

Adding Machine Learning to your developer toolbox

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Google AI Developer Advocate

 @gusthema



In this talk

01

Turnkey APIs to help you

All developers can leverage Machine Learning From Mobile, to Web and Backend

02

Where to find models

What should you do when you need more than Turnkey APIs?

03

Customizing a model

If no model solves your problem, customizing will help you

WHEN A USER TAKES A PHOTO,
THE APP SHOULD CHECK WHETHER
THEY'RE IN A NATIONAL PARK...

SURE, EASY GIS LOOKUP.
GIMME A FEW HOURS.

... AND CHECK WHETHER
THE PHOTO IS OF A BIRD.

I'LL NEED A RESEARCH
TEAM AND FIVE YEARS.



IN CS, IT CAN BE HARD TO EXPLAIN
THE DIFFERENCE BETWEEN THE EASY
AND THE VIRTUALLY IMPOSSIBLE.





TensorFlow



Mobile Developers

Android, iOS

Pros

Easy API

Run on-device

Available offline

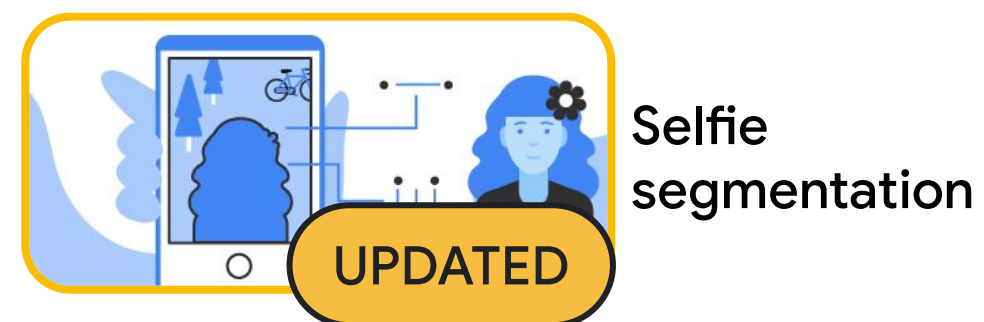
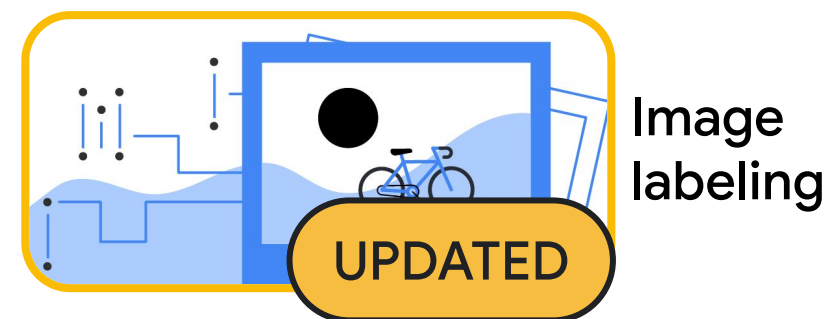
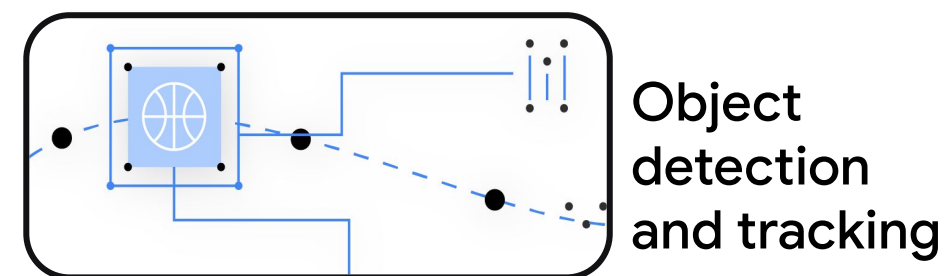
Vision and Text

Models included

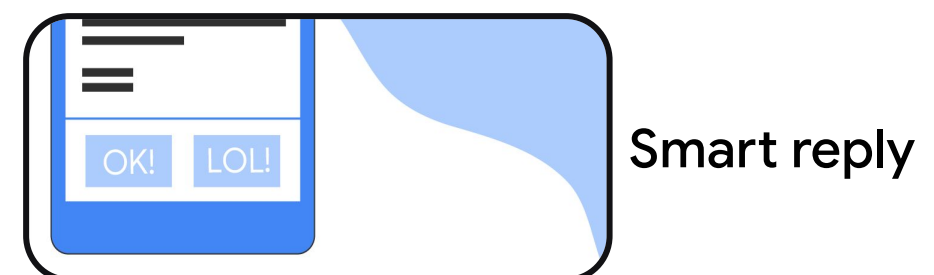


developers.google.com/ml-kit

Vision



Natural Language



```
val image = InputImage.fromBitmap(bitmap, rotation)

val labeler =
    ImageLabeling.getClient(ImageLabelerOptions.DEFAULT_OPTIONS)

labeler.process(image)
    .addOnSuccessListener { labels ->
        for (label in labels) {
            val text = label.text
            val confidence = label.confidence
            val index = label.index
        }
    }
```

```
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    ImageLabeling.getClient(ImageLabelerOptions.DEFAULT_OPTIONS)

labeler.process(image)
    .addOnSuccessListener { labels ->
        for (label in labels) {
            val text = label.text
            val confidence = label.confidence
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        }
    }
```



+98% confidence

Bird



TensorFlow Lite

www.tensorflow.org/lite

TensorFlow Hub

The models repository for all your
TensorFlow needs

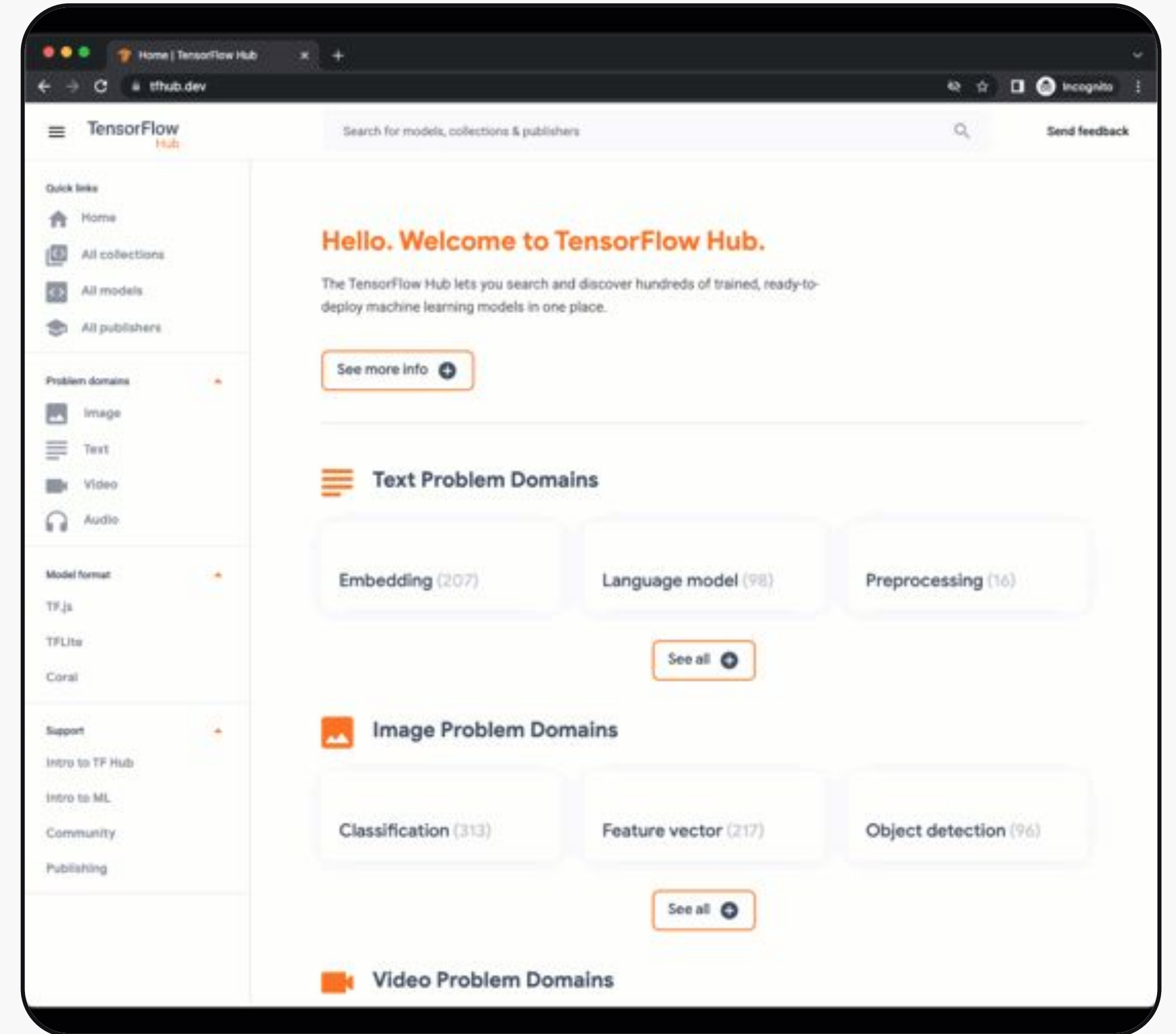
Models for all kinds of tasks

tfhub.dev





TensorFlow Lite



```
val image = InputImage.fromBitmap(bitmap, rotation)
```

```
val localModel = LocalModel.Builder()  
    .setAssetFilePath("birds.tflite")  
    .build()
```

```
val customOptions = CustomImageLabelerOptions  
    .Builder(localClassifier)  
    .build()
```

```
val labeler = ImageLabeling.getClient(customOptions)
```

```
labeler.process(image)  
    .addOnSuccessListener { labels ->  
        ...  
    }
```

```
val image = InputImage.fromBitmap(bitmap, rotation)
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        ...  
    }
```



+70% confidence

Berylline Hummingbird

The first recorded travels by Europeans to China and back date from this time. The most famous traveler of the period was the Venetian Marco Polo, whose account of his trip to "Cambaluc," the capital of the Great Khan, and of life there astounded the people of Europe. The account of his travels, *Il milione* (or, *The Million*, known in English as the *Travels of Marco Polo*), appeared about the year 1299. Some argue over the accuracy of Marco Polo's accounts due to the lack of mentioning the Great Wall of China, tea houses, which would have been a prominent sight since Europeans had yet to adopt a tea culture, as well the practice of foot binding by the women in capital of the Great Khan. Some suggest that Marco Polo acquired much of his knowledge **through contact with Persian traders** since many of the places he named were in Persian.

How did some suspect that Polo learned about China instead of by actually visiting it?

Answer: **through contact with Persian traders**



TensorFlow Task Library

<https://goo.gle/36T1PuW>

TensorFlow Task Library

<https://goo.gle/36T1PuW>

Pros

Customizable

Data processing

High Performance

Extensible

Open sourced

TensorFlow Task Library

<https://goo.gle/36T1PuW>

Tasks

Image Classification

Object Detection

Image Segmentation

Text Classification

Text Question and Answer

Audio Classification

Similarity Search



```
// Initialize the audio classifier
val classifier = AudioClassifier.createFromFile(context, modelPath)
val audioTensor = classifier.createInputTensorAudio()

// Initialize the audio recorder
val record = classifier.createAudioRecord()
record.startRecording()

// Load the latest audio sample
audioTensor.load(record)
val output = classifier.classify(audioTensor)
```

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<https://goo.gle/3uv4a7k>



Web Developers

For JavaScript

[Overview](#)
[Tutorials](#)
[Guide](#)
[Models](#)
[Demos](#)
[API](#)

Go from zero to hero with web ML in a new online course from TensorFlow.js.

[Register now](#)

TensorFlow.js is a library for machine learning in JavaScript

Develop ML models in JavaScript, and use ML directly in the browser or in Node.js.

[See tutorials](#)

Tutorials show you how to use TensorFlow.js with

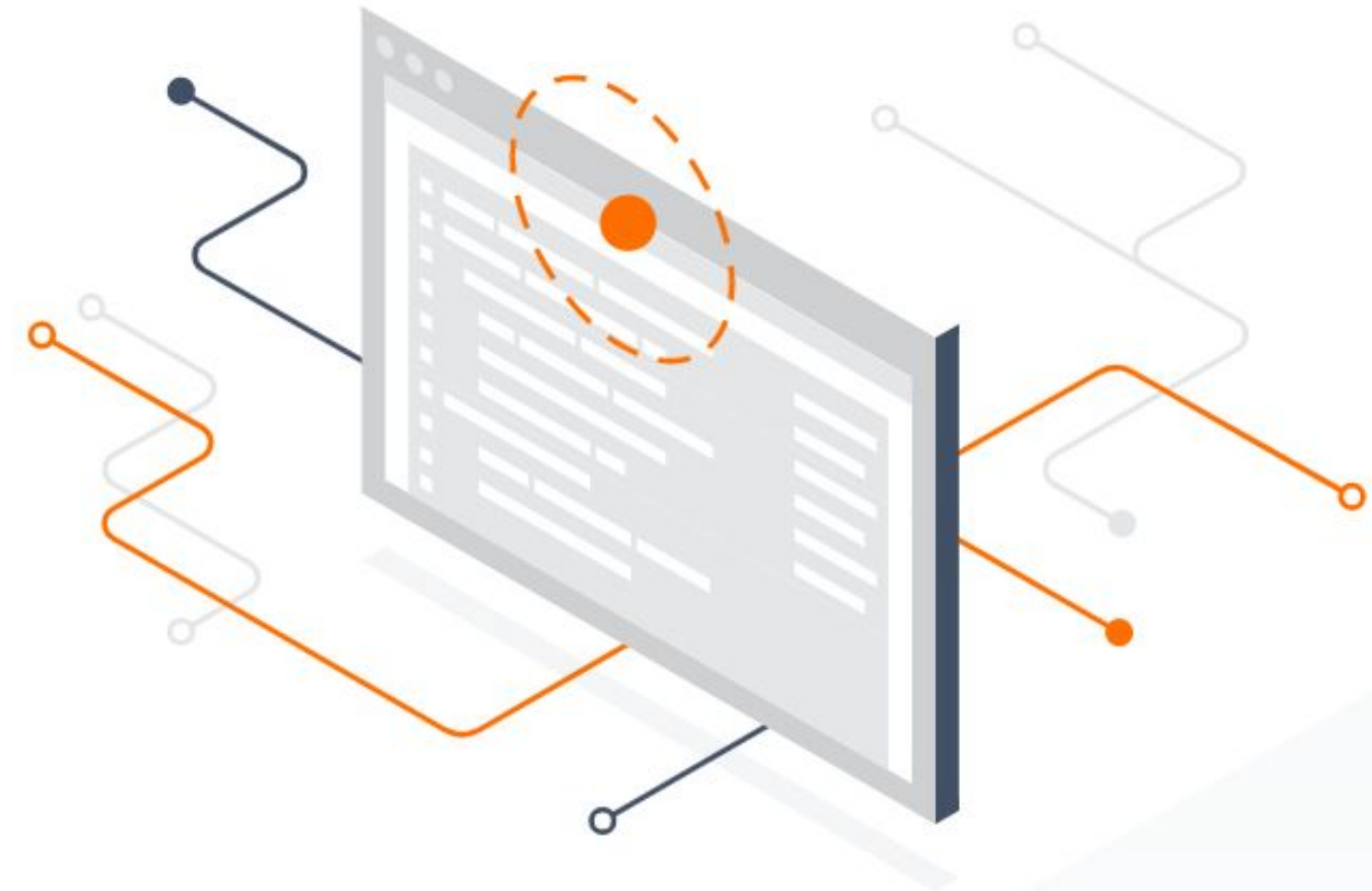
[See models](#)

Pre-trained, out-of-the-box models for common use

[See demos](#)

Live demos and examples run in your browser using TensorFlow.js.

www.tensorflow.org/js



TensorFlow.js models

www.tensorflow.org/js/models

Out of the box

Image classification

Pose Detection

Body segmentation

Object Detection

Hand pose detection

Text toxicity

Face landmark detection

Image segmentation

Text Question and Answering

```
<script src="https://cdn.jsdelivr.net/npm/@tensorflow/tfjs@1.0.1"> </script>
<script src="https://cdn.jsdelivr.net/npm/@tensorflow-models/mobilenet@1.0.0">
</script>
```

```

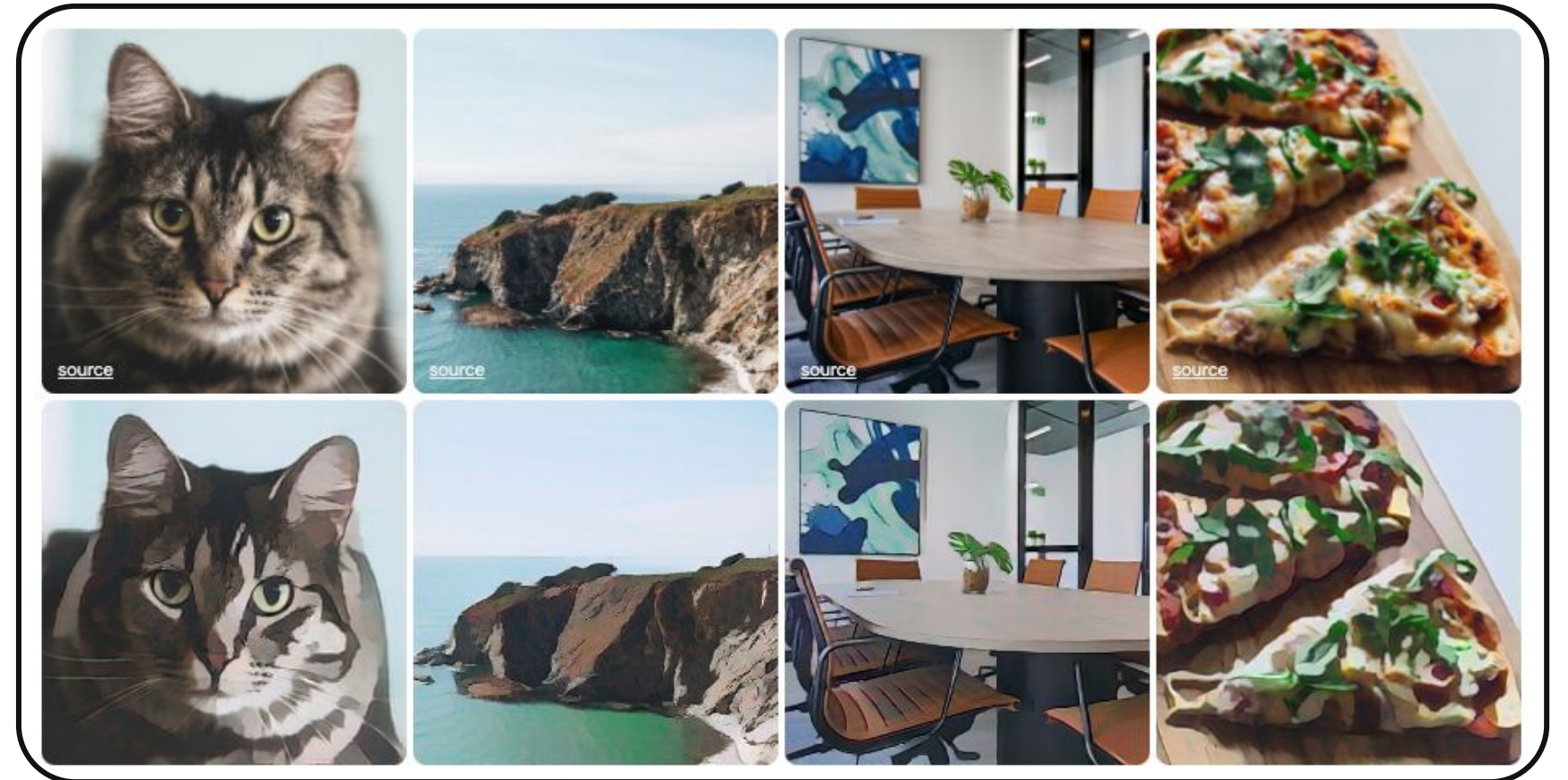
```

```
<script>
  const IMG = document.getElementById('img');

  async function classify() {
    const model = await mobilenet.load();
    // Classify the image.
    const predictions = await model.classify(IMG);
    console.log('Predictions: ');
    console.log(predictions);
  }

  classify();
</script>
```

TensorFlow.js + TFLite models



<https://goo.gle/3iGihkH>


```
<script src="https://cdn.jsdelivr.net/npm/@tensorflow/tfjs"></script>
<script
src="https://cdn.jsdelivr.net/npm/@tensorflow/tfjs-tflite@0.0.1-alpha.7/dist/tf-tflite.min.js"></sc
ript>

// Load the model.
let tfliteModel = await tflite.loadTFLiteModel(
  "https://tfhub.dev/google/lite-model/aiy/vision/classifier/birds_V1/3");

// Prepare input.
const EXPECTED_IMAGE_SIZE = 224;
const IMG = document.querySelector("img");
let inputTensor = tf.cast(
  tf.image
    .resizeBilinear(tf.browser.fromPixels(IMG),
      [EXPECTED_IMAGE_SIZE, EXPECTED_IMAGE_SIZE]) // Resize
    .expandDims(),
  "int32");

// Run the inference and get the output tensor.
let outputTensor = tfliteModel.predict(inputTensor);
console.log(outputTensor.dataSync());
```



```
<script src="https://cdn.jsdelivr.net/npm/@tensorflow/tfjs"></script>
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Backend Developers

TensorFlow Serving

www.tensorflow.org/tfx/guide/serving

Can serve multiple models and versions simultaneously

gRPC and REST api

Low latency, high throughput

Supports A/B testing experimental models

Out-of-the-box support for accelerators (GPU)

Download the TensorFlow Serving Docker image and repo

```
docker pull tensorflow/serving
```

Start TensorFlow Serving container and open the **REST API** port

```
docker run -t --rm -p 8501:8501 \
    -v "/my_models/saved_model/model_half_plus_two:/models/half_plus_two" \
    -e MODEL_NAME=half_plus_two \
    tensorflow/serving &
```

Query the model using the predict **API**

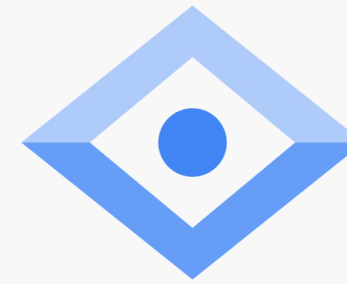
```
curl -d '{"instances": [1.0, 2.0, 5.0]}' \
    -X POST http://localhost:8501/v1/models/half_plus_two:predict
```

Returns => { "predictions": [2.5, 3.0, 4.5] }

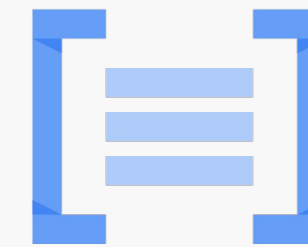
Google Cloud ML APIs

Powerful ML models over REST and RPC

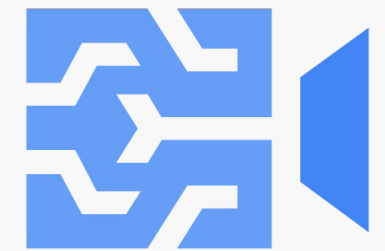
<https://goo.gle/3wOen1o>



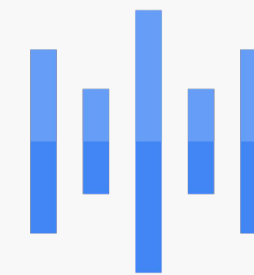
Cloud Vision API



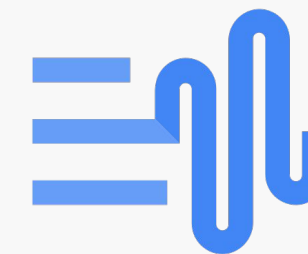
Natural Language API



Video Intelligence API



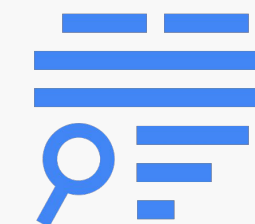
Speech-to-Text



Text-to-Speech



Cloud Translation API



Healthcare Natural Language AI

Objects

Labels

Properties

Safe Search



bird.jpeg

Bird 96%



Sky 94%



Hummingbird 91%



Beak 82%



Wing 77%



Feather 76%



What is next?

Customizing a model

And when there is no model that solve my problem?

What can you do?

How to customize?

When there is no model
that solve my problem?



Training Models

TensorFlow Lite Model Maker

Simplify the process of training a model using custom data

Model types include:

Image-based

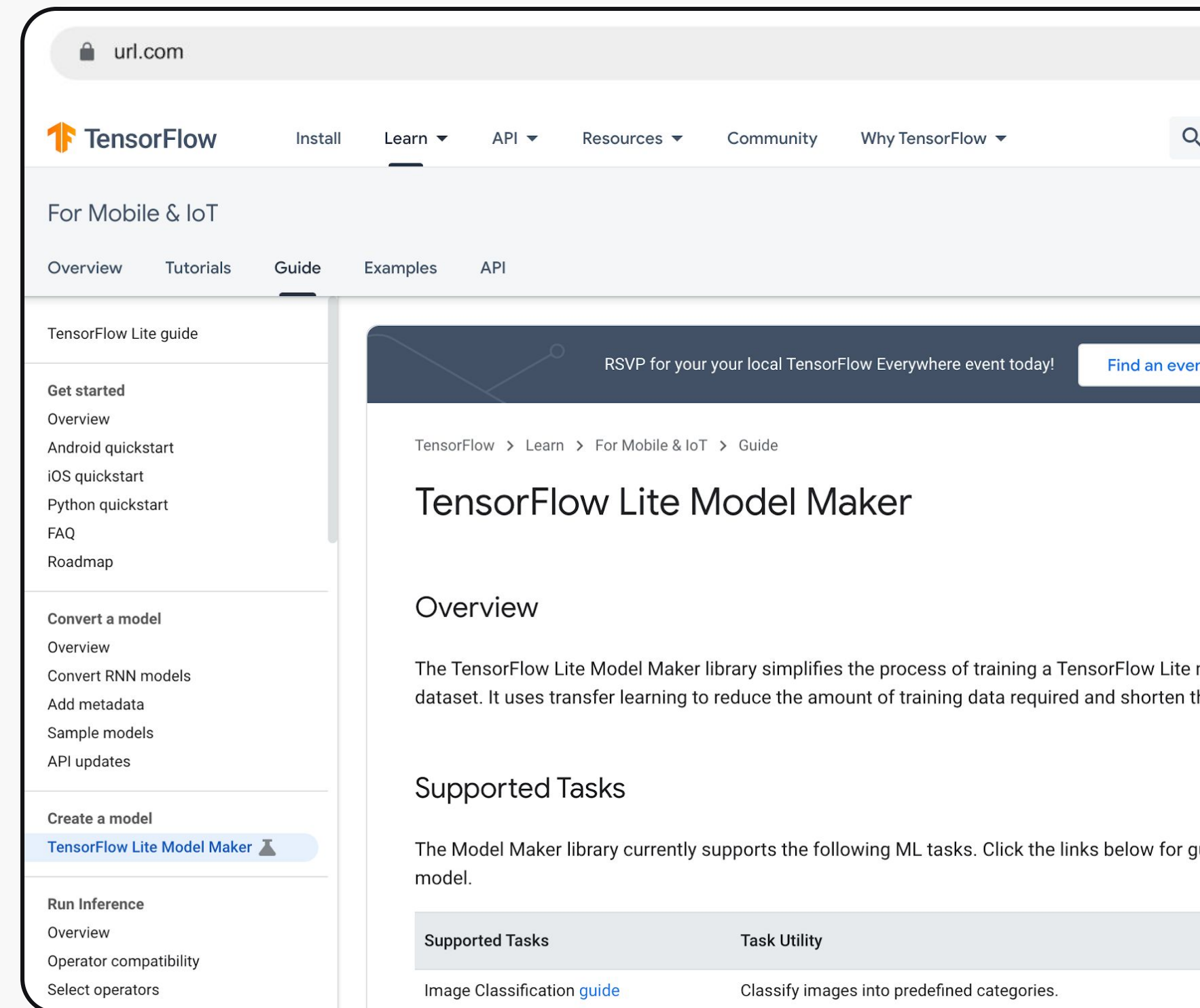
Text-based

Object Detection

Audio

...and more

<https://goo.gle/3wPwcNP>



TensorFlow Lite Model Maker

Overview

The TensorFlow Lite Model Maker library simplifies the process of training a TensorFlow Lite model on a custom dataset. It uses transfer learning to reduce the amount of training data required and shorten the training time.

Supported Tasks

The Model Maker library currently supports the following ML tasks. Click the links below for more information about each task.

| Supported Tasks | Task Utility |
|--|---|
| Image Classification guide | Classify images into predefined categories. |

```
from tf_lite_model_maker import image_classifier
from tf_lite_model_maker.image_classifier import DataLoader

# Load input data specific to an on-device ML app.
data = DataLoader.from_folder('toys_photos/')
train_data, test_data = data.split(0.9)

# Customize the TensorFlow model.
model = image_classifier.create(train_data)

# Evaluate the model.
loss, accuracy = model.evaluate(test_data)

# Export to Tensorflow Lite model and label file in `export_dir`.
model.export(export_dir='/tmp/')
```

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```

Google Cloud AutoML

Train high-quality custom machine learning models with minimal effort and machine learning expertise.

cloud.google.com/automl



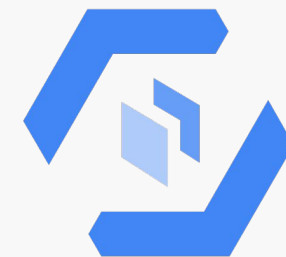
AutoML



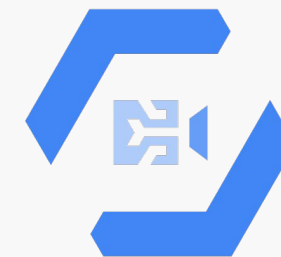
AutoML
Translation



AutoML
Vision



AutoML
Tables



AutoML Video
Intelligence



AutoML Natural
Language

Summary

01

Use Turnkey APIs

Easy-to-use APIs that provide complete ML-powered use cases for your apps

02

Use Existing models

Need a model?
Tensorflow Hub is here to help!

03

Build Custom models

If no model solves your problem, you can customize them to your data with Google Cloud AutoML or TensorFlow Lite Model Maker

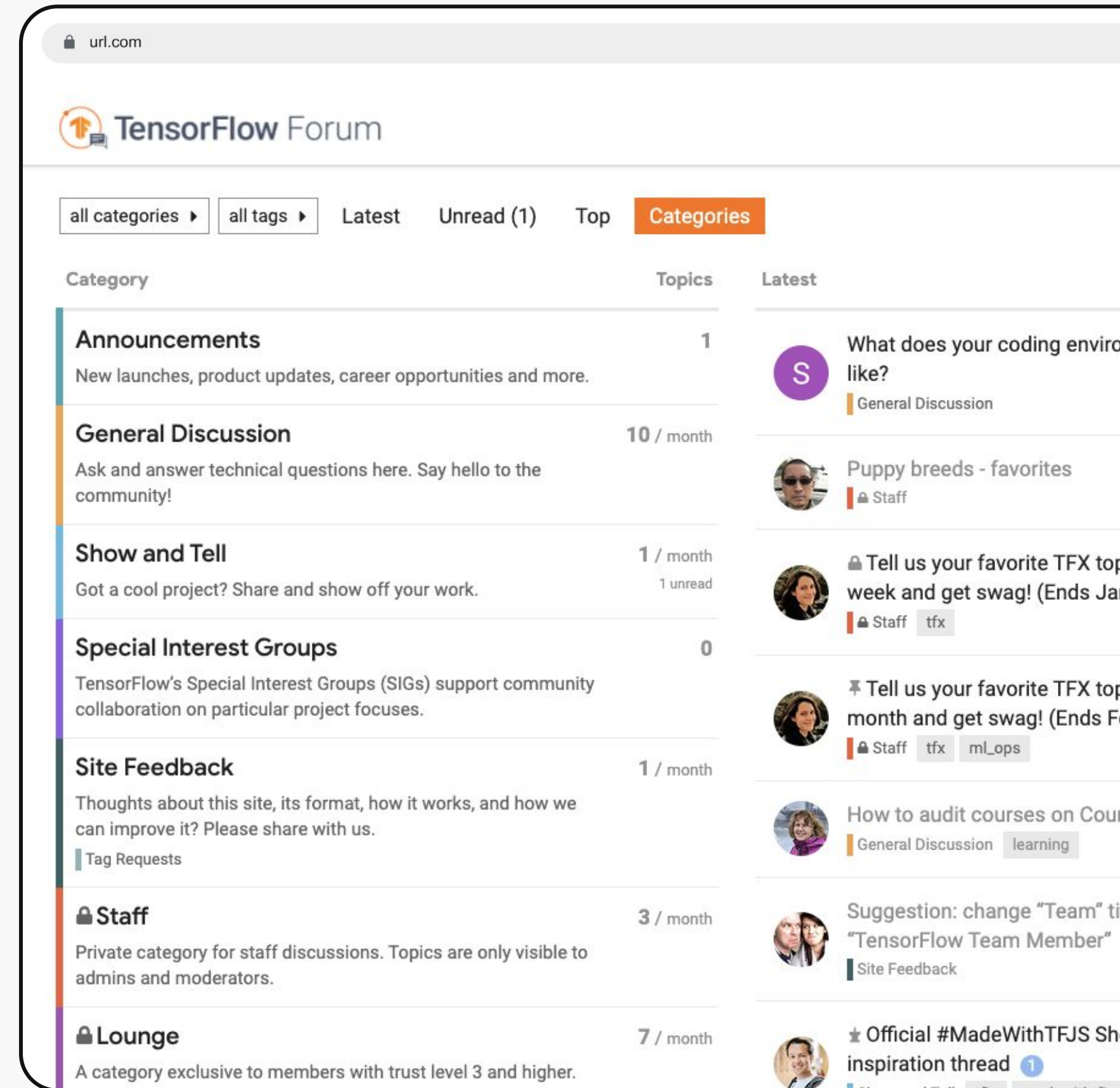
Training Models

Let's continue the conversation in the TensorFlow Forum!

A place for constructive conversation, support, inspiration, and sharing of best practices between the TensorFlow community.

Create your account and join the conversation!

discuss.tensorflow.org



Thank you!



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Google AI Developer Advocate
He / him



@gusthema