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Terrestrial Biodiversity and Ecosystems

From Pixels to Patterns: Advancing Plant Morphometry with Computer Vision and Machine Learning

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Time: 2025. 03. 20 Thu. 15:00
Venue: Auditorium, 1st Floor,
    Interdisciplinary Research Building
    跨領域科技研究大樓1樓演講廳
Host: Dr. Jen-Pan Huang 黃仁磐副研究員

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Abstract

In the genomic era, while our ability to detect genetic variation has advanced rapidly, our capacity to objectively and comprehensively analyze morphology remains limited. My research bridges this gap by integrating computer vision, machine learning, and advanced imaging techniques to quantify plant morphological diversity. This talk will demonstrate how my work enhances our ability to measure, recognize, and interpret morphological diversity through image-based morphometry. I will begin by presenting my research on floral symmetry transitions and corolla shape diversity using 2D and 3D geometric morphometrics, and followed by the study of nectar guide patterns under a developmental homology framework. These studies reveal a deeper philosophical insight: morphological traits are often viewed through a human-defined lens. From a biological perspective, morphology can be expressed as the summation of functions representing developmental events. Inspired by these insights, I further apply image-based deep learning to address practical biodiversity challenges in leaf morphology. I will present my works of using artificial intelligence (AI) models to distinguish visually similar species with high accuracy. The work extends to large-scale analyses across diverse plant groups, demonstrating that AI can extract biologically meaningful and interpretable features and assist in biodiversity and conservation efforts. By combining computer vision and machine learning with morphometry, my work not only deepens our understanding of plant morphology but also expected to provide practical solutions to uncover hidden patterns in plant diversity.