

Eleanor G. Rieffel

Title: Utilizing NISQ devices for evaluating quantum algorithms

Abstract: With the advent of quantum supremacy, we have an unprecedented opportunity to explore quantum algorithms in new ways. The emergence of general-purpose quantum processors opens up empirical exploration of quantum algorithms far beyond what has been possible to date. Challenging computational problems arising in the practical world are often tackled by heuristic algorithms. While heuristic algorithms work well in practice, by definition they have not been analytically proven to be the best approach or to outperform the best previous approach. Instead, heuristic algorithms are empirically tested on benchmark and real world problems. With the empirical evaluation NISQ hardware enables, we expect a broadening of established applications of quantum computing. What to run and how best to utilize these still limited quantum devices to gain insight into quantum algorithms remain open research questions. We discuss opportunities and challenges for using NISQ devices to evaluate quantum algorithms, including in elucidating quantum mechanisms and their uses for quantum computational purposes, in the design of novel or refined quantum algorithms, in compilation, error-mitigation, and robust algorithms design, and in techniques for evaluating quantum algorithms empirically.