



QUANTUM-INSPIRED OPTIMAL RESOURCE ALLOCATION FOR 6G

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1. ABSTRACT

Quantum computing is envisaged as an evolving paradigm for solving computationally complex optimization problems with a large-number factorization and exhaustive search. Recently, there has been a proliferating growth of the size of multi-dimensional datasets, the input-output space dimensionality, and data structures. Hence, the conventional approaches in data training and processing have exhibited their limited computing capabilities to support the sixth-generation (6G) networks with highly dynamic applications and services. In this regard, the fast developing quantum computing with machine learning and optimisation for 6G networks is investigated. Quantum-inspired optimal resource allocation algorithms can significantly enhance the processing efficiency and exponentially computational speed-up for effective quantum data representation and superposition framework, highly capable of guaranteeing high data storage and secured communications. This talk will present the state-of-the-art in quantum computing and provide a comprehensive overview of its potential, via machine learning and optimisation approaches. Furthermore, this talk will also introduces quantum-inspired optimal resource allocation for 6G networks, considering their enabling technologies and potential challenges. Finally, some dominating research issues and future research directions for the quantum-inspired machine learning and optimisation in 6G networks are elaborated.

2. SHORT BIO

From 1 November 2023, Prof Trung Q. Duong will hold a position as a Professor at Memorial University of Newfoundland, Canada. He is also a Chair Professor in Telecommunications at Queen's University Belfast (QUB), UK and a Research Chair of the Royal Academy of Engineering, UK. His current research focuses on signal processing, real-time optimisation, machine learning, 6G wireless communications, Internet-of-Things (applied to healthcare, disaster management, agriculture, environment, and smart cities). Currently, his main research focus on 5G/6G include:

- Joint optimal design for communications and computing.
- Digital twin networks.
- Integrated satellite and terrestrial networks (ISTN).
- Quantum machine learning for dynamic radio resource allocation in wireless networks.
- Real-time optimisation for unmanned aerial vehicles (UAV).
- Semantic communications.
- Integrated sensing and communications (ISAC).
- Physical layer security for wireless networks.
- Quantum communications, quantum machine learning, and quantum optimisation.

He has established a strong record in these areas with 500+ publications including **14** books, **16** book chapters, **303** journal articles and **169** conference papers (Google Scholar: 17,800+ citations, h-index of **72**). He is the only UK-based researcher awarded both prestigious awards: i) the **Royal Academy of Engineering Research Fellowship** (2015-2020) and ii) **Research Chair of Royal Academy of Engineering** (2020-2025).

He has served as an Editor for major technical journals including IEEE Trans. on Wireless Communications, IEEE Trans. on Communications, IEEE Trans. on Vehicular Technology, IEEE Wireless Communications Letters, IEEE Communications Letters, and IEEE Communications Surveys & Tutorials. He is an IEEE Fellow, AAIA Fellow, and a recipient of the prestigious **Newton Prize** awarded in 2017 from the UK Government.

He has received research grants with an amount of more than 28 million GBP from funding agencies, governmental organizations, and industry, e.g., Canada NSERC, EU H2020, EPSRC, ESRC, DCMS, Royal Academy of Engineering, Royal Society, British Council, Innovate UK, NI Department for Employment and Learning,

NI Department for Economy, UK Department for Business, Energy & Industrial Strategy (BEIS).

3. AWARDS/HONOURS

- 2023 **Best Paper Award** 19th International Conf. on Wireless Communications & Mobile Computing (IWCMC).
- 2022 **Best Paper Award** IEEE Global Communications Conference (GLOBECOM) - 2 awards.
- 2019 **Best Paper Award** IEEE Global Communications Conference (GLOBECOM).
- 2019 **Best Paper Award** International Conf. on Wireless Communications & Mobile Computing (IWCMC).
- 2017 **Newton Prize**.
- 2017 **Best Paper Award** 20th Digital Signal Processing Conference (DSP).
- 2016 **Best Paper Award** IEEE Global Communications Conference (GLOBECOM).
- 2014 **Best Paper Award** IEEE International Conference on Communications (ICC).
- 2013 **Best Paper Award** IEEE 77th Vehicular Technology Conference (VTC-Spring).