Quantum Machine Learning Research Topic and Corresponding Literatures

LaTeX

1 Topic 1: Design Variational Quantum Circuit (VQC) Ansatz by AI, eg. Reinforcement Learning

1. A quantum information theoretical analysis of reinforcement learning-assisted quantum architecture search `https://arxiv.org/pdf/2404.06174.pdf`
2. Bayesian Parameterized Quantum Circuit Optimization `https://arxiv.org/pdf/2404.11253.pdf`
3. Quantum Architecture Search with Unsupervised Representing Learning `https://arxiv.org/pdf/2401.11576.pdf`
4. Optimizing ZX-Diagrams with Deep Reinforcement Learning `https://arxiv.org/pdf/2311.18588`
5. Light-cone feature selection for quantum machine learning `https://arxiv.org/pdf/2403.18733`
6. Light Cone Cancellation for VQE Ansatz `https://arxiv.org/pdf/2404.19497`

2 Topic 2: Design VQC with some features, eg. Symmetry, Topology

1. Here comes the $SU(N)$: multivariate quantum gates and gradients `https://quantum-journal.org/papers/q-2024-03-07-1275/`

2. Geodesic Algorithm for Unitary Gate Design with Time-independent Hamiltonians https://arxiv.org/pdf/2401.05973.pdf

3. Tensorized Pauli decompsition algorithm https://arxiv.org/pdf/2310.13421

3 Topic 3: Simulate VQC or in real device, eg. State vector, Tensor

1. Hybrid tree tensor networks for quantum simulation https://arxiv.org/pdf/2404.05784.pdf

4 Topic 4: About Reading-out information from VQC

5 Topic 5: The inductive bias for VQC as machine learning models

1. Inductive Bias for Deep Learning of High-Level Cognition https://arxiv.org/pdf/2011.15091.pdf

2. Contextually and inductive bias in quantum machine learning https://arxiv.org/pdf/2302.01365.pdf

3. The inductive bias of quantum kernel https://arxiv.org/pdf/2106.03747.pdf

6 Topic 6: Optimize method, eg. Gradient descent, natural gradient, gradient-free or with some features

1. Efficient Gradient Estimation of Variational Quantum Circuit with Lie Algebraic Symmetries https://arxiv.org/pdf/2404.05108.pdf

2. Optimizing Variational Quantum Algorithms with qBang: Efficient Interweaving metric and Momentum to Navigate Flat Energy Landscapes https://quantum-journal.org/papers/q-2024-04-09-1313/

3. Quantum conjugate gradient method using the positive-side quantum eigenvalue transformation https://arxiv.org/pdf/2404.02713.pdf
4. A Novel Noise-Aware Classical Optimizer for Variational Quantum Algorithms https://arxiv.org/pdf/2401.10121.pdf
5. Variational Quantum Simulation: A case study for understanding warm startshttps://arxiv.org/pdf/2404.10044.pdf
6. Guided-SPSA: Simultaneous Perturbation Stochastic Approximation assisted by the Parameter shift rule https://arxiv.org/pdf/2404.15751.pdf
7. Improving Gradient Methods via Coordinate Transformations: Applications to Quantum Machine Learninghttps://arxiv.org/pdf/2304.06768
8. Better Optimization of VQE by Combining the Unitary Block Optimization Scheme with Classical Post-Processing https://arxiv.org/pdf/2404.19027
9. Quantum Global Minimum Finder Based on Quantum Variational Search https://arxiv.org/pdf/2405.00450
10. Hybrid Quantum-Classical Scheduling for Accelerating NN Training with Newton's Gradient Descent https://arxiv.org/pdf/2405.00252

7 Topic 7: Mitigation Noise and Barren Plateau

1. Can Error Mitigation Improve Trainability of Noisy Variational Quantum Algorithms? https://quantum-journal.org/papers/q-2024-03-14-1287/
2. Exploiting many-body localization for scable quantum simulation https://arxiv.org/pdf/2404.17560

8 Topic 8: Scale Quantum Machine Learning, the most literature aimed at small applications or problems

1. Towards provably efficient quantum algorithms for large-scale machine-learning models https://www.nature.com/articles/s41467-023-43957-x#Sec7

2. Quantum machine learning of large datasets using randomized measurements `https://arxiv.org/pdf/2108.01039.pdf`

3. QNLP `https://arxiv.org/pdf/2403.19758`

5. A quantum neural network framework for scalable quantum circuit approximation of unitary matrices `https://arxiv.org/pdf/2405.00012`

9 Topic 9: What's the theory guarantee behind if QML better than Classical models

1. Better than classical? The subtle art of benchmarking quantum machine learning models `https://arxiv.org/pdf/2403.07059.pdf`

10 Topic 10: What's kind of problem set can be solved effectively by QML or VQC

1. What makes data suitable for a locally connectd neural networks ? A necessary and sufficient conditions based on quantum entanglement `https://arxiv.org/pdf/2303.11249.pdf`

   Analysising the classical model with quantum method by tensor networks.

2. Quantum Sovlable Nonlinear Differential Equations `https://arxiv.org/pdf/2305.00653.pdf`

11 Topic 11: Some hot applications, eg. Quantum Generative model, Quantum Reinforcement Learning

1. VQC-based Reinforcement Learning with Data Reuploading: Performence and Trainability `https://arxiv.org/pdf/2401.11555.pdf`

2. On Quantum Natural Policy Gradients `https://arxiv.org/pdf/2401.08307.pdf`

3. Variational Quantum Algorithms for Semidefinite Programming https://arxiv.org/pdf/2112.08859
4. Tensor Networks Based quantum Optimize Algorithm https://arxiv.org/pdf/2404.15048
5. Guardians of the Quantum Ganhttps://arxiv.org/pdf/2404.16156
6. Quantum Speedsup in Regret Analysis of Infinite Horizon Average-Reward Markov Decision Processes https://arxiv.org/pdf/2310.11684

12 Topic 12: How to explain QML

1. Understanding quantum machine learning also requires rethinking generalization https://doi.org/10.1038/s41467-024-45882-z
2. Quantum-inspired activation functions in the convolutional neural networks https://arxiv.org/pdf/2404.05901.pdf
3. Bounds and guarantees for learning and entanglement https://arxiv.org/pdf/2404.07277.pdf
4. On the interpretability on Quantum Machine Learning https://arxiv.org/pdf/2308.11098.pdf

   Explainable Quantum Machine Learning and Explainable AI, the references of "on the interpretability on Quantum Machine Learning" are worth reviewing.
5. Learning Quantum Processes with Quantum Statistical Query https://arxiv.org/pdf/2310.02075
6. Revealing the working mechanism of quantum neural networks by mutual information https://arxiv.org/pdf/2404.19312
7. Analyzing variational quantum landscapes with information content https://www.nature.com/articles/s41467-023-43957-x#Sec7
8. Theoretical guarantees for permutation-equivariant quantum neural networks https://www.nature.com/articles/s41534-024-00804-1

13 Topic 13: How to encode the classical data into VQC effectively

1. Efficient quantum amplitude encoding of polynomial functions https://quantum-journal.org/papers/q-2024-03-21-1297/
2. Optimal Universal Quantum Encoding for statistical inference https://arxiv.org/pdf/2404.08172.pdf
3. Let Quantum Neural Networks Choose Their Own Frequencies https://arxiv.org/pdf/2309.03279.pdf
4. Approximating Korobov Functions via quantum Circuit https://arxiv.org/pdf/2404.14570
5. A quantum compiler design method by using linear combinations of permutations https://arxiv.org/pdf/2404.18226
6. Qubit encoding for a mixture of localized functions https://arxiv.org/pdf/2404.18529
7. Circuit Complexity of Quantum Access models for encoding classical data https://arxiv.org/pdf/2311.11365

14 Topic 14: Continuous Problem in Quantum World

1. Quantum Kernel Method with Continuous Variable https://arxiv.org/pdf/2401.05647.pdf

Some New

1. Fermionic Machine Learning https://arxiv.org/pdf/2404.19032