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A construction method of initial Hamiltonian for singular value decomposition by quantum annealing

We investigated how the initial Hamiltonian affects the performance of quantum annealing (QA) for singular value decomposition. In the previous study, we introduced an implementation method of QA for singular value decomposition [1]. In the method, we have to find the eigenstate of the Gram matrix G generated by a target data matrix, where the eigenvalue of the eigenstate is the maximum value. In our scheme, the target Hamiltonian is defined as -G while the initial Hamiltonian H0 is prepared so that the ground state is a trivial eigenstate . After the preparation of Hamiltonians, QA realizes by changing the coefficients of both Hamiltonians. However, the previous studies [1, 2] did not clarify the performance of QA depending on the initial Hamiltonian. To make it clear systematically, in the present study, we use hierarchical data matrices. We find that the performance of the above method depends on the initial gap between the ground state and the first excited state of H0. In addition, we find that when we set the initial gap is the same order as the trace or the Frobenius norm of G, QA is efficient for singular value decomposition.
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References:
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