Lightning talks - Session 2

2022년 10월 18일 화요일 오전 11:15 to 오후 12:00

Talks

소개

Talk 1 - "Harvest-Assist Collaborative Robots" by Stavros G. Vougioukas, Professor - University of California, Davis

Talk 2 - "3D Photogrammetry and Deep Learning based Orchard Digitization and Management" by Kyeong-Hwan Lee, Chonnam National University

Talk 3 - "Hyperspectral vine virus detection from leaves and canopy using machine learning" by Eve Laroche-Pinel, Ph.D. Postdoctoral Researcher- California State University Fresno

Talk 4: Dual-purpose robotic system for precision flower thinning and pollination: A step towards automated crop-load management in tree fruit crops" by Manoj Karkee, Professor - Washington State University - University Technology Sydney

간단히 표시

3D Photogrammetry and Deep Learning based Orchard Digitization and Management

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Abstract

Digital agriculture is to make more informed decisions in agricultural production, value chains, and food systems with technologies of big data, artificial intelligence, and internet of things (IoT), aiming to optimize agricultural productivity. Traditional manual methods used for orchard management, such as quantifying fruit trees phenotyping, estimating fruit yield and making decisions of pruning, are laborious. The aim of this study is to reconstruct orchard by oblique photogrammetry and extraction of 3D information (fruit tree phenotyping, fruit yield, and pruning strategy) by deep learning in different stages. The 3D point cloud of apples was reconstructed from multi-view images collected via an unmanned aerial vehicle (UAV)-based multi-camera system. In spraying stage, the volume of each tree was estimated by improved concave-hull by slice method in 3D point cloud and the biomass map was made by the tree volume and position. The spraying machine could precisely control the spraying amount based on the biomass map. In harvest stage, the individual fruit was extracted by 3D instance segmentation algorithm and was counted to estimate the yield. In pruning stage, the skeleton of fruit tree before and after pruning was extracted by improved voxel parallel thinning algorithm and trained by graph neural networks to learn the pruning strategy and estimate the pruning points. The test result of above purposes indicates the mean absolute percentage error (MAPE) and root mean squared errors (RMSE) were 8.07% and 0.55 m^3 for volume estimation, and 12.75% and 19.25 for fruit counting. The accuracy of pruning point estimation can achieve an 89% with less than 5 cm position error. Through the 3D photogrammetry and deep learning technologies, the digitization of orchard can be obtained, and the orchard information can be extracted based on the digital model. In the future, the digitization and information extraction technologies can assist the robot to complete the orchard management automatically.

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