

Cohort Project update

Cohort 4

Quantum Engineering CDT
University of Bristol

May 24, 2018



¹<https://uob.sharepoint.com/:p:/r/teams/QECDT/Shared%20Documents/Cohort%20Project/>

Survey results

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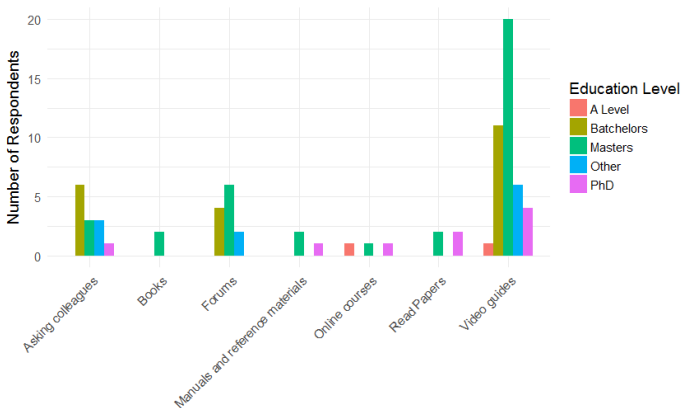


Figure: Results from onedrive ²

²[https://uob.sharepoint.com/:w:/r/teams/QECDT/Shared%20Documents/Cohort%20Project/Survey%](https://uob.sharepoint.com/:w:/r/teams/QECDT/Shared%20Documents/Cohort%20Project/Survey%20Results)

Survey results

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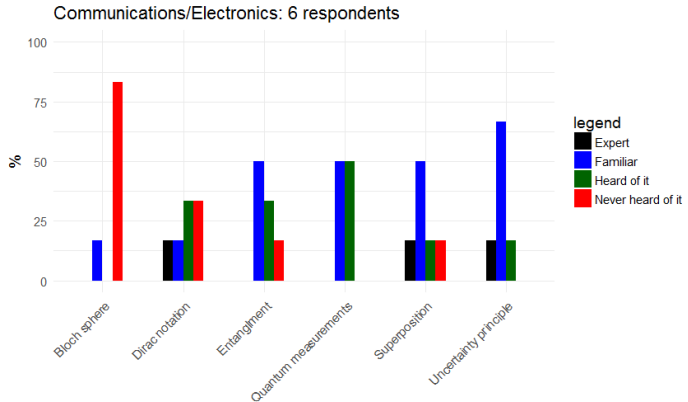


Figure: Results from onedrive ³

³[https://uob.sharepoint.com/:w:/r/teams/QECDT/Shared%20Documents/Cohort%20Project/Survey%](https://uob.sharepoint.com/:w:/r/teams/QECDT/Shared%20Documents/Cohort%20Project/Survey%20Results)

Sections we plan to include

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Quantum Meta-Programming for Dummies

Cohort 4
Quantum Engineering CDT
University of Bristol
May 11, 2018

1 Preface

This is where the preface will be

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Figure: Current document ⁴

Current work

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25 Apr 2018

Quantum machine learning for data scientists

David Kopecký
Queen's University, Manchester, United Kingdom

This text aims to present and explain quantum machine learning algorithms to a data scientist in an accessible and consistent way. The algorithms and equations presented are not written in rigorous mathematical notation, instead, the premise is put on examples and step by step explanation of different topics. This contribution gives an overview of selected quantum machine learning algorithms, however there is also a method of feature extraction for quantum PCA algorithm proposed as well as a new cost function in feed-forward quantum neural networks is introduced. The text is divided into four parts: the first part explains the basic quantum theory, then quantum computation and quantum computer architectures are explained in section two. The third part presents quantum algorithms which will be used as subroutines in quantum machine learning algorithms. Finally, the fourth section describes quantum machine learning algorithms with the use of knowledge accumulated in previous parts.

Contents

I. Introduction

10 Apr 2018

Quantum Algorithm Implementations for Beginners

Patrick J. Côté, Stephan Eidenberg,[†] Scott Pakin, Adetokunbo Adedoyin, John Ambrose, Petr Anisimov, William Cragg, Gopaltha Chennupati, Carsten Coffrin, Hiroo Dojima, David Gao, Saeed Kaya, Nathan Leseau, Shuang Lin, Andrey Lukhov, Alexander Malyukov, David Mauerer, Susan Matsuoka, Bala Nalliah, Dan O'Malley, Dima Ouy, Lakshman Prasad, Randy Roberts, Phil Romero, Nandakishore Sankar, Nikolai Shubin, Pieter Swart, Alan Velling, Jan Wenzelberger, Idriss Youn, Richard Zou, and Wei Zhu
Los Alamos National Laboratory, Los Alamos, New Mexico, USA

As quantum computers have become available to the general public, the need has arisen to train a cohort of quantum programmers, many of whom have been developing classic computer programs for most of their career. While currently available quantum computers have less than 100 qubits, quantum computer hardware is widely expected to grow in terms of qubit counts, quality, and connectivity. Our article aims to explain the principles of quantum programming, which are quite different from classical programming, with straight-forward algebra that makes understanding the underlying quantum mechanics optional (but still fascinating). We give an introduction to quantum computing algorithms and their implementation on real quantum hardware. We survey 20 different quantum algorithms, attempting to describe each in a concise and self-contained fashion; we show how they are implemented on IBM's quantum computer and in each case we discuss the results of the implementation with respect to differences of the simulator and the actual hardware runs. This article introduces computer scientists and engineers to quantum algorithms and provides a blueprint for their implementation.

Strawberry Fields: A Software Platform for Photonic Quantum Computing

Nathan Killoran, Josh Izaac, Nicolás Quesada, Ville Bergholm, Matthew Amy, and Christian Weedbrook

Quesada, 372 Richmond St W, Toronto, M5V 1X6, Canada

We introduce Strawberry Fields, an open-source quantum programming architecture for light-based quantum computers. Built in Python, Strawberry Fields is a full-stack library for design, simulation, optimization, and quantum machine learning of continuous-variable circuits. The platform consists of three main components: (i) an API for quantum programming based on an easy-to-use language named `Blackbird`; (ii) a suite of three virtual quantum computer backends, built in `Numpy` and `Tensorflow`, each targeting specialized uses; and (iii) an engine which can compile `Blackbird` programs on various backends, including the three built-in simulators, and – in the near future – photonic quantum information processors. The library also contains examples of several paradigmatic algorithms, including teleportation, `Gaussian` boson sampling, instantaneous quantum polynomial, Hamiltonian simulation, and variational quantum circuit optimization.

h] 9 Apr 2018

Publications containing the phase *Quantum Software*

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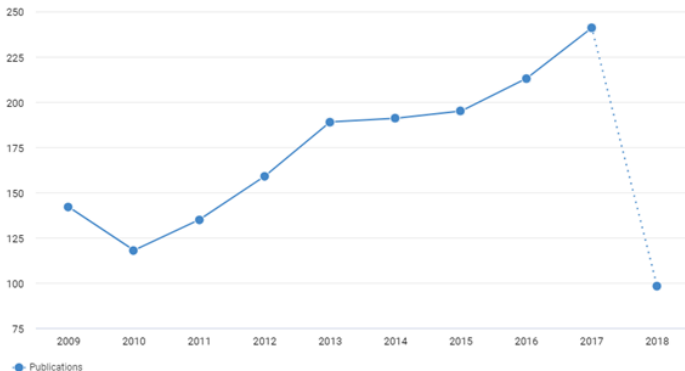


Figure: Number of publications per year ⁵

⁵https://app.dimensions.ai/analytics/publication/viz/overview-publications?search_text=Quantum%20Software&search_type=kws&full_search=false