Eden Library

Find and download free and premium plant datasets for your research or AI application, in one place.

Farm Context



Image Credits: Fountas et al.

2015



- 1. Plant **Pathology**:
 - 1. Disease Detection
 - 2. Nutrient Deficiency detection
- 2. Plant Species Classification:
 - 1. Crop/weeds Type Classification
- 3. Plant **Phenology** Recognition
- 4. Fruit Counting, Crop Yield Estimation, ...



- 1. Plant **Pathology**:
 - 1. Disease Detection
 - 2. Nutrient Deficiency detection
- 2. Plant Species Classification:
 - 1. Crop/weeds Type Classification
- 3. Plant Phenology Recognition

Has a disease? Which one?



4. Fruit Counting, Crop Yield Estimation, ...



1. Plant **Pathology**:

1. Disease Detection

2. Nutrient Deficiency detection

- 2. Plant Species Classification:
 - 1. Crop/weeds Type Classification
- 3. Plant **Phenology** Recognition

Does it need a specific nutrient?



4. Fruit Counting, Crop Yield Estimation, ...



- 1. Plant **Pathology**:
 - 1. Disease Detection
 - 2. Nutrient Deficiency detection
- 2. Plant Species Classification:
 - 1. Crop/weeds Type Classification
- 3. Plant **Phenology** Recognition

4. Fruit Counting, Crop Yield Estimation

Any of these plants is a weed?





1. Plant **Pathology**:

- 1. Disease Detection
- 2. Nutrient Deficiency detection
- 2. Plant Species Classification:
 - 1. Crop/weeds Type Classification
- 3. Plant Phenology Recognition

Which is the growth stage?



4. Fruit **Counting**, Crop **Yield** Estimation, ...



- 1. Plant **Pathology**:
 - 1. Disease Detection
 - 2. Nutrient Deficiency detection
- 2. Plant Species Classification:
 - 1. Crop/weeds Type Classification
- 3. Plant **Phenology** Recognition

4. Fruit Counting, Crop Yield Estimation, ...



Two important paradigm shifts

Technological

Hand-crafted features

+

Traditional Models (e.g.: SVM, ANN)



Epistemological

Experiments on

Laboratory Condition Images



Experiments on

Real-world Condition Images



Two important paradigm shifts

Technological

Hand-crafted features

+

Traditional Models (e.g.: SVM, ANN)





Machine Learning Shift

Shallow Learning

Hand-crafted features

+

Traditional Models (e.g.: SVM + ANN)

2 independent blocks





+

Fully-Connected

1 block where features are automatically extracted

"Feature engineering (FE) is a complex, time-consuming process which needs to be altered whenever the problem or the data set changes. Thus, FE constitutes an expensive effort that depends on experts' knowledge and **does not generalize well**" (Amara et al., 2017)



Two important paradigm shifts

Technological

Hand-crafted features (e.g.: SIFT)

+

Shallow Models (e.g.: SVM)



Epistemological

Experiments on

Laboratory Condition Images



Experiments on

Real-world Condition Images



Real-world Conditions Shift

Laboratory Conditions



Real-World Conditions



"[...] when trained solely on laboratory-conditions images and asked to identify fieldconditions images, success rates are **significantly lower** (about **33%**).*" (Ferentinos, 2018)

*Original performance was around 99%



Real-World Conditions Challenges (i) TRAINING SET (+ Val + Test)



Example in Production





Real World Conditions Challenges (ii)

TRAINING SET (+ Val + Test)

Velvet Leaf



Cotton





Example in Production





Deep Learning and **Real-World Conditions** have a price: More Data







Deep Learning and Real-World Conditions have a price: More Data

Reuse Datasets

by

Transfer





Transfer Learning (i)





Transfer Learning (ii)





- 1. What is a plant?
- 2. What is a leaf?
- 3. How many leaves has this plant?
- 4. What is a symptom?
- 5. ...





Transfer Learning (iii)



Credits: Emilio Soria Olivas et al., Handbook Of Research On Machine Learning...





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Deep Learning and Real-World Conditions have a price: More Data

More Open Datasets



Reuse Datasets

by

Transfer

Learning



AI in agrifood is a mess





Market for data

Precision agriculture market

"If 80 percent of our work is data preparation, then ensuring data quality is the important work of a machine learning team." Andrew Ng

Andrew Ng



Eden Library

High quality plant datasets for your AI application or research project, in one place.



Interested in plant images?

Focus on datasets targeted to real farm applications.

1. Explore large-scale diverse image datasets collected under real field conditions.

DATASETS

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Sign up

FAO

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NOTEBOOKS

2. Find annotated images by agronomists, with metadata about diseases, weeds, pests or nutrition deficiencies.

How it works



Premium datasets

<u>Now</u>: **6k** image data <u>End of 2021</u>: **70k** image data -plant species -diseases -insects -weeds -nutrient deficiencies



Different image types: -RGB -Multi/hyper spectral -Thermal



Different acquisition scenarios: -Lab -Proximal field -Aerial field







Annotation based on relative berry size:
Class 1 (Small size)
Class 2 (Large size)







Annotation based on relative berry color:

- •Gradient 1
- •Gradient 2
- •Gradient 3







Annotation based on health status:

- Healthy
- Not healthy





The AI tool report:

- Number of healthy / unhealthy grapes
- Percentage of healthy / unhealthy grapes
- Presence of disease Y/N
- Specific locations of disease (x, y)
- Confidence score for each report item (above 65%)





Potential applications:

Maturity level (class)

- Presence of disease causing (Y/N)
- Nutrient Deficiency (Y/N)
- Disease identification (list of diseases)
- 🔹 Problem severity (%)



Thank you!!

Q&A time...



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