Song Cheng

Ph.D

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Education

2014,9-2019,6 **Ph.D in Theoretical physics**, *Institute of Physics, Chinese Academy of Sciences*, Beijing, China.
Supervisors: Prof. Tao Xiang and Prof. Lei Wang

2010.9-2014.6 **B.S. in Physics**, *Sichuan University*, Chengdu, China.

Skills

- Tranditional Tensor Networks algorithms(Written: DMRG, TEBD, TRG, SRG, HOTRG, HOSRG, TNR, loop-TNR. Well understood: MERA, CTMRG, Fermion PEPS, PESS)
- Machine Learning models (graphical models, neural nets. etc.) and frameworks (tensorflow/pytorch)
- Some TN machine learning model, such as the MPS for image classification/generation and the Tree TN for image generation.
- Python/Matlab language

Interests

- Currently, I'm interest in both the traditional tensor network algorithms(on many body physics) and its application on machine learning and quantum computing problems.

Publications

[1] **Tree Tensor Networks for Generative Modeling**.
S. Cheng, L. Wang, T. Xiang, P. Zhang, Physical Review B,99.155131

[2] **Information perspective to probabilistic modeling: Boltzmann machines versus born machines**.
S. Cheng, J. Chen, L. Wang, Entropy 2018, 20, 583.

[3] **Equivalence of restricted Boltzmann machines and tensor network states**.
J. Chen, **S. Cheng**, H. Xie, L. Wang, T. Xiang, Physical Review B, 97 (8), 085104.

[4] **Compressing deep neural networks by matrix product operators**.
Z. F. Gao, **S. Cheng**, R. Q. He, Z. Y. Xie, H. H. Zhao, Zhong Y. Lu, and T. Xiang, arXiv:1904.06194

[5] **Phase Transition of the q-State Clock Model: Duality and Tensor Renormalization**.
Chen, J., Liao, H.-J., Xie, H.-D., Han, X.-J., Huang, R.-Z., **Cheng, S.**, et al. 2017, Chinese Physics Letters, 34, 050503.

Conferences

1 **Born machine: generative modeling using tensor network states.**
The 8th Workshop on Quantum Many-Body Computation, Huangzhou, 2018, Invited talk.

2 **A brief review on the application of tensor networks to the machine Learning problem.**
Workshop on the Statistical Physics and Machine Learning, Anqing, 2018, Invited talk.

3 **Pixel Correlation and Mutual Information: Implication to Unsupervised Learning.**
Fall Meeting of the China Physics Society, Chengdu, 2017, Invited talk.