**Hybrid Quantum–classical Systems for NISQ Devices with Fast Gates on EEG classification**

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**Abstract:**.

**Problem statement**: It is not until the advantage of quantum computing devices, the possibility to store more states than either 0 or 1 in one qubits, bring the wide variety of formation processing tasks that the computation power makes breakthrough in the new era of information process. The noisy intermediate-scale quantum (NISQ) devices are defined as the quantum computer for which general-purpose quantum error correction is not feasible and ineradicable hardware errors with modules of two-qubit operations of proper size in the classification problem of EEG signals. Meanwhile, the Gaussian boson sampling (GBS) has demonstrated to be capable of providing a highly-efficient approach to large-scale implementations limiting the fast gates operations. Furthermore, with improved Shor’s algorithm adopted, the hybrid algorithms are realized with available circuit depth in quantum phase estimation, optimizing through operation minimization, with the truth that Bayesian variance methods converge faster than the Bayesian inference methods. Last but not the least, EEG data is usually with noise and to thus to make sure of getting correct results, our model is based on NISQ devices and the correspondant results are analized on basis of noisy signals classified by the hybrid system composed of multi-qubit as the many-body entanglement and classical bits for measurement solved by the Shor’s algorithm and the improvement of annealing quantm on carry-save adder. On the othe hand, the Bose-einstein condensates, as the experiment well known for its possibility to create observable data of the entangled states, investigating the advantage of combining both quantum and classical bits operations based on many-particle entanglement.

***Index******terms:***Hybrid Quantum-Classical Systems, Gaussian boson sampling, Variational Quantum Eigensolver, Rabi Fit, Fidelity, EMD，Shor’s algorithm