Abstract Submitted
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Virtual Parallel Computing and a Search Algorithm Using Matrix Product States[1] EDUARDO MUCCIOLO, University of Central Florida, CLAUDIO CHAMON, Boston University — We propose a form of parallel computing on classical computers that is based on matrix product states. The virtual parallelization is accomplished by representing bits with matrices and by evolving these matrices from an initial product state that encodes multiple inputs. Matrix evolution follows from the sequential application of gates, as in a logical circuit. The action by classical probabilistic one-bit and deterministic two-bit gates such as NAND are implemented in terms of matrix operations and, as opposed to quantum computing, it is possible to copy bits. We present a way to explore this method of computation to solve search problems and count the number of solutions. We argue that if the classical computational cost of testing solutions (witnesses) requires less than $O(n^2)$ local two-bit gates acting on n bits, the search problem can be fully solved in subexponential time. Therefore, for this restricted type of search problem, the virtual parallelization scheme is faster than Grover's quantum algorithm.

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