing Machinery, New York, NY, USA, 4393–4402. https://doi.org/10.1145/3459637.3481933

PROJECTS

PipeLearn: Pipeline Parallelism for Collaborative Machine Learning Oct. 2022 - Now

Collaborative machine learning (CML) techniques, such as federated learning, were proposed to collaboratively train deep learning models using multiple end-user devices and a server. However, the low resource utilisation of CML techniques makes the training process inefficient, thereby limiting the use of CML in the real-world. A novel framework PipeLearn that leverages pipeline parallelism for CML techniques is developed to substantially improve resource utilisation. A new training pipeline is designed to parallelise the computations on different hardware resources and communication on different bandwidth resources, thereby accelerating the training process in CML.

SKILLS

Advanced	Python, Java, Scala, Spark, Linux, Docker, Hadoop
Good	SQL, R, C/C++, SAS

AWARDS & HONORS

Scholarship sponsored by Rakuten Mobile @ University of St Andrews *Equivalent to £133,277*	Feb. 2022
Scholarship sponsored by Rakuten Mobile @ Queen's University Belfast *Equivalent to £12,536*	Feb. 2022
Rising Star @ Huawei *Awarded to top 10% of employees by performance*	Dec. 2020
Informatics International Master's Scholarship @ University of Edinburgh *Up to 10 per cohort*	Nov. 2017
Hua Luogeng Schorlarship @ Hua Luogeng Class, Shandong University *Up to 15 per cohort*	Dec. 2016
Honorable Mention @ Interdisciplinary Contest in Modeling (US) *Top 15%*	Apr. 2016
First Prize @ Shandong Province Mathematics Competitions (China) *Top 5%*	Dec. 2015
Third Prize @ Chinese Mathematics Competitions *Top 25%*	Nov. 2015
Provincial Second Prize @ China Undergraduate Mathematical Contest in Modeling (MCM) *Top 30%*	Oct. 2015
Meritorious Winner @ Certificate Authority Cup International MCM *Top 5%*	Jan. 2015
Merit (96/100) @ National Computer Rank Examination (Level 2) with specialization in C language	Apr. 2014