

深層学習を利用した 植物画像解析 (実習)

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2019/5/21 17:15-18:45

本講義の内容

- ・ プログラムコードベースで深層学習を活用した識別モデルを使用・訓練の体験。

Metrics in Phenotype

Evaluation of Interest

Genotype Effect

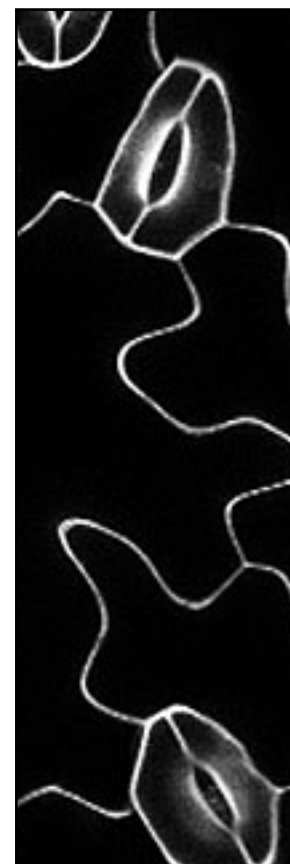
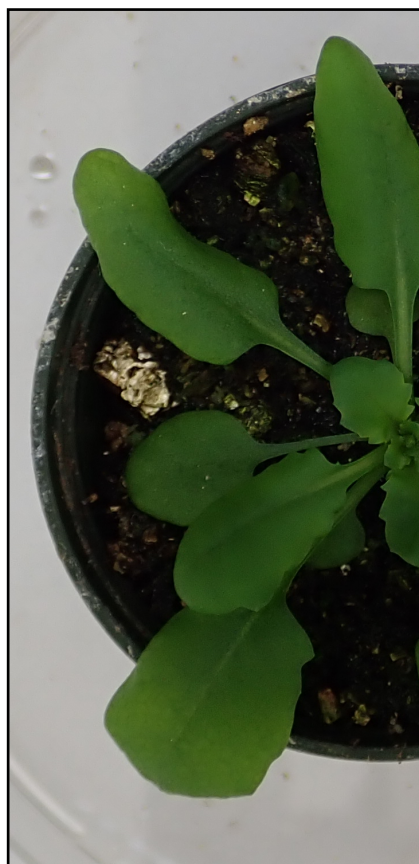
Protein Function

Environmental Stimulus

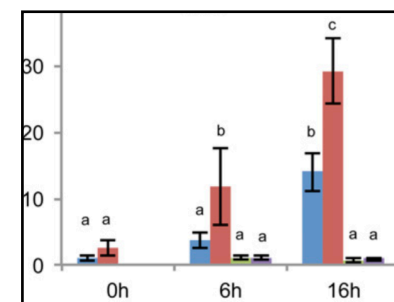
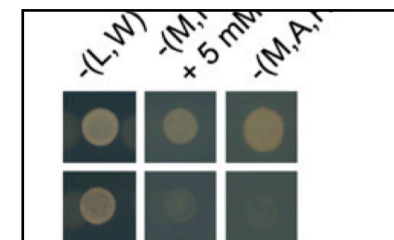
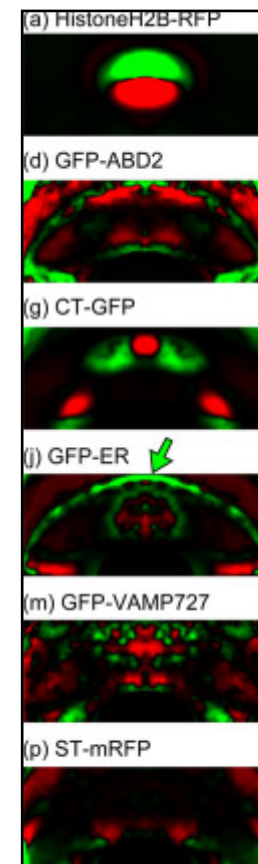
Compound Effect



Phenotyping Metrics



...



Hard

Difficulty in Defining
Appropriate Quantification Metrics

Easy

High

Information Content

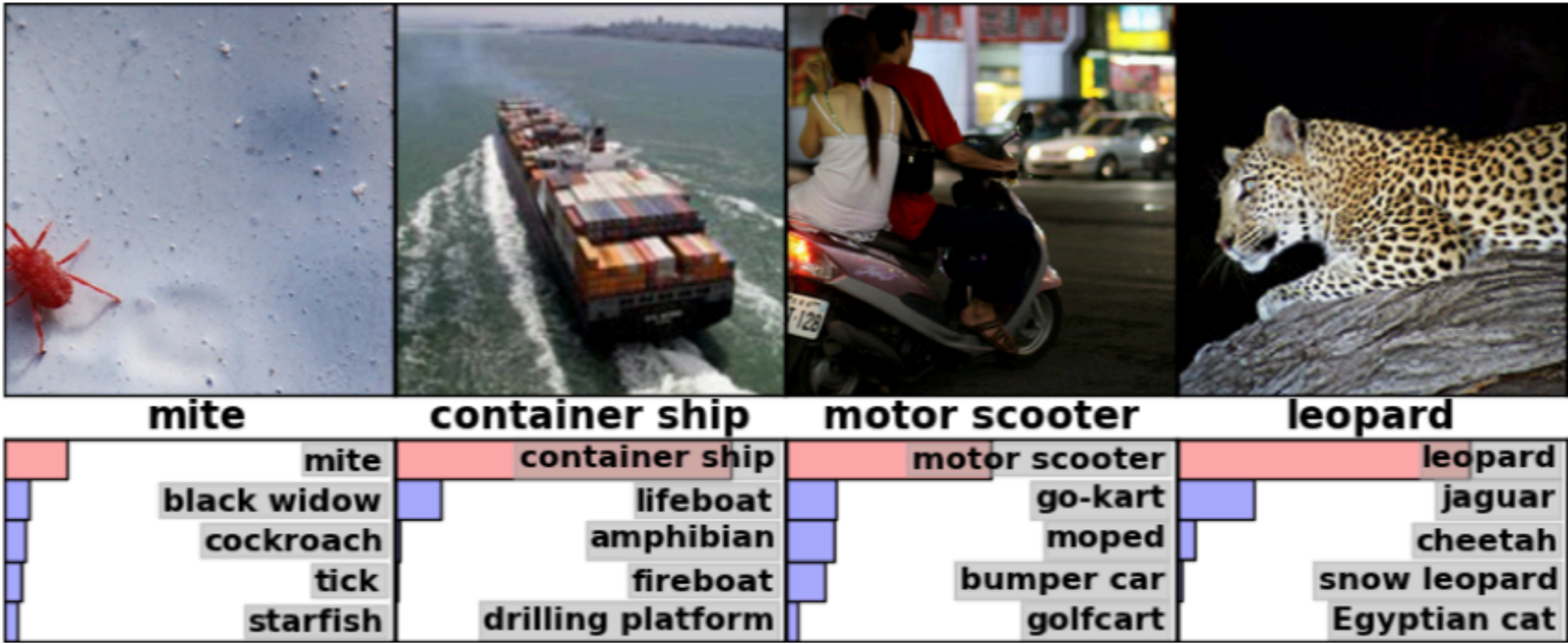
Low

GFP Image, Higaki et al., 2012

Epidermis image, http://news.stanford.edu/news/2008/december3/gifs/stomata_epidermis.jpg

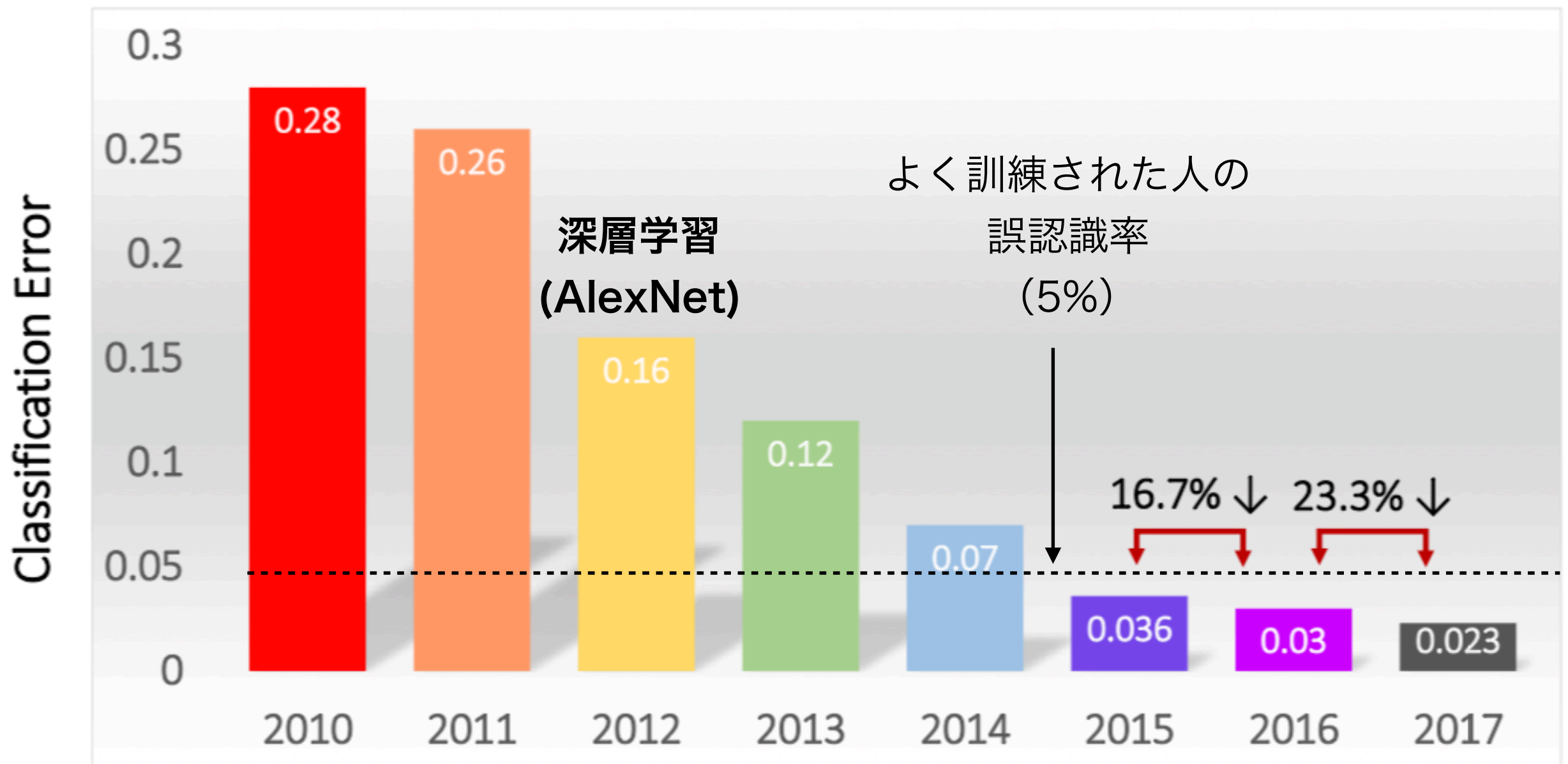
その他のデータは著者が撮影もしくは作成したもの

Practical Convolutional Neural Network (AlexNet), Breakthrough Technology in Computer Vision



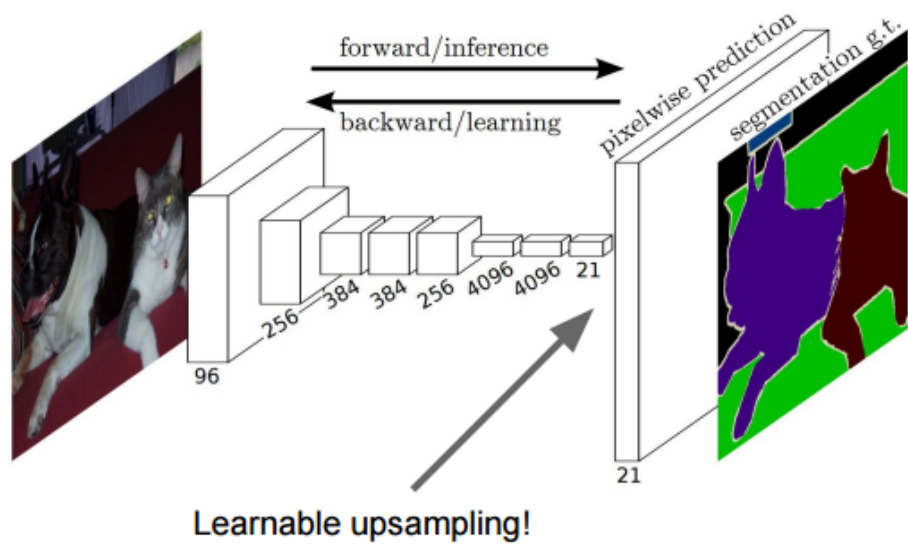
Krizhevsky et al., 2012

Classification Results (CLS)



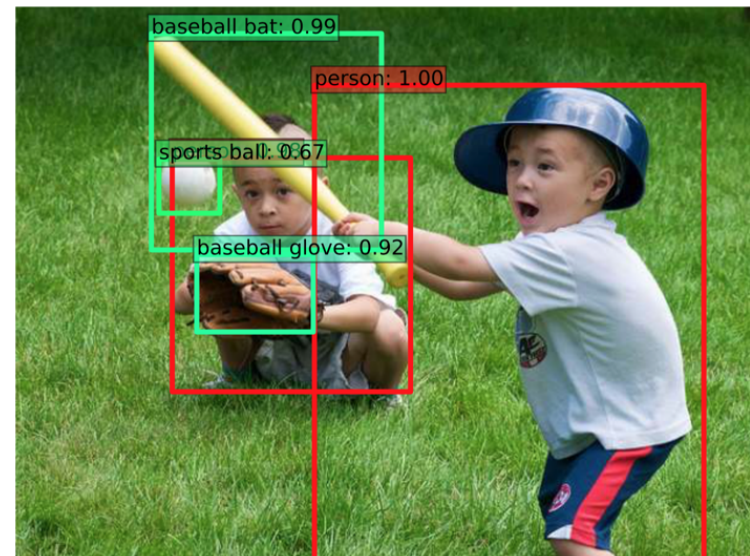
http://image-net.org/challenges/talks_2017/ILSVRC2017_overview.pdf

Application examples (related in image analysis)



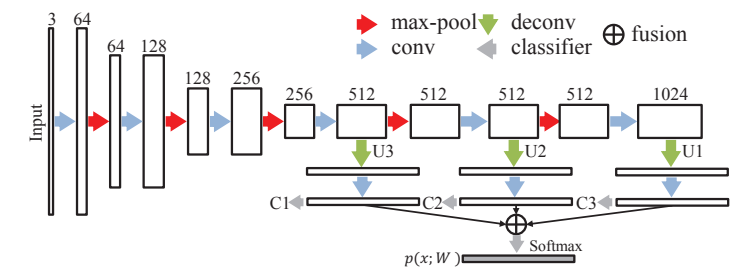
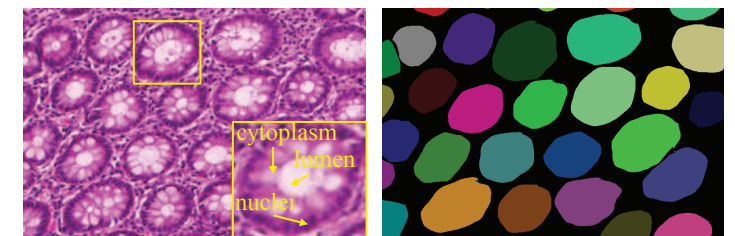
Long et al., 2015

物体領域抽出



Liu et al., 2015

物体検出



Chen et al., 2016

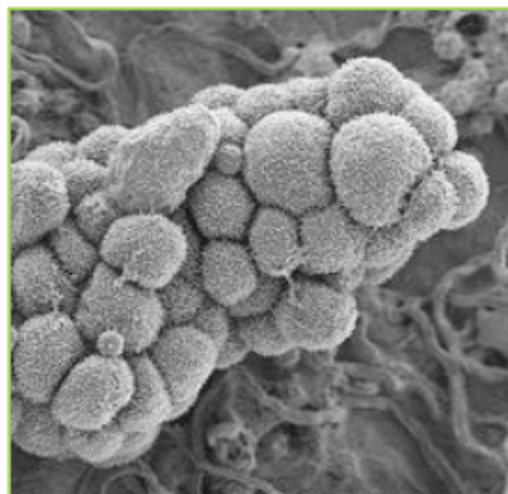
物体領域分割

Applications in various domain



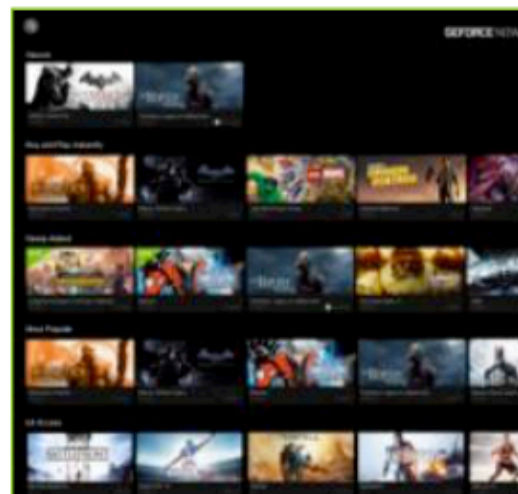
INTERNET & CLOUD

Image Classification
Speech Recognition
Language Translation
Language Processing
Sentiment Analysis
Recommendation



MEDICINE & BIOLOGY

Cancer Cell Detection
Diabetic Grading
Drug Discovery



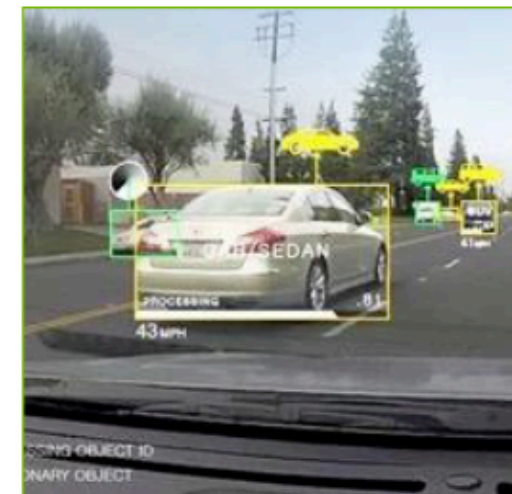
MEDIA & ENTERTAINMENT

Video Captioning
Video Search
Real Time Translation



SECURITY & DEFENSE

Face Detection
Video Surveillance
Satellite Imagery



AUTONOMOUS MACHINES

Pedestrian Detection
Lane Tracking
Recognize Traffic Sign

Recommendation
Sentiment Analysis
Language Processing
Language Translation
Speech Recognition
Image Classification

Drug Discovery
Diabetic Grading
Cancer Cell Detection

Real Time Translation
Video Search
Video Captioning

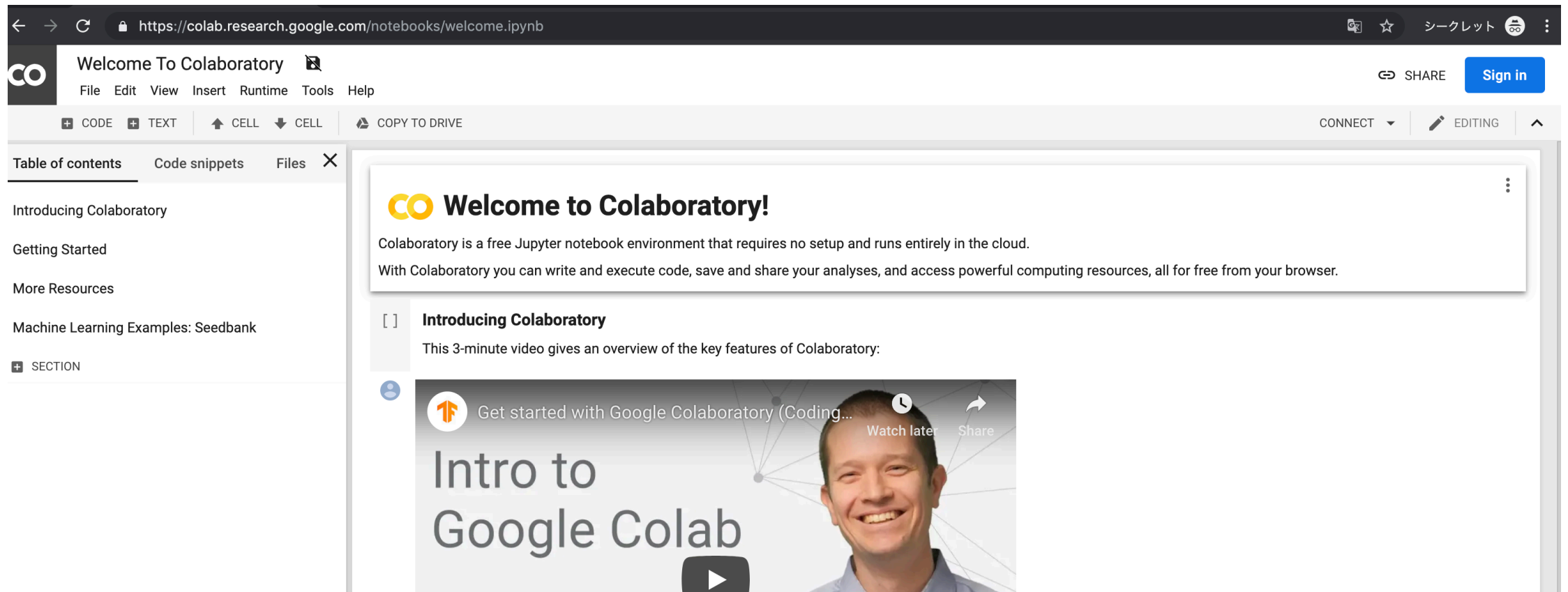
Satellite Imagery
Video Surveillance
Face Detection

Recognize Traffic Sign
Lane Tracking
Pedestrian Detection

NVIDIA

Google Colaboratory

次のサイトにアクセス <https://colab.research.google.com/>

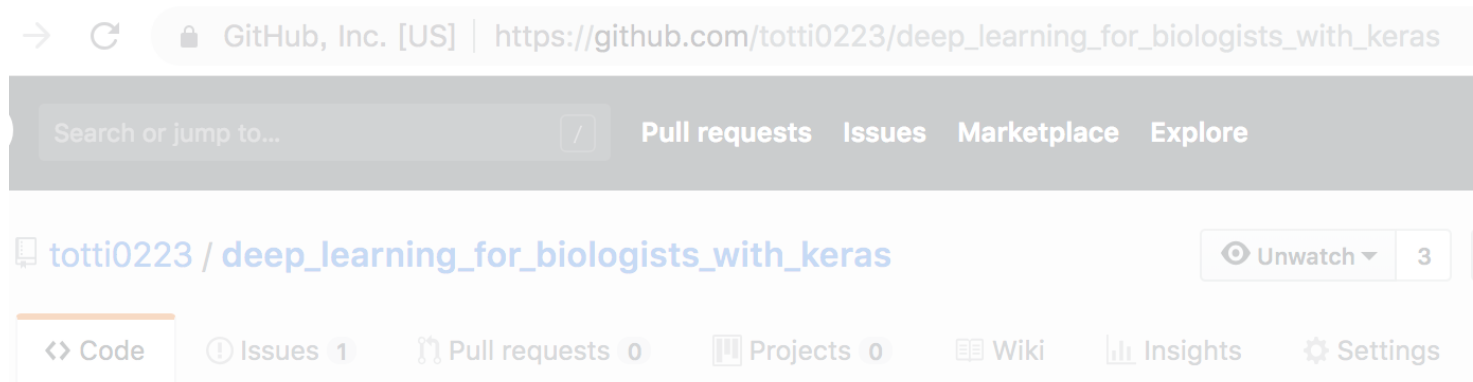


The screenshot shows the Google Colaboratory interface in a web browser. The address bar displays the URL `https://colab.research.google.com/notebooks/welcome.ipynb`. The page title is "Welcome To Colaboratory". The top navigation bar includes "File", "Edit", "View", "Insert", "Runtime", "Tools", and "Help". On the right, there are links for "SHARE" and "Sign in". Below the navigation bar, there are tabs for "+ CODE", "+ TEXT", "CELL", and "COPY TO DRIVE". The left sidebar contains a "Table of contents" with links to "Introducing Colaboratory", "Getting Started", "More Resources", and "Machine Learning Examples: Seedbank". The main content area features a "Welcome to Colaboratory!" message, stating that it is a free Jupyter notebook environment that runs in the cloud. Below this, there is a section titled "Introducing Colaboratory" with a video player showing a video titled "Intro to Google Colab" by Google.

チュートリアルへのアクセスの仕方

1. Github経由

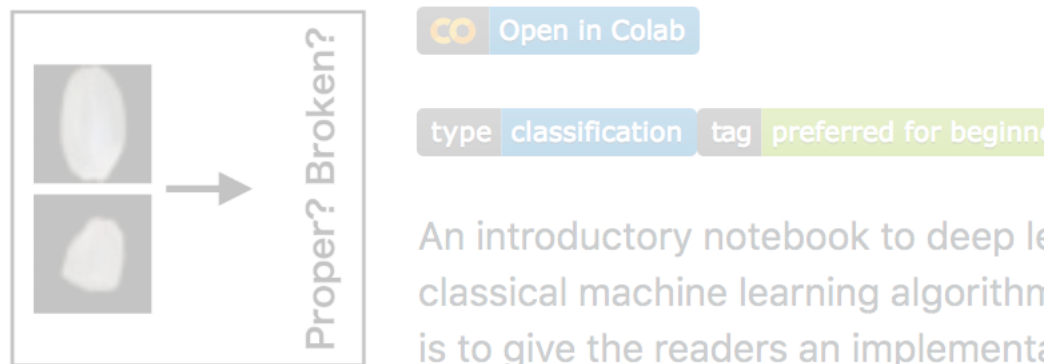
totti0223 github
で検索



open in colabをクリック

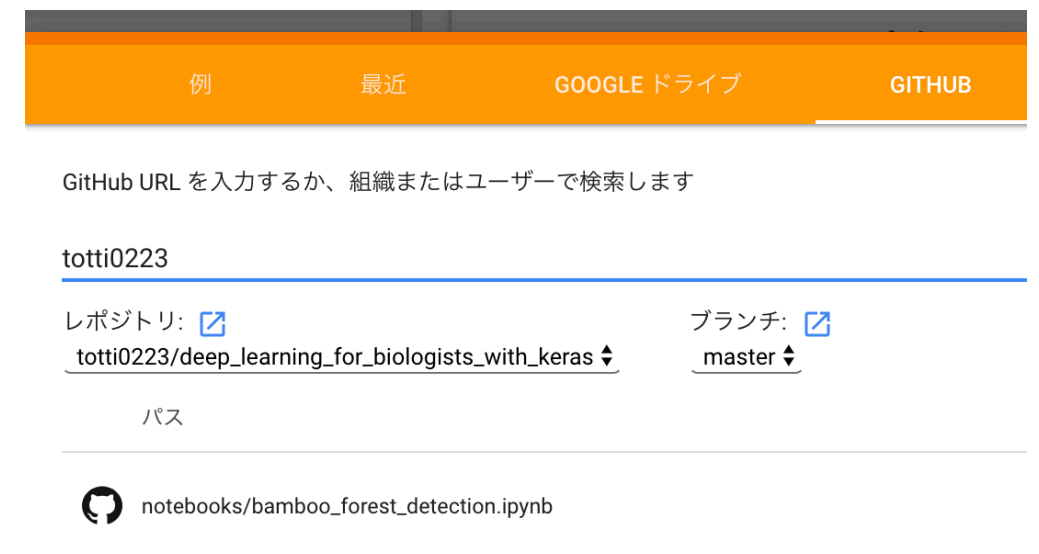
(ないしは右クリックで新しいタブ)

Rice Seed Integrity: What is deep learning.



2. Colab経由

colab.research.google.comにアクセス



初期画面か「ノートブックを開く」で
出てくるメニューから

→github→totti0223と入力

→repoからdeeplearningforbiologists~
を選択

→該当のtutorialを開く

今回は**VGG_demo.ipynb**

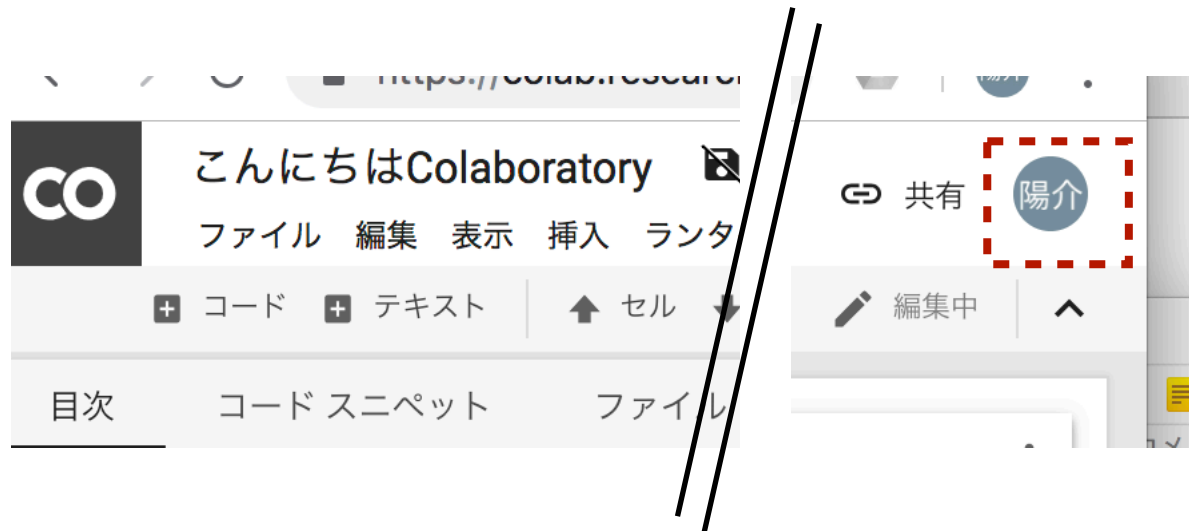
or **PlantDisease_tutorial.ipynb**

colab notebookを始める前に

1. googleアカウントにログインしていることを確認

(していない場合途中指示が出る)

ログイン中は画面右上に自分の名前が表示される



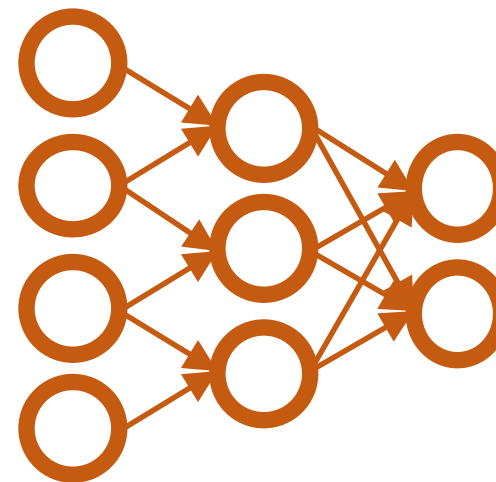
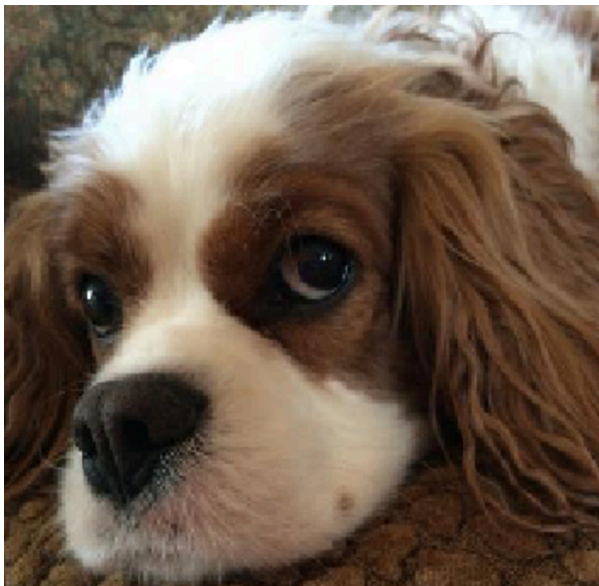
はじめてnotebookを実行するときは上記の注意が出るので、
～リセットするのチェックを外して実行

2. notebookをgoogle docにダウンロード

(自分で改変したコードを保存できるようになる)



VGG_demo.ipynb



Pre-trained
VGG19 network



[コイの確率、
金魚の確率、
イタチザメの確率、
シュモクザメの確率、
.
.
.
トイレットペーパーの確率
]

(height, width, channel)
= (224,224,3)

(カテゴリの数)
=(1000)

ImageNet(1000)ラベル

```
{0: 'tench, Tinca tinca',  
  1: 'goldfish, Carassius auratus',  
  2: 'great white shark, white shark, man-eater, man-eating shark, Carcharodon carcharias',  
  3: 'tiger shark, Galeocerdo cuvieri',  
  4: 'hammerhead, hammerhead shark',  
  5: 'electric ray, crampfish, numbfish, torpedo',  
  6: 'stingray',  
  7: 'cock',  
  8: 'hen',  
  9: 'ostrich, Struthio camelus',  
 10: 'brambling, Fringilla montifringilla',  
 11: 'goldfinch, Carduelis carduelis',  
 12: 'house finch, linnet, Carpodacus mexicanus',  
 13: 'junco, snowbird',  
 14: 'indigo bunting, indigo finch, indigo bird, Passerina cyanea',  
 15: 'robin, American robin, Turdus migratorius',  
 16: 'bulbul',  
 17: 'jay',  
 18: 'magpie',  
 19: 'chickadee',  
  
990: 'buckeye, horse chestnut, conker',  
991: 'coral fungus',  
992: 'agaric',  
993: 'gyromitra',  
994: 'stinkhorn, carrion fungus',  
995: 'earthstar',  
996: 'hen-of-the-woods, hen of the woods, Polyporus frondosus, Grifola frondosa',  
997: 'bolete',  
998: 'ear, spike, capitulum',  
999: 'toilet tissue, toilet paper, bathroom tissue'}
```

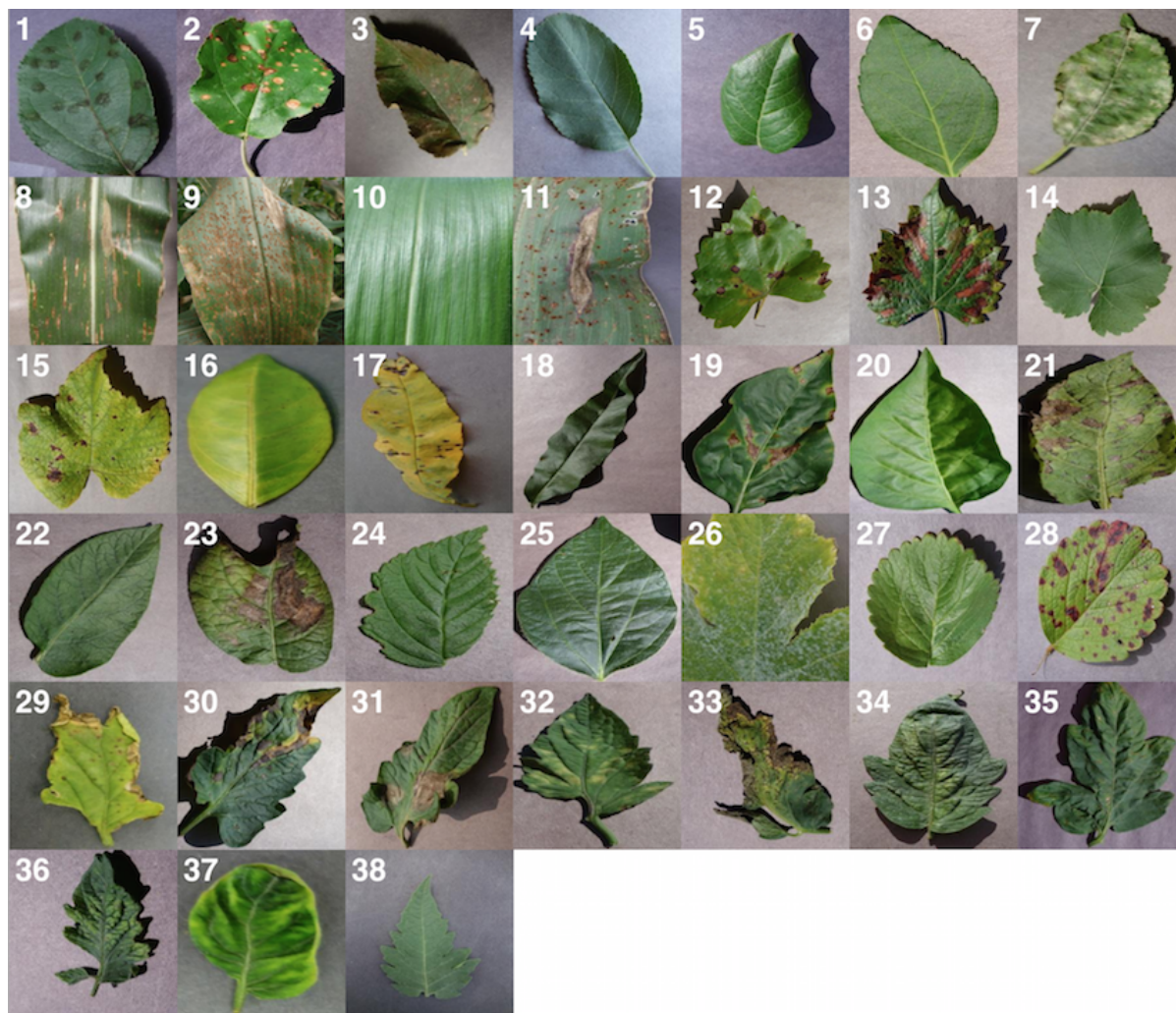
<https://gist.github.com/yrevar/942d3a0ac09ec9e5eb3a>

Constructing a crop disease diagnosis model

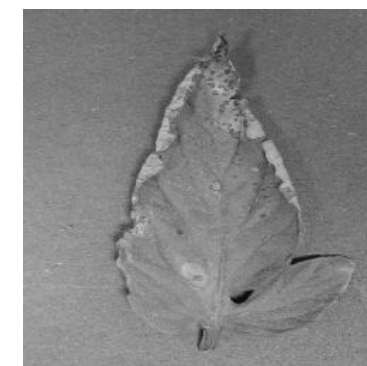
Using Deep Learning for Image-Based Plant Disease Detection

Sharada Prasanna Mohanty^{1,2}, David Hughes^{3,4,5}, and Marcel Salathé^{1,2,6}

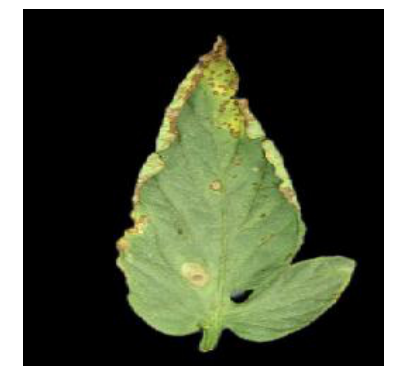
¹Digital Epidemiology Lab, EPFL, Switzerland; ²School of Life Sciences, EPFL, Switzerland; ³Department of Entomology, College of Agricultural Sciences, Penn State University, USA; ⁴Department of Biology, Eberly College of Sciences, Penn State University, USA; ⁵Center for Infectious Disease Dynamics, Huck Institutes of Life Sciences, Penn State University, USA; ⁶School of Computer and Communication Sciences, EPFL, Switzerland



(a) **Leaf 1:** Color



(b) **Leaf 1:** Grayscale



(c) **Leaf 1:** Segmented



(d) **Leaf 2:** Color



(e) **Leaf 2:** Grayscale



(f) **Leaf 2:** Segmented

Fig. 2. Sample images from the three different versions of the PlantVillage dataset

PlantDisease_tutorial.ipynb

Late_blight



healthy



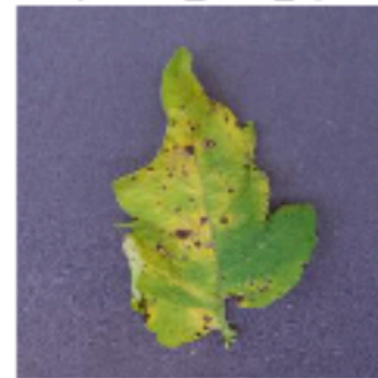
Target_Spot



Early_blight



Septoria_leaf_spot



Bacterial_spot



PlantVillageDatasetのうち、トマト 5 種の病気（+健康）を
利用して病害診断モデルを作成してみましょう

Late Blight : 疫病

Target Spot : 褐色輪紋病

Early Blight : 輪紋病

Septoria Leaf Spot : 白星病

Bacterial Spot : 細菌病