NANYANG TECHNOLOGICAL UNIVERSITY

School of Biological Sciences

Reg. No. 200604393R

Research Theme: Interdisciplinary Biology (Bioimaging, Artificial Intelligence, Cell Biology, Plant Stress Biology)

Research Project Title: **Bioimaging for Cell Signaling and AI: Imaging-Based Models of Cell Stress Responses**

Principal Investigator/Supervisor: Professor Yansong MIAO

Co-supervisor/ Collaborator(s) (if any):

Project Description

a) Background:

This interdisciplinary project focuses on integrating quantitative bioimaging and artificial intelligence (AI) to understand how plants sense and respond to stress.

Plants continuously integrate biotic stresses, such as pathogen attack, and abiotic stresses, such as drought, heat, and salinity, through dynamic changes in cellular structures and signaling activities. Modern fluorescence imaging and genetically encoded biomolecular sensors can capture these changes across scales, from single molecules to whole tissues, but the resulting datasets are large, complex, and multidimensional. AI-based image analysis offers a powerful way to extract quantitative signatures from such data and to link cellular phenotypes with molecular information.

This project will acquire large-scale imaging datasets of diverse cellular structures and biomolecular sensors in living plants and use them to build imaging-based AI models of plant signaling under biotic and abiotic stress. We are looking for a highly motivated PhD student to work on this novel and well-designed project, ensuring high-quality training, high-impact outcomes, and scientific publications.

We provide solid scientific training for your future career and aim to nurture the next generation of scientists. The Ph.D. candidate will acquire cell biology imaging data from the single-molecule level to the tissue level in living systems, develop and train AI models for image analysis, and integrate imaging with large-scale omics-based information through multimodality analysis and training.

Miao lab students have different high-quality scientific training opportunities, such as international conferences, workshops, exchanges.

For our recent work and publications, please see https://blogs.ntu.edu.sg/miaolab/
For more details of ongoing and new projects, feel free to contact Prof. Miao at yansongm@ntu.edu.sg.

b) Proposed work:

The Ph.D. candidate will (i) image diverse cellular structures, such as the cytoskeleton, membranes, organelles, and condensates, together with biomolecular sensors in living plant cells and tissues under

biotic and abiotic stress; (ii) build and train deep-learning models for segmentation, tracking, and classification to extract quantitative imaging signatures of stress signaling; and (iii) integrate imaging features with transcriptomic, proteomic, and other omics datasets through multimodal analysis to predict signaling states and stress outcomes.

Our top-notch bioimaging technologies in the lab and long-term collaborations with computer science, data science, and imaging groups will ensure a comprehensive, AI-driven understanding of plant signaling across scales.

c) Preferred skills:
Enthusiasm for science; Sufficient coding background (e.g., Python) and experience with AI or machine learning in imaging analysis; A background in biology is an advantage but not required; Excellent oral and written communication skills; Good collaboration skills.

Supervisor contact:

If you have questions regarding this project, please email the Principal Investigator:

yansongm@ntu.edu.sg

SBS contact and how to apply:

Associate Chair-Biological Sciences (Graduate Studies) : AC-SBS-GS@ntu.edu.sg

Please apply at the following:

Application portal:

https://venus.wis.ntu.edu.sg/GOAL/OnlineApplicationModule/frmOnlineApplication.ASPX