AI-Powered Imaging and Spectral Techniques: From Crop Growth Monitoring to Flavor Analysis

Abstract

In crop production, harvesting, and post-harvest handling, traditional methods heavily rely on human labor for monitoring, recording, and decision-making. However, the growing shortage of experts and the decline in available labor present significant challenges. By integrating IoT sensors, autonomous vehicles, image processing, spectral sensing, and AI algorithms, expert decision-making processes can be emulated. This presentation will explore how these advanced technologies have the potential to significantly enhance agricultural practices. Examples such as tomato, tea, and coffee will illustrate the application of deep learning in crop growth monitoring, pest and disease identification, harvest prediction, and even market-level quality grading and flavor prediction of beverages. These innovations not only offer more efficient and labor-saving field management practices but also provide groundbreaking insights into food flavor science.

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RESEARCH AREAS AND EXPERTISE

- General area: Precision Agriculture and Quality Control
- Specific area: Machine Vision and Spectral Sensing

SELECTED AWARDS AND RECOGNITION

- Excellent Teaching Award, National Taiwan University, 2018, 2019, and 2024
- Associate Editor, Engineering in Agriculture, Environment and Food, 2023-
- Third Place, 2021 CTCI Foundation AI Innovation Competition, 2021
- National Agricultural Science Award, Ministry of Agriculture, 2019

Shih-Fang Chen is an Associate Professor in the Department of Biomechatronics Engineering from National Taiwan University (NTU). She received her Bachelor and Master's degrees in Bio-Industrial Mechatronics Engineering at NTU, and Ph.D. degree in Agricultural and Biological Engineering from the University of Illinois at Urbana-Champaign, USA. Shih-Fang's research focuses on applying image processing and spectral techniques in plant status monitoring and agricultural product quality evaluation. She is dedicated to advancing smart agriculture by integrating Internet of Things (IoT) and Artificial Intelligence (AI) technologies to enhance precision farming practices. She has worked on a variety of projects, including plant disease identification, harvest time prediction, agricultural product grading, pesticide residue detection, and flavor prediction. She served as a Guest Editor for Special Issues of Computer and Electronics in Agriculture and currently serves as one of the Associate Editors for Engineering in Agriculture, Environment and Food. She is also the leader of the research group at the Center for Intelligent Agriculture (CIA) Education and Research at NTU.