Air Force Research Laboratory Information Directorate & SUNY Quantum Warrior Challenge 2020

Request for Proposals
Deadline: May 15, 2020

I. Background
In January 2019, the State University of New York and Air Force Research Laboratory Information Directorate executed a landmark Education Partnership Agreement calling for the rapid collaboration in technology areas with potential to enhance our national security and economic competitiveness, with focus on applications for artificial intelligence and quantum technologies. This Quantum Warrior Challenge creates an opportunity for SUNY faculty, staff and students to submit a 1-2 page white paper to gain access to the IBM Q Network through AFRL’s Quantum Hub.

II. Challenge Focus
Experiments within this project will primarily focus on the application of quantum techniques and subroutines to tackle Boolean satisfiability (i.e., propositional satisfiability or SAT) NP-Hard and NP-Complete problems (e.g., graph covering, graph coloring, graph partitioning and traveling salesman). The objective is to study hybrid quantum-classical approaches for tackling large datasets of Air Force optimization problems, including but not limited to supply chain, logistics, resource allocation, and complex scheduling. Subroutines to be explored to provide quantum advantage to optimization problems will include but are not limited to: quantum random walks, quantum approximation optimization algorithm (QAOA) and tree traversal. Air Force relevant functional problems in graph theory have the potential to see exponential speed-ups through the application of quantum techniques and subroutines.

Challenge Problem #1
The white paper will explore how to implement a subset of these quantum techniques/subroutines for optimization to the IBM NISQ devices in pathfinder problems, and then begin to expand to larger scale problems, especially as the devices grow/change, all with the intent to achieve and showcase scalability.

Challenge Problem #2
Benchmarking is currently difficult due to the size/scale of problems able to fit on a quantum processor and the effects of noise on the qubits (e.g., quantum decoherence). The white paper will explore methods to benchmark the above-mentioned techniques/subroutines on current quantum processors, with the potential to use techniques/subroutines that extend beyond quantum to classical comparisons (see for instance: https://www.quantamagazine.org/teenager-finds-classical-alternative-to-quantum-recommendation-algorithm-20180731/).

III. Responding to this RFP
A. White paper description of proposed research project
White paper submission is due by May 15, 2020
• All white papers should be 11-point Times or Arial font, single spaced and be a maximum of two (2) pages.
• Applicants submitting white papers must follow the white paper template (Attachment A).
• Submitters are limited to one submission.

IV. Due Dates

• The deadline for 1-2 page white papers is May 15, 2020. Proposals should be submitted via e-mail to Angela.Albanese@suny.edu. Please use, “AFRL Quantum Warrior Challenge White Paper,” in the subject line.

V. Evaluation Process

White papers will be reviewed by members of the AFRL Quantum Information Science Team and will be notified of acceptance or denial by May 29, 2020. White papers that meet the selection criteria will be invited to access the IBM Q Network.