

“Deep learning-based classification and generation for paired chest X-ray images”

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National Science and Technology Council, Taiwan: 08/01/2026-07/31/2027

Chest X-rays (CXRs) are a foundational imaging modality in clinical practice, yet their diagnostic potential is often limited by subjective interpretation, image noise, and the difficulty of accurately assessing longitudinal changes. This project aims to develop an integrated deep learning (DL) framework for automated analysis of paired CXR images, leveraging advances in convolutional neural networks, generative modeling, and attention mechanisms. We propose two complementary approaches: (1) a modified Siamese neural network with correlation-based feature comparison for multi-class classification of treatment response, and (2) an image-to-image generation pipeline that adapts Pix2PixHD and an attention-augmented conditional generative adversarial networks to synthesize post-treatment CXRs from pre-treatment scans, thereby enabling improved downstream prediction. Building on a long-standing collaboration with E-Da Hospital and informed by prior successes in Parkinson's disease staging, multi-label CXR classification, and few-shot object detection, this project will systematically compare state-of-the-art learning paradigms to identify robust, generalizable strategies for longitudinal CXR interpretation. The resulting system aims to enhance diagnostic accuracy, reduce clinical workload, and establish a scalable foundation for future developments in medical image analysis.

Keywords: chest X-ray image, deep learning, paired images, Siamese neural network, generative adversarial network