

The background is decorated with various colorful geometric shapes and icons. At the top, there's a yellow semi-circle, a blue triangle, a vertical stack of three yellow circles, a pink rectangle, a yellow circle with a triangle inside, a small blue circle, a red squiggly line, and a blue diamond. On the left side, there's a blue line-art icon of a hand, a pink rectangle with a red speech bubble, and a green line-art icon of a face. On the right side, there's a red square, a red line-art icon of a hand, a blue vertical rectangle, and a small blue square. At the bottom, there's a yellow square with a white square inside, a green line-art icon of a hand, a blue triangle, a green semi-circle, a blue plus sign, a yellow L-shaped piece, a small orange arc, and a pink triangle.

Machine Learning for Mobile with ML kit and TensorFlow lite.



Yohannis Kifle

Academic and Research Assistant @ ASTU

@joekifle





What is Machine Learning?

Learning

“Learning is any process by which a system improves performance from experience.” Herbert Alexander Simon



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Machine Learning



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Why Machine Learning?

Develop systems that can automatically adapt and customize themselves to individual users.

Discover new knowledge from large databases

Ability to mimic human and replace certain monotonous tasks - which require some intelligence.



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Why now?

Flood of available data

Increasing computational power

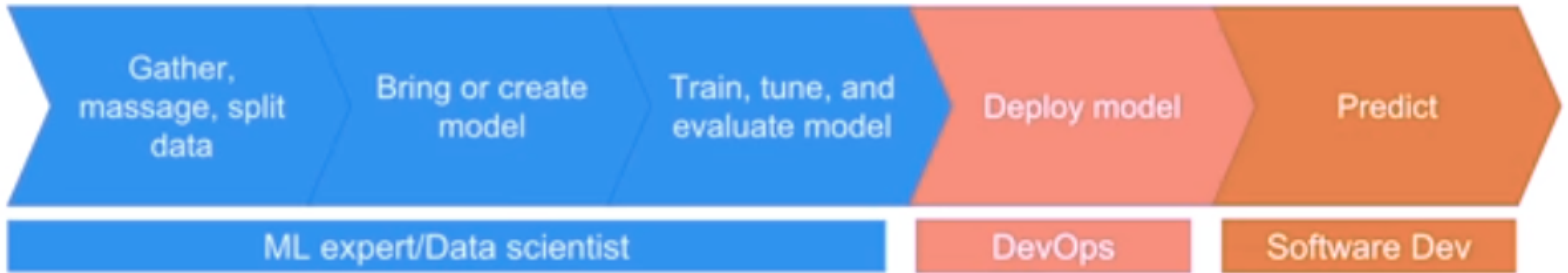
Growing progress in available algorithms
and theory developed by researchers



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ML Workflow



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ML in Mobile Apps

Doing ML on mobile was difficult for mobile developers.



ML in Mobile Apps

Until Now !!



Brought by  Firebase



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What is ML Kit?

1. For both IOS and Android Sdk
2. Shipped with pre-trained models
3. Support for custom models
4. On device and Google cloud AI interface Api



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[Project Overview](#)


Develop

[Authentication](#)
[Database](#)
[Storage](#)
[Hosting](#)
[Functions](#)
[ML Kit](#)

Quality

[Crashlytics](#), [Performance](#), [Test Lab](#)

Analytics

[Dashboard](#)
[Events](#)
[Conversions](#)
[Audiences](#)
[Funnels](#)
[Extensions](#)
[Spark](#)

Free \$0/month

[Upgrade](#)

[APIs](#)
[Custom](#)
[AutoML](#)

New

Cloud and on-device processing ▾

Upgrade your project to Blaze to enable Cloud-based APIs

[Upgrade](#)


Text recognition



Recognize and extract text from images

[Get started](#)


Face detection



Detect faces and facial landmarks, now with Face Contours

[Get started](#)


New

Object detection and tracking



Detect, track and classify objects in live camera and static images

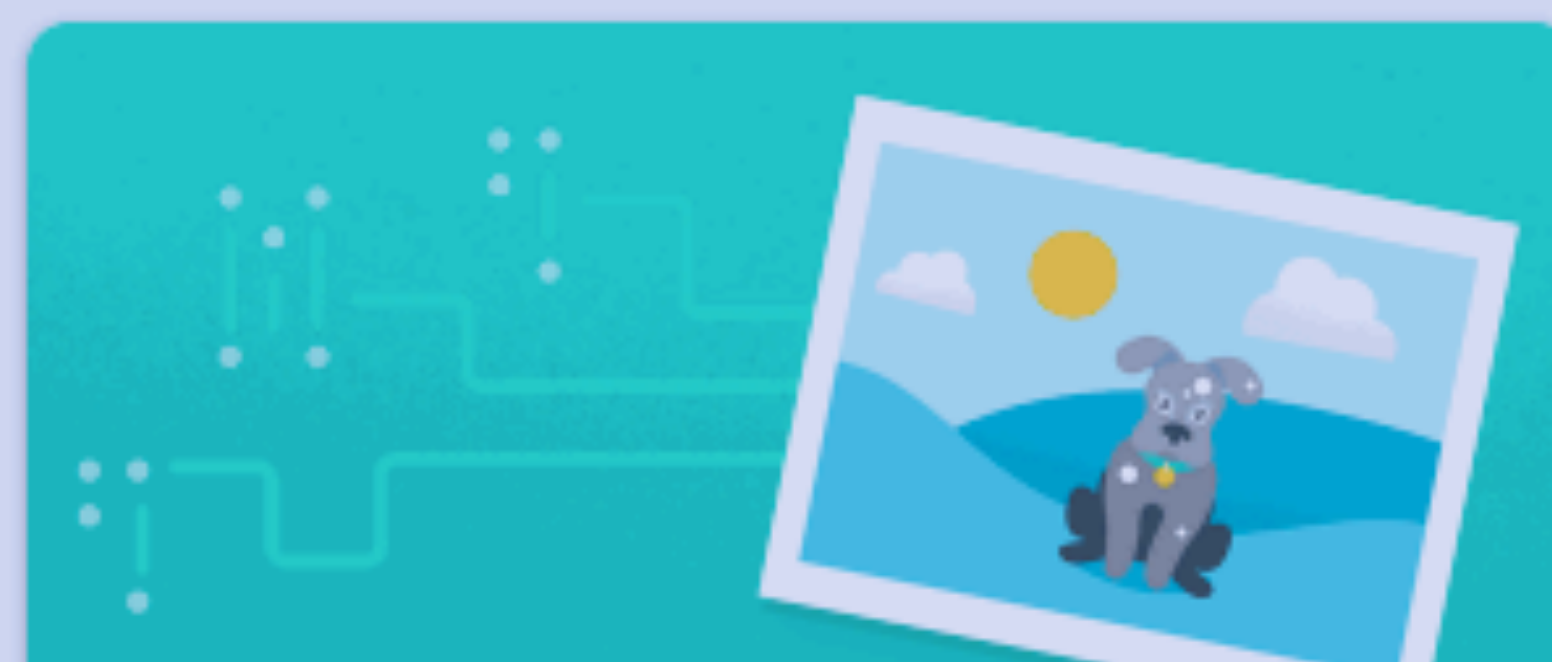
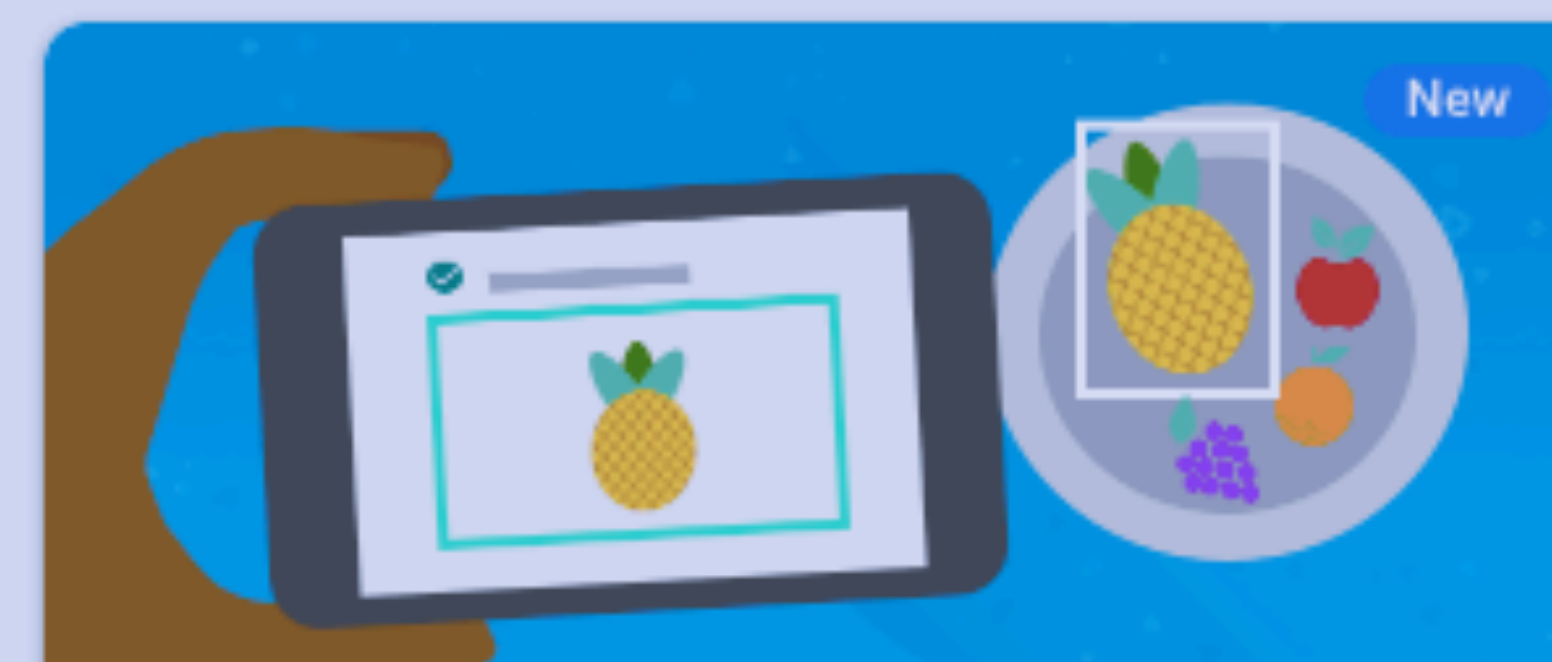
[Get started](#)


Image labeling



Identify objects, locations, activities, animal species, products, and more

[Get started](#)


New

AutoML Vision Edge



Train and publish your own image classification models

[Explore AutoML Vision Edge](#)


Barcode scanning



Scan and process barcodes

[Get started](#)

Develop

Authentication

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Scan and process barcodes

[Get started](#)



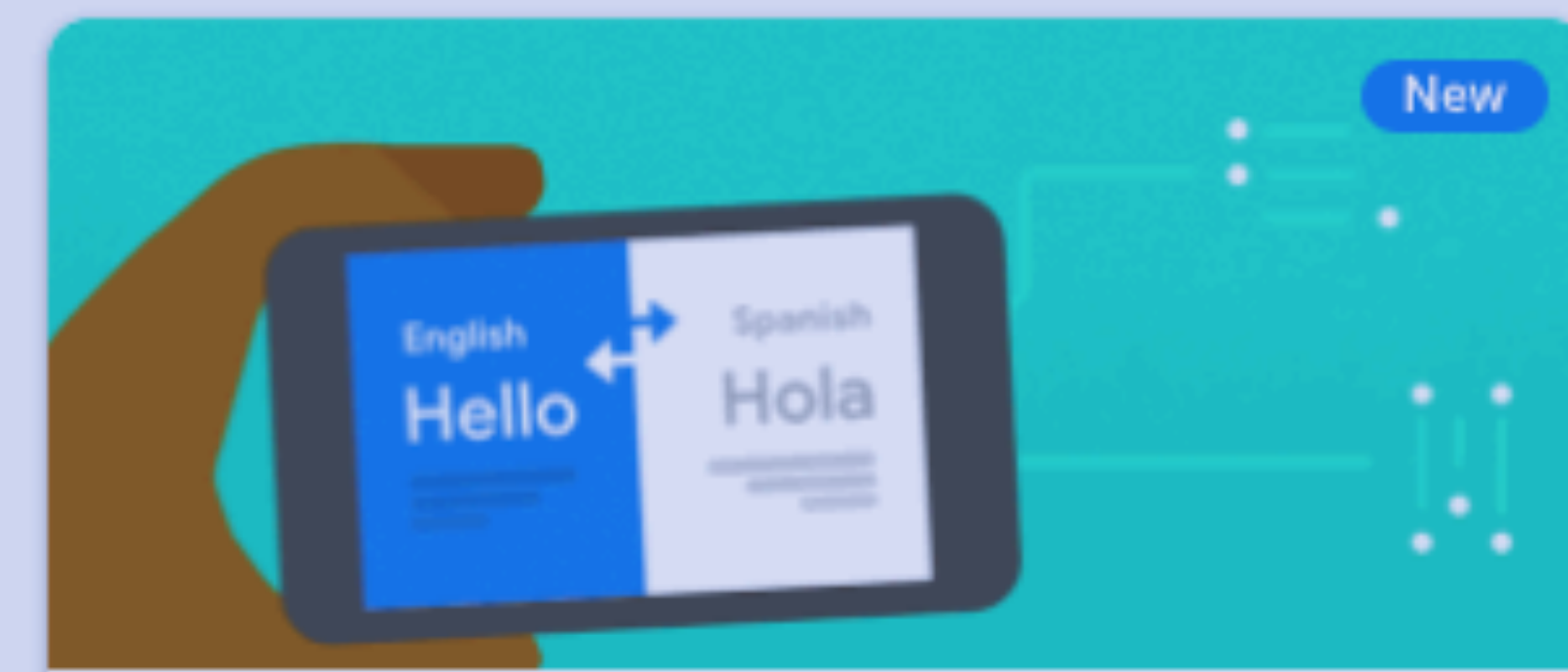
Landmark recognition
Identify popular landmarks in an image

[Get started](#)



Language ID
Detect the language of text

[Get started](#)



On-device translation
Translate text from one language to another

[Get started](#)



Smart Reply
Generate text replies based on previous messages

[Get started](#)

Getting started with MLkit

1. Add Firebase to your Android Project



Getting started with MLkit

2. Add MLkit Dependency

```
28  
29     implementation 'com.wonderkiln:camerakit:0.13.1'  
30     implementation 'com.google.firebase:firebase-core:16.0.3'  
31     implementation 'com.google.firebase:firebase-ml-vision:17.0.0'  
32     implementation 'com.github.d-max:spots-dialog:1.1@aar'  
33
```



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Let's Demo



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What if you want to create your own model?





TensorFlow



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TensorFlow Lite



Training custom models.

- Training a new model can take a long time and requires large amount of data



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Transfer Learning



Gather data

Retrain Model with new Images

Optimize for mobile

Embed in App / Store in Firebase



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SILICON VALLEY



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HBO®

SEEFOOD FOUNDER LAUNCHES
"NOT HOT DOG" APP



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Dataset



^

40

Hot Dog - Not Hot Dog



DanB • updated a year ago (Version 5)

[Data](#)[Kernels \(147\)](#)[Discussion](#)[Activity](#)[Metadata](#)

Download (46 MB)

[New Notebook](#) **Usability** 6.3**License** Other (specified in description)**Tags** arts and entertainment,
mobile apps and add-ons

Data (46 MB)



Data Sources

- ▼ test
 - > hot_dog
 - > not_hot_dog
- ▼ train
 - > hot_dog
 - > not_hot_dog

About this file

No description yet



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Use pre-existing model

MobileNet_V1



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Select Model and Retrain

IMAGE_SIZE=224

ARCHITECTURE="mobilenet_0.50_\${IMAGE_SIZE}"

```
python -m scripts.retrain \  
  --bottleneck_dir=output/bottlenecks \  
  --how_many_training_steps=500 \  
  --model_dir=output/models/ \  
  --summaries_dir=output/training_summaries/"${ARCHITECTURE}" \  
  --output_graph=output/retrained_graph.pb \  
  --output_labels=output/retrained_labels.txt \  
  --architecture="${ARCHITECTURE}" \  
  --image_dir=datasets/hot-dog-not-hot-dog
```



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Optimize for Mobile

```
toco \  
-input_file=output/retrained_graph.pb \  
--output_file=output/dogs_optimized_graph.tflite \  
--input_format=TENSORFLOW_GRAPHDEF \  
--output_format=TFLITE \  
--input_shape=1,${IMAGE_SIZE},${IMAGE_SIZE},3 \  
--input_array=input \  
--output_array=final_result \  
--inference_type=FLOAT \  
--input_data_type=FLOAT
```



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```
42  /** Tag for the {@link Log}. */
43  private static final String TAG = "TfLiteCameraDemo";
44
45  ⚠️ /** Name of the model file stored in Assets. */
46  private static final String MODEL_PATH = "dogs_optimized_graph.tflite";
47
48  /** Name of the label file stored in Assets. */
49  private static final String LABEL_PATH = "retrained_labels.txt";
50
51  /** Number of results to show in the UI. */
52  private static final int RESULTS_TO_SHOW = 3;
53
```

Let's Demo



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What if your model changes?



Ship an app update !



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Host on Firebase

Update automatically downloaded



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You can Read more @

<https://firebase.google.com/docs/ml-kit>



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Get my slides

<https://speakerdeck.com/joekifle>



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Thank you!



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