Tze-Yang Tung

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Education

PhD in Electrical and Electronic Engineering Sep. 2019 — Sep. 2022
Imperial College London, UK
Research: Machine learning for video compression and communication systems. Reinforcement learning for multi-agent collaboration and communication.
Thesis: Semantic and Effective Communications.

MSc. in Electrical and Computer Engineering Aug. 2017 — May. 2019
University of Southern California, USA
Thesis: Synchronization Error Robust Transceivers for Molecular Communications.

BEng. in Electrical and Electronic Engineering - First Class Honours Oct. 2014 — Jun. 2017
Imperial College London, UK
Thesis: Uncoded Image Transmission Over Wireless Channels Exploiting Frequency Domain Sparsity.
Award: IEEE Thesis Prize in Telecommunications.

Awards and Honours:

- Graduated First Class Honours from Imperial College London.
- Awarded IEEE Thesis Prize in Telecommunications for undergraduate thesis work at Imperial College London.

Technical Skills:

- Programming: Python, C++, TensorFlow, Pytorch, MATLAB, LabView.
- Hardware: Verilog HDL, USRP software defined radio, GNU Radio.

Work/Research Experience:

Co-founder of WAIveform Sep. 2019 — present

- Startup company focusing on wireless video delivery (https://waiveform.github.io/waiveform-tech/).
- Reduces latency by up to 100x compared to current industry standard.
- Video never buffers or drops regardless of network environment.

Research Assistant — Advisor: Prof. Deniz Gündüz Sep. 2019 — present
Information Processing and Communications Lab, Imperial College London

- *Semantic communications*:
  - Using deep learning to simultaneously optimize video compression and transmission, achieving graceful adjustment of video quality with respect to network quality.
  - Hardware implementation on USRP and GNU Radio (C++, Python) confirming superiority over industry standard methods (H.26x + standard wireless protocols).
- *Goal oriented communications*:
  - A novel framework that generalizes real world applications where intelligent machines must communicate to achieve coordination (e.g., drone swarm control, autonomous vehicle planning, factory automation).
  - *Emergent languages*: The framework jointly solves the Markov decision process as well as the communication protocol required to accomplish the task successfully using reinforcement learning.
  - The framework achieves better performance than those where the task is solved independently of the communication protocol.

Research Assistant — Advisor: Prof. Urbashi Mitra Aug. 2017 — May. 2019
Communication Science Institute, University of Southern California

- *En-vivo molecular communications*:

- Designed a causal communication scheme for en-vivo molecular communications, enabling future medical applications.
- A novel framework for optimizing signal design in diffusive environments.
- Improved asynchronous detection performance over state-of-the-art by a factor of 2.

Research Assistant — Advisor: Prof. Deniz Gündüz Jun. 2016 — Feb. 2017
Information Processing and Communications Lab, Imperial College London

- *Joint source-channel coding:*
  - Designed a joint source-channel coding scheme for wireless image transmission to achieve graceful degradation of image quality with channel quality.
  - Exploited sparsity in the frequency domain by using compressed sensing and approximate message passing to reduce bandwidth usage.
  - Improved performance over state-of-the-art by 20% and verified through hardware implementation.

Publications and Patents:

Research papers:

1. T. Tung and D. Gündüz, "*DeepWiVe*: Deep-Learning-Aided Wireless Video Transmission", *IEEE Journal on Selected Areas in Communications (JSAC), Machine Learning in Communications and Networks*, Jul, 2022. [Review]
2. T. Tung, D. Kurka, M. Jankowski, and D. Gündüz, "DeepJSCC-Q: Channel Input Constrained Deep Joint Source-Channel Coding", *IEEE International Conference on Communications (ICC)*, May, 2022.
3. T. Tung, S. Kobus, and D. Gündüz, "Context-Aware Effective Communications", *55th Asilomar Conference on Signals, Systems, and Computers*, Nov. 2021.
4. T. Tung, S. Kobus, J. Roig Pujol, and D. Gündüz, "Effective Communications: A joint learning and communication framework for multi-agent reinforcement learning over noisy channels", *IEEE Journal on Selected Areas in Communications (JSAC), Special Issue on Machine Learning in Communications and Networks*, 2021.
5. M. Boloursaz Mashhadi, M. Jankowski, T. Tung, S. Kobus, and D. Gündüz, "Federated mmWave Beam Selection Utilizing LIDAR Data", *IEEE Wireless Communications Letters*, 2021.
6. T. Tung, and U. Mitra, "Synchronization Error Robust Transceivers for Molecular Communication", *IEEE Transactions on Molecular, Biological, and Multi-Scale Communications*, Dec., 2019.
7. T. Tung, and U. Mitra, "Robust Molecular Communications: DFE-SPRTs and Synchronization", *IEEE International Conference on Communications (ICC)*, May, 2019.
8. T. Tung, and U. Mitra, "Increasing Robustness to Synchronisation Errors in Molecular Communications", *International Symposium on Turbo Codes & Iterative Information Processing*, Dec., 2018.
9. T. Tung, and D. Gündüz, "SparseCast: Hybrid Digital-Analog Wireless Image Transmission Exploiting Frequency Domain Sparsity", *IEEE Communications Letters*, Vol. 22 - No. 12, 2018.

Patents:

1. T. Tung, D. Kurka, D. Gündüz, "Encoder, decoder and communication system and method for conveying sequences of correlated data items from an information source across a communication channel using joint source and channel coding, and method of training an encoder neural network and decoder neural network for use in a communication system" U.K. Patent, GB2112665.1, 06 Sep. 2021.