Healthy Harvest Made Accessible

Climate Change AI Hackathon 2019

ScareCrow.Ai

The Problematic

- To feed 7 billion people
- Threat for food security:
  - Climate change
  - Decline in pollinators
  - Plants diseases
  - etc.

Plants Diseases Consequences

- Contaminations & infestation of nearby plants
- Yield loss→ Food insecurity
- Malnutrition
- Loss of money → Stress

Current Solutions

- Herbicides
- Insecticides
- Bactericides
- Fertilizers (Organic & Inorganic)
- Synthetic Chemicals

Current Solutions → Problematics

- Costly
- Enter food chains
- Damage soil & groundwater supplies
- Altering nearby & distance ecosystems
- Pollute rivers, lakes & oceans
- Damage fish supplies

- Organisms evolve!!!

ScareCrow.AI

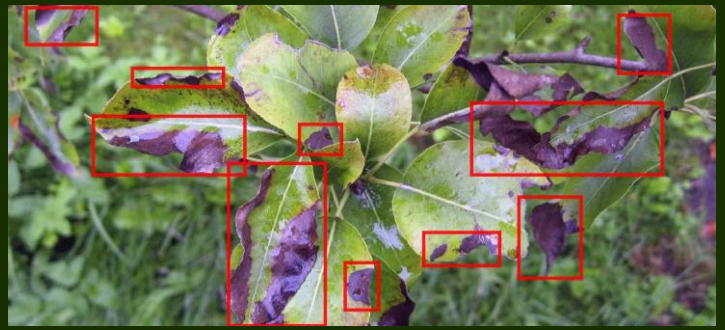
Healthy Harvest Made Accessible!

ScareCrow.AI

Our solution is:

- Cost effective
- Minimum knowledge required
- Effortless
- Preventive

ScareCrow.AI



Methodology

- 14 different crops species
- 38 class labels
- 26 different diseases
- Use deep learning to analyse 54k + images
  - Dataset distributions: Train: 88% ; Test: 12%

Methodology

Apple - Healthy

Apple – Apple Scab

Apple – Black Rot

- Using fastai.vision
  - Train model

```
# # Pre Processing
from fastai.metrics import error_rate # 1 - accuracy
learn = create_cnn(data, models.resnet34, metrics=accuracy
```

```
learn.fit_one_cycle(1)
```

epoch	train_loss	valid_loss	accuracy	time
0	0.261561	0.139192	0.953993	05:18

```
learn.fit_one_cycle(4)
```

epoch	train_loss	valid_loss	accuracy	time
0	0.225359	0.133326	0.955470	05:20
1	0.170816	0.082072	0.972850	05:26
2	0.113246	0.058147	0.980007	05:19
3	0.082028	0.048742	0.983528	05:20

AI

- Using fastai.vision
  - Train model

99%

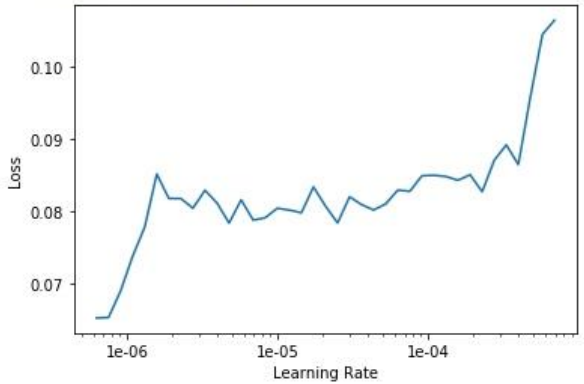
```
learn.fit_one_cycle(8,max_lr=slice(1e-5,1e-4))
```

epoch	train_loss	valid_loss	accuracy	time
0	0.065497	0.042077	0.985914	05:59
1	0.069740	0.037083	0.988527	05:59
2	0.053619	0.028164	0.991026	05:59
3	0.030326	0.022064	0.993411	06:00
4	0.038158	0.019822	0.993298	06:42
5	0.026234	0.017531	0.994547	07:57
6	0.016811	0.015522	0.994434	08:05
7	0.012487	0.014921	0.995229	08:10

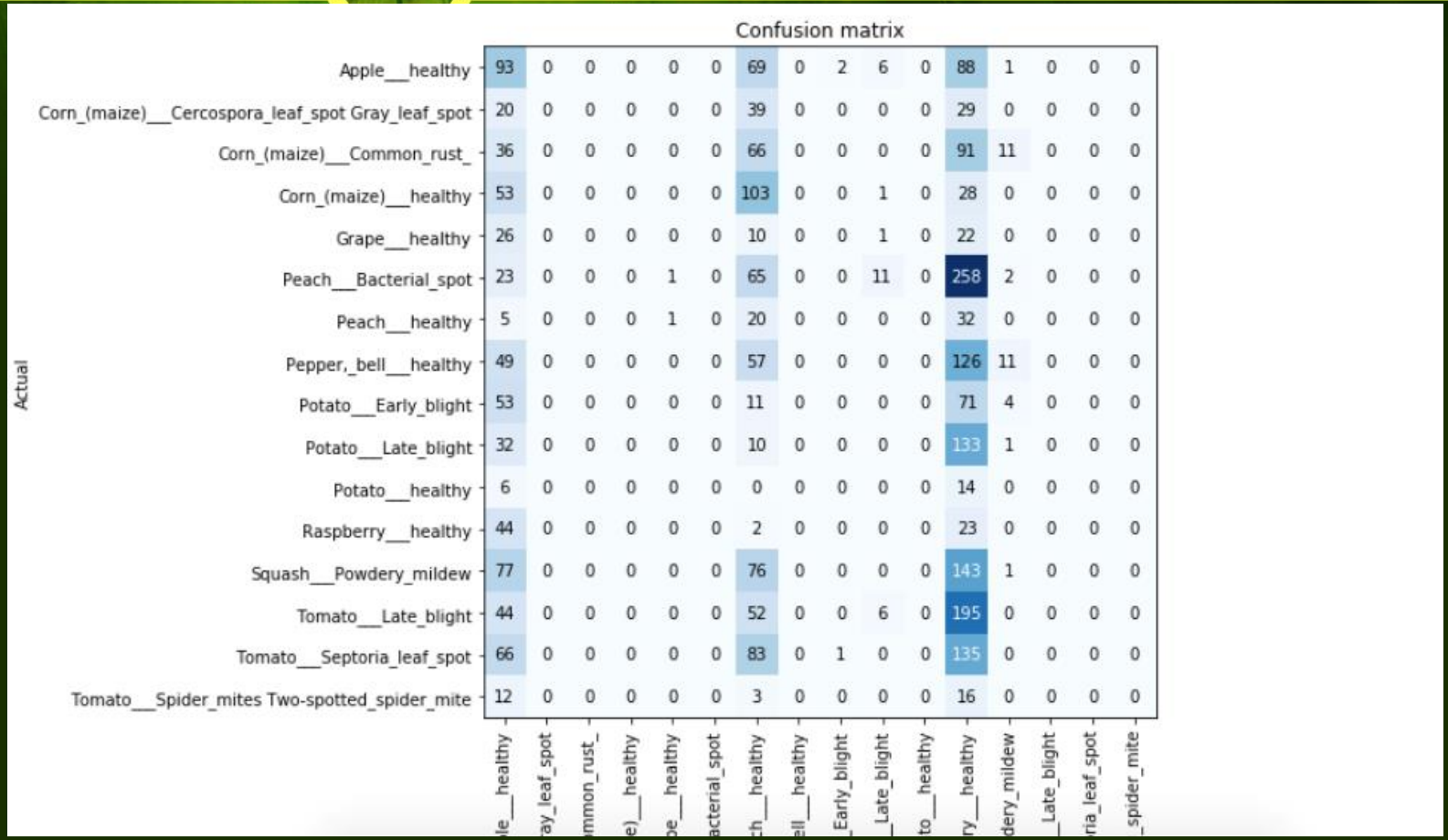
- Using fastai.vision
  - Learning Rate vs Loss Rate

```
# Find the learning rate
learn.unfreeze() # must be done before calling lr_find
learn.lr_find()
learn.recorder.plot()
```

```
LR Finder is complete, type {learner_name}.recorder.plot() to see the graph.
```

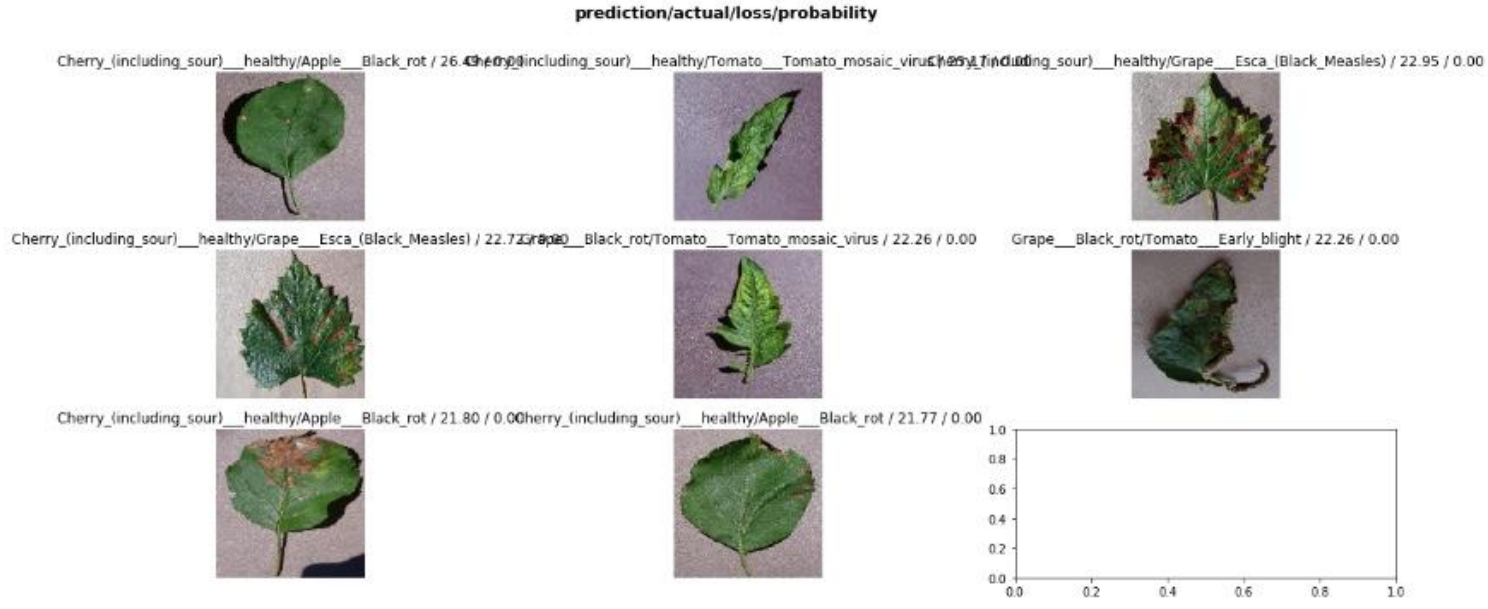


AI

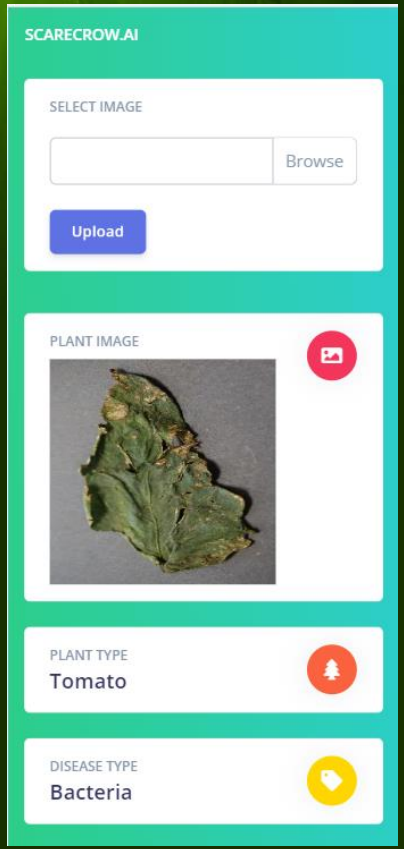

Confusion matrix
Actual
Apple___healthy 93 0 0 0 0 0 69 0 2 6 0 88 1 0 0 0
Corn_(maize)___Cercospora_leaf_spot Gray_leaf_spot 20 0 0 0 0 0 39 0 0 0 0 29 0 0 0 0
Corn_(maize)___Common_rust_ 36 0 0 0 0 0 66 0 0 0 0 91 11 0 0 0
Corn_(maize)___healthy 53 0 0 0 0 0 103 0 0 1 0 28 0 0 0 0
Grape___healthy 26 0 0 0 0 0 10 0 0 1 0 22 0 0 0 0
Peach___Bacterial_spot 23 0 0 0 1 0 65 0 0 11 0 258 2 0 0 0
Peach___healthy 5 0 0 0 1 0 20 0 0 0 0 32 0 0 0 0
Pepper,_bell___healthy 49 0 0 0 0 0 57 0 0 0 0 126 11 0 0 0
Potato___Early_blight 53 0 0 0 0 0 11 0 0 0 0 71 4 0 0 0
Potato___Late_blight 32 0 0 0 0 0 10 0 0 0 0 133 1 0 0 0
Potato___healthy 6 0 0 0 0 0 0 0 0 0 0 14 0 0 0 0
Raspberry___healthy 44 0 0 0 0 0 2 0 0 0 0 23 0 0 0 0
Squash___Powdery_mildew 77 0 0 0 0 0 76 0 0 0 0 143 1 0 0 0
Tomato___Late_blight 44 0 0 0 0 0 52 0 0 6 0 195 0 0 0 0
Tomato___Septoria_leaf_spot 66 0 0 0 0 0 83 0 1 0 0 135 0 0 0 0
Tomato___Spider_mites Two-spotted_spider_mite 12 0 0 0 0 0 3 0 0 0 0 16 0 0 0 0
Late_blight
healthy
Powdery_mildew
Late_blight
Septoria_leaf_spot
Spider_mite

AI

```
interp = ClassificationInterpretation.from_learner(learn)
interp.plot_top_losses(8, figsize=(20,8))
interp.plot_confusion_matrix(figsize=(20,10))
```



GUI


SCARECROW.AI
SELECT IMAGE
Browse
Upload
PLANT IMAGE
PLANT TYPE
Tomato
DISEASE TYPE
Bacteria

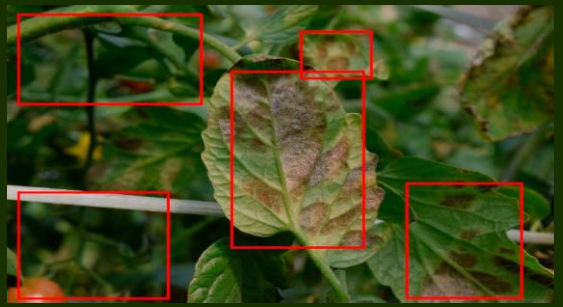
Applications

Tomato - Healthy

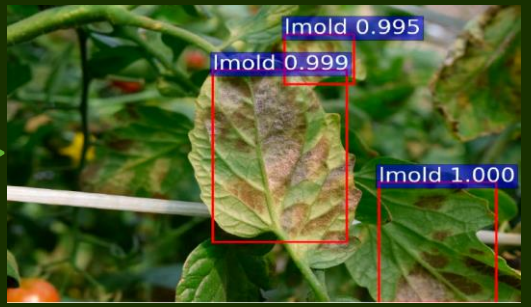
Tomato – Leaf Mold

Applications -Tomato Leaf Mold

Input Image



Annotated Image

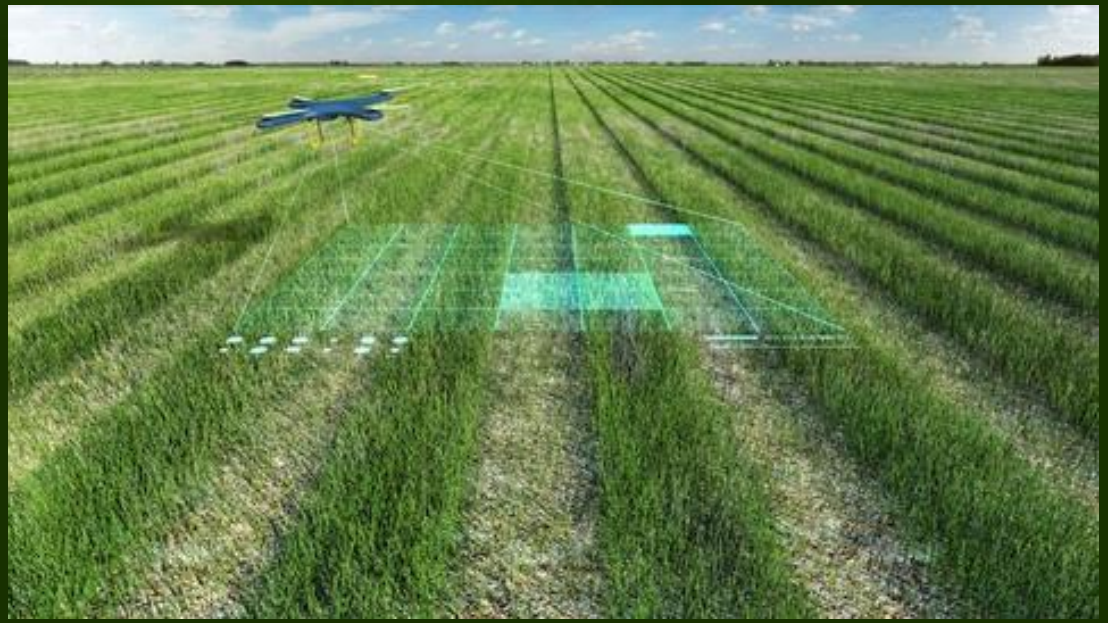


Predicted Result

Applications – Multiple Diseases

Advanced Features

- Train the model using inputs from drones



Advanced Features

- A platform of images/videos of plants shared by all farmers.

Relevance

- 450–500 million smallholder farmers worldwide
- 50% of hungry people live in those smallholder farms
- Yield loss of more than 50%

Q&A

Healthy Harvest Made Accessible!

Thank You!