



DEPARTMENT OF APPLIED MATHEMATICS 用數 學

Department of Applied Mathematics

Seminar

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Topic

Meta-learning with GANs and Its Applications in Anomaly Detection

Date | Time

22nd February 2024 (Thursday) | 4:00pm – 5:00pm (HK Time)

Venue

FJ301, Main Campus

Abstract

Anomaly detection has been an active research area with a wide range of potential applications. Key challenges for anomaly detection in the AI era with big data include lack of prior knowledge of potential anomaly types, highly complex and noisy background in input data, scarce abnormal samples, and imbalanced training dataset. This talk is a collection of four engineering-based research works, aiming to detect anomalous images, with little-to-no labeled training data and limited priori knowledge of the anomaly class.

To begin, we design CNN-based algorithms that handle the problem of data imbalance between normal and abnormal samples for tasks with sufficient prior knowledge and labeled samples. Moreover, in our second direction, for tasks with prior knowledge but little anomaly samples, we design a transfer learning-based method that reuses anomalous features from a similar task and applies to a target task. Such deep learning methods have shown significant effect in the field of medical diagnosis.

Moving away from CNN-based approaches, in our third direction, we propose a novel reconstruction-based approach for tasks without any prior knowledge. Our GAN-based approach has shown great promise in the field of industrial defect detection. Finally, for tasks without any prior knowledge or any labeled samples, we propose and develop a meta-learning framework to solve multiple anomaly detection tasks with different but similar distributions. Our framework has been deployed and tested in five high-speed railways of China since 2021. Experiments with limited labeled data for highspeed rail inspection demonstrate that our meta-learning framework is promising for general anomaly detection tasks: it is sharp and robust in identifying anomalies and capable of significantly reducing workload.

ALL ARE WELCOME