

ACHINTHA WIJESINGHE

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EDUCATION

University of California, Davis, *Davis, CA*

Sep. 2021 - Present

Ph.D. candidate in Electrical and Computer Engineering, GPA: 4.0/4.0

- Mentors: Prof. Zhi Ding
- Research Topic: federated learning, generative learning, semantic communications

University of California, Davis, *Davis, CA*

Sep. 2021 - Aug. 2023

M.S. in Electrical and Computer Engineering, GPA: 4.0/4.0

- Thesis Topic: Distributed Generative Learning for Wireless Communication and Intelligence

University of Moratuwa, *Sri Lanka*

Dec. 2015 - Jan. 2020

BSc. Engineering (Hons) specialized in Electronic and Telecommunication Engineering, GPA: 3.91/4.20

- Awards: Prof. K.K.Y.W. Perera award for the best GPA in the field of Electronic and Telecommunication Engineering in the senior year

WORKING EXPERIENCES

Graduate Student Researcher — University of California, Davis, *Davis, CA*

2021 - Present

- Research topics: Federated Learning; Diffusion Model; Generative Adversarial Networks; Semantic Communications; Radio Coverage Cartography and Spectrum Management.
- Maintenance and management of Lab Computation Resources: Lead GPU servers and support equipment.

Teaching Assistant — University of California, Davis, *Davis, CA*

2021 - Present

- EEC 150 - Introduction to Signals & Systems;
- EEC 260 - Random Signals & Noise

Lecturer on Contract — University of Moratuwa, *Sri Lanka*

2020-2021

- Laboratory Practice I (EN 1093): Introduction to Telecommunication, Digital Electronics, and Analog Electronics

Research Intern — Data 61 CSIRO *Sydney Australia*

July— December, 2018

- Investigation of the use of different sampling and sketching methods, and hybrid methods like Flow Sampling and Sketching (FSS), and Optimal Flow Sampling and Sketching (OFFS), and **C1**

RESEARCH PROJECTS

Generative AI for Next-Generation Semantic Communications

Aug. 2023 - Present

— *Mentor: Prof. Zhi Ding* at UC Davis

- Designed an innovative semantic communications framework utilizing conditional diffusion models integrated with codebook-based noise learning, which significantly increase compression ratio for bandwidth usage and enhance the quality of image reconstruction. Three manuscripts/publications are resulted from this work [**C2**, **C3**, **J4**].
- Developed an efficient goal-oriented communications framework empowered by masked latent mixup for latent diffusion models, which reduce the communication overhead and computation burden at the edge device. One manuscript is under working for IEEE Transactions on Wireless Communications [**J1**].

- Worked on the goal-oriented semantic communications based on the task-driven semantic quantization and imitation learning, which reduce the computation cost and improve performance in downstream tasks with an application background in autonomous driving. One conference paper is under preparation [C1].

Federated Learning with Communication Efficiency and Privacy Preservation Sep. 2022 - Present
— Mentor: Prof. Zhi Ding at UC Davis & Dr. Songyang Zhang at University of Louisiana at Lafayette

- Developed a novel federated learning frameworks based on generative adversarial networks to handle non-IID data distributions and efficient model sharing using partially-shared generative models, which achieves communication efficiency and preserve privacy. Two publications are generated from this work (J5,C4).
- Evaluated clients' data distributions via a novel auto-encoder design. Developed efficient data augmentation and model fusion for personalized federated learning, which significantly improve the personalized quality in privacy-preserved distributed learning. One manuscript is ready for IEEE transactions (J3).

Physics-inspired Generative Learning for Spectrum Coverage Cartography Sep. 2022 - Present
— Mentor: Prof. Zhi Ding at UC Davis & Dr. Songyang Zhang at UL Lafayette

- Developed novel frameworks of radiomap estimation based on generative adversarial networks, which integrated the generative AI models with radio propagation models. These physics-inspired generative AI models significantly improve the prediction of spectrum coverage, particularly with limited observations, with broad applications in spectrum optimization and network management. Two manuscripts are produced from this work [J2,J6]. The RME-GAN developed in this work is considered as one of the state-of-the-art methods in the communication community.

Three-Dimensional (3D) Point Cloud Processing Jan. 2021 - Sep. 2021

- Developed point cloud releasing mechanism using privacy aware loss function utilizing Auto-Encoders.

Deep Reinforcement Learning Based Carrom Manipulator Jan. 2019 - Jan. 2020

- Developed end-to-end system that continuously captures a Carrom board configuration using computer vision and learns optimal shots using Reinforcement Learning. One paper accepted to IEEE SMC(C5);
- 2nd price award in IEEE IAS CMD Student Robotics Demonstration Contest.

RELEVANT PUBLICATIONS

Have authored or coauthored 7 journal manuscripts and 7 conference manuscripts, with topics in wireless communications, machine learning, and computer vision.

Working Papers: Conference (C) & Journal (J)

- (C1) Y. Chao, Y. Chen, **A. Wijesinghe**, S. Wanninayaka, S. Zhang, and Z. Ding, "Task-Driven Semantic Quantization and Imitation Learning for Goal-Oriented Communications", under preparation for *2025 IEEE International Conference on Communications*.
- (C2) S. Wanninayaka, **A. Wijesinghe**, W. Wang, Y. Chao, S. Zhang, and Z. Ding, "Diff-GOⁿ: Enhancing Diffusion Models for Goal-Oriented Communications with Noise Banks", under preparation for *2025 IEEE International Conference on Communications*.
- (J1) **A. Wijesinghe**, S. Wanninayaka, W. Wang, Y. Chao, S. Zhang, and Z. Ding, "LaMi-GO: Latent Mixup for a High-Speed Goal-Oriented Communications", under preparation for *IEEE Transactions on Wireless Communications*.
- (J2) Y. Zhou, **A. Wijesinghe**, Y. Ma, S. Zhang and Z. Ding, "TiRE-GAN: Task-Incentivized Generative Learning for Radiomap Estimation", arXiv:2405.02567, 2024. under preparation for *IEEE Wireless Communications Letters*.
- (J3) **A. Wijesinghe**, S. Zhang, and Z. Ding, "Pfl-gan: when client heterogeneity meets generative models in personalized federated learning," arXiv:2308.12454, 2023 under preparation for *IEEE Transactions on Machine Learning in Communications and Networking*.

Journal Papers

- (J4) **A. Wijesinghe**, S. Zhang, S. Wanninayaka, W. Wang, and Z.Ding “Diff-GO+: An Efficient Diffusion Goal-Oriented Communication System with Local Feedback” Authorea. June 24, 2024. (Submitted to IEEE Transactions on Wireless Communications)
- (J5) **A. Wijesinghe**, S. Zhang, and Z.Ding “PS-FedGAN: An Efficient Federated Learning Framework Based on Partially Shared Generative Adversarial Networks For Data Privacy” IEEE Internet of Things Journal (2024)
- (J6) S. Zhang, **A. Wijesinghe**, and Z. Ding “RME-GAN: A Learning Framework for Radio Map Estimation based on Conditional Generative Adversarial Network”, in IEEE Internet of Things, (Impact factor - 10.238) [**co-first author**].
- (J7) C. M. M. Kattadige, K. N. Choi, **A. Wijesinghe**, K. Thilakarathna, S. Seneviratne, and G. Jourjon, “SETA++: Real-Time Scalable Encrypted Traffic Analytics in Multi-Gbps Networks,” in IEEE Transactions on Network and Service Management, vol. 18, no. 3, pp. 3244-3259, Sept. 2021 (Impact factor - 4.758).

Conference Papers

- (C3) **A. Wijesinghe**, S. Zhang, S. Wanninayaka, W. Wang, and Z.Ding “Diff-GO: Diffusion Goal-Oriented Communications to Achieve Ultra-High Spectrum Efficiency”. In 2024 IEEE International Conference on Communications Workshops (ICC Workshops), pp. 1079-1084. IEEE.
- (C4) **A. Wijesinghe**, S. Zhang, S Qi, and Z.Ding “UFed-GAN: A Secure Federated Learning Framework with Constrained Computation and Unlabeled Data” In 2024 IEEE International Conference on Communications Workshops (ICC Workshops), pp. 1079-1084. IEEE.
- (C5) N. Karunanayake, **A. Wijesinghe**, C. Wijethunga, C. Kumaradasa, P. Jayasekara, and R. Rodrigo, “Towards a Smart Opponent for Board Games: Learning beyond Simulations”, in IEEE International Conference on Systems, Man, and Cybernetics, Toronto, CA, 2020. (**co-first author**, H index - 62)
- (C6) K. N. Choi, **A. Wijesinghe**, C. M. M. Kattadige, K. Thilakarathna, S. Seneviratne, and G. Jourjon, “SETA: Scalable Encrypted Traffic Analytics in Multi-Gbps Networks”, in IEEE International Conference on Local Computer Networks, Sydney, AUS, 2020. (CORE A)
- (C7) G. Jourjon, **A. Wijesinghe**, K. Thilakarathna, and S. Seneviratne, “Towards Flow Sampling for Deep Content Analysis”, in Cyber Defence Next Generation Technology & Science Conference, Brisbane, AUS, 2020.

PROGRAMING LANGUAGES

- Python: Pytorch, Keras, TensorFlow
- Matlab

ACADEMIC SERVICE

Reviewing

- Journal: IEEE Transactions on Wireless Communications
- Journal: IEEE Communications Letters