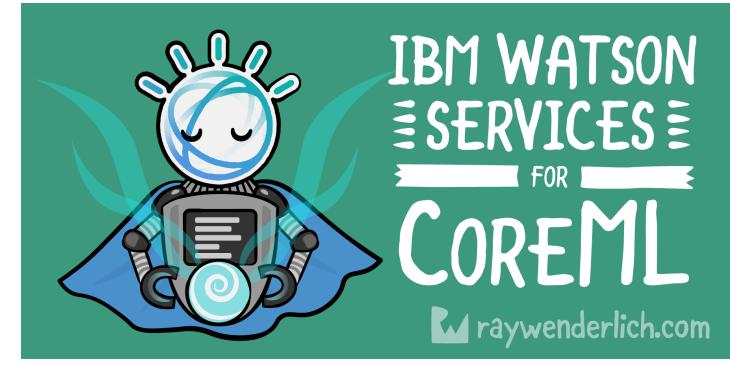
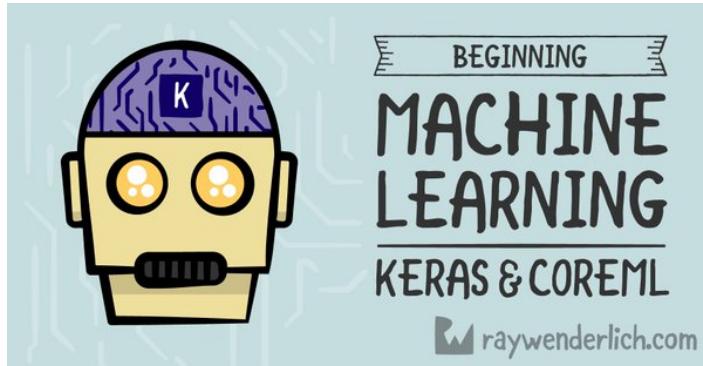
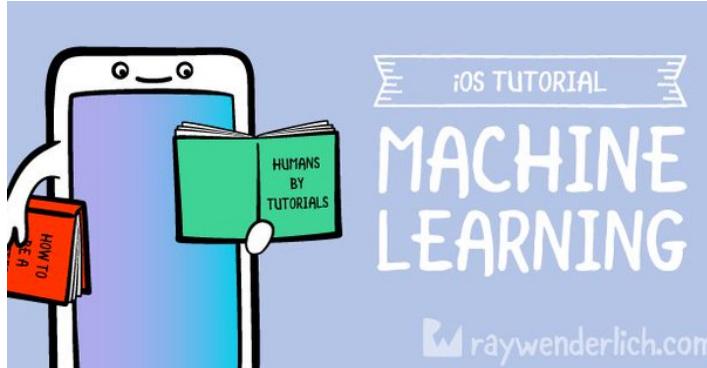


Getting Started with Apple ML



AUDREY TAM @ TRY! SWIFT NYC 2018

@ RAYWENDERLICH.COM



APPLE ML JOURNAL

An On-device Deep Neural Network for Face Detection

Vol. 1, Issue 7 · November 2017
by Computer Vision Machine Learning Team

Using Vision Framework

Did we accomplish what we set as our goal of developing a performant, easy-to-use, face detection API? You can try the Vision framework and judge for yourself. Here's how to get started:

- Watch the WWDC presentation: [Vision Framework: Building on Core ML](#).
- Read the [Vision Framework Reference](#).
- Try out the Core ML and Vision: Machine Learning in iOS 11 Tutorial. [\[5\]](#)

[5] Tam, A. **Core ML and Vision: Machine learning in iOS Tutorial**. Retrieved from <https://www.raywenderlich.com>, September, 2017.



WHAT IS MACHINE LEARNING?

In 1959, Arthur Samuel, a pioneer in the field of machine learning (ML) defined it as the "field of study that gives computers the ability to learn without being explicitly programmed".



Will Wilson @WAWilsonIV · Oct 31

"What's the **difference** between **AI** and **ML**?"

"It's **AI** when you're raising money, it's **ML** when you're trying to hire people."

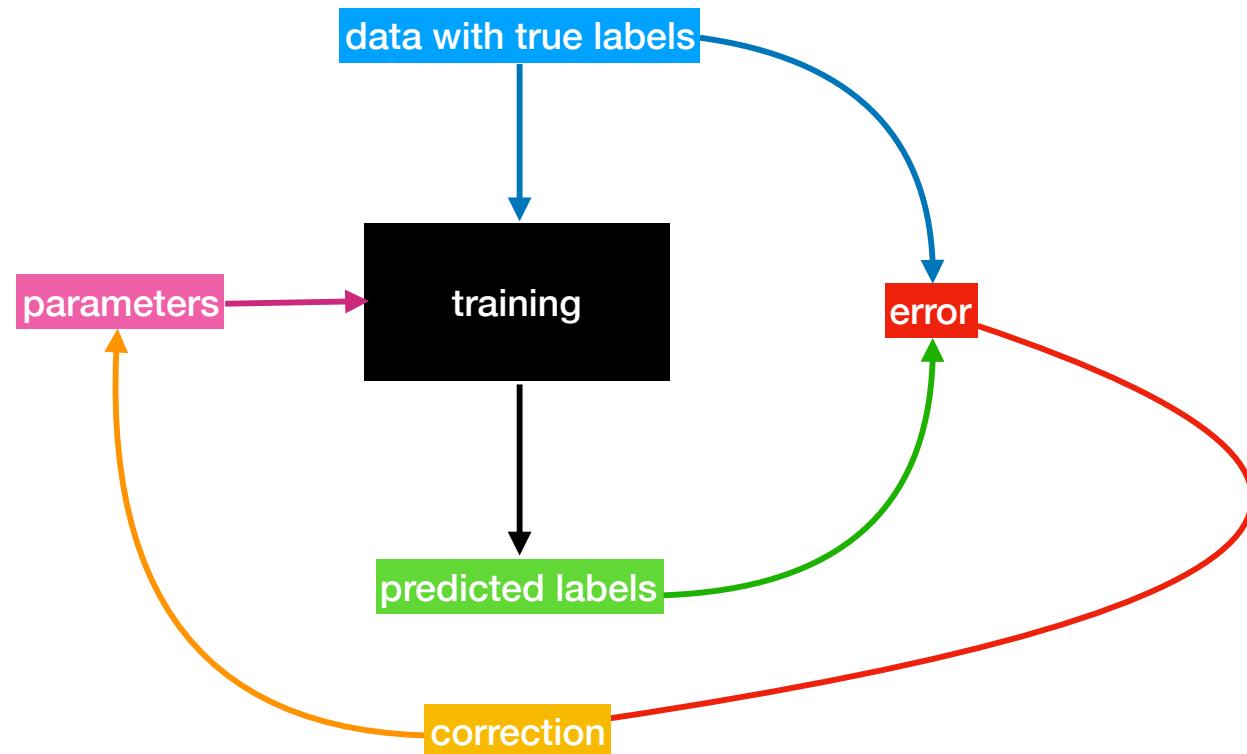
65

4.6K

9.5K

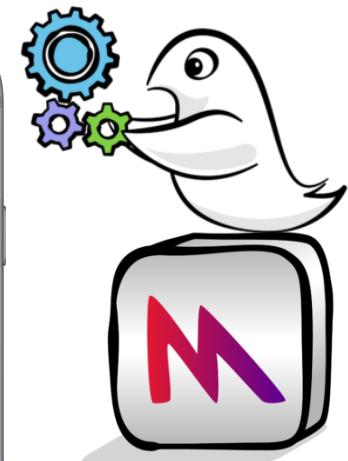


TRAINING



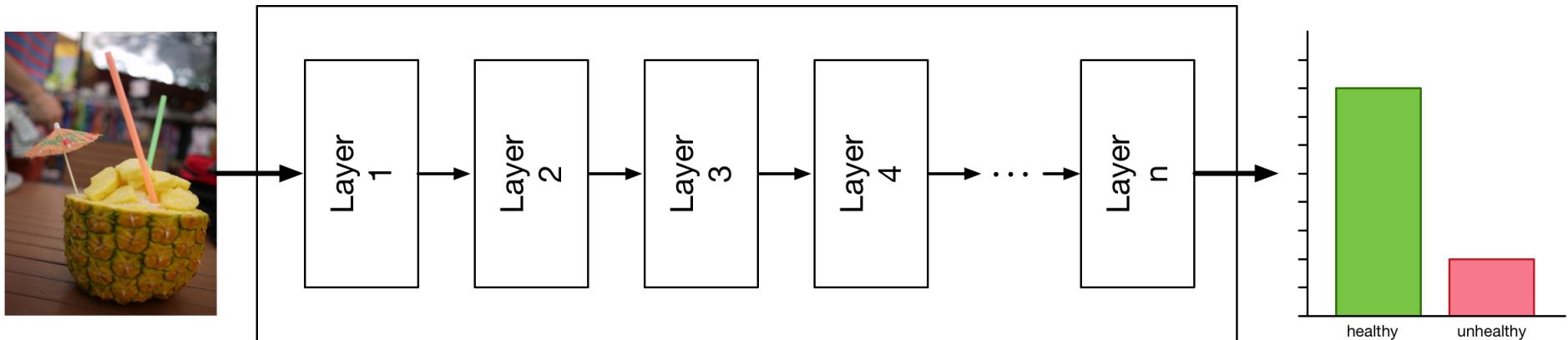
TRAINING & INFERENCE

Training

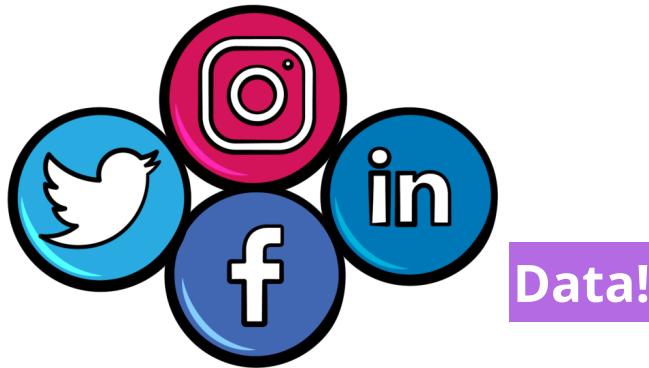


Inference

DEEP LEARNING?



neural network classifier



GPUs



http://www.nvidia.com/object/io_1236061095357.html



IS IT HARD / A LOT OF WORK?

TASKS

Existing models

Frameworks

Transfer learning

You don't have to be a machine learning expert ...

MODELS

CNN architectures

Hyperparameters

Activation functions

ALGORITHMS

Gradient descent

Complex math

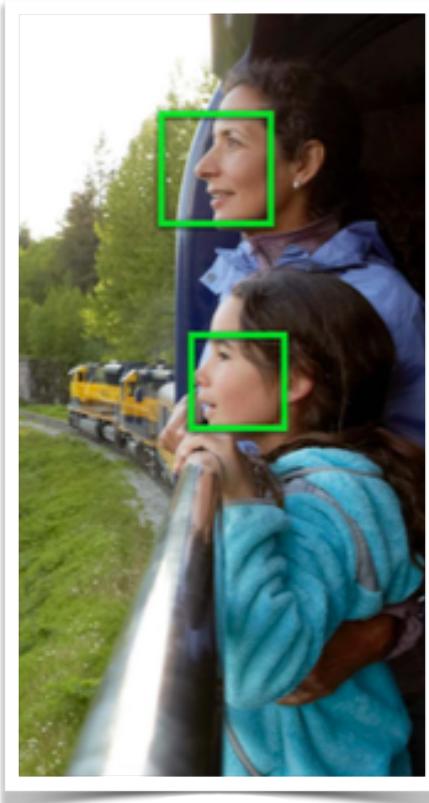


APPLE ML

- ⚙️ Core ML
- ⚙️ Core ML Tools
- ⚙️ Turi Create
- ⚙️ Create ML
- ⚙️ Vision
- ⚙️ Natural Language
- ⚙️ Speech
- ⚙️ SiriKit
- ⚙️ GameplayKit



VISION FRAMEWORK



images from WWDC 2017 #506



VN IMAGE REQUEST HANDLER



```
let imageHandler = VNImageRequestHandler(cgImage: cgImage,  
orientation: orientation)  
let faceRequest = VNDetectFaceRectanglesRequest(  
completionHandler: handleFaces)  
try? imageHandler.perform([faceRequest])
```



READY-TO-USE MODELS

SqueezeNet

5 MB

Places205-GoogLeNet

17 MB

MobileNet

25 MB

Inception v3

95 MB

ResNet50

103 MB

VGG16

554 MB



CORE ML CONVERTERS

Keras / Auto Keras

Caffe

scikit-learn

LIBSVM

XGBoost



Watson Vision

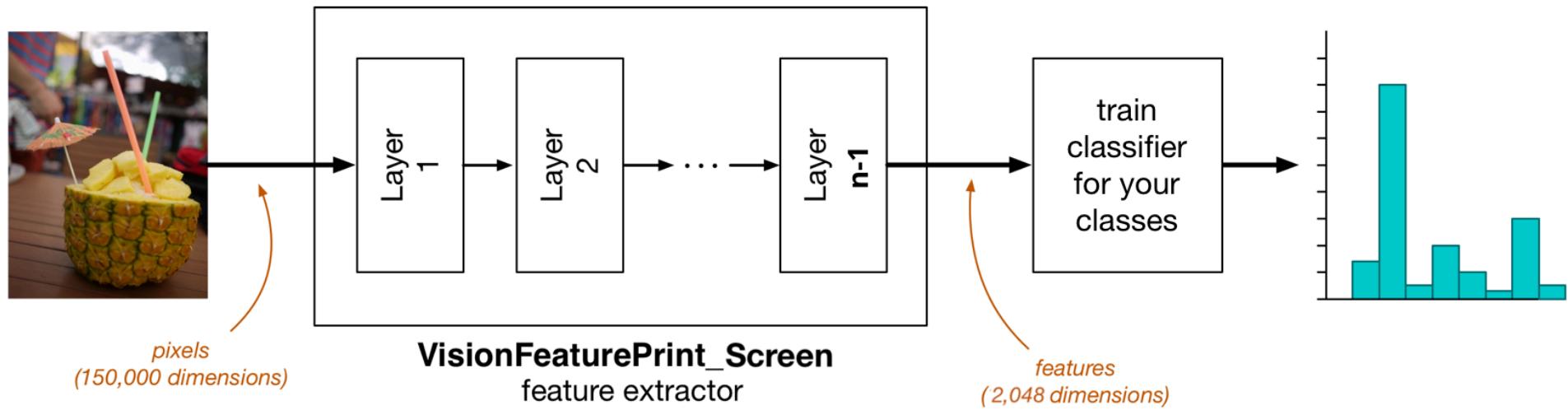
MXNet

TensorFlow

ONNX



TRANSFER LEARNING



“JUST” ADD DATA



doughnut/0e4d2f7afc5efeee.jpg



ice cream/4472c8cc1e2becc0.jpg



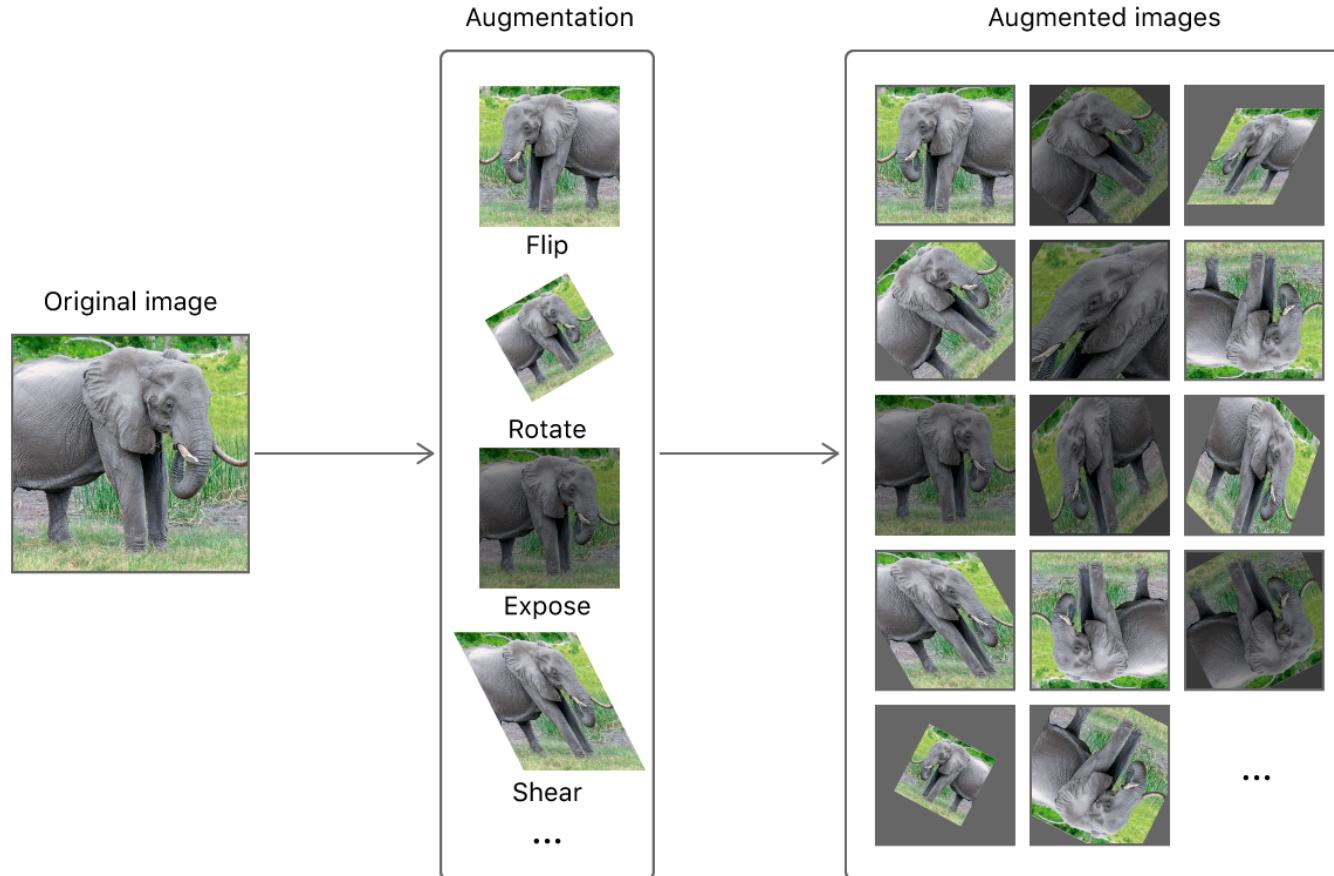
pineapple/856841a5b385c465.jpg



salad/ea2347b86bc95314.jpg

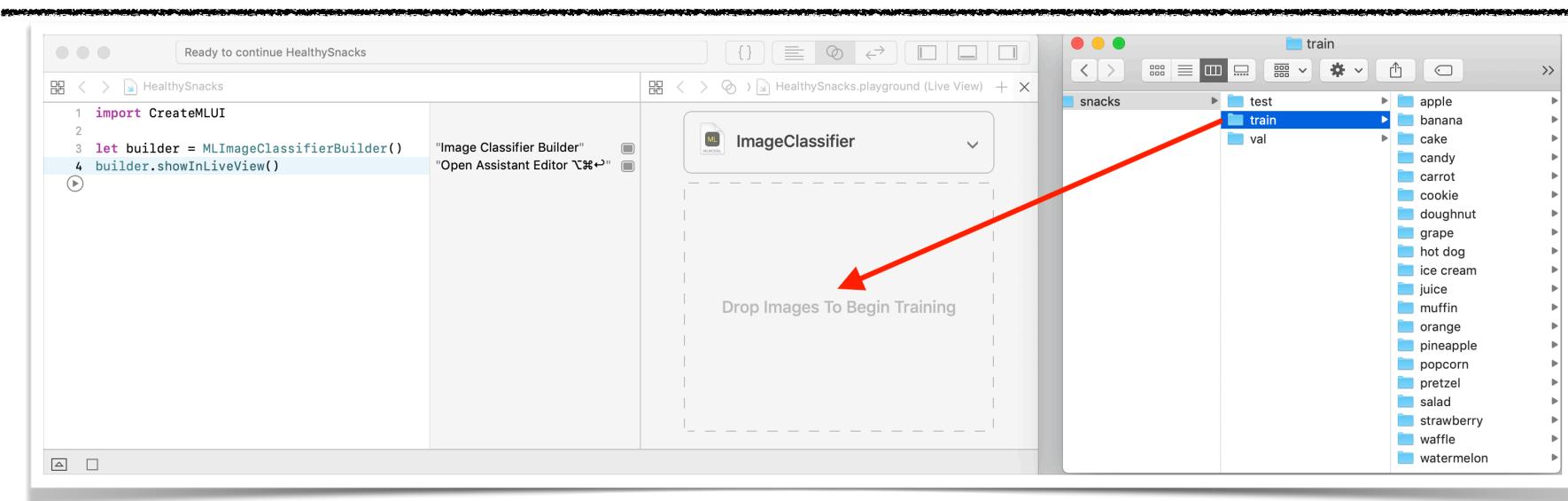


DATA AUGMENTATION

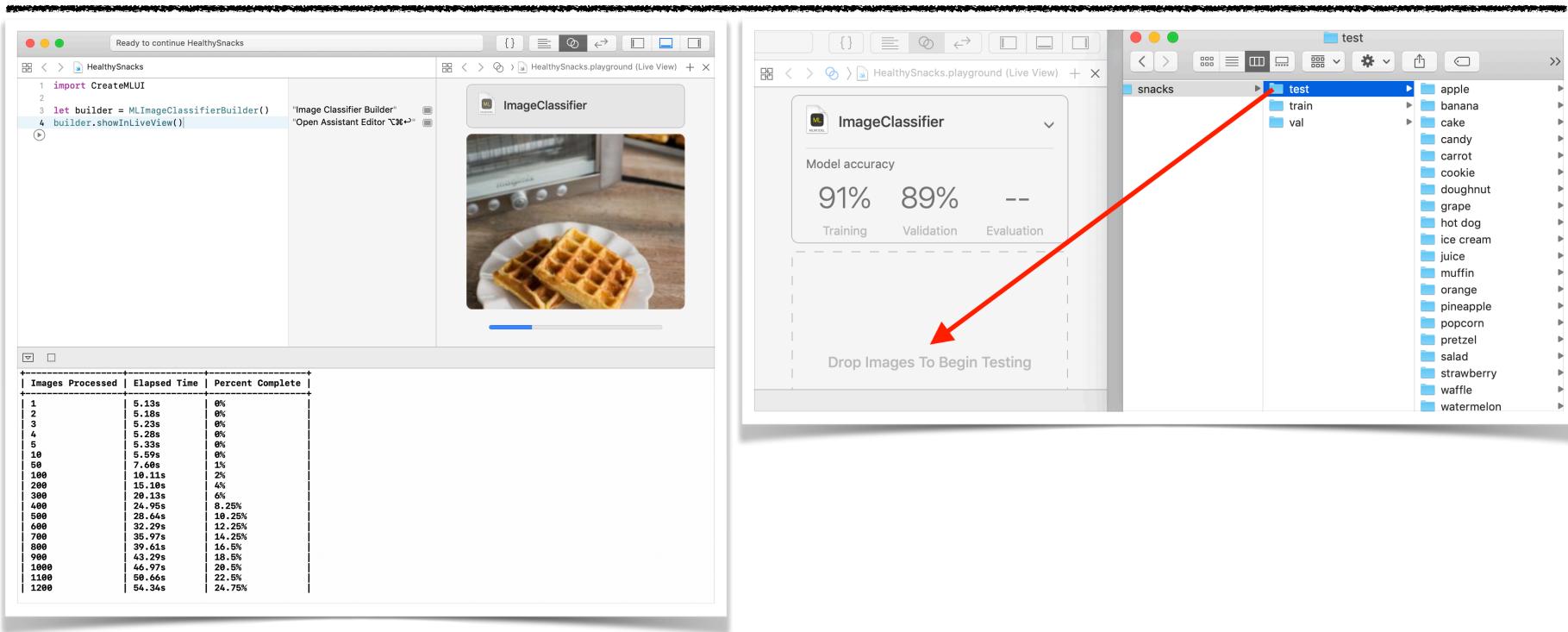


source: https://developer.apple.com/documentation/create_ml/improving_your_model_s_accuracy

CREATE ML



CREATE ML



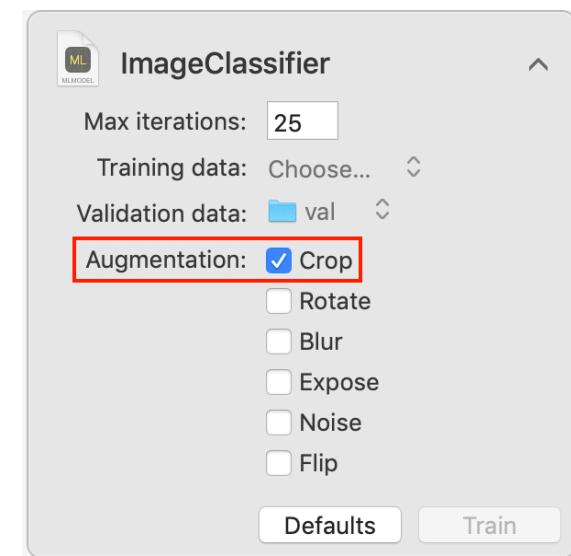
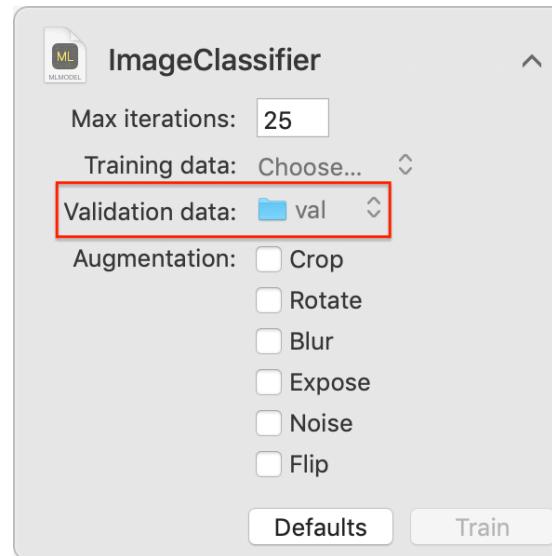
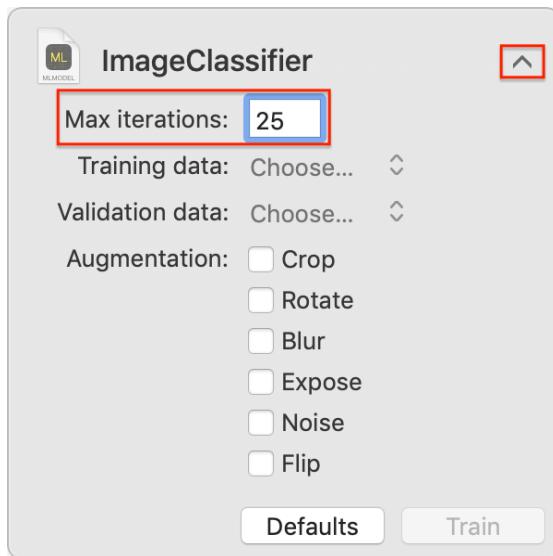
R

VALIDATION VS TEST

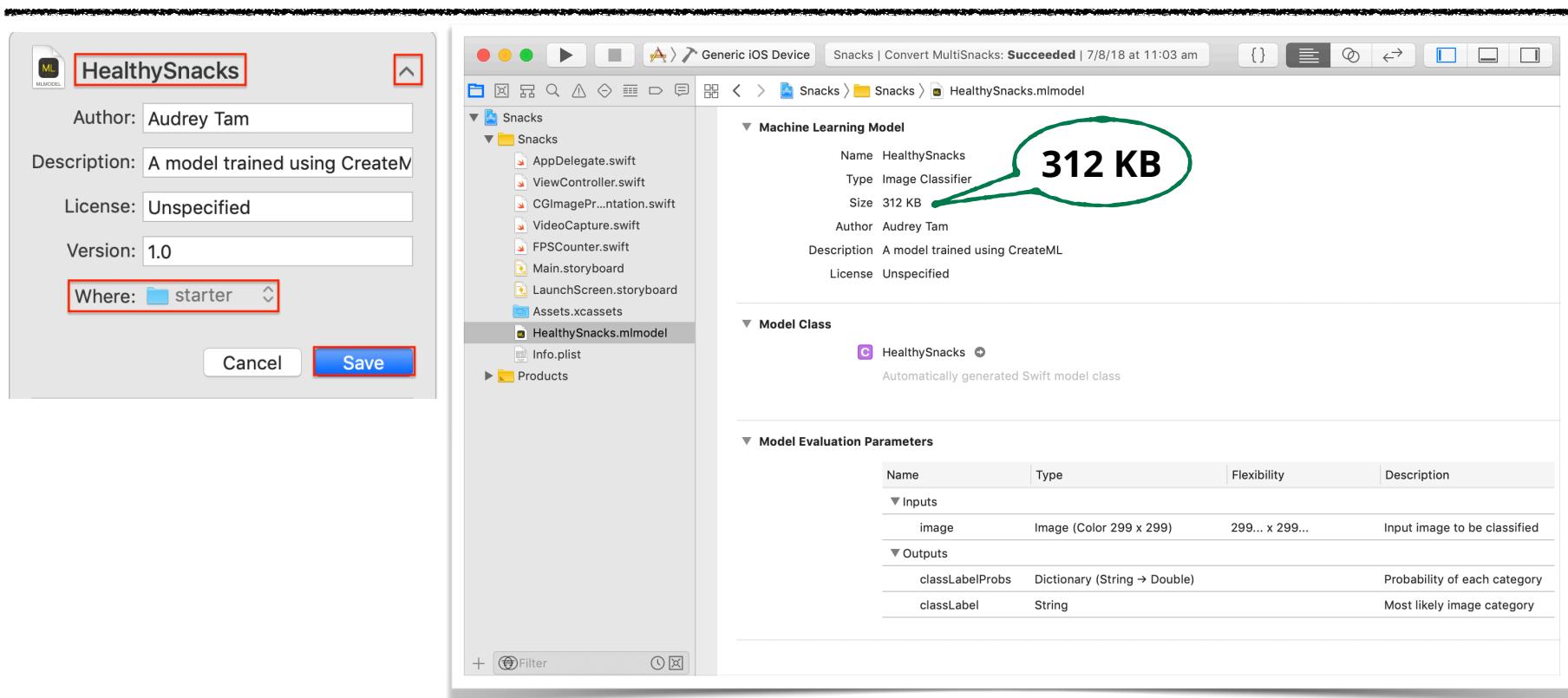
Iteration	Passes	Step size	Elapsed Time	Training Accuracy	Validation Accuracy
5	8	1.000000	3.421915	0.815468	0.850806
10	13	1.000000	5.857664	0.884532	0.875000
15	19	1.000000	8.655192	0.926580	0.903226
20	24	1.000000	11.080811	0.944227	0.895161
25	29	1.000000	13.513294	0.982353	0.883065
30	34	1.000000	15.903836	0.994553	0.879032
35	39	1.000000	18.329717	0.998911	0.875000
40	44	1.000000	20.812450	1.000000	0.850806
45	49	1.000000	23.279066	1.000000	0.854839
50	55	1.000000	26.231560	1.000000	0.866935



CREATE ML



CREATE ML



CREATE ML

```
lazy var classificationRequest: VNCoreMLRequest = {
    do {
        let healthySnacks = HealthySnacks()
        let visionModel = try VNCoreMLModel(for: healthySnacks.model)
        let request = VNCoreMLRequest(model: visionModel,
            completionHandler: handleImage)
        return request
    } catch {
        fatalError("Failed to create VNCoreMLModel: \(error)")
    }
}()
```

```
let imageHandler = VNIImageRequestHandler(cgImage: cgImage,
    orientation: orientation)
try? imageHandler.perform([faceRequest])
```



TEXT CLASSIFIER

```
1 import Foundation
2 import CreateML
3
4 let trainSet = URL(fileURLWithPath: "/Users/coreml/Desktop/wwdc_demo/train")
5
6 let model = try MLTextClassifier(trainingData: .labeledDirectories(at: trainSet))
7
```

source: <https://developer.apple.com/videos/play/wwdc2018/703/>

- ⚙️ See also <https://flight.school/articles/classifying-programming-languages-with-createml/>



TURI CREATE TASKS

- ⚙️ *Image Classifier*
- ⚙️ *Text Classifier*
- ⚙️ Object Detection
- ⚙️ Style Transfer



source: https://apple.github.io/turicreate/docs/userguide/style_transfer/

- ⚙️ Recommender
- ⚙️ Activity Classifier
- ⚙️ Image Similarity

The screenshot shows a user interface titled "Biometric Mirror". On the left is a camera feed showing a man standing outdoors with his arms crossed. On the right is a table titled "Information Display" with the session ID "Session x7f7t". The table lists various attributes with their values and confidence levels:

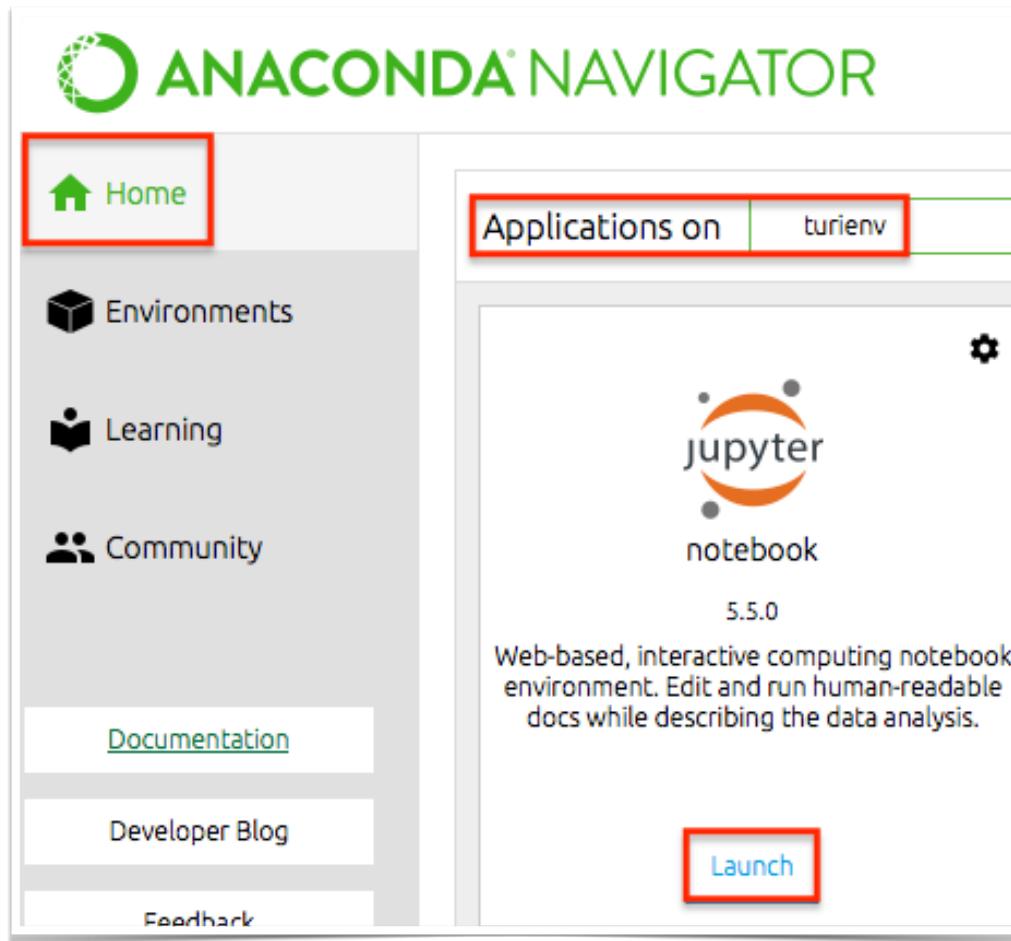
Attribute	Value	Conf
Gender	MALE	N/A
Age	29	N/A
Ethnicity	CAUCASIAN	98%
Emotion	NEUTRAL	89%
Kindness	AVERAGE	76%
Happiness	AVERAGE	96%
Commonness	LOW	92%
Responsibility	LOW	98%
Attractiveness	LOW	51%
Sociability	AVERAGE	94%
Introversion	AVERAGE	100%
Aggressiveness	HIGH	98%
Weirdness	AVERAGE	98%
Emotional Stability	AVERAGE	99%

COVER FACE-Exit

more information via <http://go.unimelb.edu.au/vi56>

source: <https://www.smh.com.au/technology/this-algorithm-says-i-m-aggressive-irresponsible-and-unattractive-but-should-we-believe-it-20180801-p4zuu6.html>

TURI CREATE



TURI CREATE

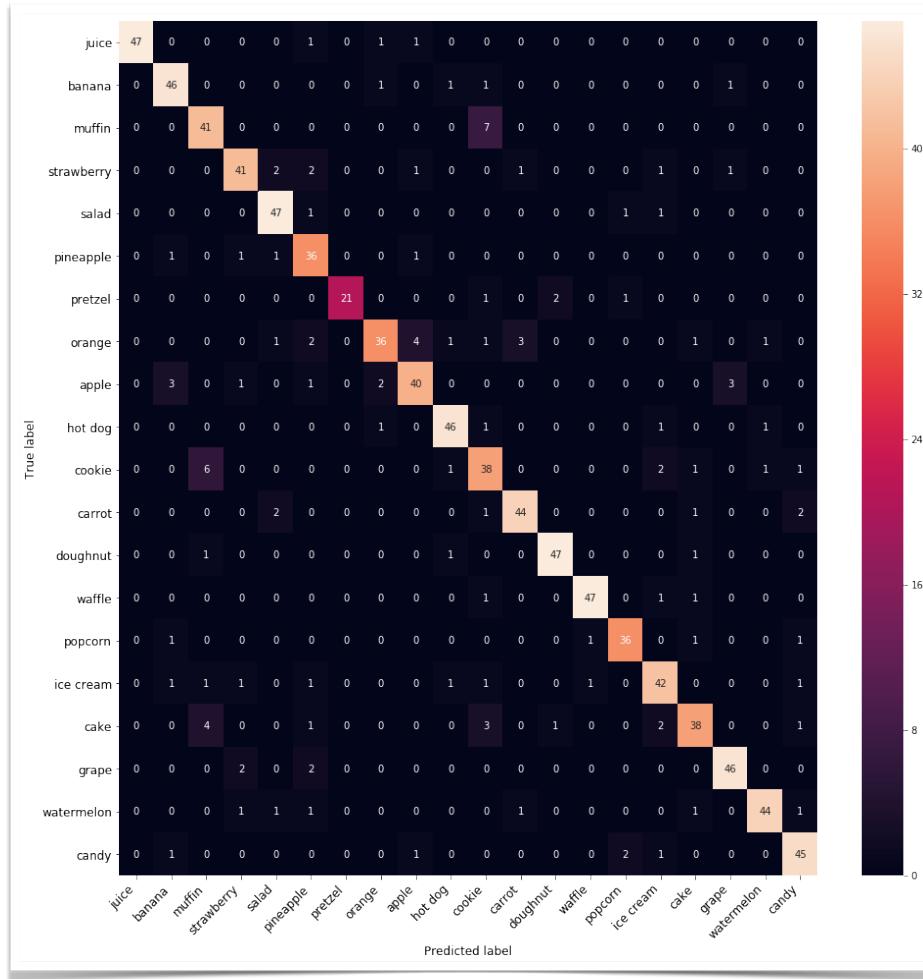
```
import turicreate as tc
import os

train_data = tc.image_analysis.load_images("snacks/train", with_path=True)
train_data["label"] = train_data["path"].apply(lambda path:
    os.path.basename(os.path.split(path)[0]))

model = tc.image_classifier.create(train_data, target="label",
    model="VisionFeaturePrint_Screen",
    verbose=True, max_iterations=15)
```



TURI CREATE



TRY IT!

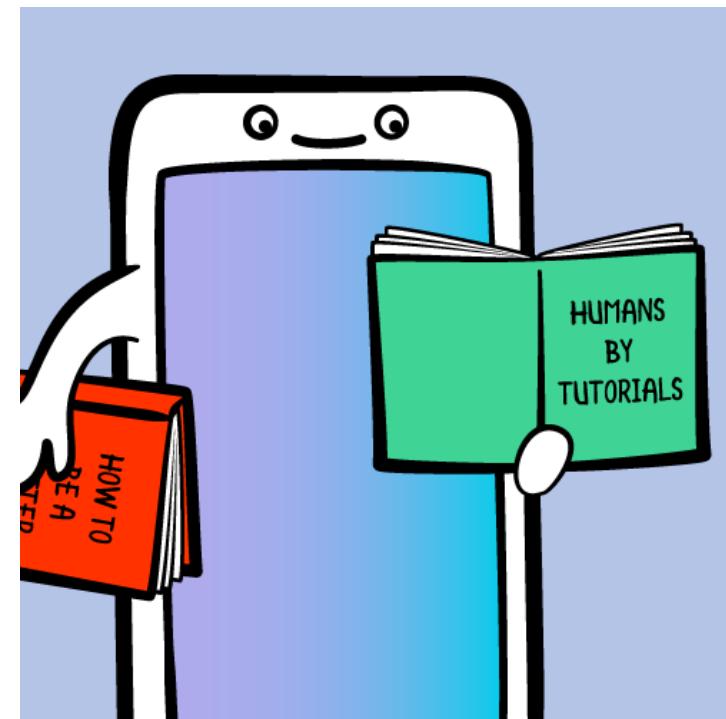
- ⚙️ Start with ML in Xcode and Swift
- ⚙️ Frameworks
- ⚙️ Create ML
- ⚙️ Core ML
- ⚙️ Try Turi Create in Anaconda and turienv
- ⚙️ Venture into Keras



WHERE To Go FROM HERE?

- ⚙ developer.apple.com/machine-learning/
- ⚙ www.raywenderlich.com
- ⚙ Twitter: @mataharimau

just one more thing ...



MACHINE LEARNING Book!

- ⚙️ Matthijs Hollemans
- ⚙️ iOS Apprentice,
machinethink.net
- ⚙️ Chris LaPollo
- ⚙️ Udacity ML
- ⚙️ Audrey Tam

