「Release of Hokkaido Agriculture Image Dataset」

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Abstract

Hokkaido University and Sony Group Corporation have constructed and released Hokkaido Agriculture Image Dataset including various agricultural scenes in Hokkaido to reduce the high-cost data collection process in agricultural image AI. This dataset is the achivement of Joint research, Social Innovation Division for Planetary Boundary.

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https://huggingface.co/datasets/Sony/Hokkaido_Agriculture_Image_Dataset

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Introduction

In the face of declining numbers and aging of agricultural workers, image AI undoubtedly represents a crucial technology for smart agriculture. For instance, it enables accurate monitoring of farmland and crop conditions through counting crops and detecting pests, while precise shape recognition allows robots to reduce heavy labor, with many such applications anticipated.

The rapid advance of image AI algorithm and model is remarkable, but datasets, along with models, are essential for image AI development. Even when the same AI model is used, the specification of dataset like quality and quantitiy of images and annotations decides the accuracy of it [1]. It can be said that no matter how capable a model is, without datasets tailored to the environment where the AI will be used, achieving sufficient performance becomes difficult, making datasets extremely important.

Dataset construction involves two major steps: raw data collection and annotation. Annotation is still performed by humans in many case and is considered a costly process [2].

However, in agricultural AI, even data collection must be described as high-cost. This is because it requires gathering comprehensive data on crops and surrounding environments that change daily, sometimes necessitating multiple visits to vast agricultural lands.

Hokkaido Agriculture Dataset

To help lower these barriers in agricultural image AI development, Hokkaido University and Sony Group Corporation have jointly constructed an agricultural image dataset.　This dataset consists of images collected from various agricultural lands in Hokkaido, tailored for DIVERSE and REAL agricultural AI application scenarios including crop counting, heading detection, harvesting, and pruning. As it is available for commercial use by anyone, we hope it will contribute to the development and implementation of agricultural AI.　Fugure 1 shows the stucuture of the dataset.

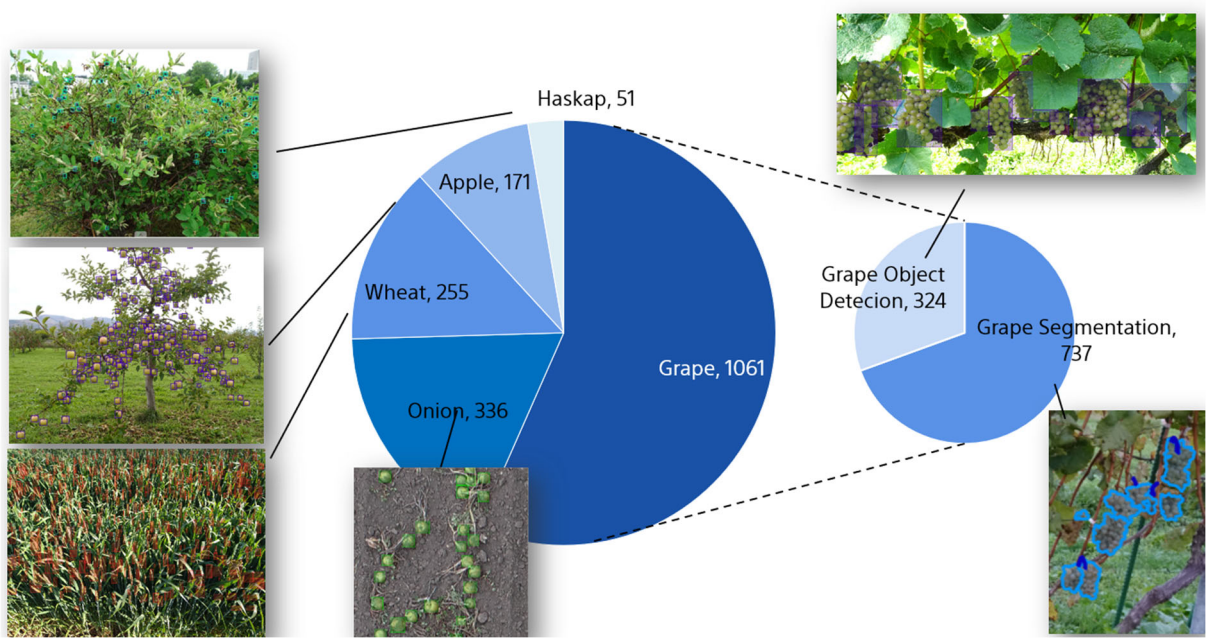

Fig.1 Structure of Hokkaido Agriculture Image Dataset

The dataset consists of five crops: grapes, onions, wheat, apples, and haskap with object detection labeling applied to all crops and instance segmentation also included for grapes.

Object detection is one of the mainstream tasks in vision AI that aims to detect target crops appearing in images and enclose them in rectangular boxes. In agriculture, this enables the measurement of quantity, approximate crop size, their distribution, and temporal changes. This dataset includes images at various growth stages as each crop was photographed over a specific period.

Instance segmentation is another mainstream image AI task that detects target crops while distinguishing between them and recognizes them

at the pixel level. Applications of instance segmentation for grapes include component estimation using hyperspectral cameras and harvest mechanization. Since grape harvesting is labor-intensive, research and development of sensors and robots are progressing to analyze each bunch of components, determine appropriate harvest timing, and perform actual harvesting operations [3, 4]. Accurate recognition of target grape bunch positions is crucial in this process, which is where instance segmentation is applied. In this dataset, labels for cut points have been added to identify areas where robot arms can be inserted between branches, in addition to grape bunches and branches. Table 1 shows the information for each crop's data.

Tabel. 1 Specification of Hokkaido Agriculture Image Dataset

Crop	Number of Image	Classes	resolution	Annotation Format
Grape	1,124	grape, cordon, rope, shoot, wire, branch, cutpoint, wire	4896 x 3672, 1024 x 768, 640 x 480	Object Detection, Instance Segmentation
Wheat	258	wheat	4056 x 3040, 4000 x 3000, 640 x 480	Object Detection
Onion	336	onion	600 x 600	Object Detection
Apple	171	apple	4896 x 3672	Object Detection
Haskap	50	haskap, flower	4896 x 3672	Object Detection

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Acknowledment

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・HOKKAIDO WINE CO.,LTD.

・MIURA FARM CO.,LTD.

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・The Field Science Center for Northern Biosphere, Hokkaido University

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