

Science Week - 2019



Report of Contributions

Contribution ID: 1

Type: **not specified**

Welcome

Wednesday, August 21, 2019 8:30 AM (5 minutes)

Primary author: Dr DILLING, Jens (TRIUMF)

Presenter: Dr BAGGER, Jonathan (TRIUMF)

Session Classification: ISAC20 Symposium

Contribution ID: 2

Type: **not specified**

Introduction

Wednesday, August 21, 2019 8:35 AM (10 minutes)

Presenter: Dr BALL, Gordon (TRIUMF)

Session Classification: ISAC20 Symposium

Contribution ID: 3

Type: **not specified**

ISAC RIB Production Systems and target development

Wednesday, August 21, 2019 8:45 AM (20 minutes)

Presenter: Dr BRICAULT, Pierre

Session Classification: ISAC20 Symposium

Contribution ID: 4

Type: **not specified**

ISAC Source Development

Wednesday, August 21, 2019 9:05 AM (20 minutes)

Presenter: Dr LASSEN, Jens (TRIUMF)

Session Classification: ISAC20 Symposium

Contribution ID: 5

Type: **not specified**

ISAC Linear Accelerators

Wednesday, August 21, 2019 9:25 AM (20 minutes)

Presenter: LAXDAL, Robert (TRIUMF)

Session Classification: ISAC20 Symposium

Contribution ID: 6

Type: **not specified**

Welcome

Thursday, August 22, 2019 8:30 AM (5 minutes)

Presenter: Dr BAGGER, Jonathan (TRIUMF)

Session Classification: TUG AGM

Contribution ID: 7

Type: **not specified**

Introduction

Thursday, August 22, 2019 8:35 AM (10 minutes)

Presenter: Dr KWIATKOWSKI, Anna (TRIUMF)

Session Classification: TUG AGM

Contribution ID: 8

Type: **not specified**

Physical Sciences Division Report

Thursday, August 22, 2019 8:45 AM (25 minutes)

Presenter: Prof. DILLING, Jens (TRIUMF)

Session Classification: TUG AGM

Contribution ID: 9

Type: **not specified**

Life Sciences Division Report

Thursday, August 22, 2019 9:10 AM (25 minutes)

Presenter: Dr HOEHR, Cornelia (TRIUMF)

Session Classification: TUG AGM

Contribution ID: **10**

Type: **not specified**

Accelerator Division Report

Thursday, August 22, 2019 9:35 AM (25 minutes)

Presenter: Dr KESTER, Oliver (TRIUMF)

Session Classification: TUG AGM

Contribution ID: 11

Type: **not specified**

Update to TRIUMF Governance

Thursday, August 22, 2019 10:00 AM (15 minutes)

Presenter: Dr BAGGER, Jonathan (TRIUMF)

Session Classification: TUG AGM

Contribution ID: 12

Type: **not specified**

Update to TRIUMF Org Chart

Thursday, August 22, 2019 10:15 AM (15 minutes)

Presenter: ABOUD, Anne Louise (TRIUMF)

Session Classification: TUG AGM

Contribution ID: 13

Type: **not specified**

Update to TRIUMF Org Chart

Presenter: ABOUD, Anne Louise (TRIUMF)

Contribution ID: 14

Type: **not specified**

TRIUMF Users Office

Thursday, August 22, 2019 11:00 AM (15 minutes)

Presenter: Dr PAVAN, Marcello (TRIUMF)

Session Classification: TUG AGM

Contribution ID: 15

Type: **not specified**

Beam time planning for 2020

Thursday, August 22, 2019 11:15 AM (25 minutes)

Presenter: Prof. KRUECKEN, Reiner (TRIUMF)

Session Classification: TUG AGM

Contribution ID: 16

Type: **not specified**

Q&A with TRIUMF Management

Thursday, August 22, 2019 11:40 AM (50 minutes)

Session Classification: TUG AGM

Contribution ID: 17

Type: **not specified**

New electron gun for the TITAN-EBIT (Student Prize Talk)

Thursday, August 22, 2019 1:30 PM (15 minutes)

Presenter: DIETRICH, Kilian (TRIUMF)

Session Classification: TUG AGM

Contribution ID: **18**

Type: **not specified**

TUG Poster Slam!

Thursday, August 22, 2019 1:45 PM (1h 30m)

Session Classification: TUG AGM

Contribution ID: **19**

Type: **not specified**

TUG Poster Session

Contribution ID: 20

Type: **not specified**

Ab initio predictions of light nuclei

Thursday, August 22, 2019 4:00 PM (15 minutes)

Presenter: Dr MCCOY, Anna

Session Classification: TUG AGM

Contribution ID: 21

Type: **not specified**

Range Verification in Proton Therapy using a Tumor Marker and Gamma Ray Spectroscopy

Thursday, August 22, 2019 4:15 PM (15 minutes)

Presenter: Prof. MUECHER, Dennis

Session Classification: TUG AGM

Contribution ID: 22

Type: **not specified**

Current-Induced Non-Magnetic State in Mott Insulator Ca₂RuO₄

Thursday, August 22, 2019 4:30 PM (15 minutes)

Presenter: Prof. LUKE, Graeme

Session Classification: TUG AGM

Contribution ID: 23

Type: **not specified**

ALPHA, the Trapped Antihydrogen Experiment: Status and Prospects

Thursday, August 22, 2019 4:45 PM (15 minutes)

Presenter: Dr CAPRA, Andrea

Session Classification: TUG AGM

Contribution ID: 24

Type: **not specified**

TUG News and Information

Thursday, August 22, 2019 5:00 PM (15 minutes)

Presenter: Prof. GRINYER, Gwen (University of Regina)

Session Classification: TUG AGM

Contribution ID: 25

Type: **not specified**

Student Prize Announcements

Thursday, August 22, 2019 5:15 PM (15 minutes)

Session Classification: TUG AGM

Contribution ID: 26

Type: **not specified**

Angular correlation measurements at ISAC: using the atomic nucleus to search for BSM physics for 20 yrs

Wednesday, August 21, 2019 10:35 AM (20 minutes)

Presenter: Prof. MELCONIAN, Dan

Session Classification: ISAC20 Symposium

Contribution ID: 27

Type: **not specified**

Superallowed Fermi Beta Decay: Two decades of fundamental research at ISAC

Wednesday, August 21, 2019 10:55 AM (20 minutes)

Presenter: Prof. GRINYER, Gwen (University of Regina)

Session Classification: ISAC20 Symposium

Contribution ID: 28

Type: **not specified**

Early Days of beta-NMR at TRIUMF

Wednesday, August 21, 2019 11:15 AM (20 minutes)

Presenter: Prof. KIEFL, Rob (TRIUMF and UBC)

Session Classification: ISAC20 Symposium

Contribution ID: 29

Type: **not specified**

ISAC's continuing mission to explore the stars

Wednesday, August 21, 2019 11:35 AM (30 minutes)

Presenter: Prof. LAIRD, Alison (York University)

Session Classification: ISAC20 Symposium

Contribution ID: **30**

Type: **not specified**

Twenty+ years of ab initio nuclear theory

Wednesday, August 21, 2019 12:05 PM (25 minutes)

Presenter: Dr NAVRATIL, Petr (TRIUMF)

Session Classification: ISAC20 Symposium

Contribution ID: 31

Type: **not specified**

Unmasking nuclear halo features with two decades of ISOL beams at TRIUMF

Wednesday, August 21, 2019 1:45 PM (25 minutes)

Presenter: Prof. KANUNGO, Rituparna (Saint Mary's University)

Session Classification: ISAC20 Symposium

Contribution ID: 32

Type: **not specified**

The Emergence of nuclear-shell-model studies at ISAC

Wednesday, August 21, 2019 4:10 PM (25 minutes)

Presenter: Dr KWIATKOWSKI, Anna (TRIUMF)

Session Classification: ISAC20 Symposium

Contribution ID: 33

Type: **not specified**

Nuclear shapes, coexistence and collective behaviors studied at ISAC

Wednesday, August 21, 2019 2:10 PM (25 minutes)

Presenter: Dr GARNSWORTHY, Adam (TRIUMF)

Session Classification: ISAC20 Symposium

Contribution ID: 34

Type: **not specified**

Indirect studies of astrophysics around the Coulomb barrier

Wednesday, August 21, 2019 2:35 PM (20 minutes)

Presenter: Dr DAVIDS, Barry (TRIUMF)

Session Classification: ISAC20 Symposium

Contribution ID: 35

Type: **not specified**

From structural distortions to weak magnetism - exploring the capabilities of beta-NMR

Wednesday, August 21, 2019 2:55 PM (20 minutes)

Presenter: Dr SALMAN, Zaher

Session Classification: ISAC20 Symposium

Contribution ID: 36

Type: **not specified**

Application of ISAC facility for production of medical radionuclides: past, present and future perspectives

Wednesday, August 21, 2019 9:45 AM (20 minutes)

Presenter: Dr RADCHENKO, Valery (TRIUMF)

Session Classification: ISAC20 Symposium

Contribution ID: 37

Type: **not specified**

Francium: Uranium and hydrogen baked into one

Wednesday, August 21, 2019 4:35 PM (20 minutes)

Presenter: Prof. GWINNER, Gerald (University of Manitoba)

Session Classification: ISAC20 Symposium

Contribution ID: **38**

Type: **not specified**

Advances in beta-NMR @ ISAC

Wednesday, August 21, 2019 4:55 PM (20 minutes)

Presenter: Dr DUNSIGER, Sarah (TRIUMF)

Session Classification: ISAC20 Symposium

Contribution ID: 39

Type: **not specified**

Pushing the limits: Towards the neutron drip line with ISAC

Wednesday, August 21, 2019 3:45 PM (25 minutes)

Presenter: Dr DILLMANN, Iris (TRIUMF)

Session Classification: ISAC20 Symposium

Contribution ID: 40

Type: **not specified**

Symposium Summary

Wednesday, August 21, 2019 5:15 PM (10 minutes)

Presenter: Prof. SHOTTER, Alan

Session Classification: ISAC20 Symposium

Contribution ID: 41

Type: **not specified**

Deep Learning Applications to Medical Imaging

Friday, August 23, 2019 1:30 PM (30 minutes)

Medical imaging has revolutionized medicine. Now medical imaging itself is witnessing a deep learning revolution. Clinically-relevant medical image interpretation tasks (e.g. image segmentation and image classification) have been re-formulated under a deep learning framework with impressive results. These early successes have been attributed to three factors: data, learning algorithms, and fast computation. I will present examples of deep learning applications to medical imaging from our research group highlighting the versatility, opportunities, and challenges in this area (website: www.MedicalImageAnalysis.com).

Primary author: Dr HAMARNEH, Ghassan

Presenter: Dr HAMARNEH, Ghassan

Session Classification: Data Science and Quantum Computing Workshop

Contribution ID: 42

Type: **not specified**

Hands on Machine Learning session

Friday, August 23, 2019 8:30 AM (2 hours)

We will develop a deep learning solution for event classification in a particle physics experiment

Presenter: Dr FEDORKO, Wojciech (TRIUMF)

Session Classification: Data Science and Quantum Computing Workshop

Track Classification: Data Science and Quantum Computing Workshop

Contribution ID: 43

Type: **not specified**

Hands-on Session: Developing Quantum Applications in Q#

Friday, August 23, 2019 11:00 AM (1h 30m)

In this workshop, participants will learn to use the Quantum Development Kit and the Q# programming language to develop quantum applications and test them using simulators. The workshop consists of a short lecture and a series of hands-on exercises, covering a wide variety of tasks and concepts. No prior software installation needed to participate, all materials are available online.

Presenter: Dr GRANADE, Christopher (Microsoft)

Session Classification: Data Science and Quantum Computing Workshop

Contribution ID: 44

Type: **not specified**

Projects at TRIUMF

Friday, August 23, 2019 4:00 PM (3 minutes)

A foreword on Machine Learning projects started at TRIUMF

Presenter: Dr FEDORKO, Wojciech (TRIUMF)

Session Classification: Data Science and Quantum Computing Workshop

Contribution ID: 45

Type: **not specified**

Quantum Variational Autoencoders and their applications

Friday, August 23, 2019 2:00 PM (30 minutes)

Generative models are among the most promising approaches toward understanding unlabelled data. They have a wide range of applications in structured prediction, molecular & material design, image analysis, speech synthesis, and computer vision. They pair with supervised learning models to help perform ML tasks when labelling data is expensive or labels are only available in a different domain.

Quantum Boltzmann machine is a powerful generative model that can naturally be implemented on a quantum annealing device. However, the development of quantum-classical hybrid (QCH) algorithms is critical to deploy state-of-the-art computational models on current commercially available devices. A Quantum Variational Autoencoder (QVAE) is one such hybrid algorithm that consists of a latent generative process, formalized as a quantum or classical Boltzmann machine (QBM or BM). A quantum annealing processor is used for sampling from the Boltzmann prior distribution. The classical autoencoding structure is realized by a deep neural network, which allows inference to and generating samples from, the latent space. We have successfully employed D-Wave quantum annealers as Boltzmann samplers to train end-to-end QVAE. The hybrid structure of QVAE allows us to deploy current quantum annealing devices in a QCH generative model with latent variables that achieves competitive performance on datasets such as MNIST.

Presenter: Dr SADEGHI, Hossein (D-Wave)

Session Classification: Data Science and Quantum Computing Workshop

Contribution ID: 46

Type: **not specified**

Enhancing quantum simulators with neural networks

Friday, August 23, 2019 2:30 PM (30 minutes)

The recent advances in qubit manufacturing and coherent control of synthetic quantum matter are leading to a new generation of intermediate scale quantum hardware, with promising progress towards scalable simulation of quantum matter and materials. In order to enhance the capabilities of this class of quantum devices, some of the more arduous experimental tasks can be off-loaded to classical algorithms running on conventional computers. In this talk, I will present recent efforts in deploying machine learning algorithms on data generated by quantum simulators, and show how neural networks can be trained to detect quantum phase transitions and reconstruct experimental wavefunctions.

Primary author: Dr TORLAI, Giacomo (Flatiron Institute)

Presenter: Dr TORLAI, Giacomo (Flatiron Institute)

Session Classification: Data Science and Quantum Computing Workshop

Contribution ID: 47

Type: **not specified**

Quantum Algorithms for Solving Dynamic Programming Problems

Friday, August 23, 2019 3:00 PM (30 minutes)

We introduce quantum algorithms for solving finite-horizon and infinite-horizon dynamic programming problems. We visit the query complexity lower bounds for classical randomized algorithms for the same tasks and consequently demonstrate a polynomial separation between the query complexity of our quantum algorithms and best-case query complexity of classical randomized algorithms. Up to polylogarithmic factors, our quantum algorithms provide quadratic advantage in terms of the numbers of states and actions in the dynamic programming problem. Nevertheless, the speed-up achieved is at the expense of appearance of other polynomial factors in the scaling of the algorithm which contribute to the precision of the solution. Our framework pertains to discrete and combinatorial optimization problems solved classically using dynamic programming techniques. As an example, we show how quantum computers can solve the travelling salesperson problem quadratically faster than the Bellman–Held–Karp algorithm does.

Primary author: Dr RONAGH, Pooya (1QBit, IQC, UW)

Presenter: Dr RONAGH, Pooya (1QBit, IQC, UW)

Session Classification: Data Science and Quantum Computing Workshop

Contribution ID: 48

Type: **not specified**

Expressive Structured Representations in Deep Generative Models

Friday, August 23, 2019 4:40 PM (25 minutes)

Deep generative models, such as variational autoencoders and generative adversarial networks, are among the most exciting recent developments in machine learning. Variational autoencoders, in particular, have seen a tremendous rise in popularity due to their principled variational framework and powerful neural approximations to previously infeasible inference tasks, including marginal and posterior inference with arbitrary distributions. Their applications comprise a broad range of topics in computer science, such as image and video synthesis, temporal forecasting, and feature learning.

In this talk, we first revisit the basic principles of variational autoencoders with a focus on the underlying implicit modeling assumptions. Using these insights, we identify their representational limitations and reinterpret them from the viewpoint of probabilistic graphical models. Finally, we discuss a structure learning approach that overcomes these limitations through an explicit and dynamic encoding of latent dependencies, leading to an efficient and more expressive variant of traditional variational learning. The benefits of this approach will be illustrated with applications in computer vision and computer graphics.

Short Bio

Andreas Lehrmann works at the intersection of machine learning, quantitative finance, and computer vision. His research focuses on the development of expressive neural architectures for structured data and approximate methods for the associated inference tasks. He is also interested in deep generative models exploiting contextual information in non-stationary time-series. Fields of application in finance and vision include volatility and hedging of derivatives, natural language processing, conditional video synthesis, and scene understanding. Before assuming his current role as a machine learning research team lead with Borealis AI, Andreas was a postdoctoral research scientist at Facebook Reality Labs and Disney Research (United States). Prior to that, he was a Microsoft Research Ph.D. scholar at ETH Zurich (Switzerland) and the Max-Planck-Institute for Intelligent Systems (Germany).

Presenter: Dr LEHRMANN, Andreas

Session Classification: Data Science and Quantum Computing Workshop

Contribution ID: 49

Type: **not specified**

Solving Technological Challenges with the Fujitsu Digital Annealer

Friday, August 23, 2019 5:05 PM (25 minutes)

The Fujitsu Digital Annealer is a new technology that is used to solve large-scale combinatorial optimization problems instantly. The Digital Annealer uses a digital circuit design and can solve problems which are intractable for classical computers. In this workshop, we introduce how the Digital Annealer works for solving combinatorial optimization problems with use cases drawn from scientific fields including health care, pharmaceuticals, and physics. Included is an introduction to expressing technical problems in a quadratic unconstrained binary optimization (QUBO) format for solution using the Digital Annealer.

Presenters: Mr ENGLISH, Jeffrey (Fujitsu); Mr OZAKI, Tadayoshi (Fujitsu)

Session Classification: Data Science and Quantum Computing Workshop

Track Classification: Data Science and Quantum Computing Workshop

Contribution ID: 63

Type: **not specified**

Variational AutoEncoders (VAEs) for water Cherenkov detectors

Friday, August 23, 2019 4:03 PM (18 minutes)

A Variational AutoEncoder (VAE) is a generative method used to approximate the probability distribution of processes in very high dimensional spaces. We apply VAEs for generative modelling of Water Cherenkov detectors which are used to perform precision measurements on neutrinos. In this talk, I will discuss the steps and challenges in applying VAEs to simulated neutrino events in the proposed Intermediate Water Cherenkov Detector (IWCD). Initial results from the project show promise in the application of VAEs for synthetic data generation and unsupervised learning from labelled and unlabelled datasets.

Presenter: Mr KAJAL, Abhishek (TRIUMF/University of Manitoba)

Session Classification: Data Science and Quantum Computing Workshop

Track Classification: Data Science and Quantum Computing Workshop

Contribution ID: 64

Type: **not specified**

Extrapolating Nuclear Many-Body Calculations with Constrained Gaussian Processes

Friday, August 23, 2019 4:21 PM (19 minutes)

The properties of nuclei can be computed from first principles starting from realistic interactions between nucleons. Using suitable basis functions, the many-body wavefunction is found by diagonalizing a Hamiltonian matrix (i.e. solving the Schrödinger equation).

Due to limited computational resources only a finite basis size can be used. This is frequently insufficient for complete convergence. The “true value” of a calculated quantity (e.g. ground state energy) is predicted by extrapolating to infinite basis size.

The functional form of such an extrapolation is unknown but by the variational principle the signs of the derivatives are known. In this work we use knowledge of monotonicity and convexity to constrain a Gaussian Process (GP) model and predict ground state energies.

A GP is a machine learning tool which generates a distribution of viable functions which satisfy known data points. It is easy to compute and automatically produces uncertainties on predictions. However, applying derivative constraints is not simple and requires iteratively tightening the constraints and improving the GP model via Sequential Monte Carlo.

This novel method shows promise in providing more meaningful confidence intervals on theoretical predictions than existing methods, allowing a more useful comparison to experiment.

Presenter: Mr GYSBERS, Peter

Session Classification: Data Science and Quantum Computing Workshop