The Chinese University of Hong Kong
Department of Biomedical Engineering

Graduate Seminar – PhD Oral Defence

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Date	***:***	4 June 2025
Time	***:***	9:30 am
Venue	***:***	Room 1122, William M W Mong Engineering Building, CUHK

Title: Towards Affordable, Robust, and Deployable Medical Image Analysis Under Imperfect Data Scenarios

Medical imaging modalities such as magnetic resonance imaging (MRI) and computed tomography (CT) generate high-dimensional, multimodal data that form the backbone of modern diagnostic and therapeutic workflows. However, interpreting these complex datasets remains labor-intensive and requires expert annotation, which is both time-consuming and costly—particularly for 3D volumetric scans. As the demand for scalable medical AI continues to grow, developing affordable, robust, and clinically deployable solutions becomes a critical research priority.

In this talk, I will present a suite of deep learning strategies developed in my Ph.D. research to tackle key challenges posed by imperfect medical data, with a focus on segmentation tasks. I will first introduce two semi-supervised learning (SSL) frameworks—Cyclic Prototype Consistency Learning (CPCL) and Ambiguity-Consensus Mean-Teacher (AC-MT)—that effectively leverage unlabeled data through prototype-based regularization and plug-and-play ambiguity modeling. Next, I will extend this discussion to the multi-site setting with our Separated Collaborative Learning (SCL) framework, which decouples local fitting and external generalization for robust cross-institutional learning.

To address the problem of noisy labels, I will introduce the Mean-Teacher-assisted Confident Learning (MTCL) framework, which combines self-denoising with consistency learning to refine unreliable annotations. Finally, I will describe the Generalist Model-driven Active Barely Supervised (GM-ABS) paradigm, which utilizes foundation models like SAM for specialist-generalist collaboration and expert-model collaboration towards effective specialist-training under extreme annotation constraints.

The proposed methods are validated on multiple benchmarks and offer a unified, scalable solution to medical image analysis under limited, noisy, and heterogeneous data. I will conclude by outlining future directions, including our recent progress in continual learning of foundation models, multimodal integration, and the development of Agentic AI systems for next-generation healthcare.

***** ALL ARE WELCOME *****

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