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Tan Zhu

QUALIFICATIONS

- Several publications at NeurIPS, AAAI, and the top-tier journal published by Nature Publishing Group.
- Strong knowledge of theory, practice, and research experience on recommendation systems and reinforcement learning, emphasizing attention mechanisms, Click-through Rate Prediction, and stochastic contextual bandit problems.
- Strong knowledge of building and tuning deep neural network in Click-through Rate Prediction, image classification, and alcohol/nicotine disorder diagnosis.
- Strong object-oriented programming experience: 6 years of C++ experience, 6 years of Python experience.
- Skilled at PyTorch, Caffe, and data structures.
- Strong coding abilities, led the development of a steel plant scheduling simulation software based on C++ and OpenGL, a data structure educational demonstration system, and a 2D game engine.

EDUCATION

2018–Present **Ph.D – Machine Learning**, *Department of Computer Science and Engineering*, Univeristy of Connecticut, Storrs, CT, GPA 4.0/4.0.
Research interests:

2014–2017 **M.A. – Computer Science and Technology**, Northeastern University – Shenyang, China.
Thesis: Research and Application of Algorithm on Knowledge Learning from Expert Game Records of Go

2010–2014 **B.S. – Computer Science and Technology**, Northeastern University – Shenyang, China.
Thesis: Design and Implementation of Script-Based Information System

RESEARCH EXPERIENCE

2019–Present **Research Assistant: Interpretable Deep Neural Network for Recommender Systems**, *University of Connecticut, Storrs, CT*.

- Phase 1: Deep Neural Network predicting brain disease based on Magnetic Resonance Imaging (MRI) datasets.
  - Designed and implemented a deep neural network predicting alcohol misuse with MRI images. This model leverages interpretable alcohol misuse and brain network clustering knowledge to enhance its performance. The paper was published in **Translational Psychiatry 2022 (by Nature Publishing Group)**.
  - The multi-task Learning framework was then applied to the model mentioned above to predict alcohol and nicotine use disorder simultaneously. The paper was published in **Biological Psychiatry: Cognitive Neuroscience and Neuroimaging 2023 (Q1 journal)**.
- Phase 2: Polyhedron Attention Module: Learning Adaptive-order Interactions
  - Design and implement a module called Polyhedron Attention Module (PAM) for deep neural networks to explicitly model the interaction effects among the model's inputs on the model's output, which has been published in **NeurIPS 2023 (Accept Ratio: 26.1%)**.
  - Theoretic analysis was conducted to show PAM's stronger expression capability than ReLU-activated networks.
  - Propose the interpretation framework to identify critical interactions from PAM-based deep neural networks.
  - Our model has state-of-the-art performance on massive datasets of the click-through rate prediction, a critical machine learning problem in the recommender system. Experiments showed that PAM achieved state-of-the-art performance on massive click-through rate prediction (a core task for recommender system) datasets and could learn meaningful main effects and two-way interactions in predicting brain age with brain white volumes.
- Phase 3: General Interpretation Framework for the Deep Neural Network
  - Ongoing work: extend the explanation framework of PAM in Phase 2 to general deep neural networks.
  - Ongoing work: develop a depression/anxiety disorder diagnosing deep neural network based on attention modules and extract the learned knowledge within it.

2018–2021 **Research Assistant: Optimization and Convergence Analysis in Deep Reinforcement Learning**, *University of Connecticut, Storrs, CT*.

- Formulate a stage-wised optimization algorithm for deep stochastic contextual bandits problem. Results have been published in **AAAI 2021 (Accept Ratio: 21.1%)**.
- Prove that with high probability, the action sequence chosen by this algorithm converges to a greedy action policy respecting a local optimal reward function.
- Extensive experiments have been performed to demonstrate the effectiveness and efficiency of the proposed algorithm on multiple real-world datasets.

2014 – 2017 **Research Assistant: Key Algorithm Research in High Complex Game Problem Based on Deep Learning**, *Northeastern University, Shenyang, China*.

- Proposed Belief-state Monte-Carlo Tree Search, a searching framework used in imperfect information games. Designed and implemented the program to play Phantom Go with Belief-state Monte-Carlo Tree Search based on open source frameworks of Fuego. The work is published in **IEEE Symposium on Computational Intelligence and Games 2015** and **IEEE Transactions on Games 2017**.
- Conducted experiments and theoretical Analysis of Only-One-Victor, an algorithm proposed for pattern learning in the Go game. The work is published in **IEEE Transactions on Games 2015**.

EXTRACURRICULAR ACTIVITIES

A Demo of 2D Game Engine.

- Designed and implemented a 2D game engine with a c#-based map editor. Users can create maps with the editor, change the trigger logic for objects within the map, and load the map with the C++-based 2D game engine. By accepting user's keyboard inputs, the graphic could be rendered with WINSDK by the game engine.

Data Structures Teaching Demonstration System.

- Designed and developed a teaching software using C++ and OpenGL that allows for dynamic interaction and demonstration of the content and algorithm execution process of the Data Structures practical course. It includes 43 sub-programs to showcase classic data structure problems, such as heap sort, Tower of Hanoi, etc.

SKILLS

Programming Python , C++, C, Matlab.

Algorithm Data Structure, Machine Learning, Deep Learning, Reinforcement Learning.

Framework Pytorch, Caffe, Scikit-learn, LightGBM, XGBoost.

SELECTED PUBLICATIONS (10/18)

2023 [1] **Tan Zhu**, Fei Dou, Xinyu Wang, Jin Lu, Jinbo Bi. "Polyhedron Attention Module: Learning Adaptive-order Interactions." NeurIPS 2023, **($\mathbf{A}^+$ conference, Accept Ratio: 26.1%)**.

2023 [2] **Tan Zhu**, Wuyi Wang, Yu Chen, Henry R Kranzler, Chiang-Shan R Li, Jinbo Bi, "Machine Learning of Functional Connectivity to Biotype Alcohol and Nicotine Use Disorders." Biological Psychiatry: Cognitive Neuroscience and Neuroimaging, 2023, **(Q1 journal)**.

2022 [3] **Zhu, Tan**, Chloe Becquey, Yu Chen, Carl W. Lejuez, Chiang-Shan R. Li, and Jinbo Bi. "Identifying alcohol misuse biotypes from neural connectivity markers and concurrent genetic associations." Translational Psychiatry 12, no. 1 (2022): 253, **(Q1 journal, by Nature Publication Group)**.

2022 [4] Tong, Qianqian, Guannan Liang, Jiahao Ding, **Tan Zhu**, Miao Pan, and Jinbo Bi. "Federated Optimization of 0-norm Regularized Sparse Learning." Algorithms 15, no. 9 (2022): 319, **(Q2 journal)**.

2021 [5] **Zhu, Tan**, Guannan Liang, Chunjiang Zhu, Haining Li, and Jinbo Bi. "An Efficient Algorithm for Deep Stochastic Contextual Bandits." In Proceedings of the AAAI Conference on Artificial Intelligence, vol. 35, no. 12, pp. 11193-11201. 2021, **($\mathbf{A}^+$ conference, Accept Ratio: 15.0%)**.

2021 [6] Liu, Qinqing, Peng-Shuai Wang, Chunjiang Zhu, Blake Blumenfeld Gaines, **Tan Zhu**, Jinbo Bi, and Minghu Song. "OctSurf: Efficient hierarchical voxel-based molecular surface representation for protein-ligand affinity prediction." Journal of Molecular Graphics and Modelling 105 (2021): 107865, **(Q3 journal)**.

2019 [7] Zhu, Chun Jiang, **Tan Zhu**, Kam-Yiu Lam, Song Han, and Jinbo Bi. "Communication-optimal distributed dynamic graph clustering." In Proceedings of the AAAI Conference on Artificial Intelligence, vol. 33, no. 01, pp. 5957-5964. 2019 , **($\mathbf{A}^+$ conference, Accept Ratio: 16.2%)**.

2017 [8] Wang, Jiao, **Tan Zhu**, Hongye Li, Chu-Husan Hsueh, and I-Chen Wu. "Belief-state monte Carlo tree search for phantom go." IEEE Transactions on Games 10, no. 2 (2017): 139-154.

2015 [9] Wang, Jiao, **Tan Zhu**, Hongye Li, Chu-Hsuan Hsueh, and I-Chen Wu. "Belief-state Monte-Carlo tree search for Phantom games." In 2015 IEEE conference on computational intelligence and games (CIG), pp. 267-274. IEEE, 2015.

2015 [10] Wang, Jiao, Chenjun Xiao, **Tan Zhu**, Chu-Husan Hsueh, Wen-Jie Tseng, and I-Chen Wu. "Only-one-victor pattern learning in computer go." IEEE Transactions on Computational Intelligence and AI in Games 9, no. 1 (2015): 88-102.