Crop Monitoring Using AI Technology on UAV Images

Abstract

Remote sensing technology has been extensively applied in agriculture. In particular, the application of unmanned aerial vehicles (UAVs) to acquire high-resolution images has become a new trend in precision farming. Compared with satellite imagery, which is subject to the satellite's repeat cycle, and aerial photography, which is costly, UAV imagery presents the advantages of high speed, convenience, and low cost, which makes it ideal for the short-term monitoring of plant growth. Because the low flight height of UAVs helps obtain images of objects in the scale of millimeters, UAV imagery has been successfully used in crop classification, weed detection, and growth monitoring, indicating its feasibility for use in in precision farming. However, a large amount of UAV images needs an efficient image process technology. With the advances in AI (Artificial Intelligence) technology, deep learning with high performance computation have been extensively used in image recognition. The presentation demonstrates the application of AI technology to UAV images in precision agriculture, especially large-area rice lodging identification. Furthermore, by combining autonomous scouting and lodging rice detection with edge computing, it is possible to estimate rice lodging by flying at a high altitude for broad scan and then at a low altitude for precise identification in one flight mission. In the future, AI identification on UAV images will provide a great opportunity to identify crop growth and field anomalies over a broad area and even in real-time for precision agriculture.
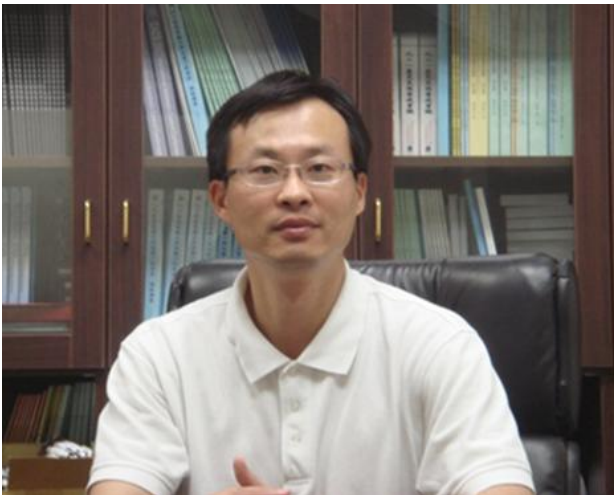
Ming-Der Yang

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RESEARCH AREAS AND EXPERTISE
- General area: Geomatics and Remote Sensing
- Specific area: Image Processing, Geographic Information Systems (GIS), Environmental Monitoring, Disaster Assessment, and AI Applications in Remote Sensing

SELECTED AWARDS AND RECOGNITION
- Tech Breakthrough Award (2019, 2020, 2022, and 2023)
- Outstanding Research Award (2021)
- Third Potential Investment Prize at International Forum and Exhibition for AI Innovation Research Center Program (2019)

Ming-Der Yang received his B.S. degree in Civil Engineering from National Chiao Tung University, Taiwan, in 1990, and M.S. and Ph.D. degrees in 1993 and 1996, respectively, from Department of Civil and Environmental Engineering and Geodetic Science, The Ohio State University, USA. He is presently a Distinguished Professor in the Department of Civil Engineering, National Chung Hsing University, and serves the Dean of College of Engineering. His expertise is geomatics and remote sensing, especially in image processing, geographic information system, environmental monitoring, and disaster assessment. He has authored about 100 international journal/conference publications. In addition, he is also granted patents on a street panoramic image preview system and gesture control. Recently, his research efforts have been put on developing Artificial Intelligence on remote sensing images for agricultural monitoring and disaster assessment. His Recent research effort has been put into 3D scene reconstruction, the applications of VR/AR and AI. Recently, he applied AI technology to UAV images for precision agriculture, and has been awarded many prizes, such as Tech Breakthrough Award in 2019, 2020, 2022, and 2023, respectively. He was also awarded Outstanding Research Award in 2021 and the Third Potential Investment Prize at International Forum and Exhibition for AI Innovation Research Center Program in 2019.