Tze-Yang Tung

Email: tzeyang.tung.work@gmail.com
LinkedIn: www.linkedin.com/in/tze-yang-tung
Website: https://tze-yang-tung.github.io/

Education

PhD in Electrical and Electronic Engineering Sep. 2019 — Oct. 2022
Imperial College London, UK
Research: Machine learning for video compression and communication systems. Multi-agent reinforcement learning.
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 Dissertation 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.
- Bronze Champion (3rd prize) in *ITU AI/ML in 5G Challenge* for "Beam-Selection in Millimeter-Wave MIMO Systems".

Technical Skills

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

Work/Research Experience

Member of Technical Staff Jan. 2023 — present
Nokia Bell Labs - Radio Systems Research

- Leading an initiative for distributed training of deep learning-driven joint source-channel coding for semantic communications, allowing heterogeneous models and data to inter-operate.
- Designed and implemented a semantic communication-based solution for improving the quality-of-service of an internal augmented reality (AR) tool, reducing the latency and accuracy of the application by 75.8%.
- Designed a reinforcement learning framework for optimizing Polar code designs, reducing the error rate of Polar codes for 5G systems by 0.5 dB.
- Mentored an intern on a project researching semantic policy optimization of MIMO systems in multi-agent settings using reinforcement learning, leading to a successful patent application.

Co-founder of WAIveform Sep. 2019 — Jan. 2023

- Startup company focusing on wireless video delivery (https://waiveform.github.io/waiveform-tech/).
- Reduces latency by up to 100x compared to current industry standard.
- Raised £250,000 from the European Research Council.

Research Assistant — Advisor: Prof. Deniz Gündüz Sep. 2019 — Jan. 2023
Information Processing and Communications Lab, Imperial College London

- *Wireless video compression and transmission (JSCC)*:
  - 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).

- *Multi-agent collaborative reinforcement learning with 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 agents learn a language that allows them to coordinate effectively.
  - 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

Journals:

1. E. Erdemir, T. Tung, P. Dragotti, and D. Gündüz, "Generative joint source-channel coding for semantic image transmission", *IEEE Journal on Selected Areas in Communications (JSAC)*, Jun., 2023.
2. T. Tung, D. Kurka, M. Jankowski, and D. Gündüz, "DeepJSCC-Q: Constellation Constrained Deep Joint Source-Channel Coding", *IEEE Journal on Selected Areas in Information Theory (JSAIT)*, Oct., 2022.
3. 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.
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 D. Gündüz, "SparseCast: Hybrid Digital-Analog Wireless Image Transmission Exploiting Frequency Domain Sparsity", *IEEE Communications Letters*, Vol. 22 - No. 12, 2018.

Conferences:

1. S. Kobus, T. Tung, and D. Gündüz, "Goal-oriented Compression with a Constrained Decoder", *IEEE International Symposium on Information Theory (ISIT)*, Jun. 2023.
2. C. Karamanli, T. Tung, and D. Gündüz, "Model-Driven Deep Joint Source-Channel Coding over Time-Varying Channels", *26th International ITG Workshop on Smart Antennas and 13th Conference on Systems, Communications, and Coding (WSA & SCC)*, Feb. 2023.

3. T. Tung, D. Gündüz, "Deep Joint Source-Channel and Encryption Coding: Secure Semantic Communications", *IEEE International Conference on Communications (ICC)*, May, 2023.

4. 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.

5. T. Tung, S. Kobus, and D. Gündüz, "Context-Aware Effective Communications", *55th Asilomar Conference on Signals, Systems, and Computers*, Nov. 2021.

6. T. Tung, and U. Mitra, "Robust Molecular Communications: DFE-SPRTs and Synchronization", *IEEE International Conference on Communications (ICC)*, May, 2019.

7. T. Tung, and U. Mitra, "Increasing Robustness to Synchronisation Errors in Molecular Communications", *International Symposium on Turbo Codes & Iterative Information Processing*, Dec., 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, Sep. 2022.

2. J. Du, S. Khosravirad, T. Tung, "METHODS OF AUGMENTATION AND TRANSFER OF ERRONEOUS PACKET OVER EFFECTIVE RADIO LINK", U.S. Patent, Nov. 2023.

3. P. Srinath, B. Liu, T. Tung, A. Valcarce, "METHOD AND SIGNALING FOR ENCODING THE DOWNLINK CONTROL INFORMATION (DCI) MESSAGE IN 6G RADIO ACCESS NETWORKS", U.S. Patent, Sep. 2023.