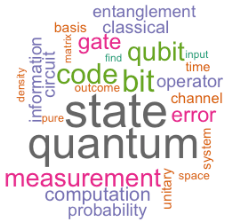

Contribution ID: **3** Type: **not specified**

Machine Learning of a Higgs Decay Classifier via Quantum Annealing

Wednesday, 6 December 2017 10:00 (1 hour)

In this talk, we describe how we used quantum and classical annealing (probabilistic techniques for approximating the global maximum or minimum of a given function) to solve a Higgs-signal-versus-background machine learning optimization problem, and mapped it to a problem of finding the ground state of a corresponding Ising spin model. We build a set of weak classifiers based on the kinematic observables of the Higgs decay photons, which we then use to construct a strong classifier. This strong classifier is highly resilient against overtraining and against errors in the correlations of the physical observables in the training data, which may result from the use of event generators in high-energy physics. We show that the resulting quantum and classical annealing-based classifier systems perform comparably to the state-of-the-art machine learning methods that are currently used in particle physics for this test case. However, in contrast to these methods, the annealing-based classifiers are simple functions of directly interpretable experimental parameters with clear physical meaning. The annealer-trained classifiers demonstrate some advantage over traditional machine learning methods for small training datasets. Given the relative simplicity of the algorithm and its robustness to error, this technique may find application in other areas of experimental particle physics, such as real-time decision making in event-selection problems and provides a proof of principle for future work on machine learning applications of quantum and digital annealing machines.

Presenter: JOB, Joshua (University of Southern California)