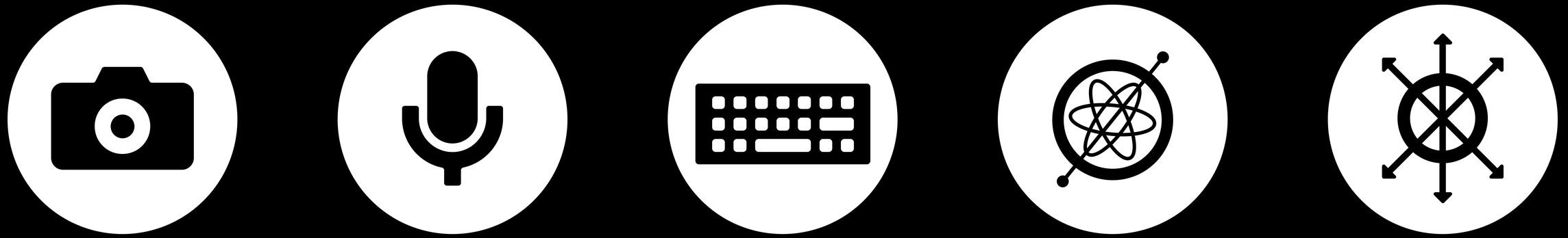
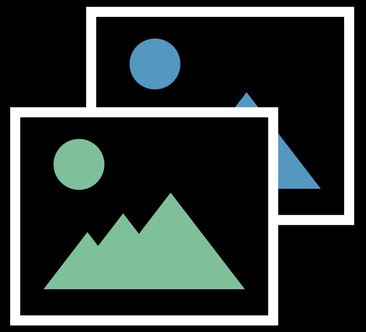
Introducing Create ML App

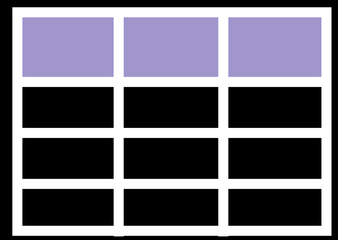
Lizi Ottens, Core ML



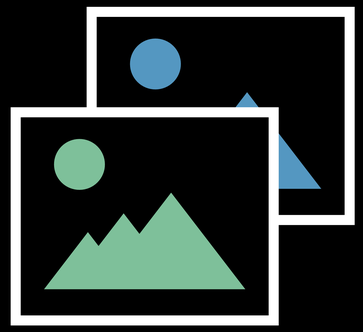


Image

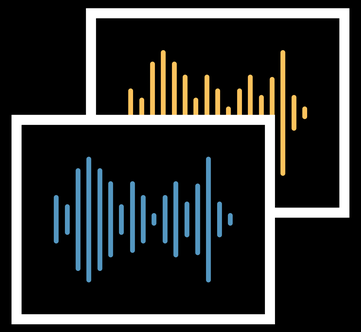
Text



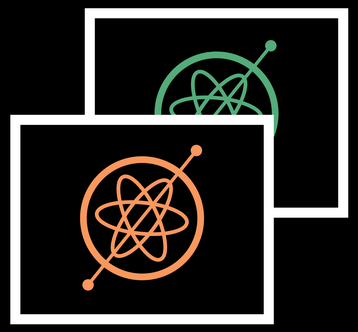
Tabular



Image

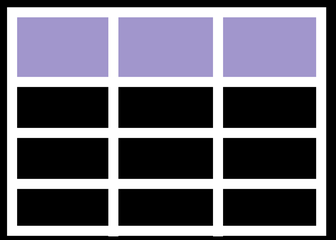


Sound



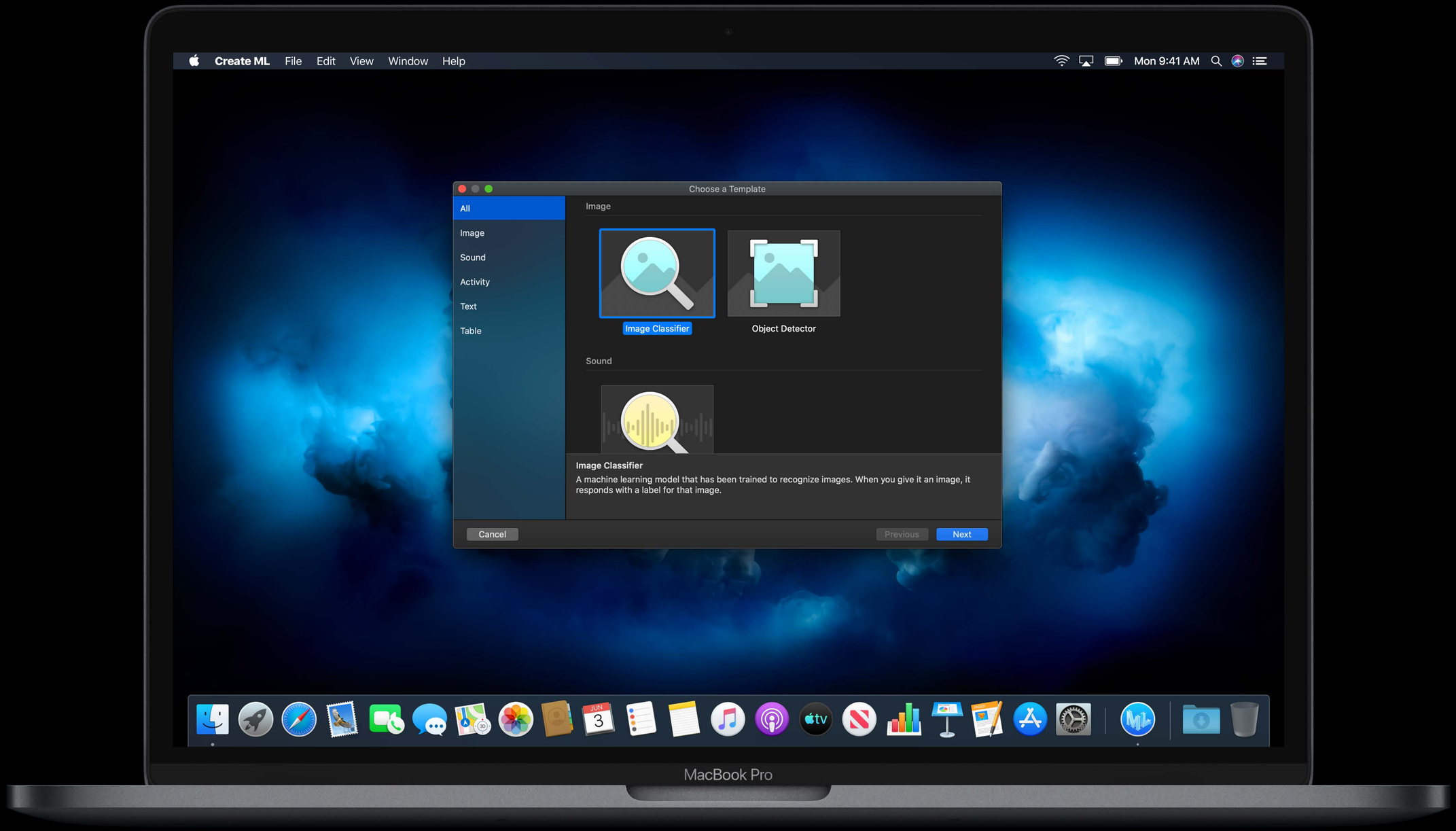
Activity

Text



Tabular

Create ML


Create ML File Edit View Window Help
Mon 9:41 AM
Choose a Template
All
Image
Sound
Activity
Text
Table
Image
Image Classifier
Object Detector
Sound
Image Classifier
A machine learning model that has been trained to recognize images. When you give it an image, it responds with a label for that image.
Cancel
Previous
Next
MacBook Pro

Choose a Template

All
Image
Sound
Activity
Text
Table

Image

Image Classifier

Object Detector

Sound

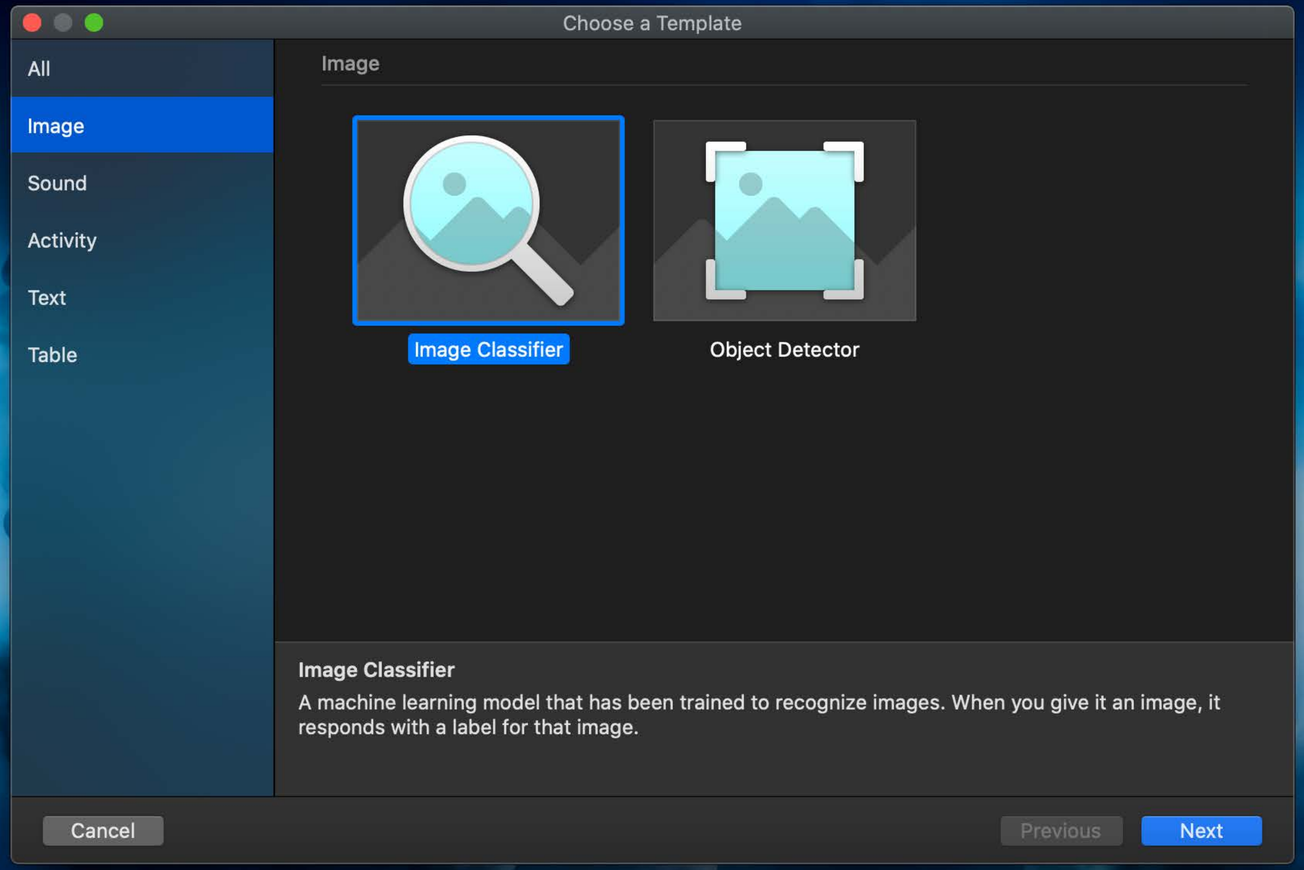
Image Classifier

A machine learning model that has been trained to recognize images. When you give it an image, it responds with a label for that image.

Cancel

Previous

Next


Choose a Template
All
Image
Sound
Activity
Text
Table
Image
Image Classifier
Object Detector
Image Classifier
A machine learning model that has been trained to recognize images. When you give it an image, it responds with a label for that image.
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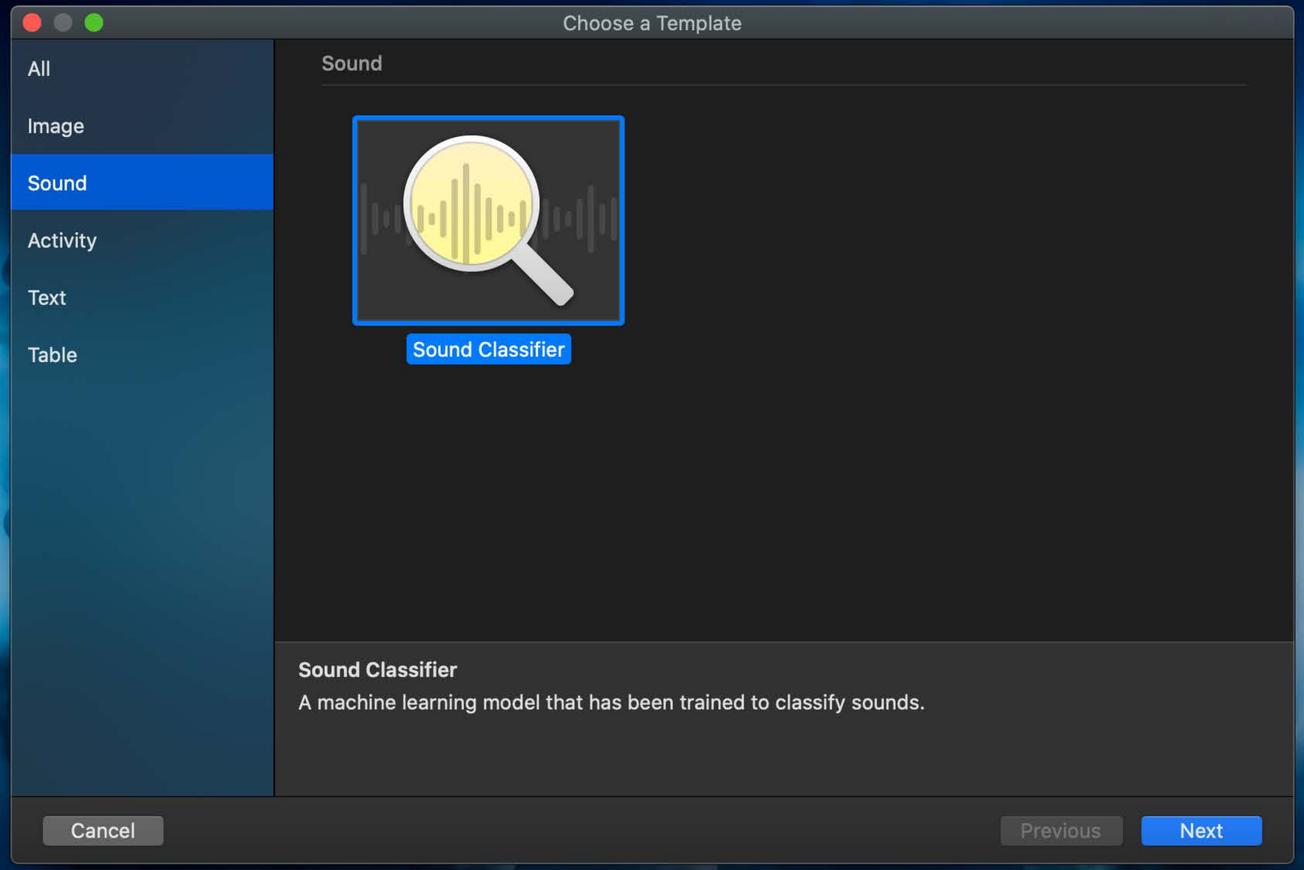
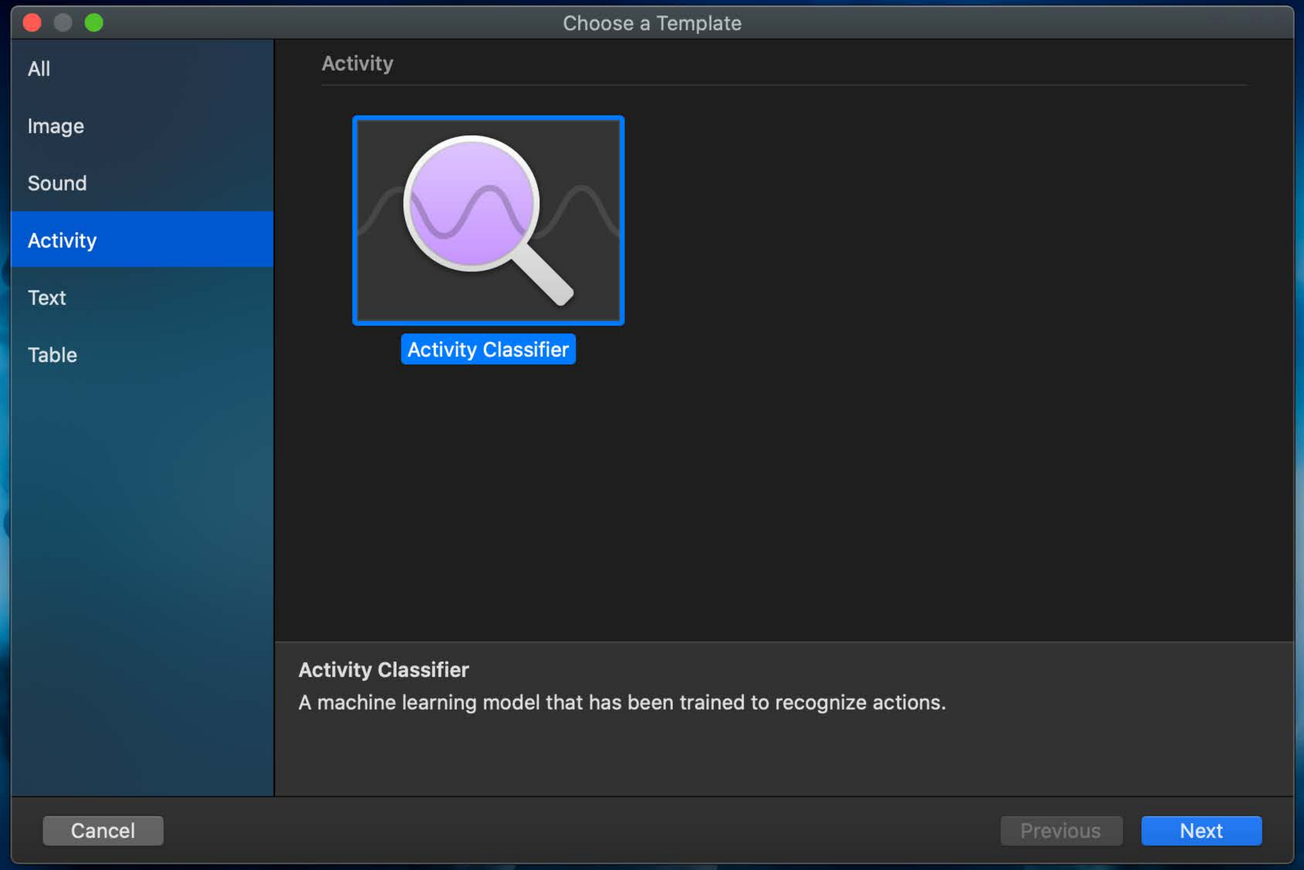
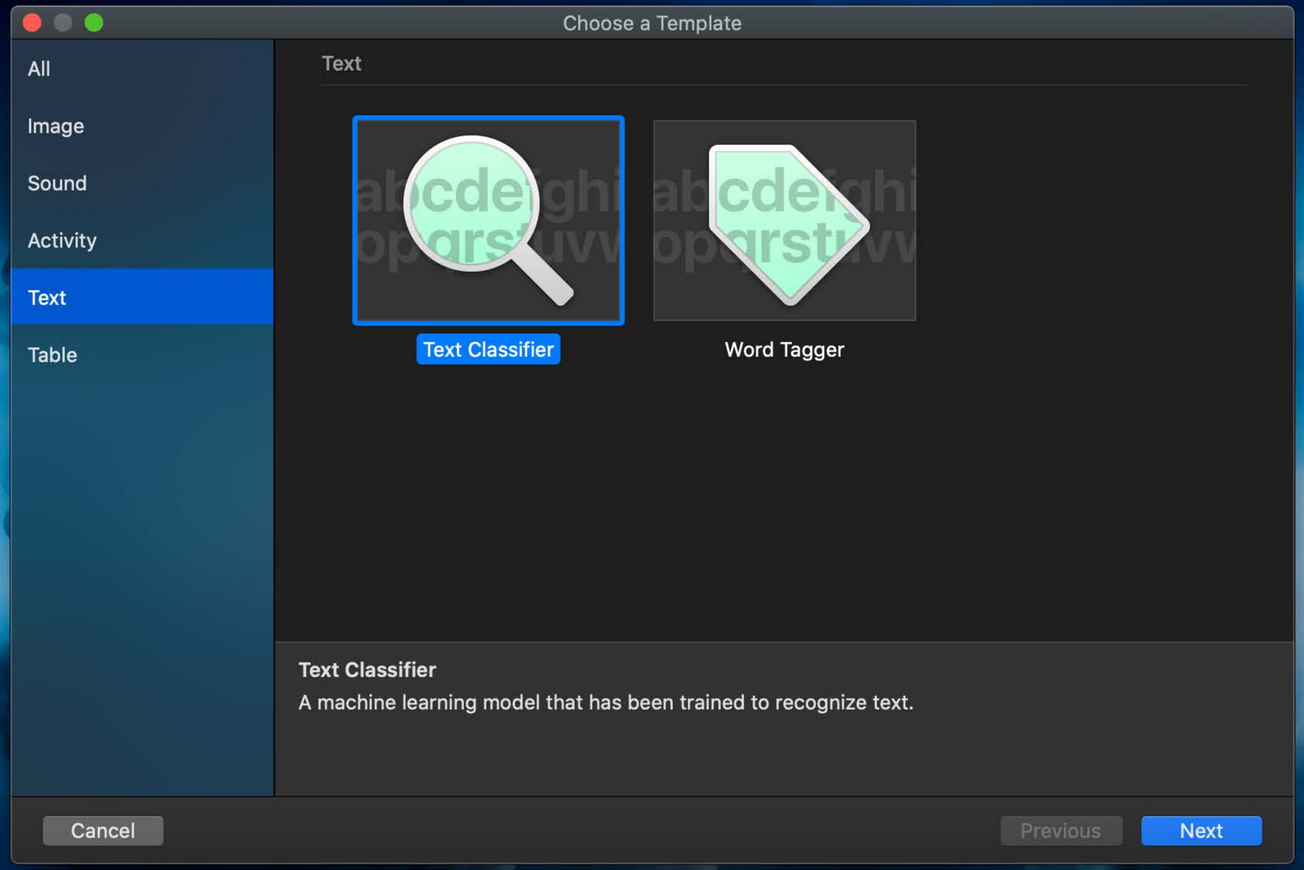

Choose a Template
All
Image
Sound
Activity
Text
Table
Sound
Sound Classifier
Sound Classifier
A machine learning model that has been trained to classify sounds.
Cancel
Previous
Next

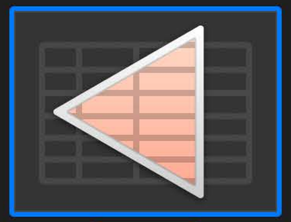

Choose a Template
All
Image
Sound
Activity
Text
Table
Activity
Activity Classifier
Activity Classifier
A machine learning model that has been trained to recognize actions.
Cancel
Previous
Next


Choose a Template
All
Image
Sound
Activity
Text
Table
Text
Text Classifier
Word Tagger
Text Classifier
A machine learning model that has been trained to recognize text.
Cancel
Previous
Next

Choose a Template

All
Image
Sound
Activity
Text
Table

Table


Regressor


Classifier

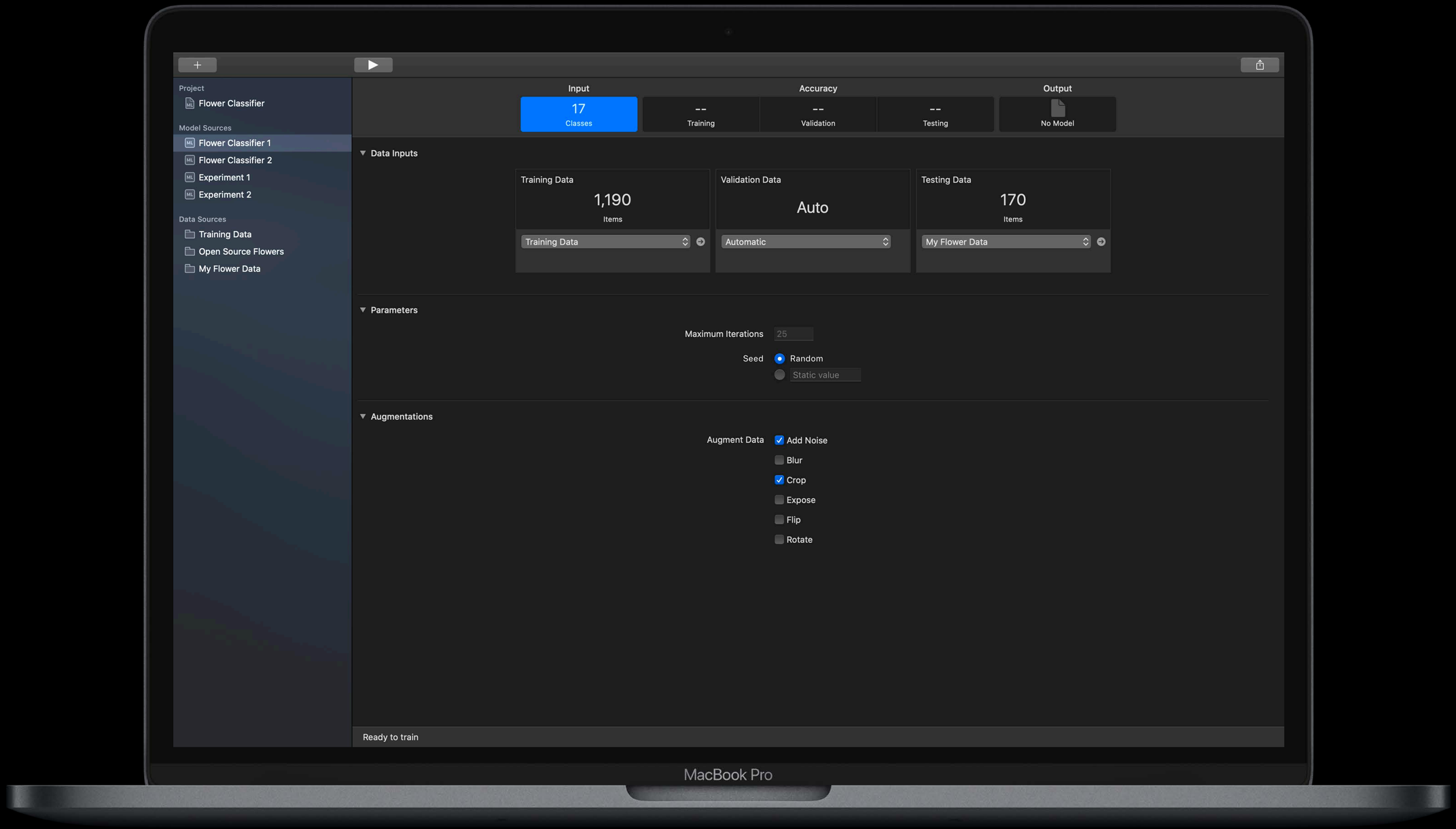

Recommender

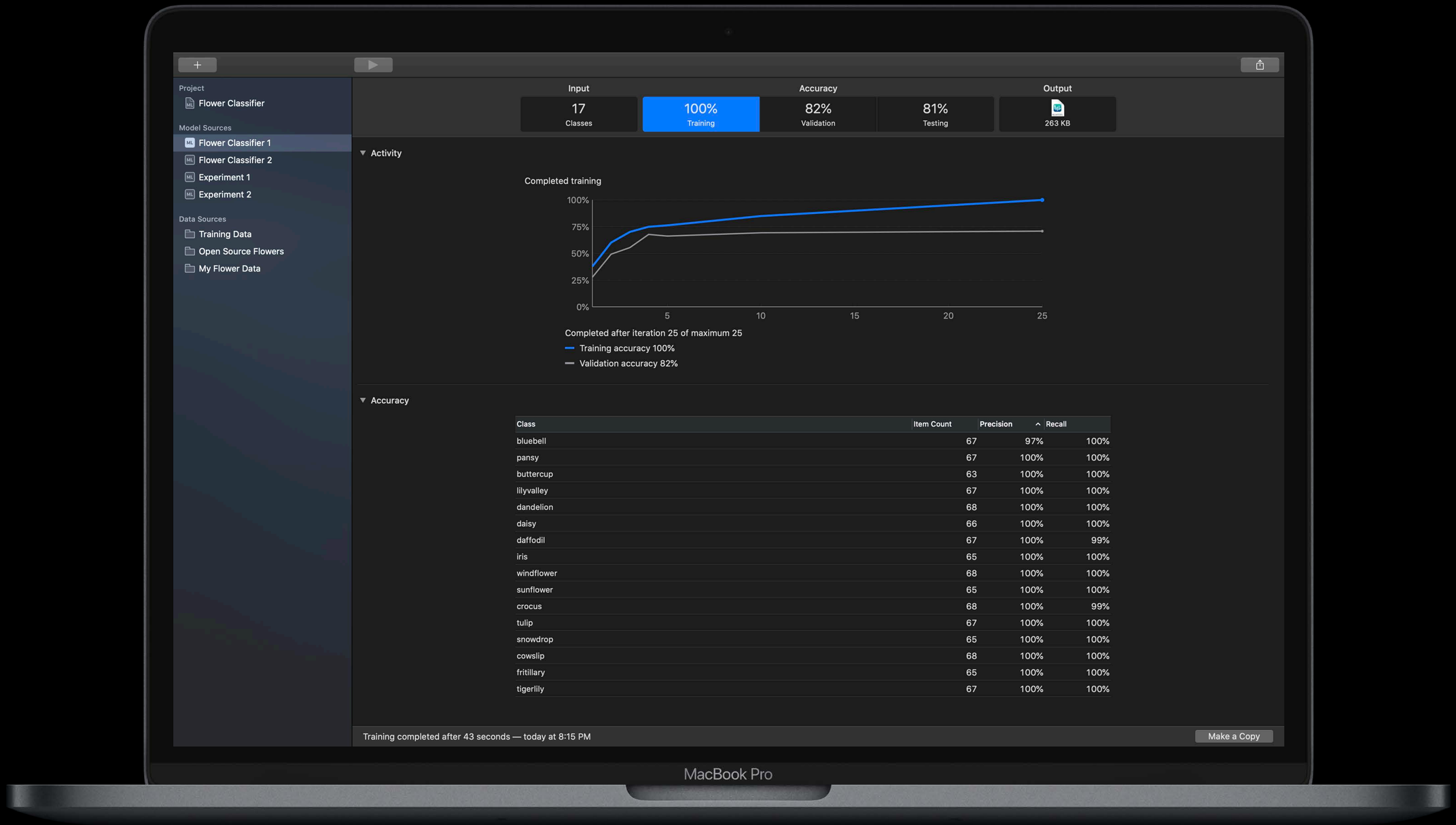
Regressor
A machine learning model that has been trained for regression.

Cancel

Previous

Next


Project
Flower Classifier
Model Sources
Flower Classifier 1
Flower Classifier 2
Experiment 1
Experiment 2
Data Sources
Training Data
Open Source Flowers
My Flower Data
Input
17
Classes
Accuracy
--
Training
--
Validation
--
Testing
Output
No Model
Data Inputs
Training Data
1,190
Items
Training Data
Validation Data
Auto
Automatic
Testing Data
170
Items
My Flower Data
Parameters
Maximum Iterations
25
Seed
Random
Static value
Augmentations
Augment Data
Add Noise
Blur
Crop
Expose
Flip
Rotate
Ready to train
MacBook Pro


Project
Flower Classifier
Model Sources
Flower Classifier 1
Flower Classifier 2
Experiment 1
Experiment 2
Data Sources
Training Data
Open Source Flowers
My Flower Data
Input
17
Classes
Accuracy
100%
Training
82%
Validation
81%
Testing
Output
263 KB
Activity
Completed training
100%
75%
50%
25%
0%
5
10
15
20
25
Completed after iteration 25 of maximum 25
Training accuracy 100%
Validation accuracy 82%
Accuracy
Class
Item Count
Precision
Recall
bluebell 67 97% 100%
pansy 67 100% 100%
buttercup 63 100% 100%
lilyvalley 67 100% 100%
dandelion 68 100% 100%
daisy 66 100% 100%
daffodil 67 100% 99%
iris 65 100% 100%
windflower 68 100% 100%
sunflower 65 100% 100%
crocus 68 100% 99%
tulip 67 100% 100%
snowdrop 65 100% 100%
cowslip 68 100% 100%
fritillary 65 100% 100%
tigerlily 67 100% 100%
Training completed after 43 seconds — today at 8:15 PM
Make a Copy
MacBook Pro

Project

Flower Classifier

Model Sources

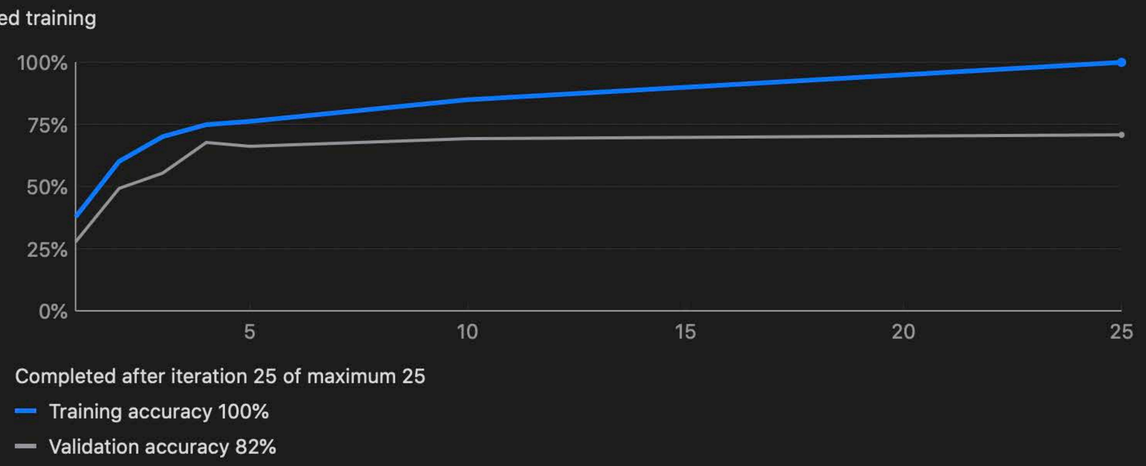
- Flower Classifier 1
- Flower Classifier 2
- Experiment 1
- Experiment 2

Data Sources

- Training Data
- Open Source Flowers
- My Flower Data

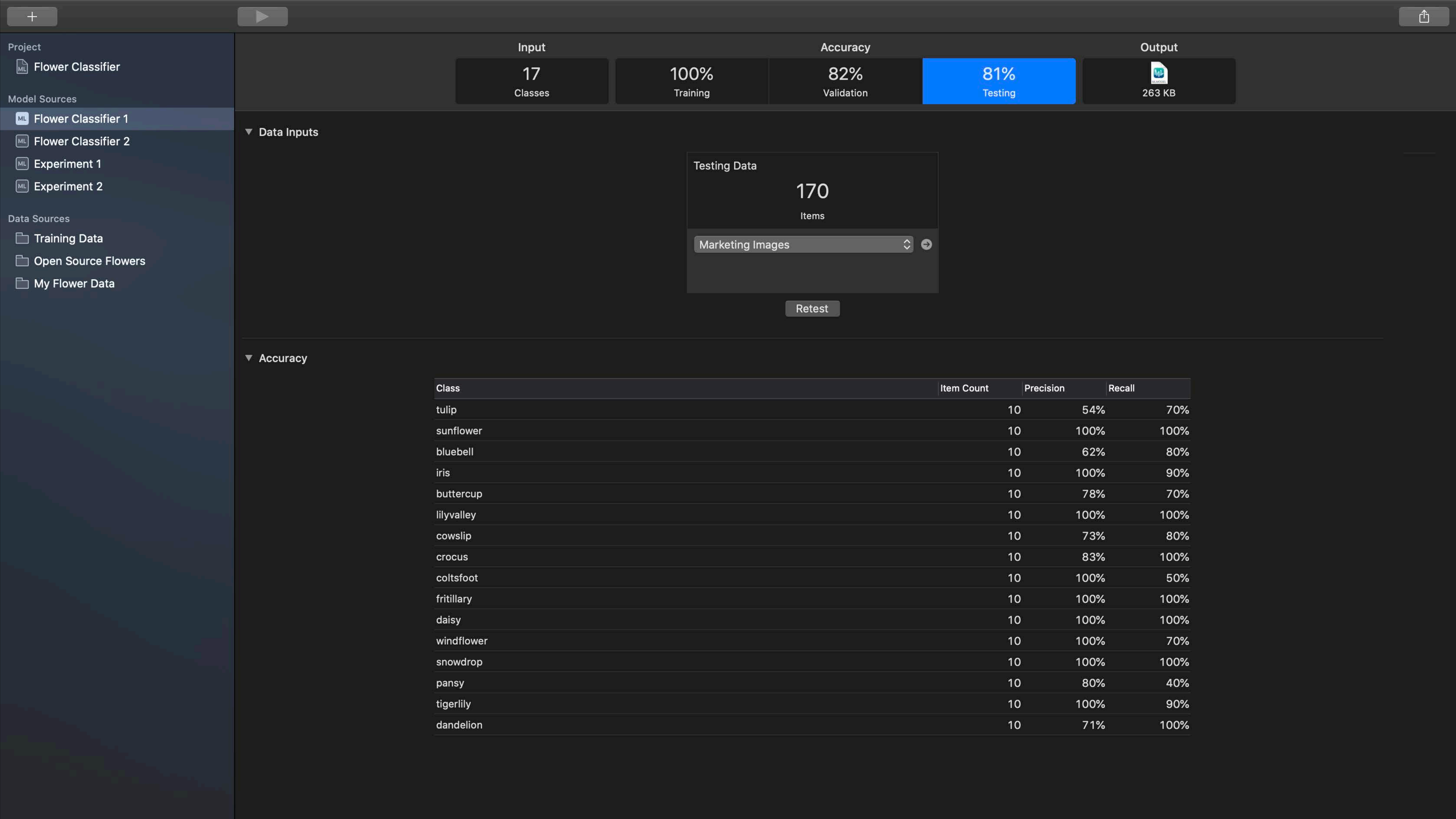
Input	Accuracy		Output
17 Classes	100% Training	82% Validation	81% Testing	263 KB

Activity



Accuracy

Class	Item Count	Precision	Recall
bluebell	67	97%	100%
pansy	67	100%	100%
buttercup	63	100%	100%
lilyvalley	67	100%	100%
dandelion	68	100%	100%
daisy	66	100%	100%
daffodil	67	100%	99%
iris	65	100%	100%
windflower	68	100%	100%
sunflower	65	100%	100%
crocus	68	100%	99%
tulip	67	100%	100%
snowdrop	65	100%	100%
cowslip	68	100%	100%
fritillary	65	100%	100%


Project
Flower Classifier
Model Sources
Flower Classifier 1
Flower Classifier 2
Experiment 1
Experiment 2
Data Sources
Training Data
Open Source Flowers
My Flower Data
Input
17
Classes
Accuracy
100%
Training
82%
Validation
81%
Testing
Output
263 KB
Data Inputs
Testing Data
170
Items
Marketing Images
Retest
Accuracy
Class
Item Count
Precision
Recall
tulip 10 54% 70%
sunflower 10 100% 100%
bluebell 10 62% 80%
iris 10 100% 90%
buttercup 10 78% 70%
lilyvalley 10 100% 100%
cowslip 10 73% 80%
crocus 10 83% 100%
coltsfoot 10 100% 50%
fritillary 10 100% 100%
daisy 10 100% 100%
windflower 10 100% 70%
snowdrop 10 100% 100%
pansy 10 80% 40%
tigerlily 10 100% 90%
dandelion 10 71% 100%

Project

Flower Classifier

Model Sources

- Flower Classifier 1
- Flower Classifier 2
- Experiment 1
- Experiment 2

Data Sources

- Training Data
- Open Source Flowers
- My Flower Data

Input	Accuracy			Output
17 Classes	100% Training	82% Validation	81% Testing	263 KB

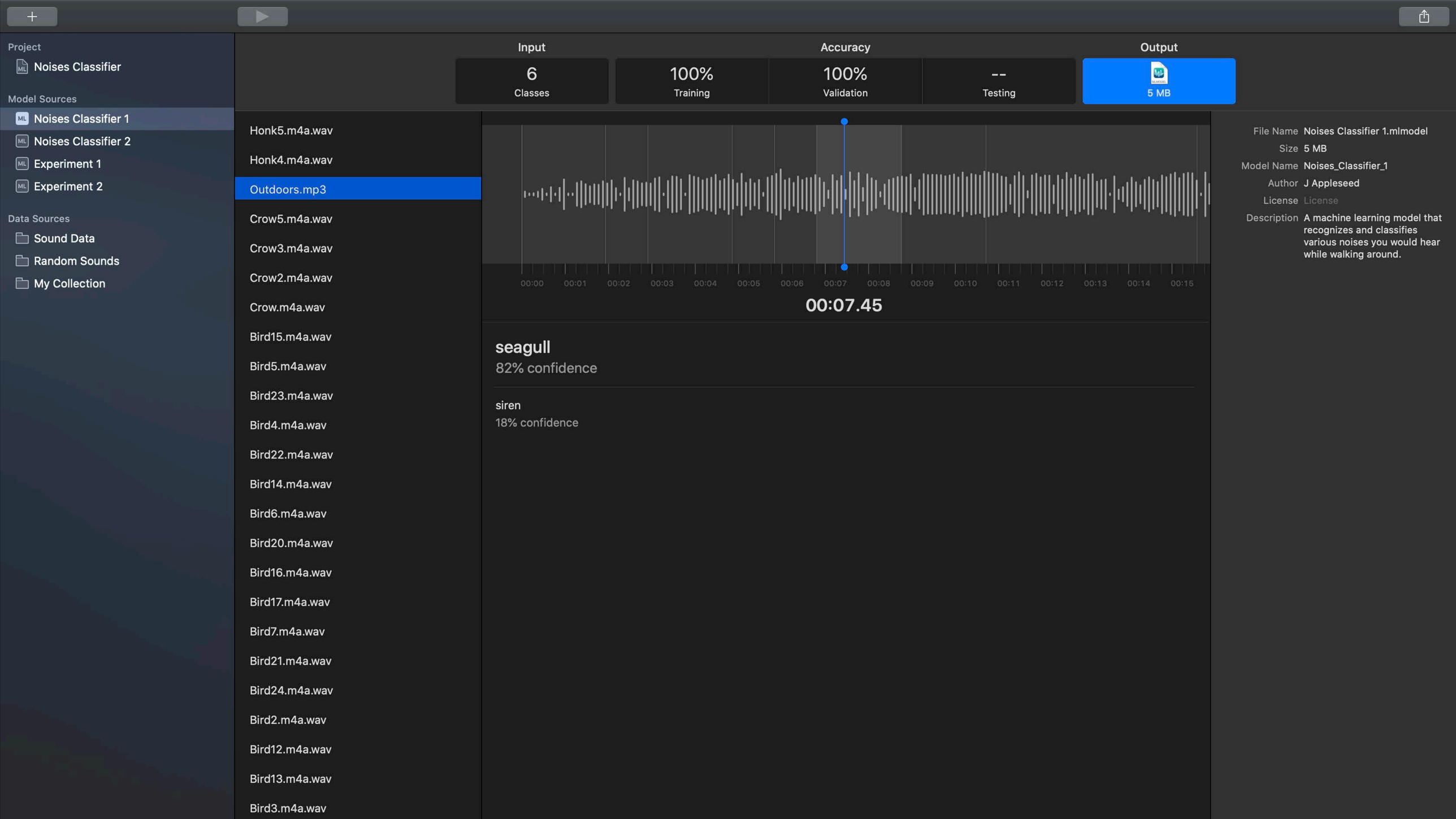
- image_1274.jpg
- image_1279.jpg
- image_1278.jpg
- image_1280.jpg
- image_0871.jpg
- image_0873.jpg
- image_0872.jpg
- image_0876.jpg
- image_0877.jpg
- image_0875.jpg
- image_0874.jpg
- image_0879.jpg
- image_0878.jpg
- image_0880.jpg
- image_0480.jpg
- image_0478.jpg
- image_0479.jpg
- image_0474.jpg
- image_0475.jpg
- image_0477.jpg
- image_0476.jpg
- image_0472.jpg
- image_0473.jpg
- image_0471.jpg

passionflower
92% confidence

bluebell
7% confidence

buttercup
1% confidence

File Name	Flower Classifier 1.mlmodel
Size	263 KB
Model Name	Flower_Classifier_1
Author	J Appleseed
License	License
Description	A machine learning model that best classifies images into flower classes.


Project
Noises Classifier
Model Sources
Noises Classifier 1
Noises Classifier 2
Experiment 1
Experiment 2
Data Sources
Sound Data
Random Sounds
My Collection
Input
6
Classes
Accuracy
100%
Training
100%
Validation
--
Testing
Output
5 MB
Honk5.m4a.wav
Honk4.m4a.wav
Outdoors.mp3
Crow5.m4a.wav
Crow3.m4a.wav
Crow2.m4a.wav
Crow.m4a.wav
Bird15.m4a.wav
Bird5.m4a.wav
Bird23.m4a.wav
Bird4.m4a.wav
Bird22.m4a.wav
Bird14.m4a.wav
Bird6.m4a.wav
Bird20.m4a.wav
Bird16.m4a.wav
Bird17.m4a.wav
Bird7.m4a.wav
Bird21.m4a.wav
Bird24.m4a.wav
Bird2.m4a.wav
Bird12.m4a.wav
Bird13.m4a.wav
Bird3.m4a.wav
00:00 00:01 00:02 00:03 00:04 00:05 00:06 00:07 00:08 00:09 00:10 00:11 00:12 00:13 00:14 00:15
00:07.45
seagull
82% confidence
siren
18% confidence
File Name Noises Classifier 1.mlmodel
Size 5 MB
Model Name Noises_Classifier_1
Author J Appleseed
License License
Description A machine learning model that recognizes and classifies various noises you would hear while walking around.

Demo

Image classification in Create ML

Create ML

Create ML

- Image Classifier
- Object Detector
- Sound Classifier
- Activity Classifier
- Text Classifier
- Word Tagger
- Tabular Classifier
- Tabular Regressor
- Recommender

Image Classifier

Object Detector

Image Classifier

Categorizes an image based on its content

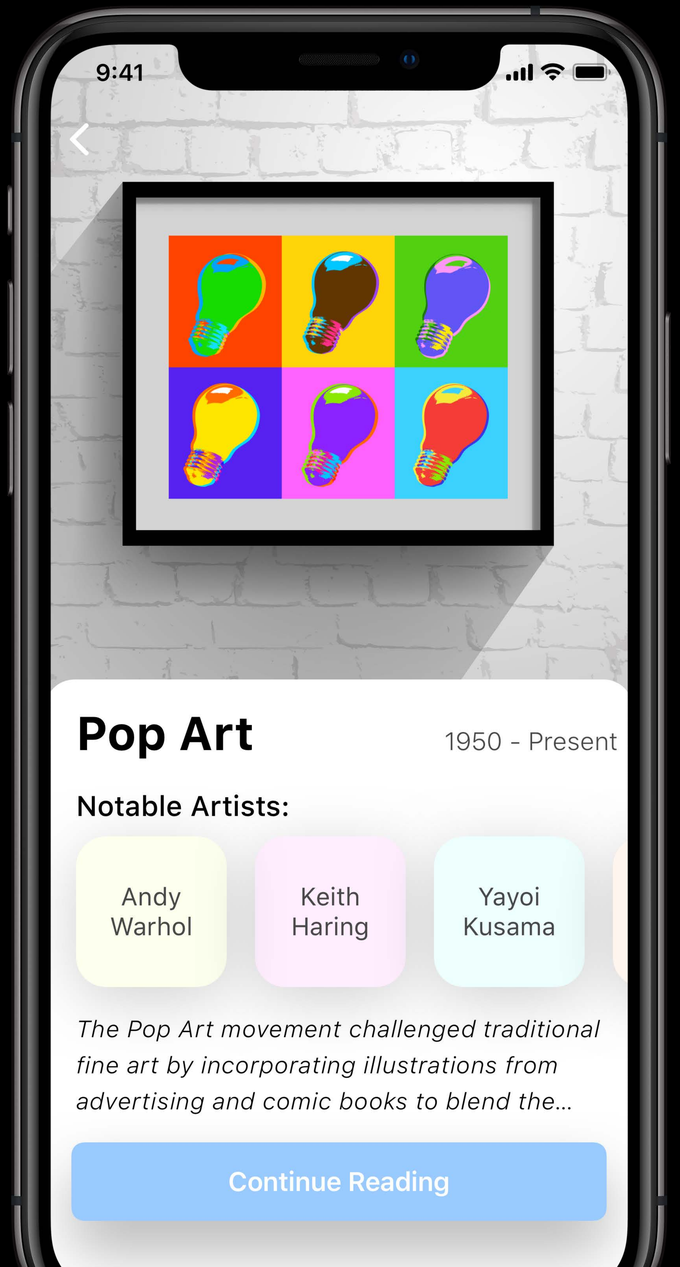


Image Classifier

Categorizes an image based on its content

Leverages transfer learning

Reduced model size

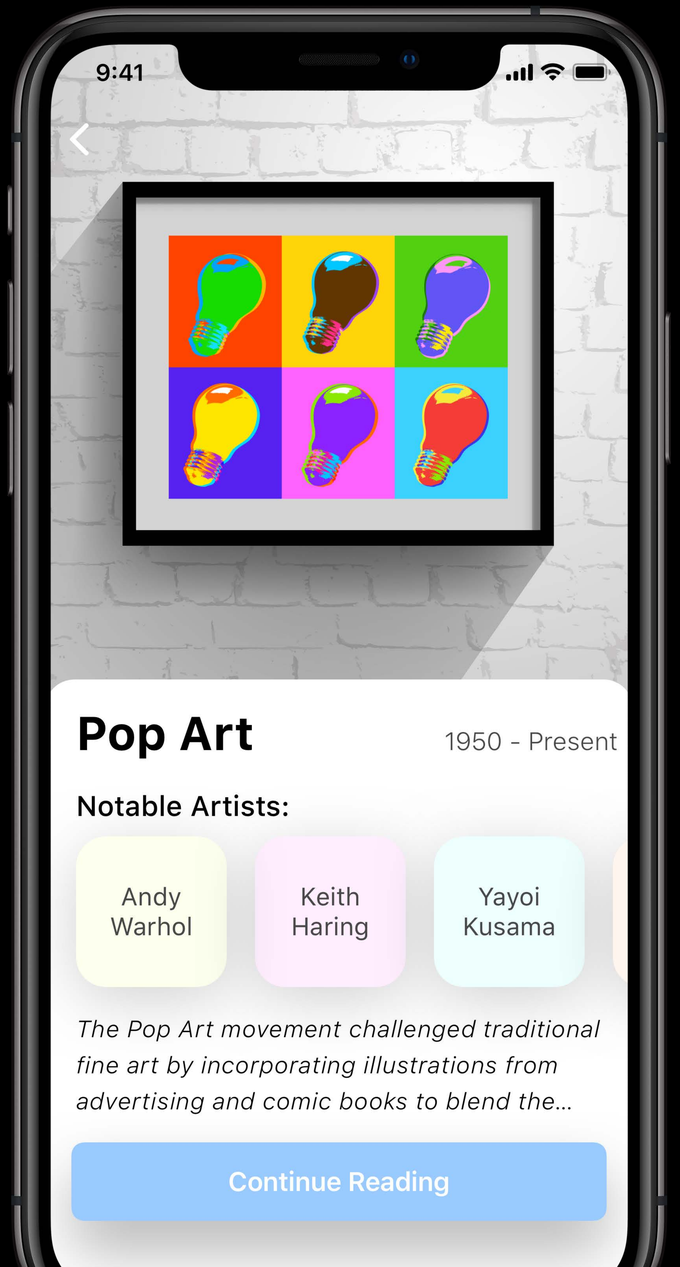


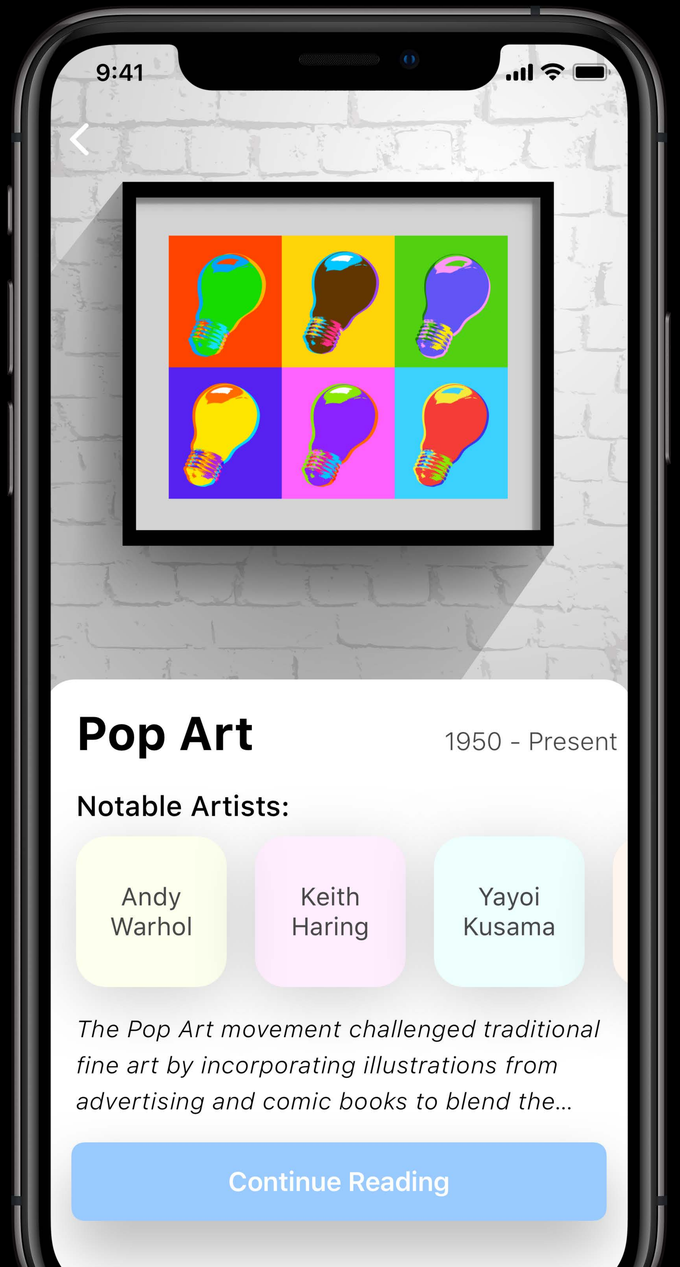
Image Classifier

Categorizes an image based on its content

Leverages transfer learning

Reduced model size

Augmentation



Object Detector

Localizes and recognizes content in an image

Object Detector

Localizes and recognizes content in an image

For one or more classes

Object Detector

Localizes and recognizes content in an image

For one or more classes

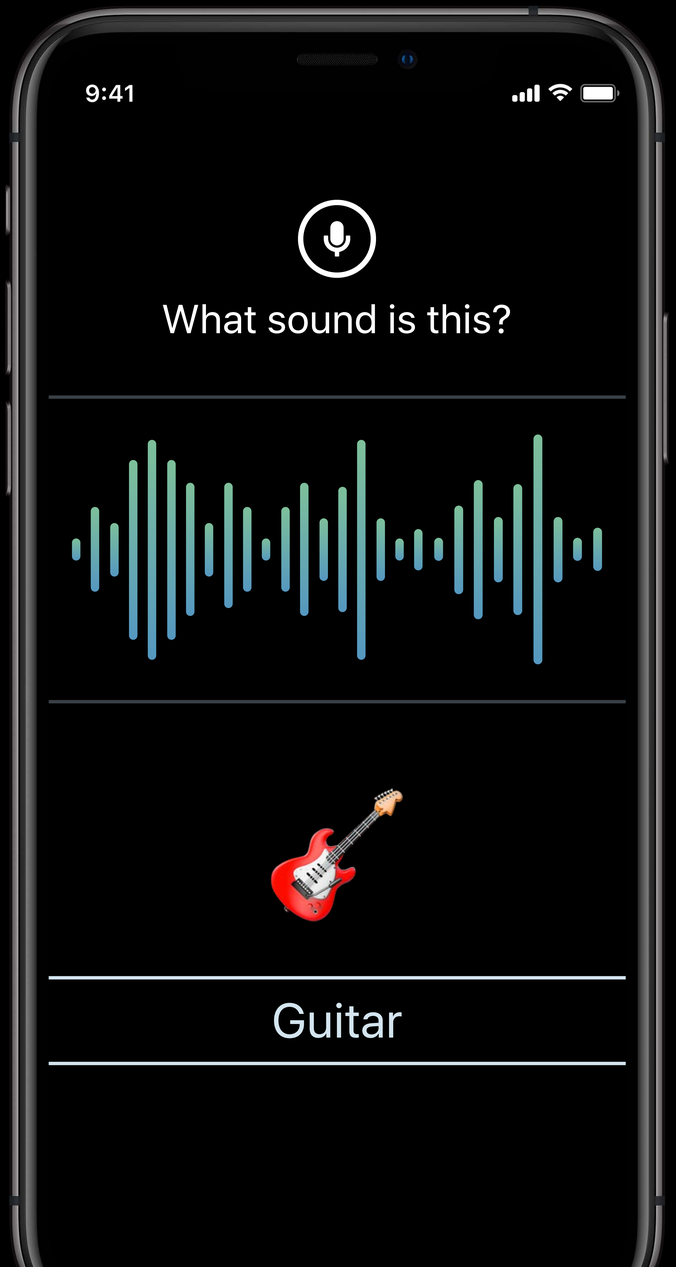
Deep learning based

In-built augmentation

Sound Classifier

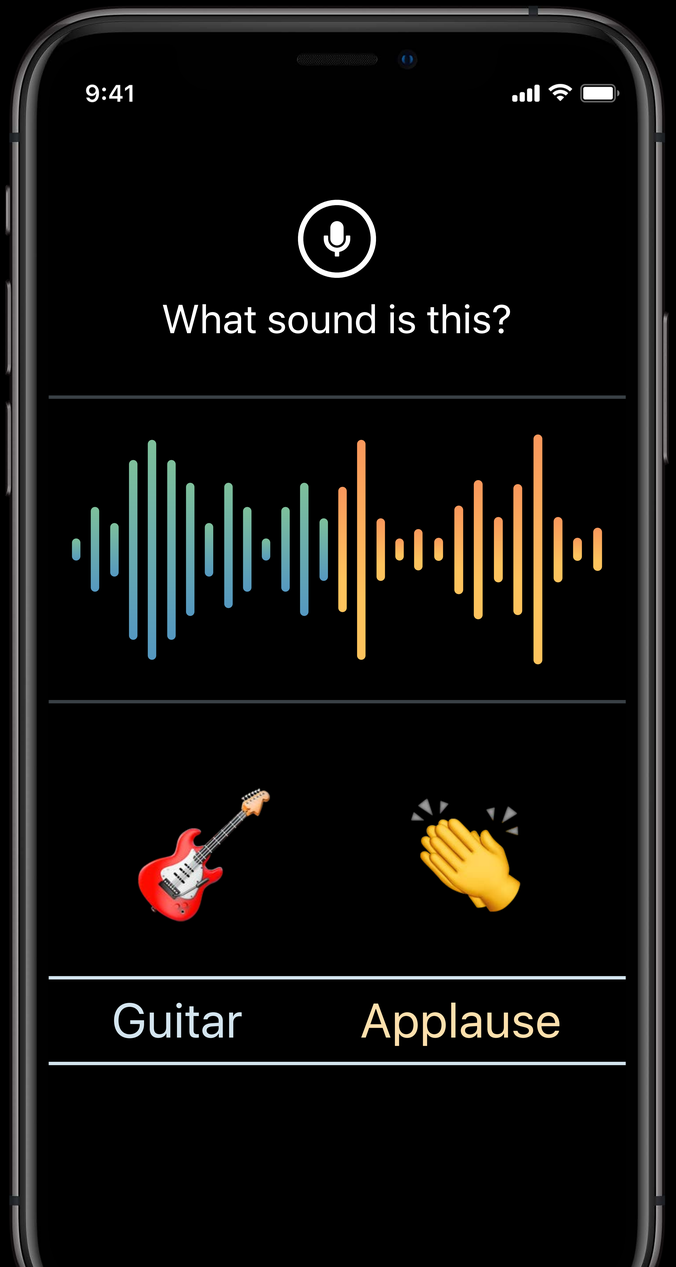
Sound Classifier

Categorizes contents of audio



Sound Classifier

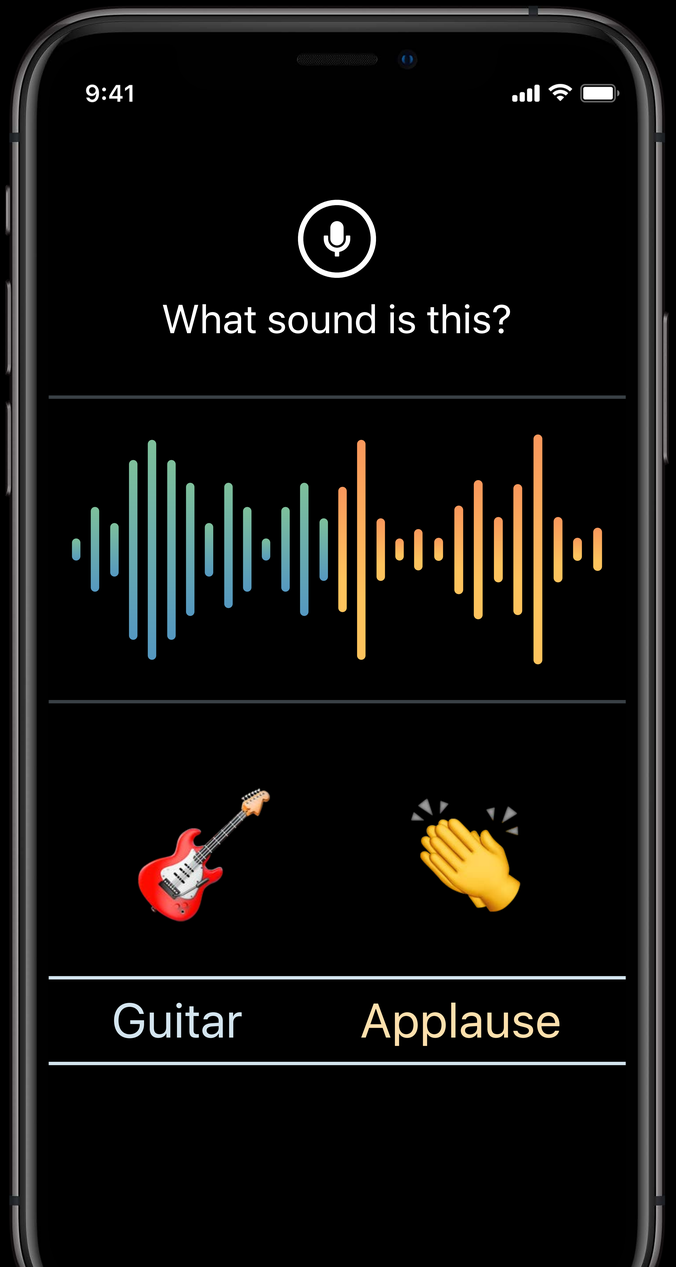
Categorizes contents of audio



Sound Classifier

Categorizes contents of audio

Leverages transfer learning



Sound Classifier

Categorizes contents of audio

Leverages transfer learning

Hardware accelerated

Create ML for Object Detection and Sound Classification

Wednesday, 9:00

Activity Classifier

Activity Classifier

Categorizes contents of motion

Deep learning based

Small model size

Create ML for Activity, Text, and Recommendations

Thursday, 2:00

Text Classifier

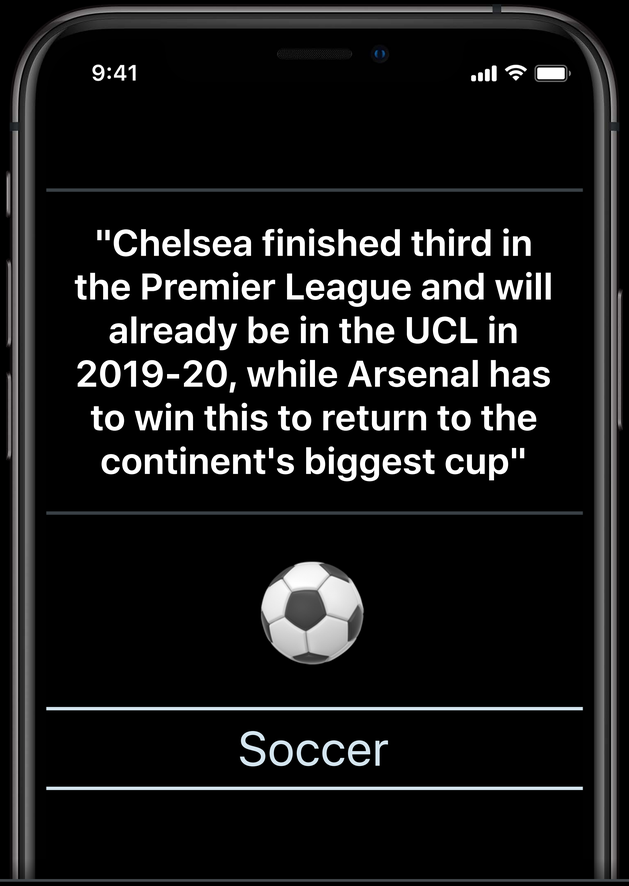
Word Tagger

Text Classifier

Labels text based on its contents

For sentences, paragraphs or articles

Variety of algorithms



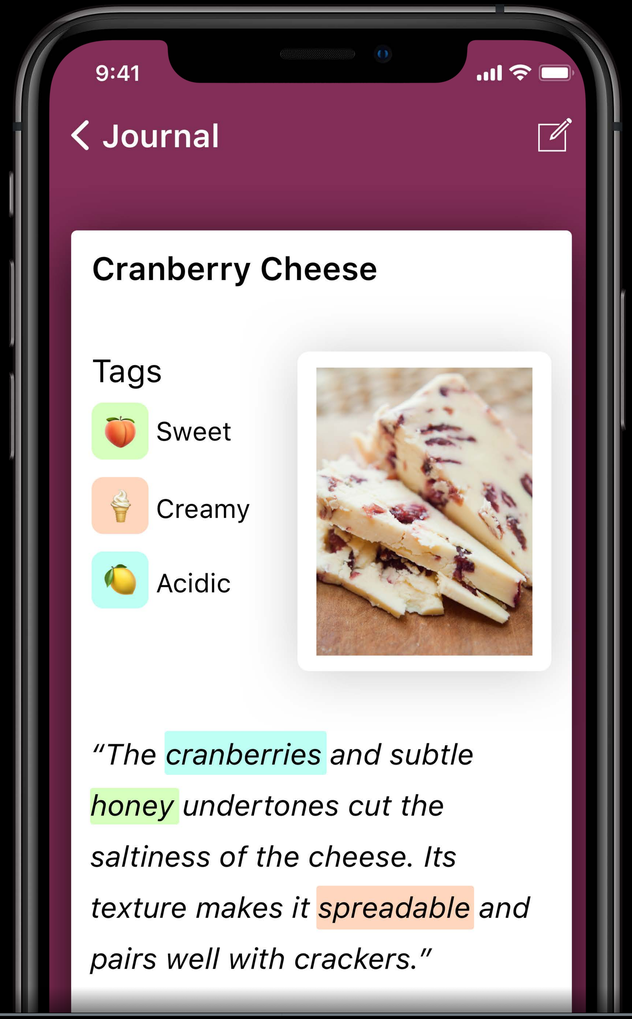
Create ML for Activity, Text, and Recommendations	Thursday, 2:00
Advances in Natural Language Framework	Thursday, 3:00

Word Tagger

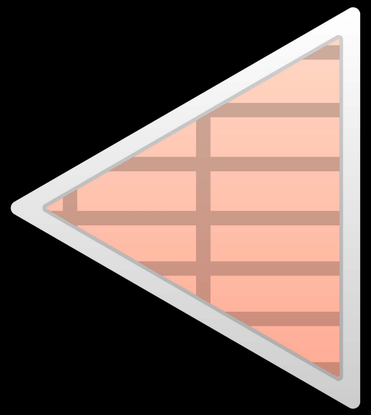
Labels tokens of interest in text

For sentences or sequences of words

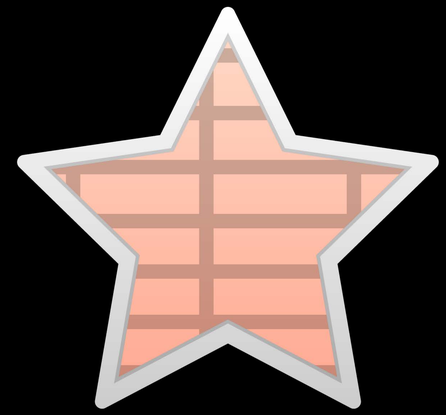
Variety of algorithms



Tabular Classifier



Tabular Regressor

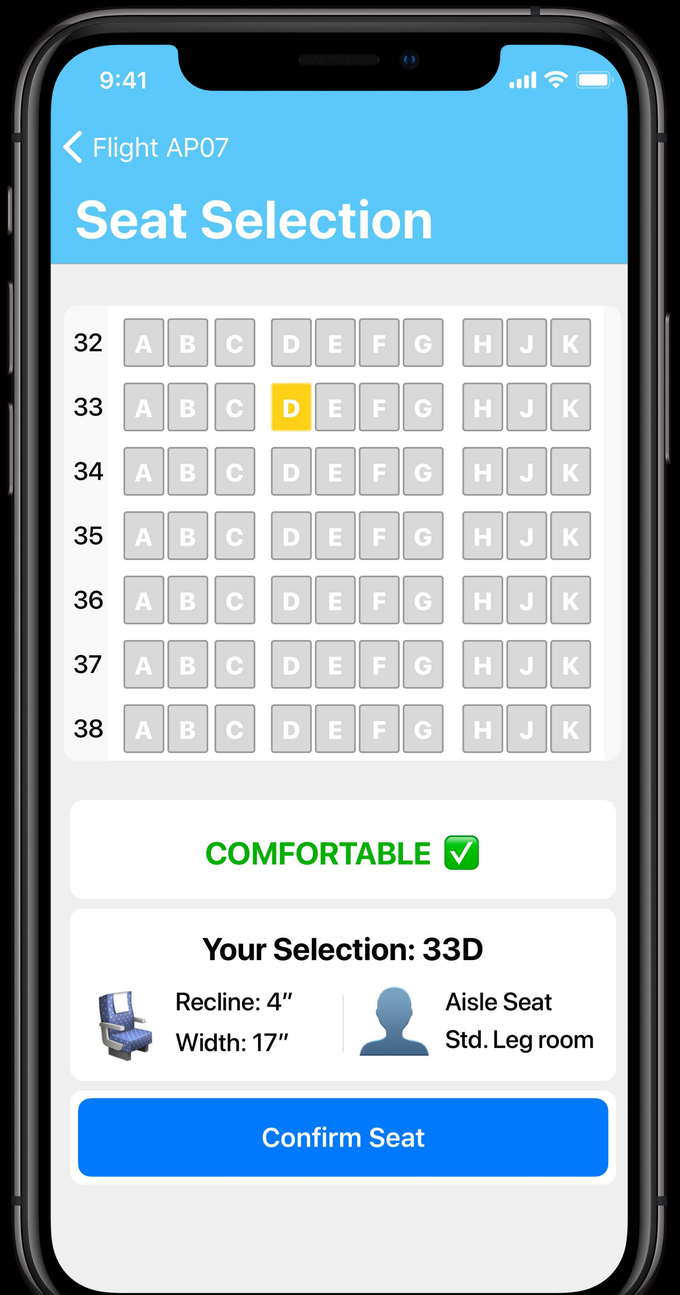


Recommender

Tabular Classifier

Categorizes a sample by features of interest

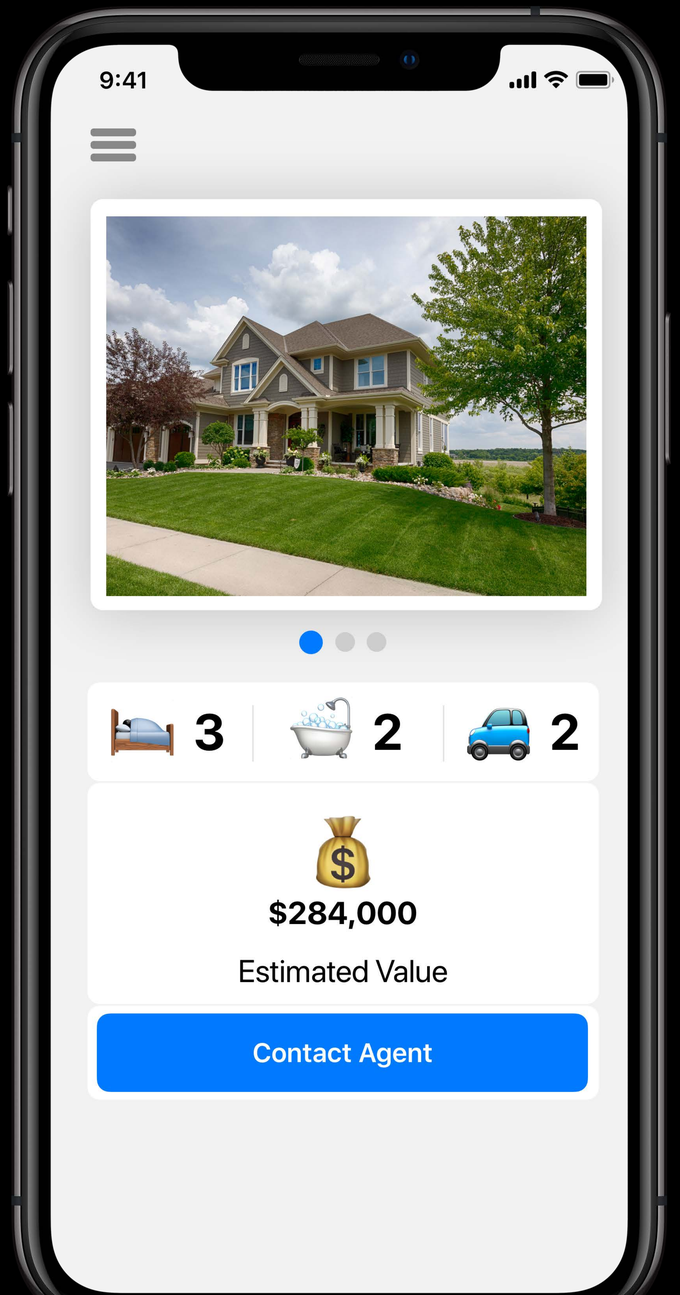
Identifies the best of multiple classifiers



Tabular Regressor

Quantifies a sample by features of interest

Identifies the best of multiple regressors



Recommender

Recommends content based on behavior

Offline and on device

Create ML for Activity, Text, and Recommendations

Thursday, 2:00

Setup experiments

Visualize performance

Save and share


SWIFT


PLAYGROUND


>_

Create ML

Create ML

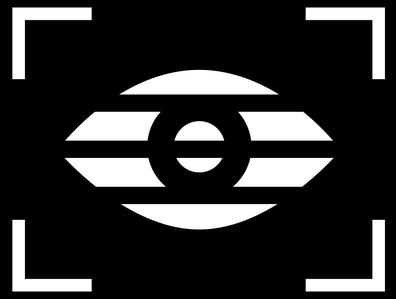
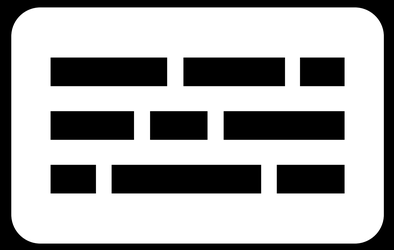
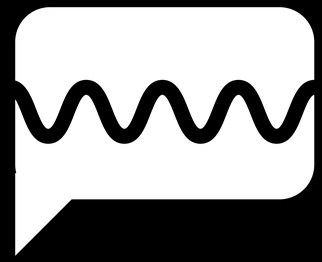
New models

Nine templates

New workflow

Domain APIs

Gaurav Kapoor, Core ML

Rectangle Detection

Landmark Detection

Image Classification

Image saliency

Image similarity

Text catalog

Image Similarity

Attention Saliency

Face Landmark

On device speech

Face capture quality

Text Recognition

Animal Detection

Document Camera

Speech Saliency

Word Tagging

Sentiment classification

NL Transfer learning

Word Embeddings

Sound analysis

Speech on Mac

Object Tracking

Vision

Image Saliency

Vision

Image Saliency

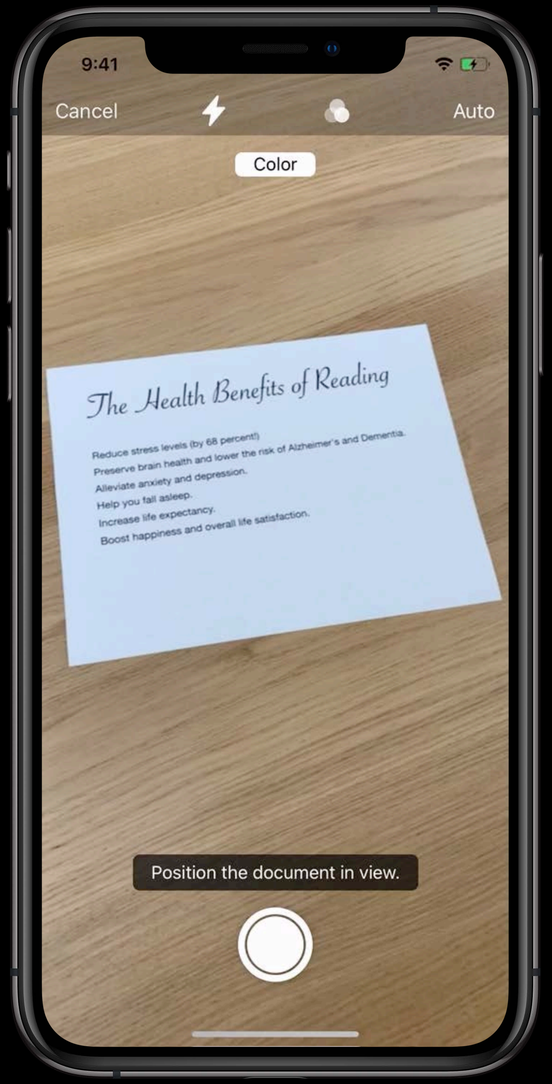
Vision

Image Saliency

Document Camera

Vision

Image Saliency



Document Camera

Vision

NEW

Image Classification	Image Similarity	Face Capture Quality	Human Detection
Object Saliency	Attention Saliency	Text Recognition	Animal Detection
Document Camera	Improved Object Tracker	Improved Face Landmarks	

Understanding Images in Vision	Wednesday, 10:00
Text Recognition in Vision	Thursday, 4:00

Natural Language

Sentiment Analysis

Natural Language

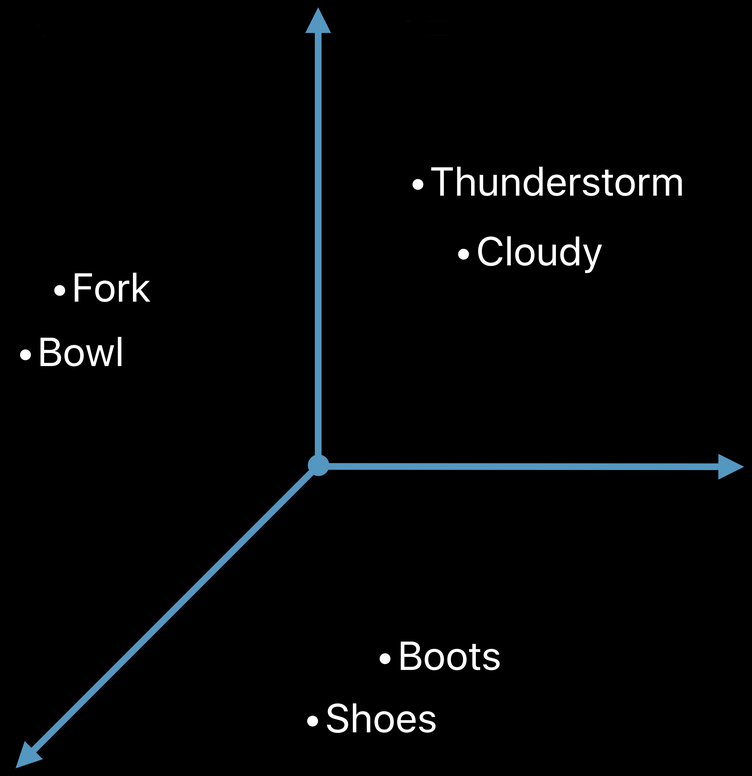
Sentiment Analysis

Natural Language

Sentiment Analysis

Natural Language

Sentiment Analysis



Word Embeddings

Natural Language

NEW

Sentiment Analysis

Text Catalogs

Word Embeddings

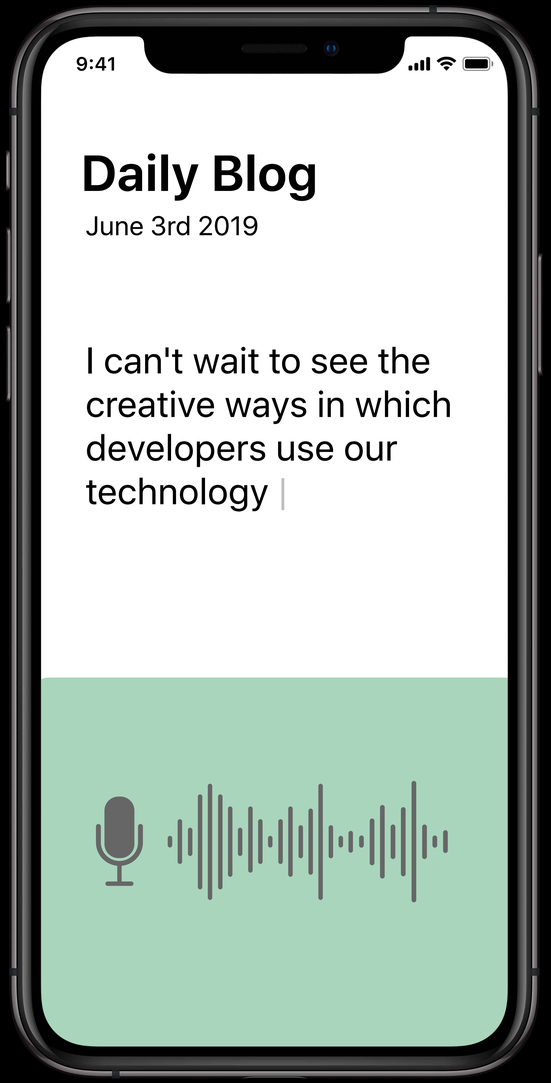
Transfer Learning

Advances in Natural Language Framework

Thursday, 3:00

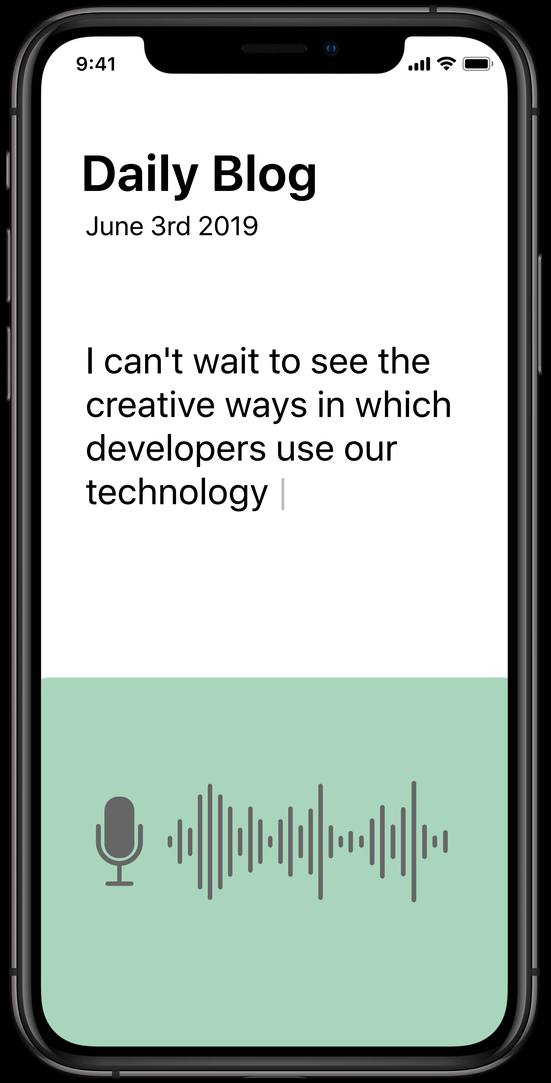
Speech and Sound

On-Device
Speech Recognition

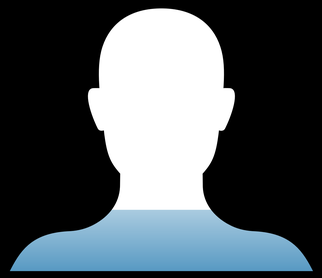


Speech and Sound

On-Device
Speech Recognition



Voice Analytics



Normal

High jitter

Speech and Sound

NEW

On-Device Speech Recognition on iOS	On-device Speech Recognition on macOS	Voice Analytics	Sound Analysis

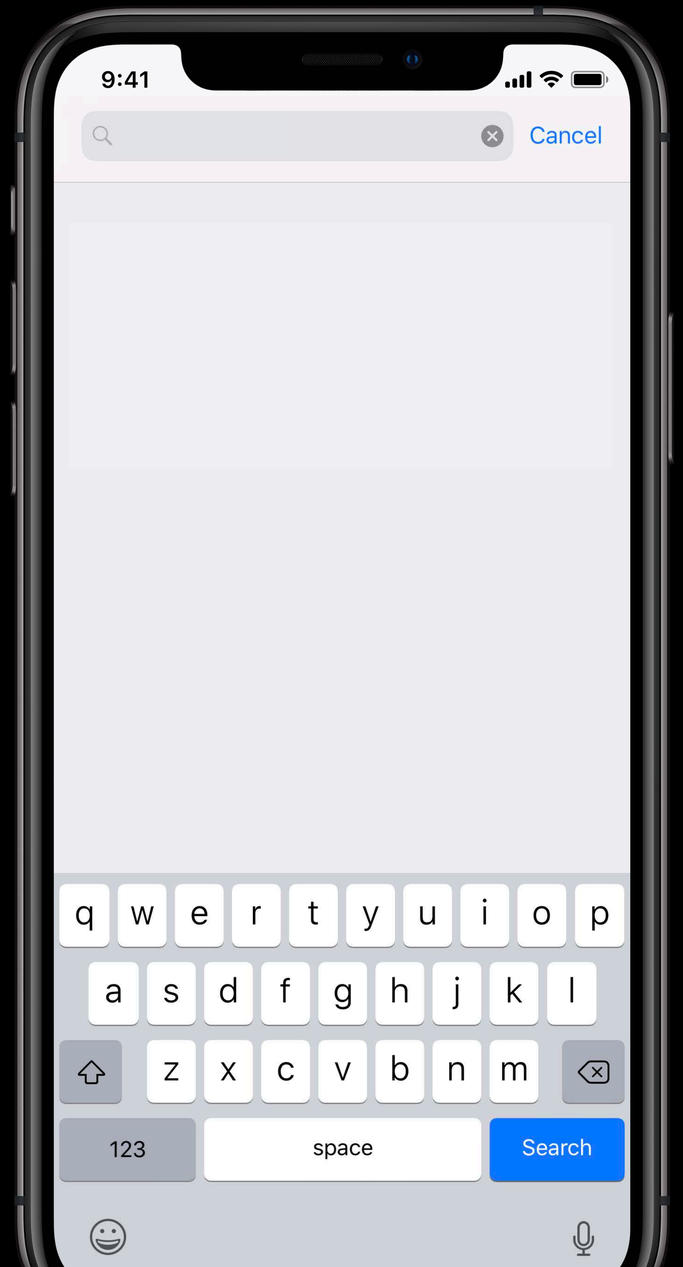
Create ML for Object Detection and Sound Classification	Wednesday, 9:00
Advances in Speech Recognition	WWDC 2019

Combining Domains

Semantic Search on Images

Search “Thunderstorm”

- Results for Thunderstorm, Sky, Cloudy



Semantic Search on Images

Search “Thunderstorm”

- Results for Thunderstorm, Sky, Cloudy

Semantic Search on Images

Semantic Search on Images

Image Classification

Tags

Giraffe

Cloudy

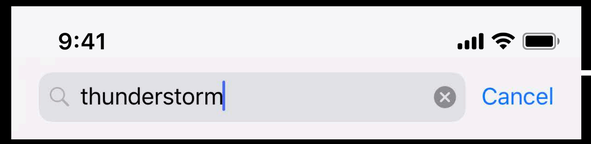
Semantic Search on Images

Image Classification

Tags

Giraffe

Cloudy



Word Embeddings

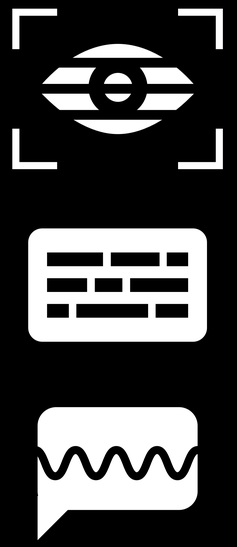
Cloudy

Lightning

Similar Words

Create ML

+

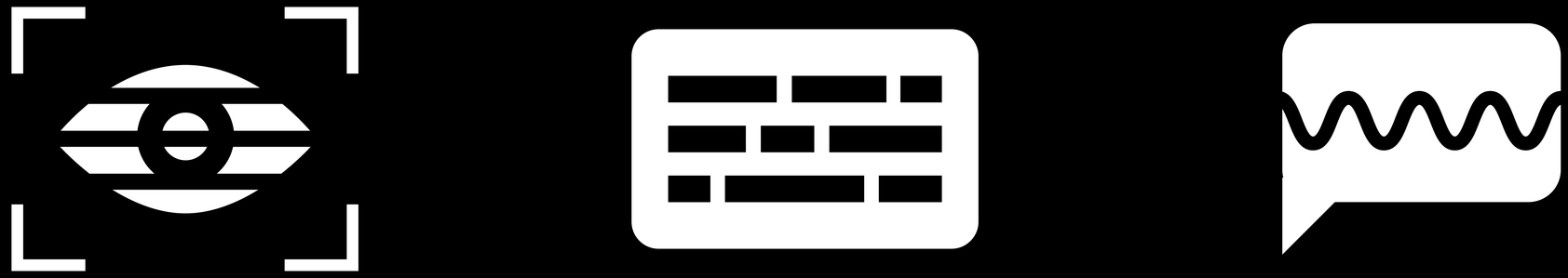


Domain APIs

Creating Great Apps Using Core ML and ARKit

Thursday, 10:00

Summary

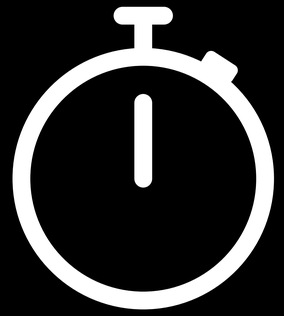


Core ML 3

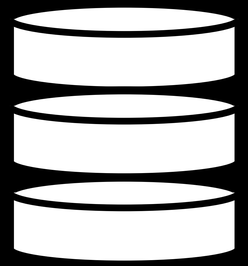
macOS iOS watchOS tvOS

On Device

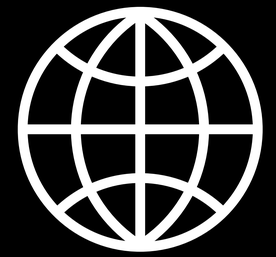
Privacy



Realtime



No server



Available

Generalized
Linear Models

Tree Ensembles

Support Vector
Machines

Feedforward
Neural Networks

Convolution
Neural Networks

Recurrent
Neural Networks

Core ML 3

NEW

Model
Flexibility

Model
Personalization

Model Flexibility

100+

Neural Network layers

BERT

DeepConvLSTM

Seq2seq

Mask R-CNN

MT-DNN

ELMo

Tacotron

GPT

Transformer

RNN-T

Nasnet

YOLO

Wavenet

Squeezenet

FCN

Deep Speech

Xception

Resnet50

PSPNet

Inceptionv2

Inceptionv4

VGG

Open AI GPT

Mobilenet

BiDAF

VoxelNet

LAS

WaveRNN

SSD Lite

ULMFit

Densenet

VGGish

WaveGlow

SSD mobilenet

GPT2

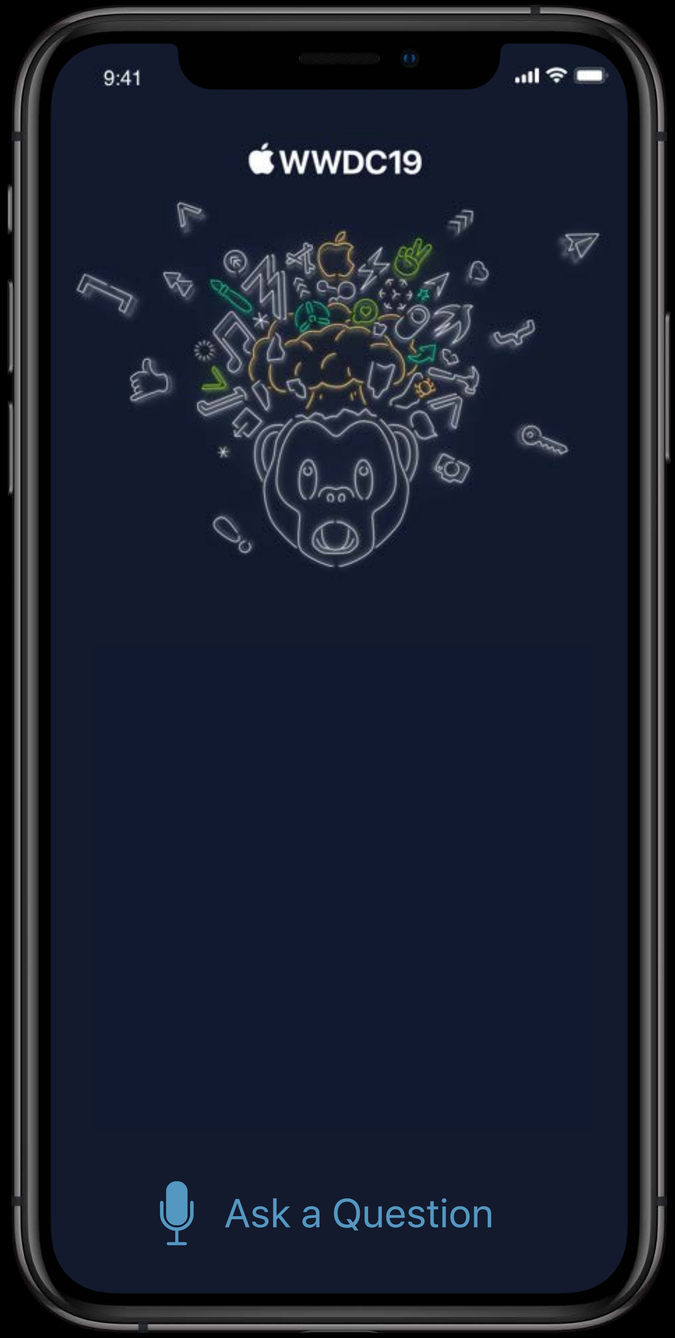
Inceptionv3

Deeplabv3

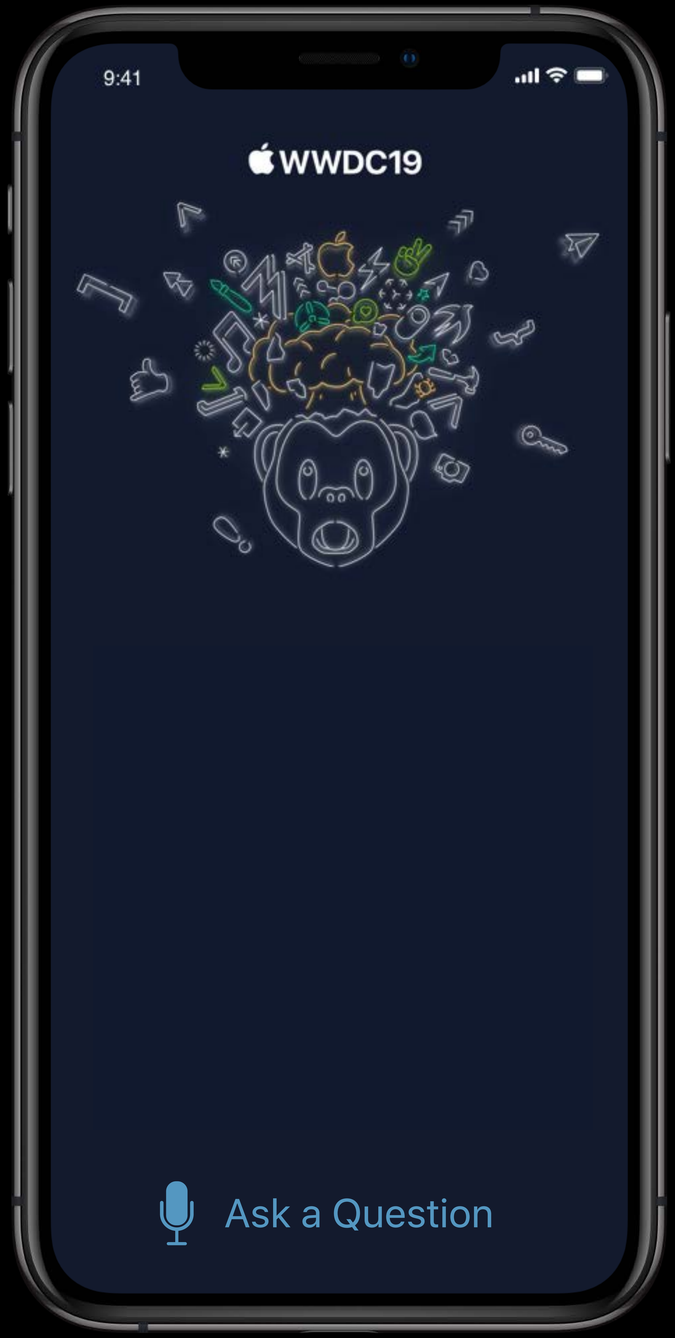
Style transfer

Inceptionv1

Resnet

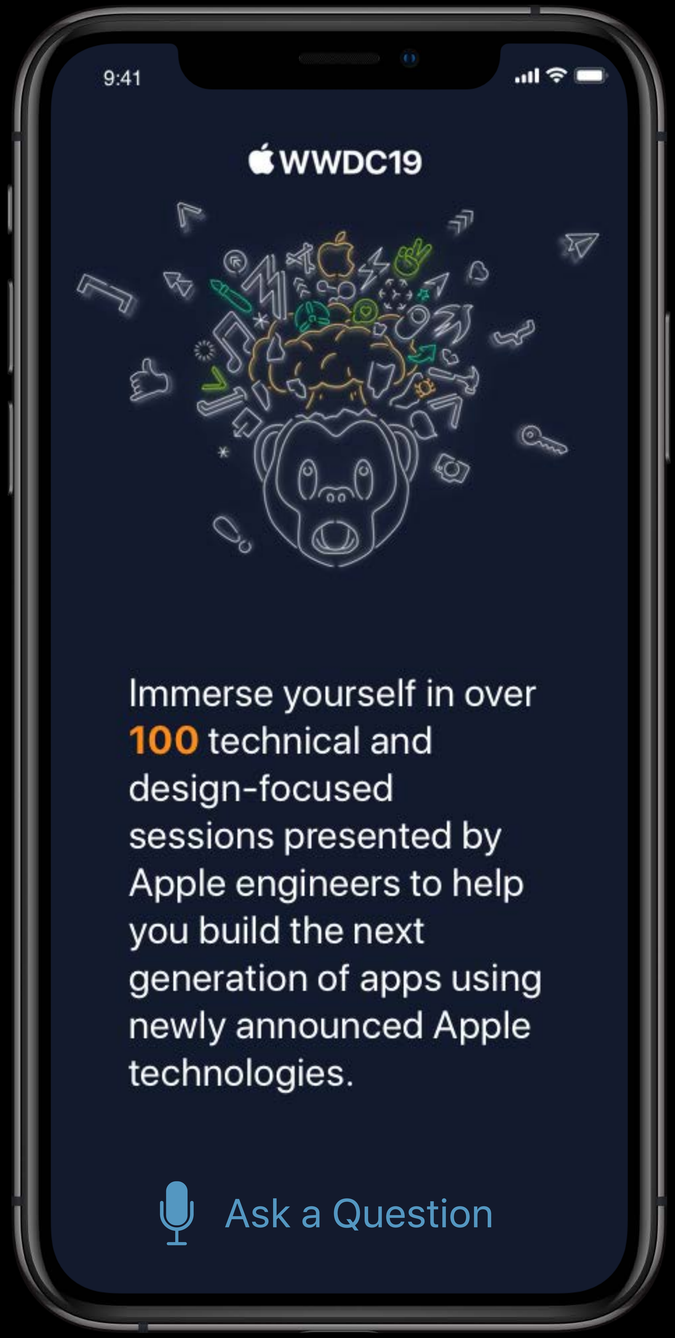


Question and Answer system



Question and Answer system

How many sessions will there be at WWDC this year?



Question and Answer system

How many sessions will there be at WWDC this year?

Instance Segmentation

Instance Segmentation

Updated Converters

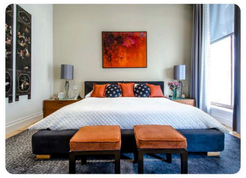
Machine Learning

Overview Core ML Create ML Models Resources

Images Text

Models can be used with Core ML, Create ML, Xcode, and are available in a number of sizes and architecture formats. Refer to the model's associated Xcode project for guidance on how to best use the model in your app.

Images



FCRN-DepthPrediction

Depth Estimation

Predict the depth from a single image.

View models

MNIST

Drawing Classification

Classify a single handwritten digit (supports digits 0-9)

View models

MobileNetV2

Image Classification

The MobileNetv2 architecture trained to classify the dominant object in a camera frame or image.

View models

Resnet50

Image Classification

A Residual Neural Network that will classify the dominant object in a camera frame or image.

SqueezeNet

Image Classification

A small Deep Neural Network architecture that classifies the dominant object in a camera frame or image.

DeeplabV3

Image Segmentation

Segment the pixels of a camera frame or image into a predefined set of classes.

View models

MacBook Pro

Core ML 3

NEW

Model
Flexibility

Model
Personalization

Model Personalization

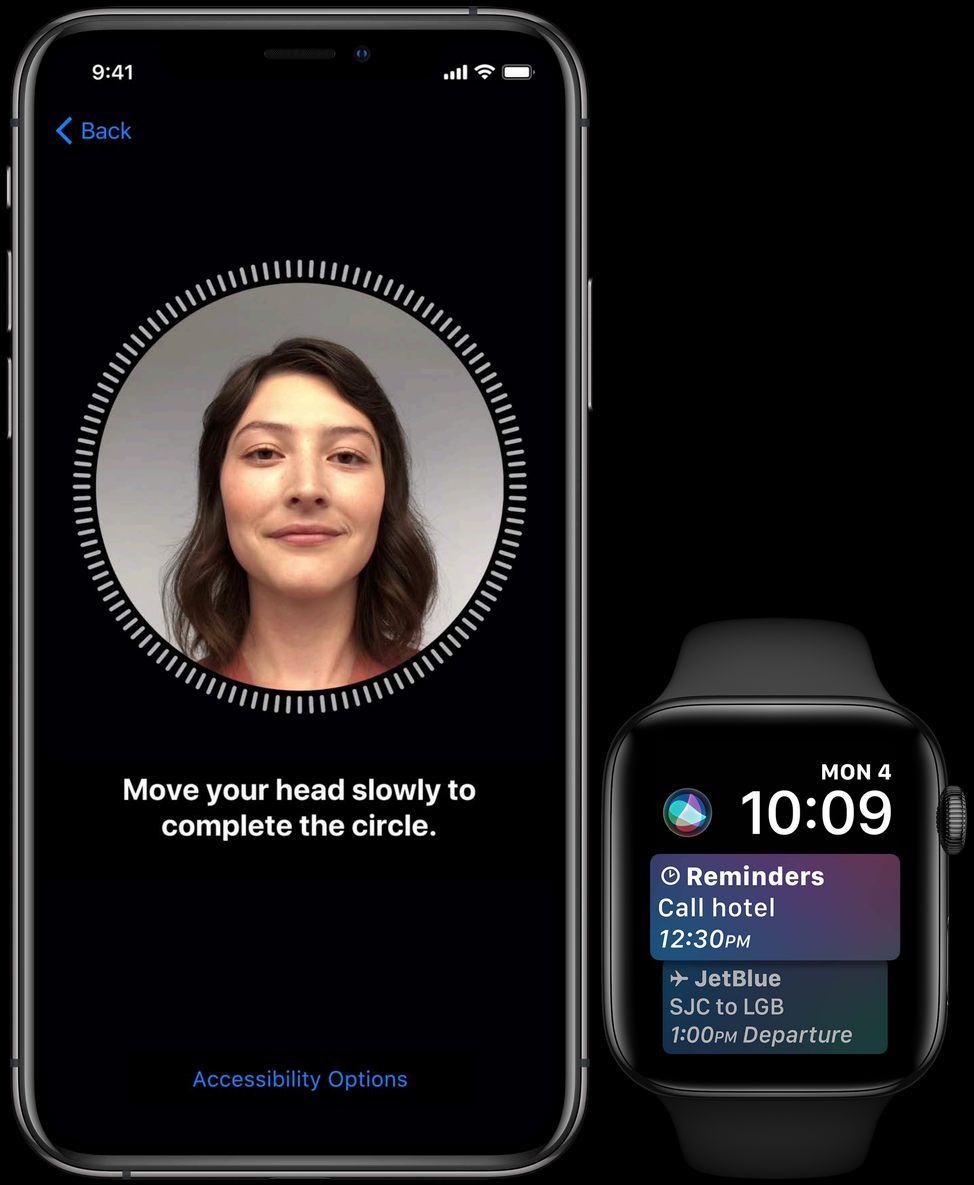
Model Building

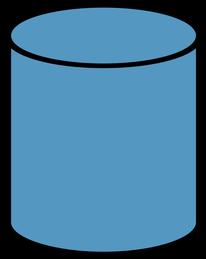
Model Deployment

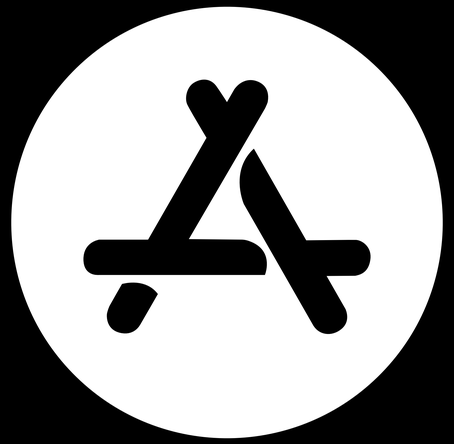
Model Building

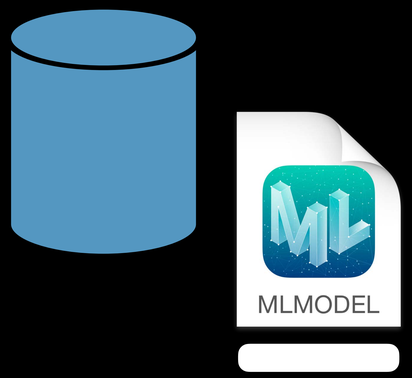
Model Deployment

On-Device Model Personalization

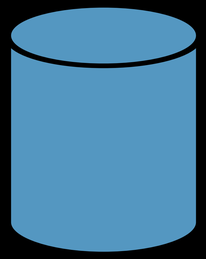

9:41
Back
Move your head slowly to complete the circle.
Accessibility Options
MON 4
10:09
Reminders
Call hotel
12:30PM
JetBlue
SJC to LGB
1:00PM Departure






MLMODEL


MLMODEL

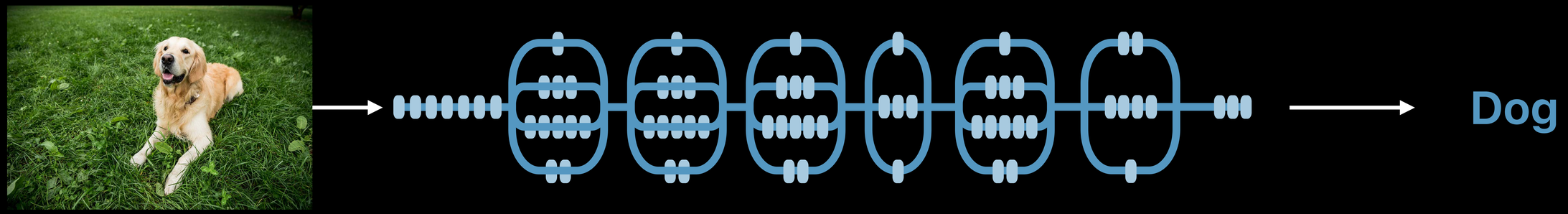



MLMODEL


MLMODEL

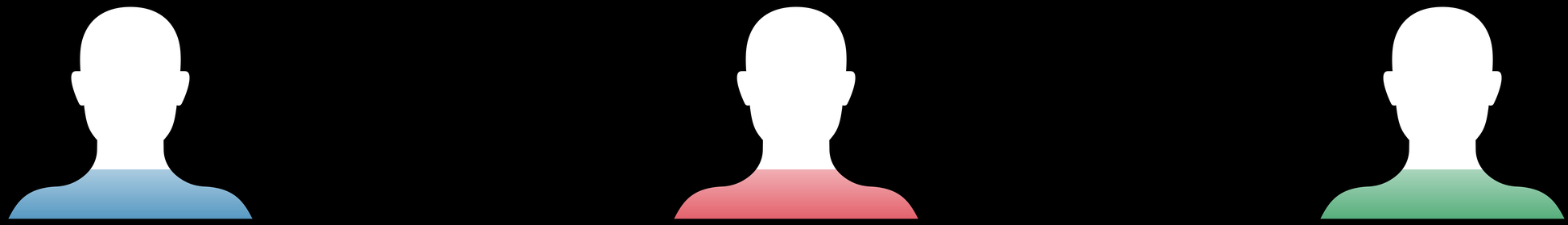

MLMODEL


MLMODEL

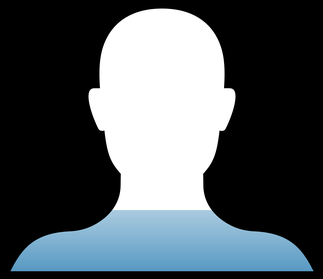


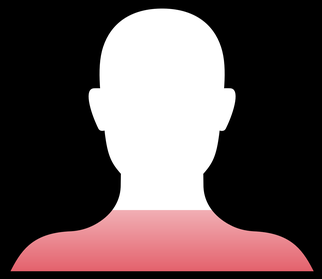
Model

My Dog ?

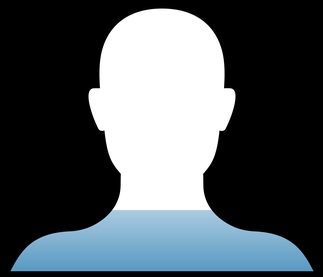


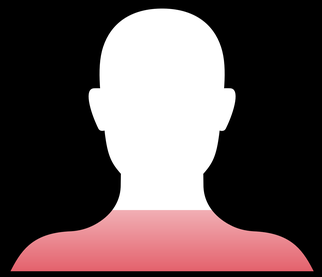
My Dog ?

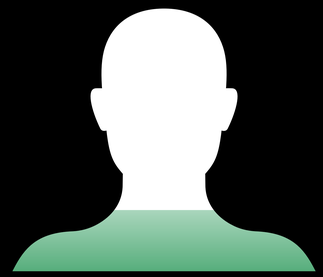




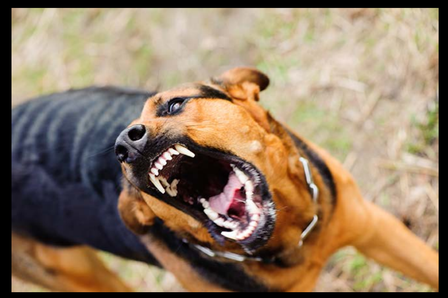
My Dog ?

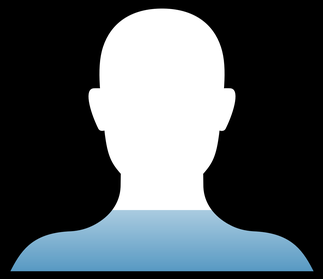


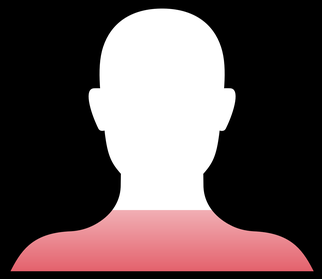


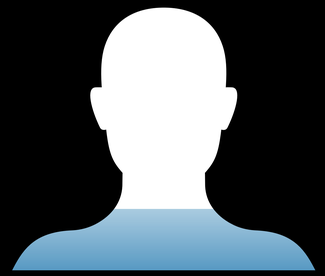


My Dog ?

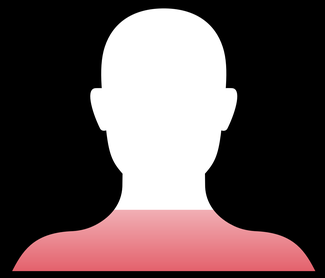




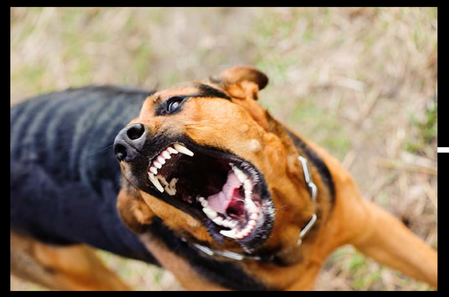





MLMODEL
My Dog

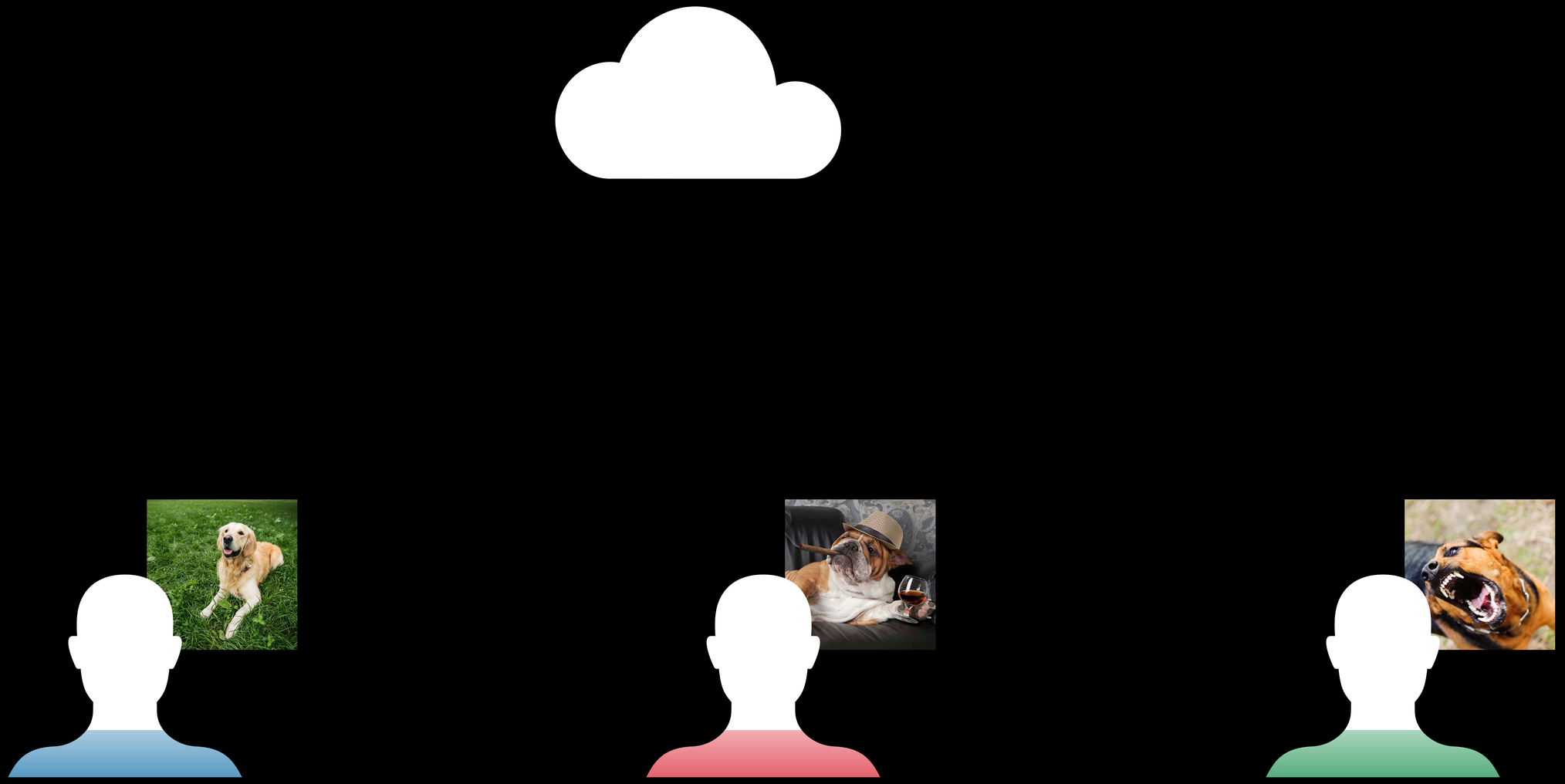


My Dog

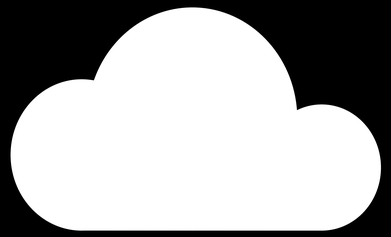


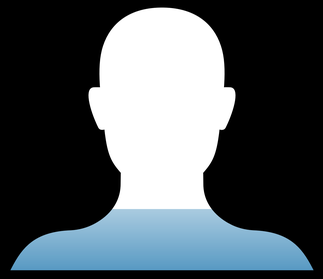
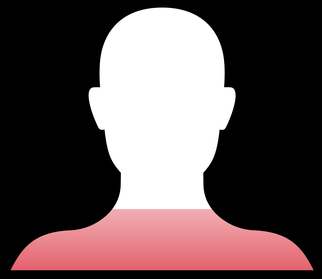
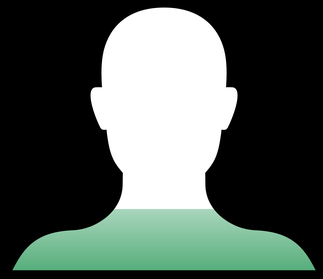
My Dog

Server Based Approach

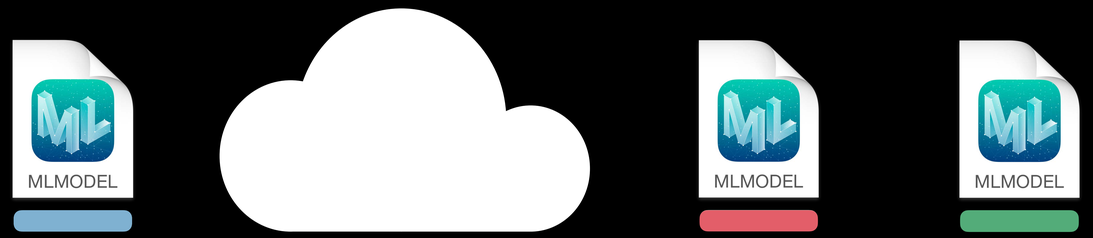


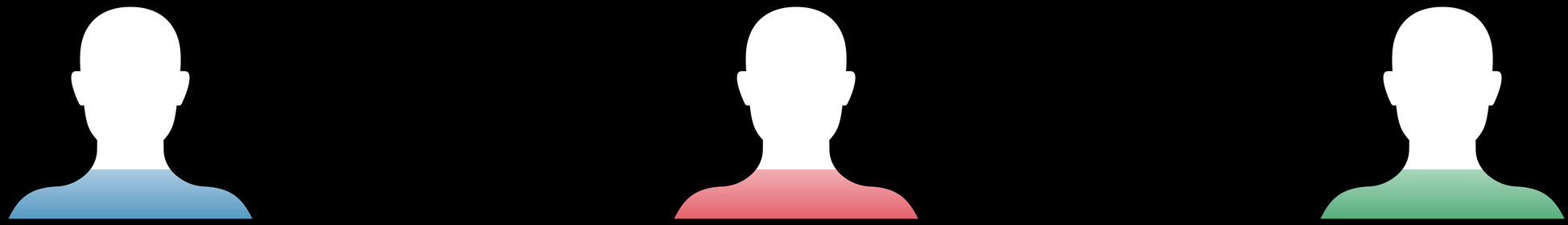
Server Based Approach

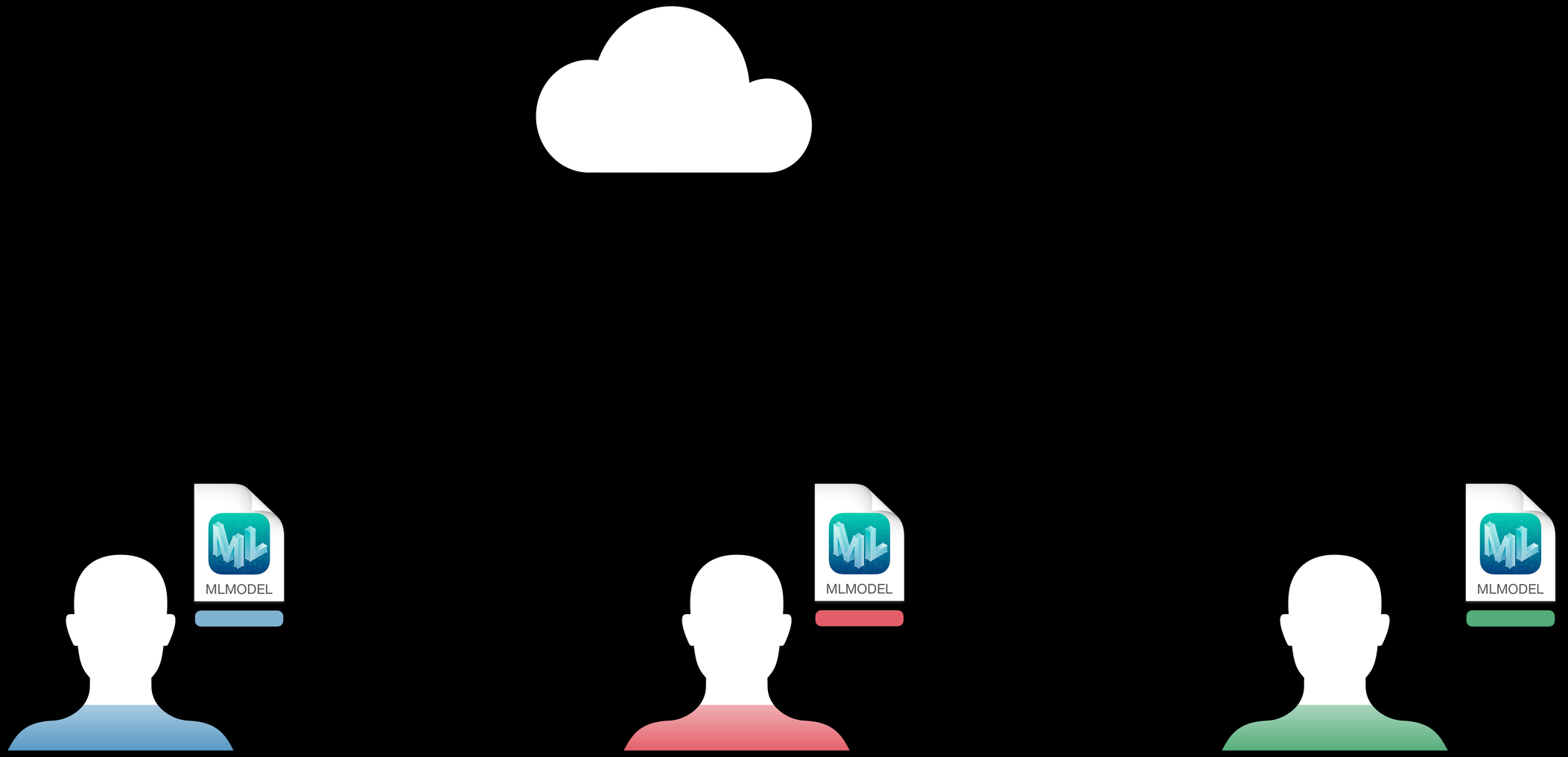




Server Based Approach



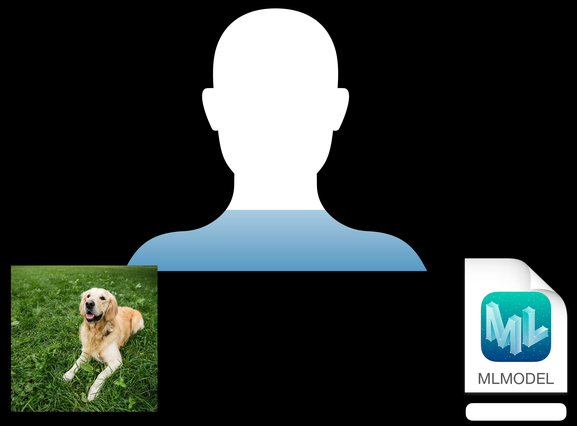


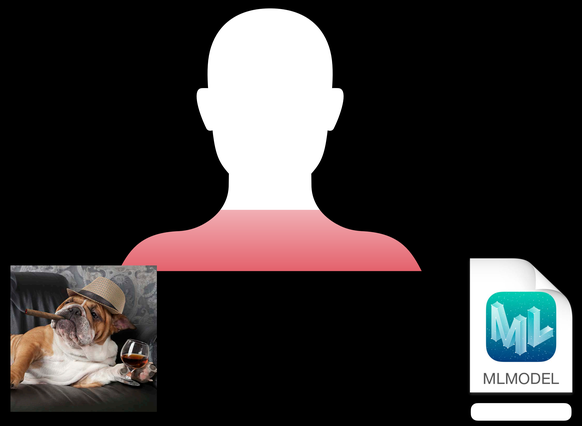
Server Based Approach



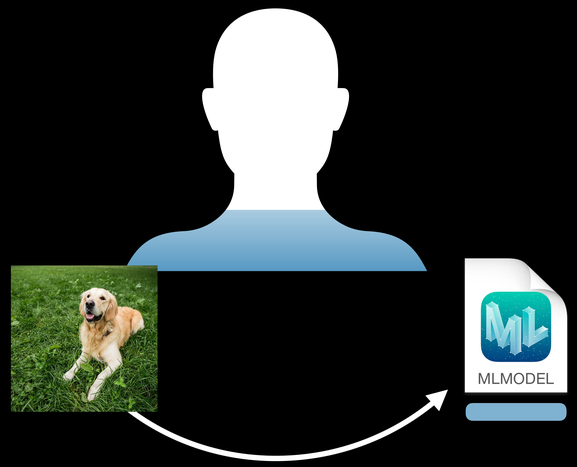
Privacy Concerns
Cost/Scalability

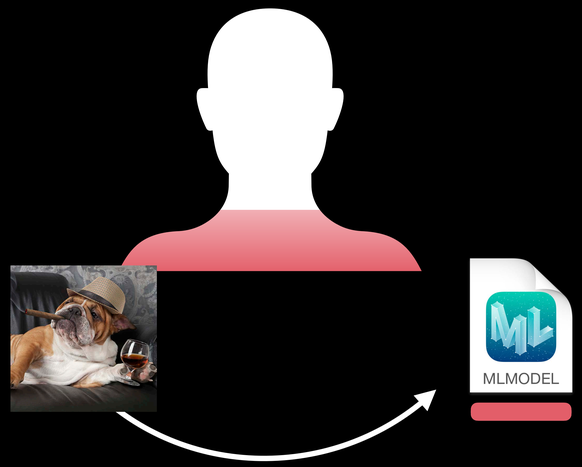
On-Device

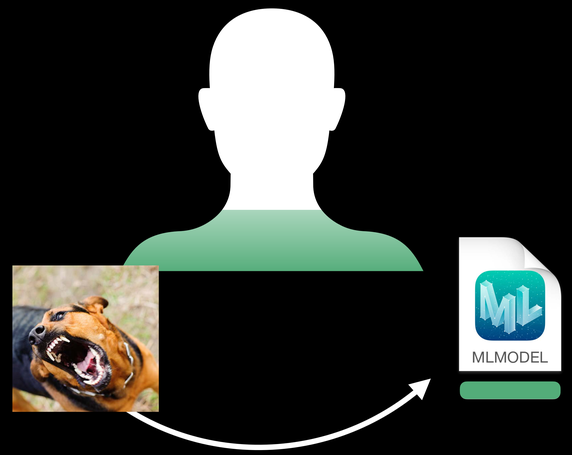


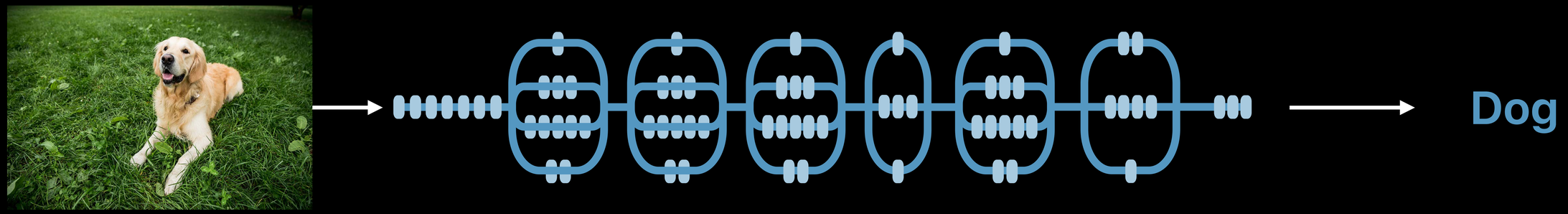


On-Device

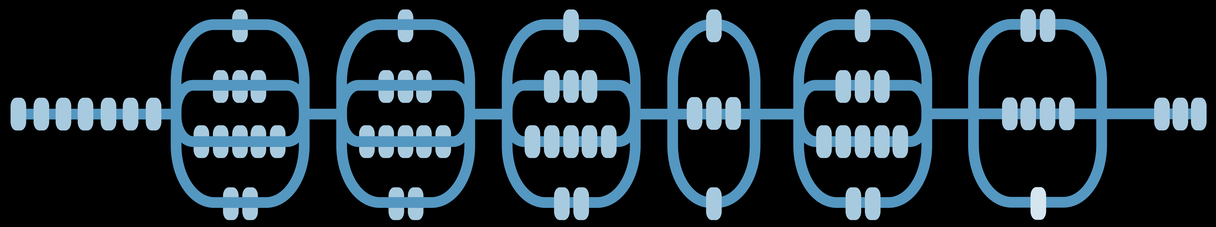








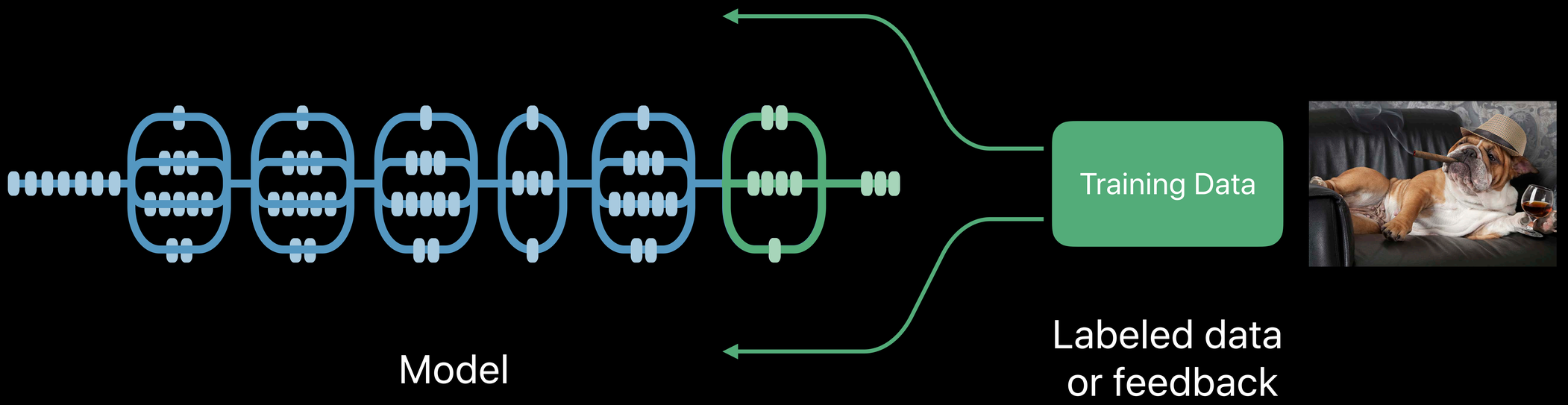
Model



Model

Training Data

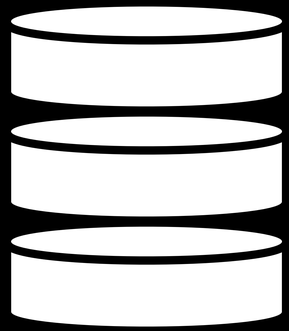
Labeled data
or feedback


Training Data
Model
Labeled data
or feedback

Personalized model for each user

On Device

Privacy



No server

On-Device Personalization

Neural Networks (fully connected, convolutional)

Nearest Neighbor

Background processing

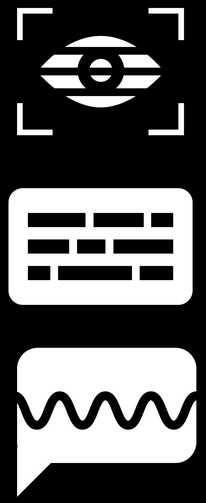
Summary

Summary

Create ML

Summary

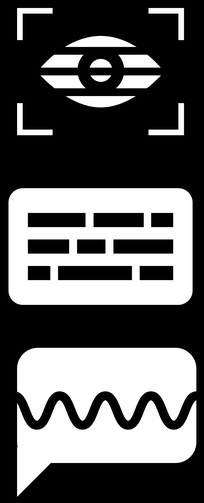
Create ML



Domain API

Summary

Create ML



Domain API

Core ML 3

More Information

developer.apple.com/wwdc19/430

Core ML 3 Framework	Tuesday, 4:00
Machine Learning Labs	WWDC 2019


WWDC19