



Launch Day – Monday 21 October 2024 at [M Shed Bristol](#)

MORNING SESSION

10:00 AM Arrival and coffee

10:15 AM Intro and Welcome [Sidharth Jaggi](#)

10:30 AM **Scheduling In Quantum Networks** [Neil Walton/ Thiru Vasantam](#)

Abstract: We assess the performance of quantum switching technologies. Such analysis is becoming increasingly important as the number of quantum networks in operation increases. Quantum switches play a crucial role in these networks by generating, distributing, and managing entanglements. Unlike traditional switching systems, quantum switches operate as a two-sided queuing network and produce Link-Level Entanglements (LLEs). These LLEs are then combined to fulfil the network's requests for entanglement. We have been able to identify an optimal the scheduling algorithm, which on a fast-timescale must solve a specific average reward Markov Decision Process. This insight opens the possibility to distributed optimization quantum switching technologies with reinforcement learning techniques.

11:00 AM **Maximal correlation and the information-theoretic Central Limit Theorem** [Oliver Johnson](#)

Abstract: I will explain how ideas from information theory can help shed light on statistical problems. I will focus on the Central Limit Theorem, showing how Barron's original proof of convergence in KL divergence has been extended to give explicit rates of convergence. By understanding this in terms of projections and eigenfunction problems, I will show how this relates to the concept of maximal correlation, a way of measuring dependence which can be useful in many AI settings.

11:30 AM 15 minute break

11:45 AM **Heterogeneous Thresholds, Social Ranking and the Emergence of Vague Categories** [Jonathan Lawry](#)

Abstract: Threshold models in which an individual's response to a particular state of the world depends on whether or not an associated measured value exceeds a given threshold, are common in a variety of social learning and collective decision making scenarios in both natural and artificial systems. If thresholds are heterogeneous across a population of agents then graded population level responses can emerge in a context in which individual responses are discrete and limited. In this paper we propose a threshold-based model for social learning of shared quality categories. This is then combined with the voting model of fuzzy categories to allow individuals to learn membership functions from their peers which can then be used for decision making including ranking a set of available options. We use agent-based simulation experiments to investigate variants of this model and compare them to an individual learning benchmark when applied to the ranking problem. These results show that a threshold-based approach combined with category based voting across a social network provides an effective social mechanism for ranking which exploits emergent vagueness.

12:15 PM Summary and discussion

12:30 PM Lunch and networking

AFTERNOON SESSION

13:30 PM Chris Swinerd (Dstl Fellow, Visiting Professor of Electromagnetic Systems, Wolfson School, Loughborough University) **INFORMED-AI CDT Launch Event – Introduction to Dstl**

Abstract: This short presentation introduces Dstl, its strategic S&T capabilities and outlines the focus of its AI Programme. Without commitment, the presentation aims to signpost the potential scope for Dstl support to the INFORMED-AI CDT.

14:00 PM Joseph Tedds (Senior Quantum Algorithm Engineer, Cambridge Consultants) **Heterogenous approaches to QML: Less quantum, more information**

Abstract: Quantum Machine Learning (QML) is a topic of great interest for near-term quantum computing. Many approaches focus on obtaining advantage from quantum by simply translating classical machine learning techniques to quantum and neglecting real-world applications. Where in a workflow should we actually use quantum and what new mathematical problems do we have to tackle classically? We consider various forms of QML and discuss two methods beyond simple quantum neural networks.

14:30 PM 30 min break

15:00 PM [Laurent Massoulié \(Scientific Director, Paris Inria Centre\)](#) **Graph Alignment: Informational and Computational limits**

Abstract: Graph alignment is a generic unsupervised learning task with many applications, from neuroscience to social network de-anonymization. The alignment of a pair of correlated random graphs turns out to be a problem in high dimensional statistics featuring a rich set of phenomena. Specifically, we shall first present results on information-theoretic limits to feasibility of graph alignment: below some threshold, the observed graphs do not contain enough information for alignment to be feasible, while above that threshold, some algorithms are known to succeed at alignment, although in exponential time. We shall then present results on computational feasibility of alignment, describing a second threshold which determines when a family of 'local', polynomial-time algorithms succeed at alignment. Together, these results show a rich phenomenology for graph alignment, displaying an 'impossible phase', a 'hard phase' and an 'easy phase' for feasibility of the task.

16:00 PM Networking opportunity

17:00 PM Close

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