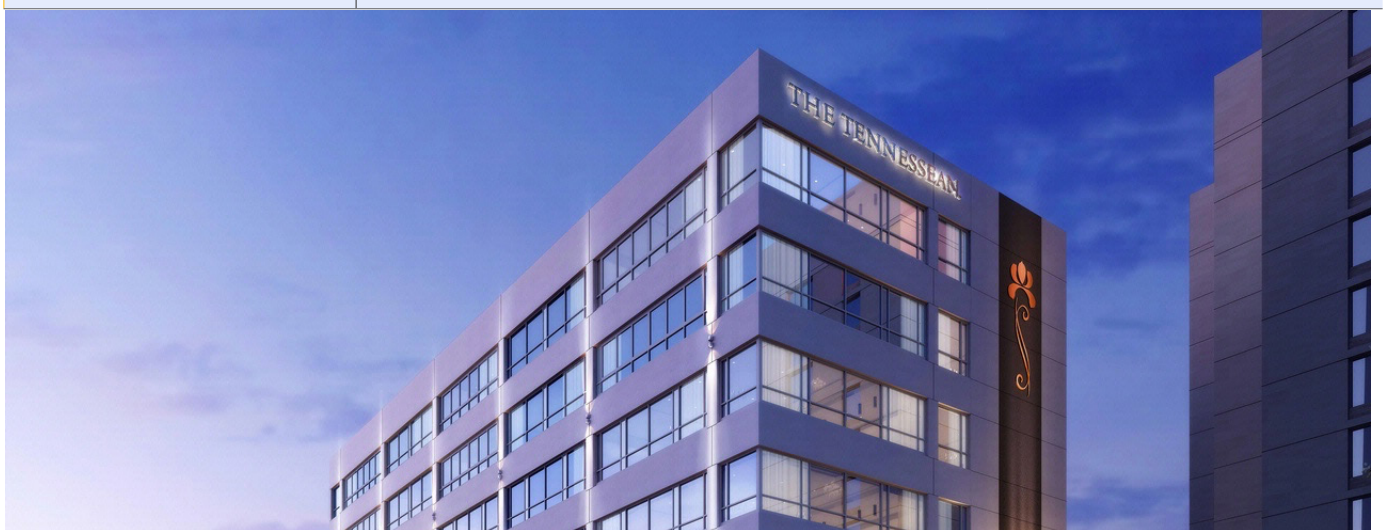
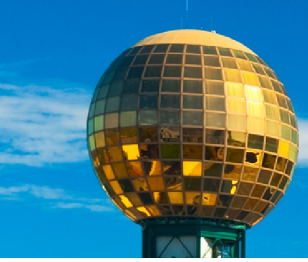
Welcome to the third D-Wave Qubits North America Users Conference! We are looking forward to hearing from users about their applications and experiences using D-Wave's quantum technology. D-Wave will also give attendees a preview of our roadmap and plans for the coming years.

Here is the agenda for the conference. Please let us know if you have any questions or need anything during the week.

The D-Wave team

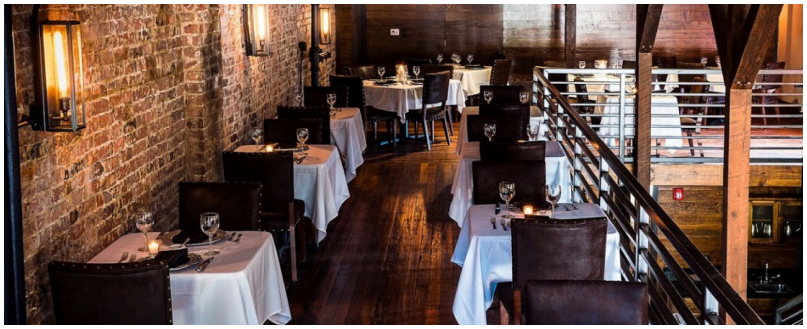
TIME	SESSION
Welcome: Monday, Sept 24	
Late afternoon	Guests staying at hotel arrive at the Tennessean Hotel, 531 Henley St, Knoxville, TN 37902
6:00 PM	Registration and Reception: Park Pavilion Cumberland/Leconte room, adjacent to Tennessean Hotel





QUBITS 2018

Day 1: Tuesday, Sept 25		Medallion room
7:30 AM	Breakfast and Registration	Pavilion Pre-Function room
WELCOME		
8:30 AM	Welcome to Qubits!	Bo Ewald, D-Wave; Jeff Nichols, Oak Ridge National Laboratory
D-WAVE DIRECTIONS		
9:00 AM	Company Update	Vern Brownell, D-Wave
9:30 AM	System Roadmap	Jed Whittaker, D-Wave
10:00 AM	Break	
10:15 AM	Software and Cloud for Quantum Application Development	Murray Thom, D-Wave
SITE REPORTS		
10:50 AM	Lockheed Martin / USC ISI Google / NASA Ames / USRA Los Alamos National Laboratory (LANL) Oak Ridge National Laboratory (ORNL)	Julia Kwok, Lockheed Martin Stuart Hadfield , NASA / USRA Scott Pakin, LANL Travis Humble, ORNL
12:00 PM	Lunch	Carriage/Crystal room
APPLICATIONS : OPTIMIZATION		
1:00 PM	Telecoms Network Optimisation on the D-Wave 2000Q System	Cathy White - British Telecom (remote)
1:30 PM	Quantum Computation in a Topological Data Analysis Pipeline	Elizabeth Munch, Michigan State University
2:00 PM	Item Listing Optimization Considering Diversity in E-commerce Websites and Introduction of DSL for QUBOs	Kotaro Tanahashi and Naoki Nishimura, Recruit Communications
2:30 PM	Financial Portfolio Optimization	Erica Grant, University of Tennessee
3:00 PM	Break	
3:15 PM	Multilevel Quantum Annealing for Graph Partitioning	Hayato Ushijima-Mwesigwa, Clemson University
3:45 PM	An Approach to Quantum-Computational Hydrologic Inverse Analysis	Dan O'Malley, LANL
4:15 PM	Day 1 Wrapup	Bo Ewald, D-Wave
4:30 PM - 5:45 PM	Birds of a Feather: Next Gen Processor Discussion and User Feedback	Mark Johnson, Andrew Berkley, D-Wave
7:00 PM	**Dinner: Lonesome Dove 100 N Central St, Knoxville, TN 37902**	



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QUBITS 2018

Day 2: Wednesday, Sept 26		Medallion room
7:30 AM	Breakfast	Pavilion Pre-Function room
8:30 AM	A NASA Perspective on Quantum Computing: Opportunities and Challenges	Stuart Hadfield , NASA
APPLICATIONS : MACHINE LEARNING		
9:00 AM	Case Studies in Machine Learning via Quantum Annealing	Richard Li, USC/ISI
9:45 AM	Bayesian Networks based Hybrid Quantum-Classical Machine Learning	Radhakrishnan Balu, US Army Research Lab
10:15 AM	Break	
10:30 AM	Graph Clustering Approaches using Quantum Annealing	Sue Mniszewski, LANL
11:00 AM	Classical and Noncommutative Boltzmann Machines: Update from the Magnolia State	Mark Novotny, Mississippi State University
SOFTWARE TOOLS and METHODS		
11:30 AM	Ocean Tools	Victoria Goliber, D-Wave
12:00 PM	The D-Wave System: New Features and Parameters	Cathy McGeoch, D-Wave
12:30 PM	Lunch	Carriage/Crystal room
1:30 PM	Programmation d'un D-Wave en Logique	Scott Pakin, LANL
2:00 PM	Interpolation and Curve Fitting with Quantum Annealing	Jason Chang, Riken
2:30 PM	Methods to Improve the Minimization of an Ising Objective Function	John Dorband, University of Maryland, Baltimore County
3:00 PM	Break	
3:15 PM	Efficiently Embedding QUBO Problems on Adiabatic Quantum Computers	Prasanna Date, Rensselaer Polytechnic Institute
3:45 PM	Optimizing Quantum Annealing Performance via Quantum Control	Gregory Quiroz, JHU/APL
4:15 PM	Our Target Applications and Embedding Algorithm of Subproblem	Shuntaro Okada, Masayoshi Terabe, DENSO
4:45 PM	T-QARD and DENSO: A Great Collaboration for Factory Optimization	Masayuki Ohzeki, Tohoku University
5:15 PM	Quantum Programming Infrastructure	Alex McCaskey, ORNL
5:45 PM	Day 2 Wrapup	Bo Ewald, D-Wave
6:00 PM - 7:30 PM	Reception and Poster Session : Carriage and Crystal Room	**Poster Abstracts on Page 4**

Day 3: Thursday, Sept 27		Medallion room
7:30 AM	Breakfast	Pavilion Pre-Function room
MATERIALS SIMULATION AND OTHER NEW AREAS		
8:30 AM	Phase Transitions in a Programmable Quantum Spin Glass Simulator	Jed Whittaker, D-Wave
9:00 AM	Kosterlitz-Thouless (KT) Transition using Quantum Annealing	Andrew King, D-Wave
9:30 AM	Quantum Annealing for Factorization and Quantum Chemistry	Sabre Kais and Shuxian Jiang, Purdue University
10:00 AM	Break	
10:15 AM	Near-term Applications in Industry	Florian Neukart, Volkswagen
10:45 AM	Simulating Electronic Structure on Noisy Quantum Hardware: From Gate to Annealing Models	Scott Genin, OTI Lumionics
11:15 AM	Quantum Magnets as a Test-bed for New Physics	Alan Tennant, ORNL
11:45 AM	Wrapup	Bo Ewald, D-Wave
12:00 PM	Lunch to Go	

QUBITS 2018

Poster Session Abstracts

Wednesday 6:00 PM - 7:30 PM Reception and Poster Session

D-Wave Cloud: Find out more and see live demonstrations!
Meet with: Alan Baratz, EVP R&D and Chief Product Officer and Murray Thom, Director of Application Development Technologies and Tools

Poster Title: Preprocessing of quantum annealing with non-transverse field type quantum fluctuation
Author: Shu Tanaka (Waseda University, PRESTO, JST)
We considered the preprocessing of quantum annealing with non-transverse field type quantum fluctuation toward the construction of high-performance combinatorial optimization. In the conventional quantum annealing, a time-dependent transverse Ising model is considered. Recently a couple of groups have considered quantum annealing in which nonstoquastic Hamiltonian is used, or classical "noise" is introduced. We found that we should take care of a preprocessing for the classical Hamiltonian which represents combinatorial optimization problems we want to solve. In the poster presentation, our proposed preprocessing scheme and the effect of preprocessing for combinatorial optimization problems with/without constraints will be given.

Poster Title: A Classical-Quantum Hybrid Approach for Unsupervised Probabilistic Machine Learning
Author: Prasanna Date (Rensselaer Polytechnic Institute)
Deep Learning has been shown to perform extremely well on both supervised and unsupervised learning tasks under the classical computation paradigm using Graphic Processing Units (GPU)s. While GPUs are good at matrix operations, they rely on pseudo-random number generators to generate samples for training probabilistic deep learning networks in an unsupervised learning setting. Adiabatic Quantum Processors (AQP), on the other hand, rely on quantum mechanical systems to generate such samples accurately and quickly, but are not suited to perform large-scale matrix operations currently, owing to limitations on the number of qubits available, and difficulty in sustaining inter-qubit coupling strengths over longer periods of time (more than a few milliseconds). We present a Classical-Quantum Hybrid Approach to perform unsupervised learning tasks leveraging GPUs to perform matrix-related operations and the D-Wave quantum Boltzmann sampling library to generate samples for training. We compare this hybrid approach to classical and quantum approaches by training Restricted Boltzmann Machines (RBM)s and Deep Belief Networks (DBN)s on the MNIST dataset. We use Matrix Computation Time (MCT), Sampling Time (ST), Training Reconstruction Error and Validation Reconstruction Error as our performance metrics for this comparison and also compute the design index. Our results indicate that the hybrid approach outperforms some of the classical and quantum approaches on the above performance metrics. Furthermore, we compare sample generation on the AQP to sample generation using D-Wave's quantum Boltzmann sampling library for smaller problems, which can be accommodated on the AQP. We observe that the AQP outperforms the sampling library on these tasks.

Poster Title: Adaptive Quantum Monte Carlo method for a class of non-stoquastic Hamiltonian by using D-Wave machine
Author: Shunta Arai (Tohoku University)
We develop a new scheme to sample spin configurations from the D-Wave 2000Q with a class of non-stoquastic Hamiltonian [1]. In general, we can not efficiently simulate non-stoquastic Hamiltonian because of the negative sign problem. However, we can simulate a limited class of non-stoquastic Hamiltonian by utilizing adaptive Quantum Monte Carlo method [2]. By adaptively changing the strength of the transverse field which is related to the transverse magnetization, we can simulate a class of non-stoquastic Hamiltonian. This method needs the precise estimation of the transverse magnetization by Monte Carlo simulation. In this research, we apply this algorithm to D-Wave 2000Q to accelerate adaptive quantum Monte Carlo simulation. We take one-dimensional and two-dimensional transverse field Ising model with ferromagnetic or anti-ferromagnetic XX interaction which is all to all connection. We compare this experimental result with numerical experiments by aid of the classical computer for performing the quantum Monte-Carlo simulation. This result gives us a testbed of a next-generation quantum annealer implementing non-stoquastic Hamiltonian.

[1] S.Arai and M.Ohzeki to appear soon
[2] M. Ohzeki: Sci. Rep. (2017) 41186.

Poster Title: A Novel Algebraic Geometry Compiling Framework for Adiabatic Quantum Computation
Author: Raouf Dridi, Hedayat Alghassi, Sridhar Tayur (Carnegie Mellon University)
Adiabatic Quantum Computing (AQC) is an attractive paradigm for solving hard integer polynomial optimization problems, as it is robust to environmental noise. Available hardware restricts the Hamiltonians to be of a structure that allows only pairwise interactions, an aspect that will likely remain for the foreseeable future. In this paper, we develop a systematic computational approach (using Algebraic Geometry) to prepare a given polynomial optimization problem for AQC. Our paper thus provides the first general purpose computational procedure that can be used directly as a translator to solve polynomial integer optimization. Alternatively, it can be used as a test-bed (with small size problems) to help design efficient heuristic quantum compilers by studying various choices of reductions and embeddings in a systematic and comprehensive manner. An added benefit of our framework is in designing Ising architectures through the study of Y minor universal graphs.
Poster Title: A Novel Algebraic Geometry Compiling Framework for Adiabatic Quantum Computation

Poster Title: CDL Quantum Program
Author: Khalid Kurji (Creative Destruction Lab)
The QML Stream at CDL-Toronto is an objective-based program where founders build startups at the intersection of quantum computing and machine learning. Through a technical bootcamp, hackathon, and five mentorship session, the program brings together entrepreneurs, investors, AI experts, leading quantum information researchers, and technology partners including D-Wave. Find out about the CDL's process and the progress of its new companies as they leverage quantum computing for many important areas.