



TensorFlow
on mobile

HWSW mobile! 2018 Budapest



Attila Blénesi

Android Project Lead @ Halcyon Mobile

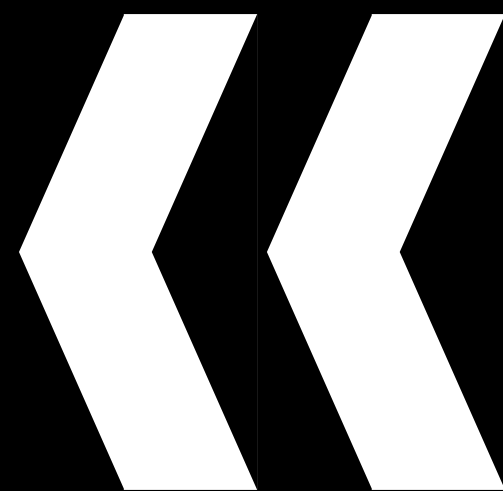
 @ablenessy



Firebase
ML Kit

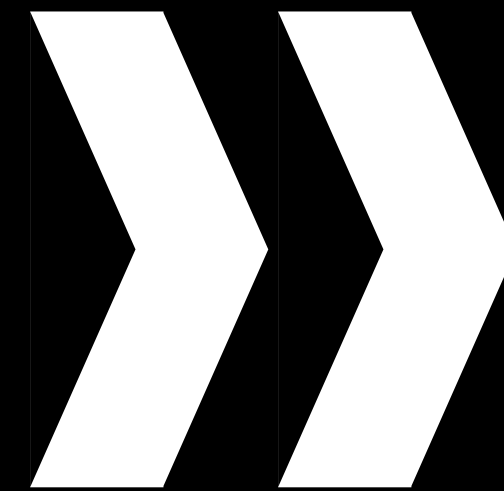


TensorFlow

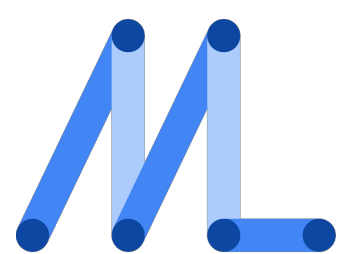


Application
Developer

ML Practitioner
Data Scientist



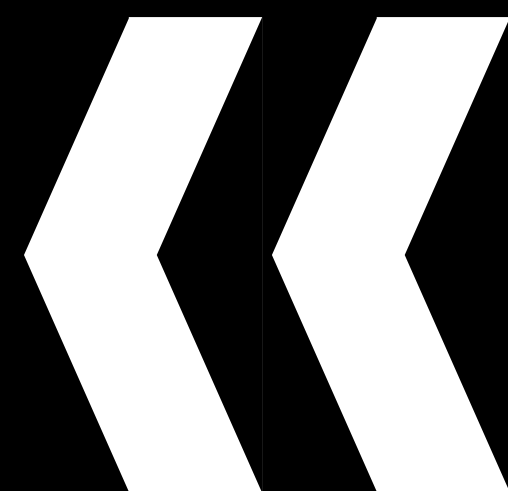
Machine Learning
APIs



**Firebase
ML Kit**

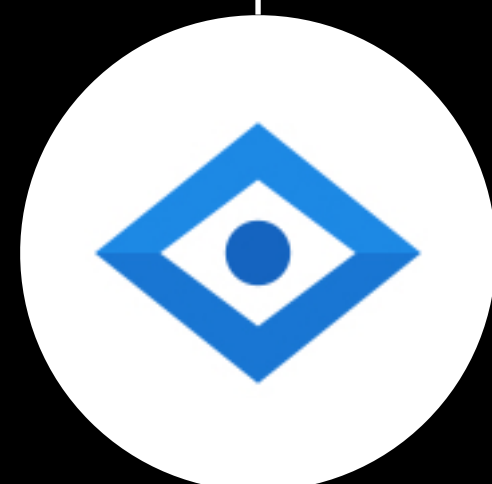
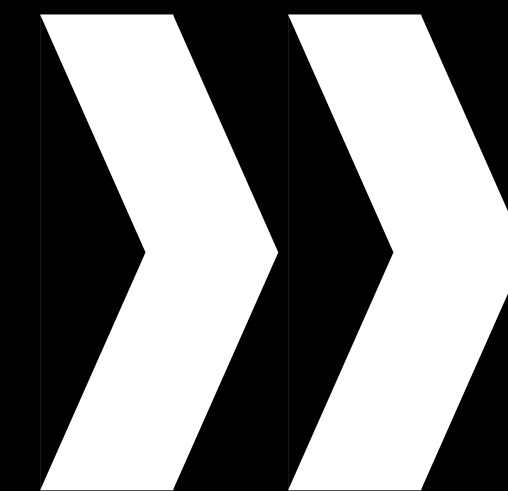


TensorFlow



**Application
Developer**

**ML Practitioner
Data Scientist**



**Machine Learning
APIs**



Text Recognition



Face Detection



Barcode scanning

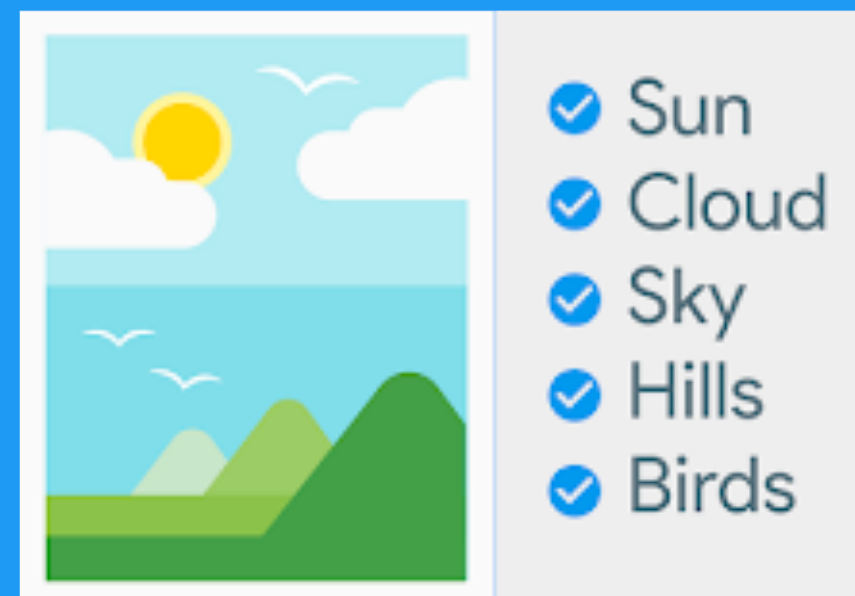
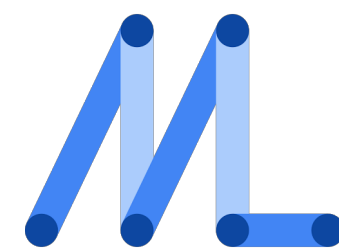
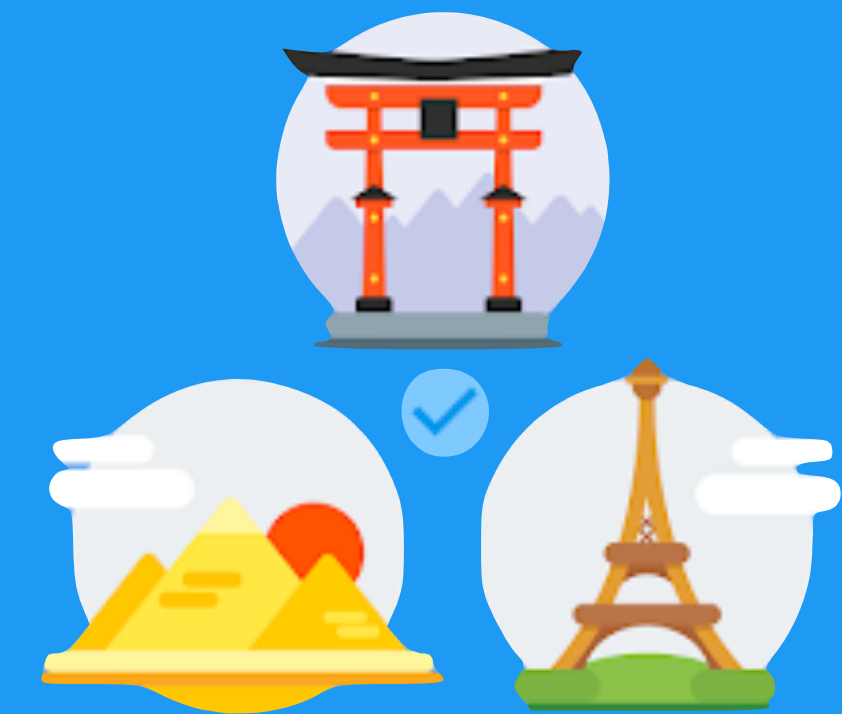


Image labelling



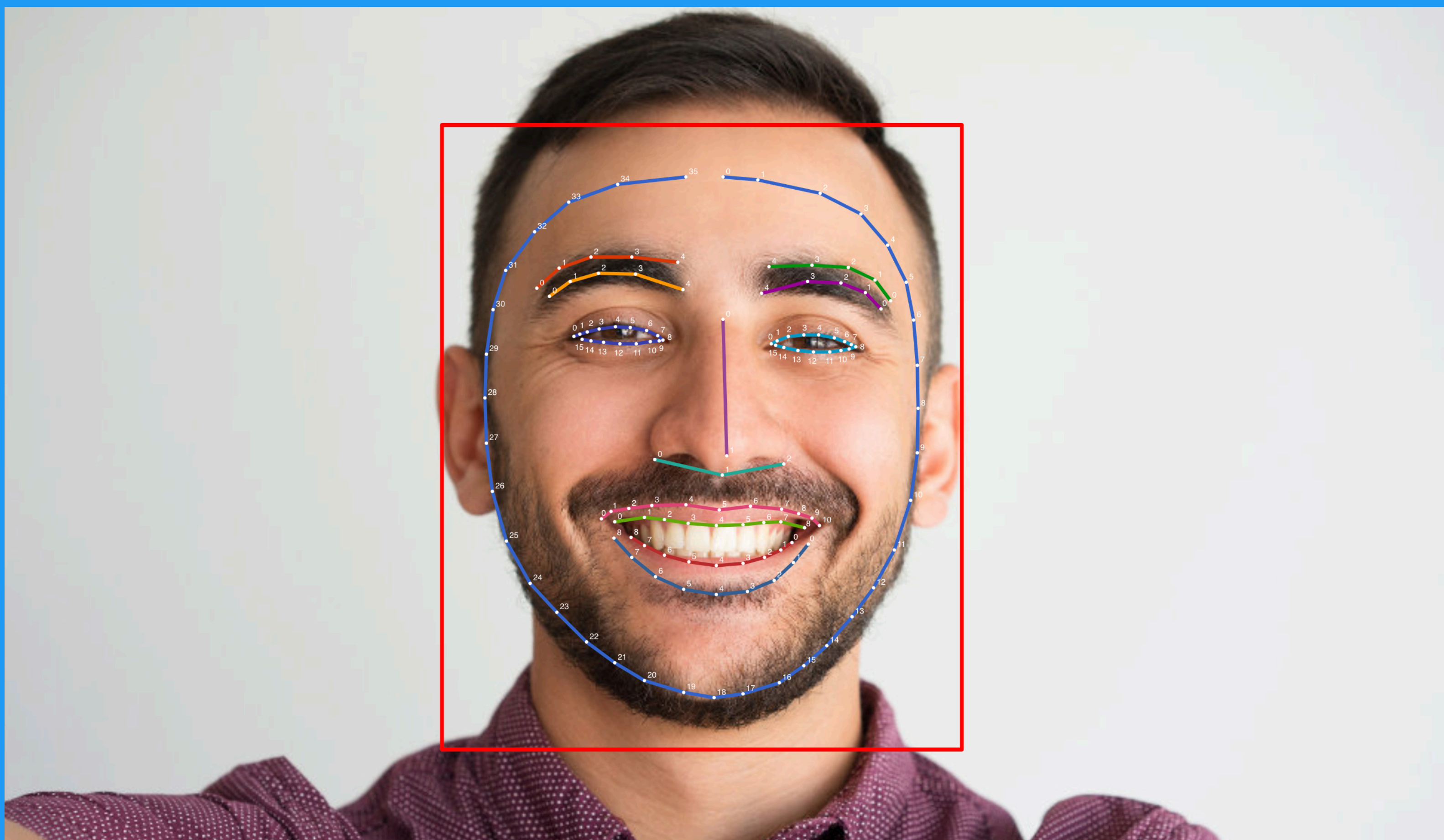
**Firebase
ML Kit**



Landmark detection

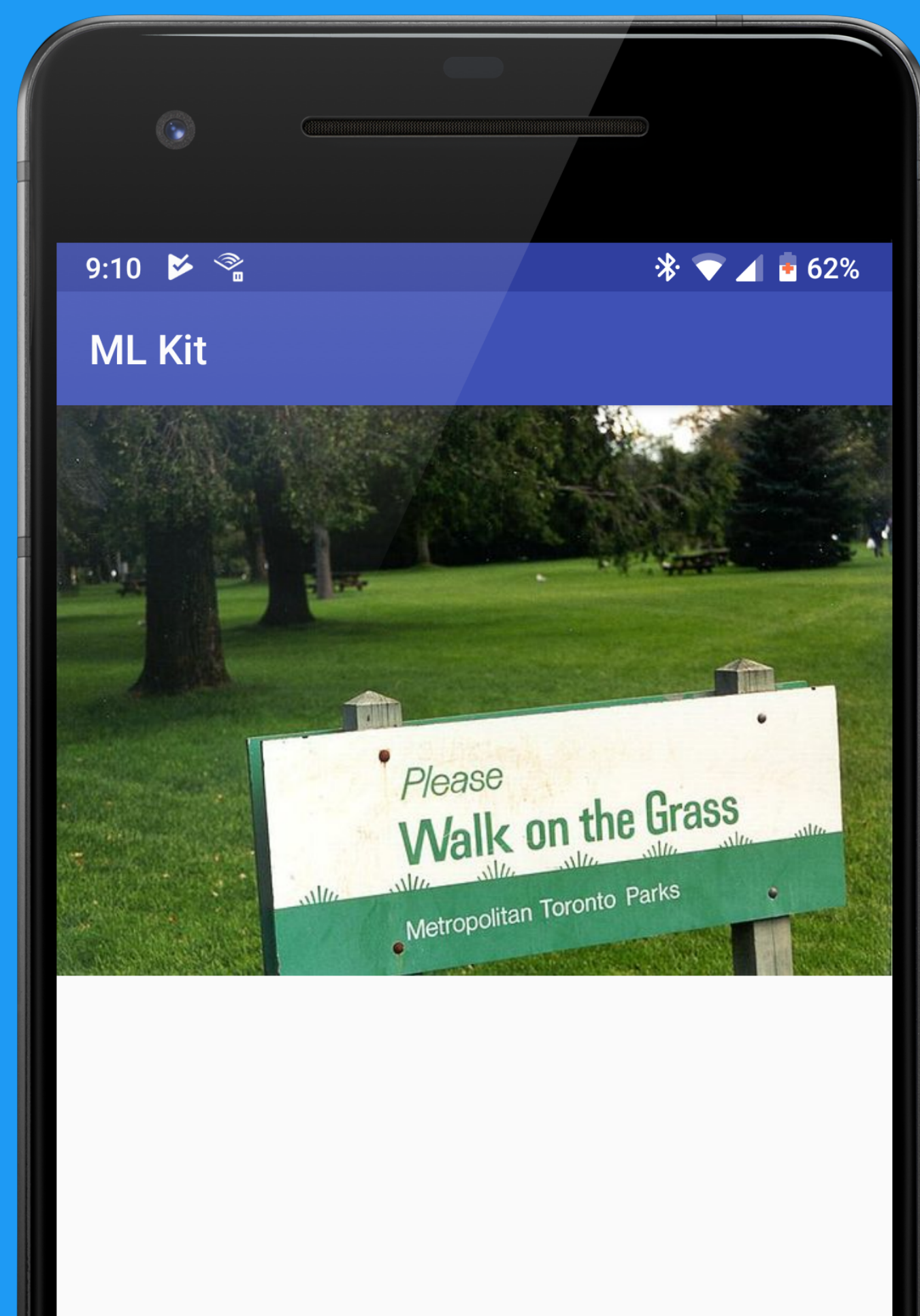


Face Contour Detection



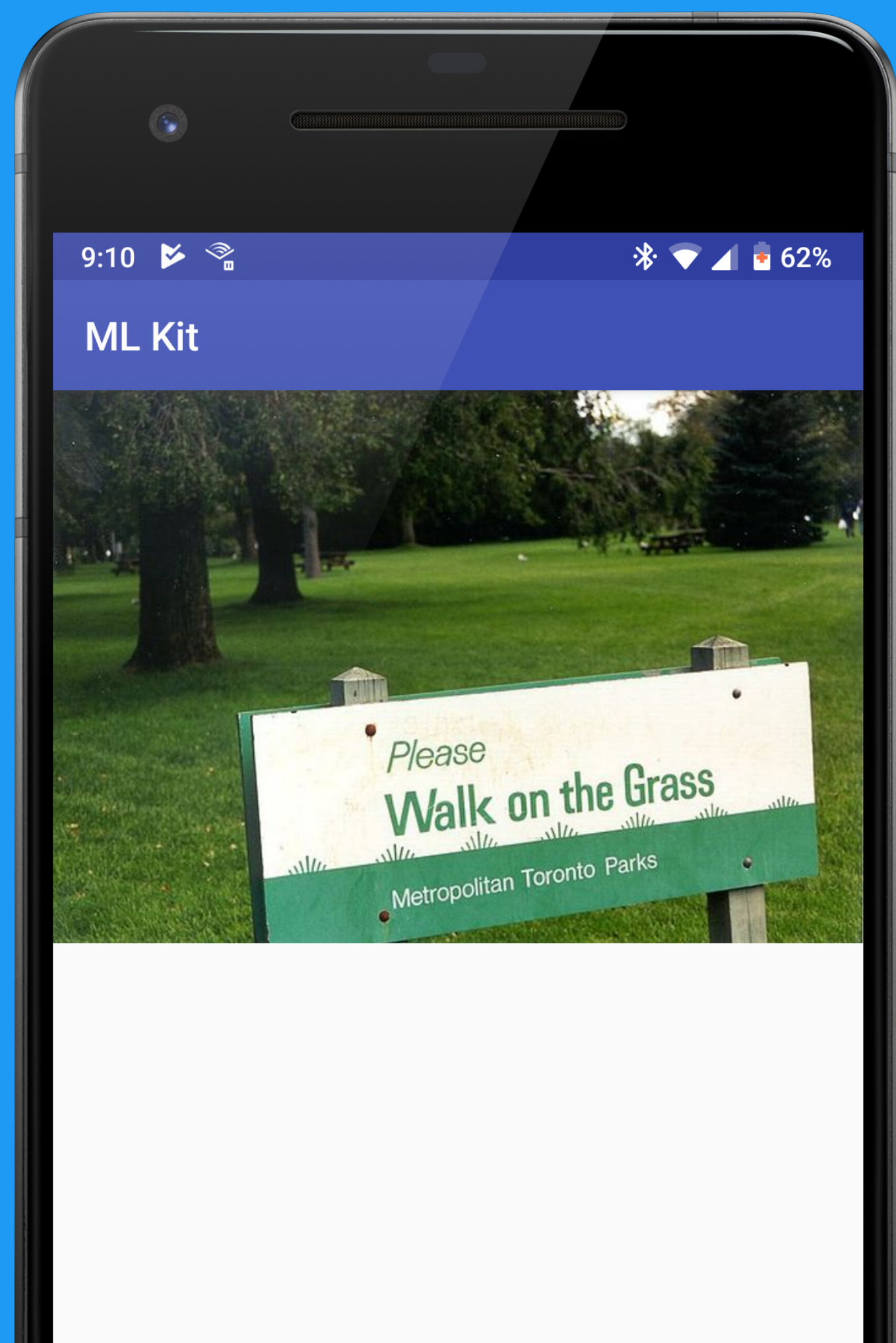


Text Recognition





Text Recognition

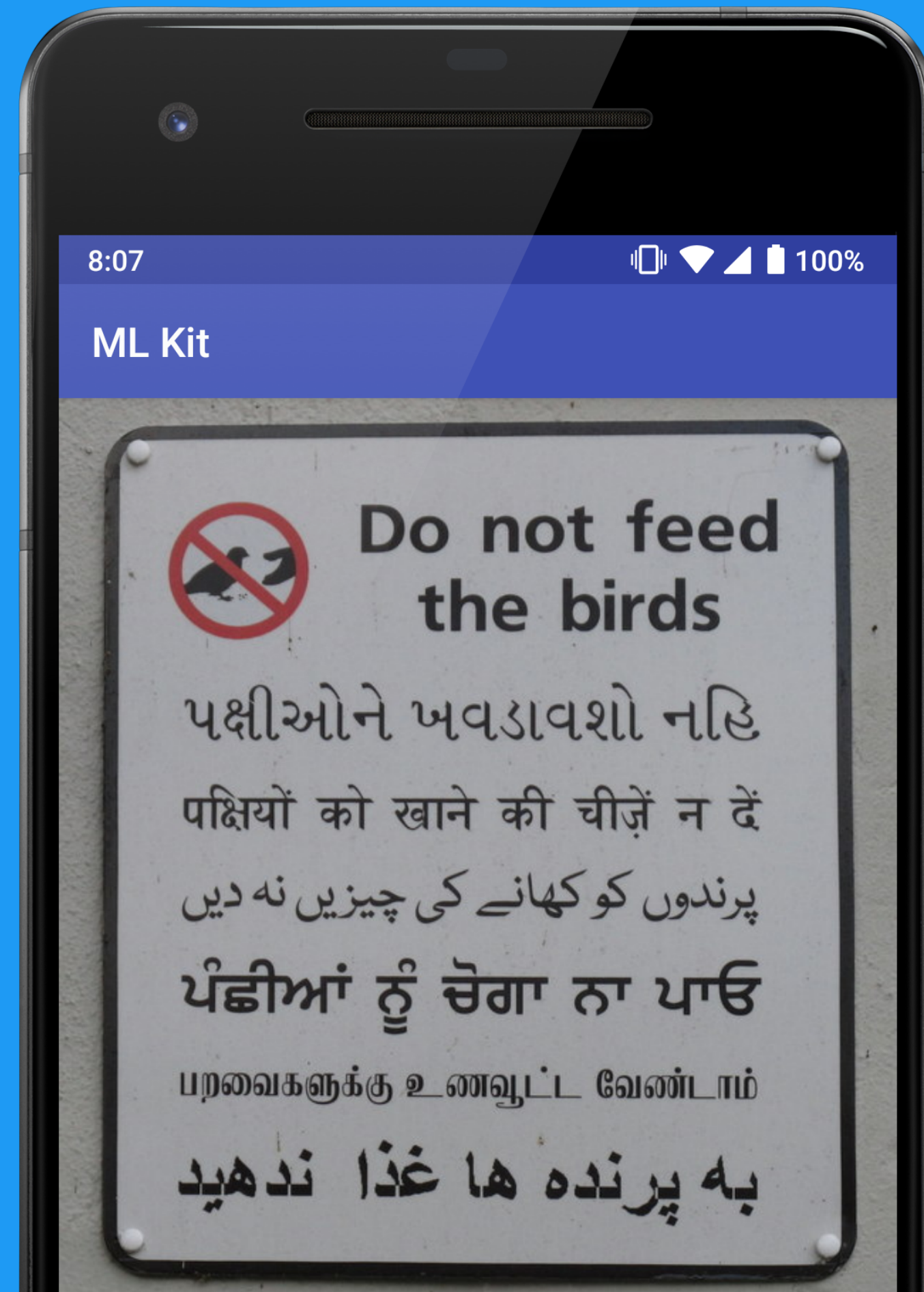



```
val image = FirebaseVisionImage.fromBitmap(selectedImage)
val detector = FirebaseVision.getInstance()
    .getVisionTextDetector()
```

```
detector.detectInImage(image)
    .addOnSuccessListener { texts ->
        processTextRecognitionResult(texts)
    }
    .addOnFailureListener(...)
```

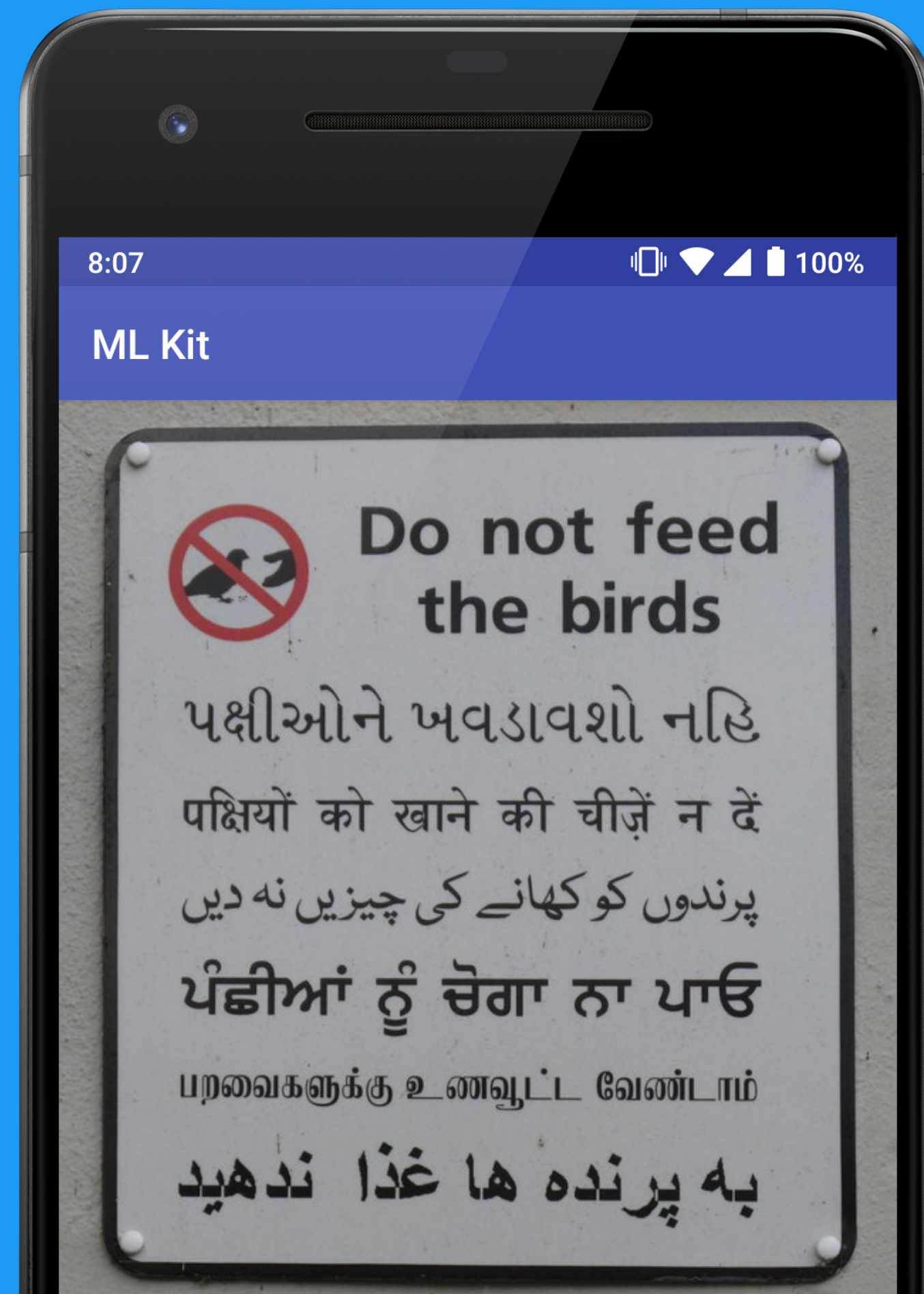


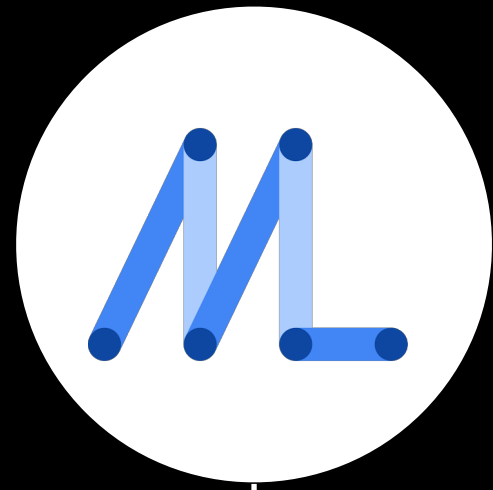
Text Recognition





Text Recognition

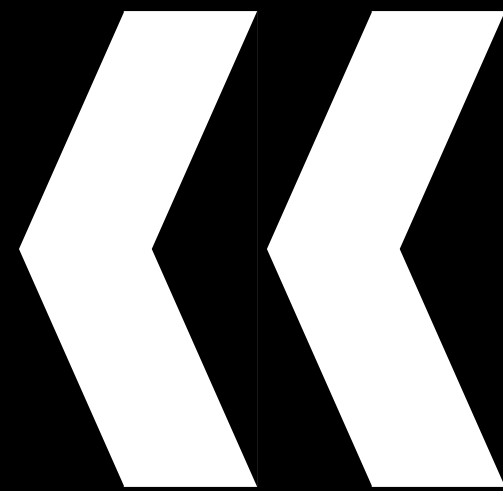




**Firebase
ML Kit**

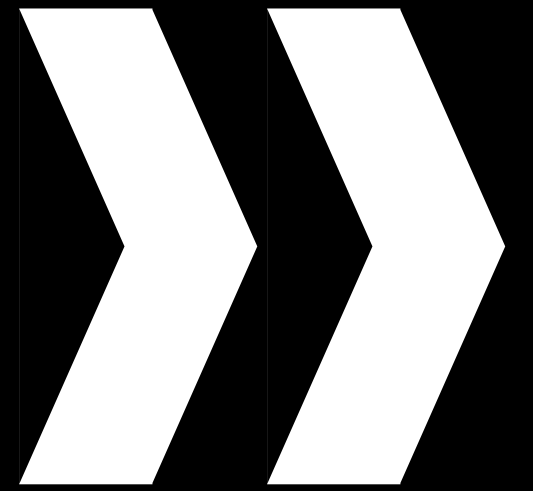


**TensorFlow
Lite**



**Application
Developer**

**ML Practitioner
Data Scientist**

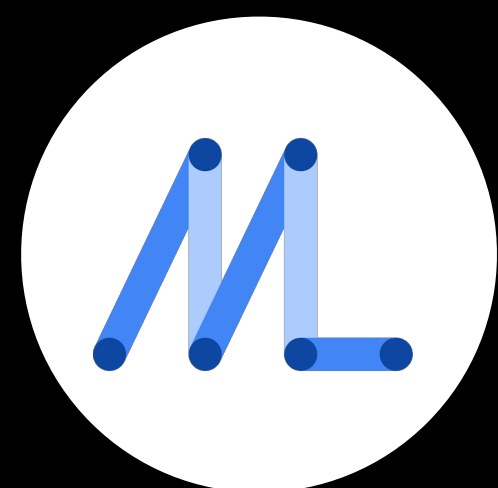


**Machine Learning
APIs**

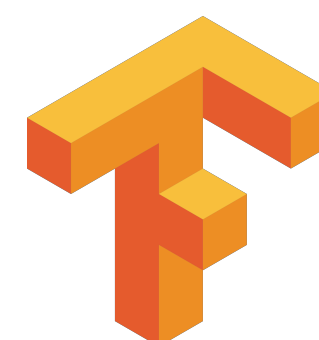


Do I even have to dig deeper ?

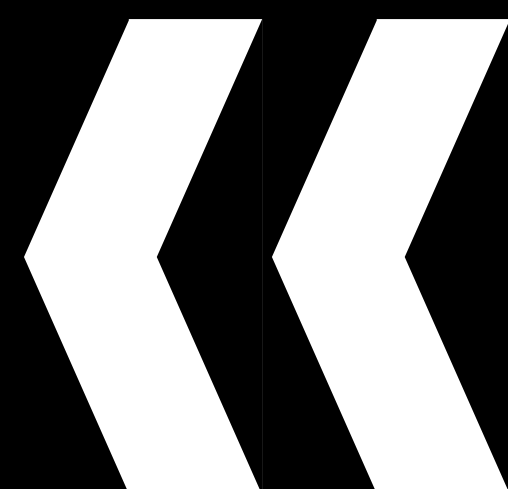
generic model = generic solution



Firebase
ML Kit

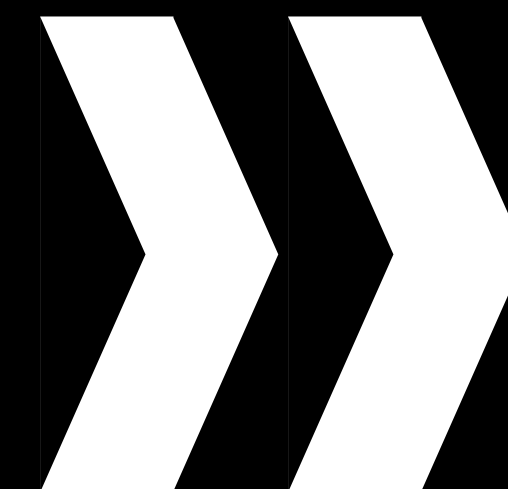


TensorFlow



Application
Developer

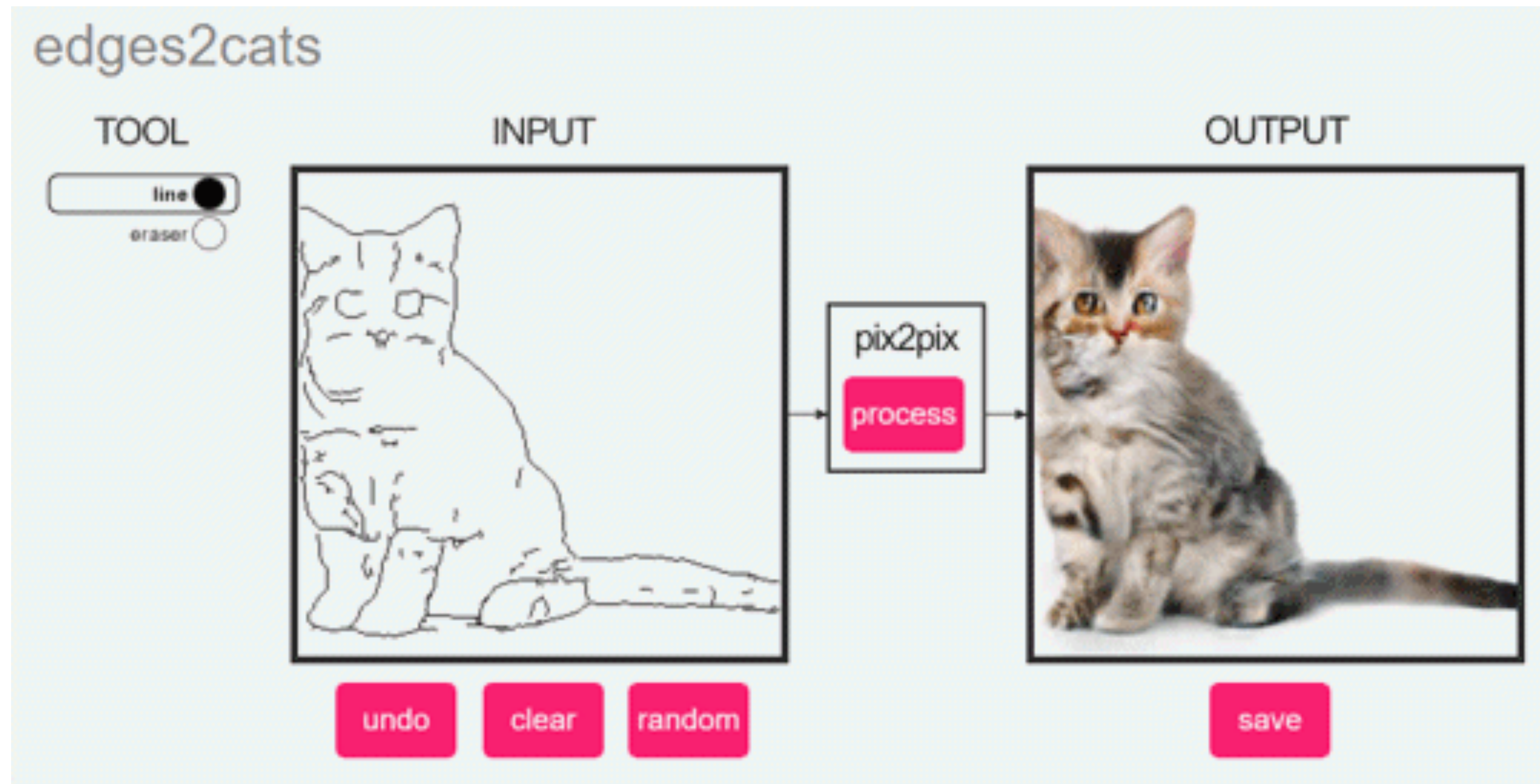
ML Practitioner
Data Scientist



Machine Learning
APIs



TensorFlow



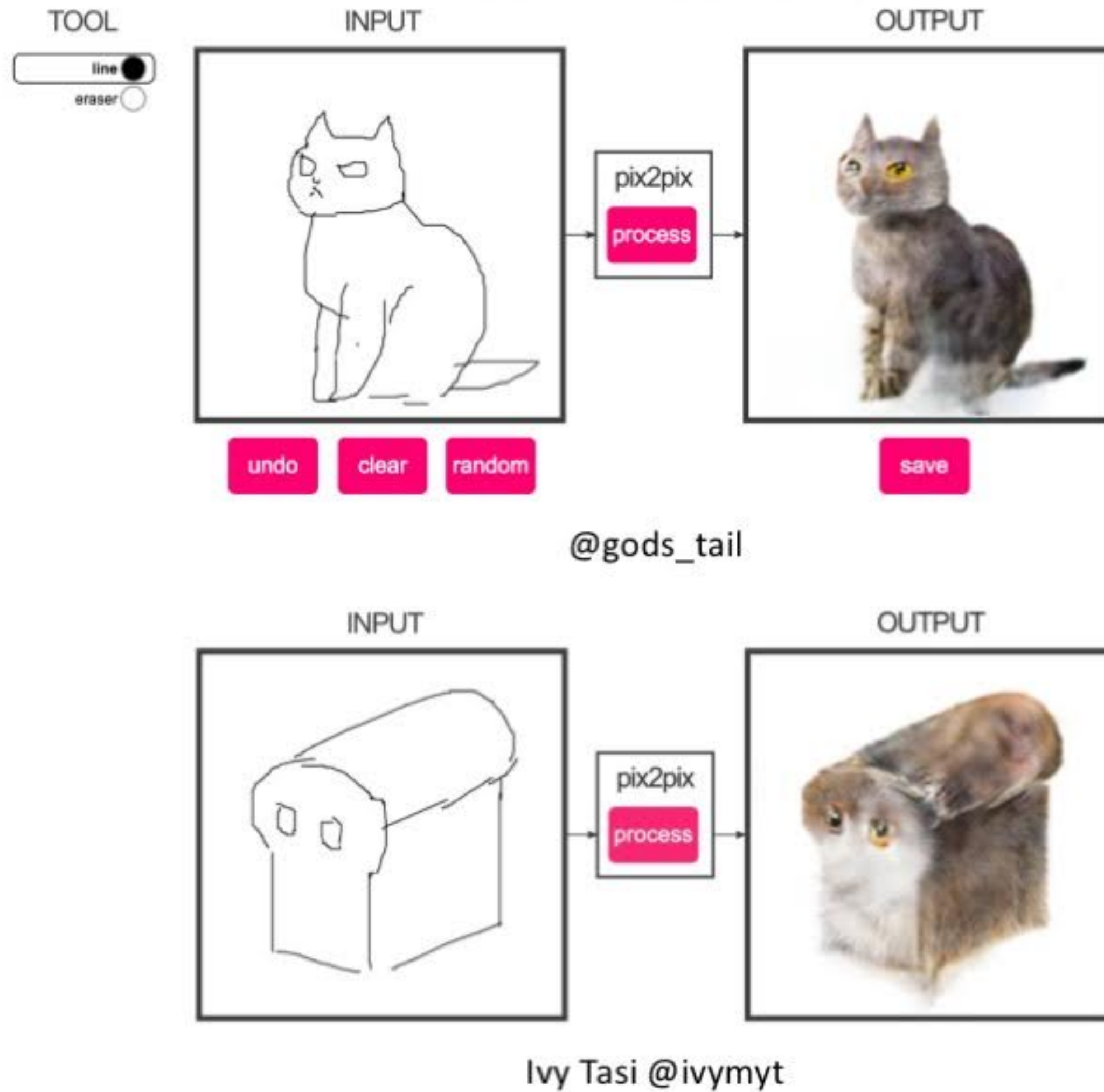
TensorFlow

#pix2pix

Source: <https://affinelayer.com/pixsrv/>

edges2cats

User Interface



Results



Vitaly Vidmirov @vvid



@ka92



TensorFlow

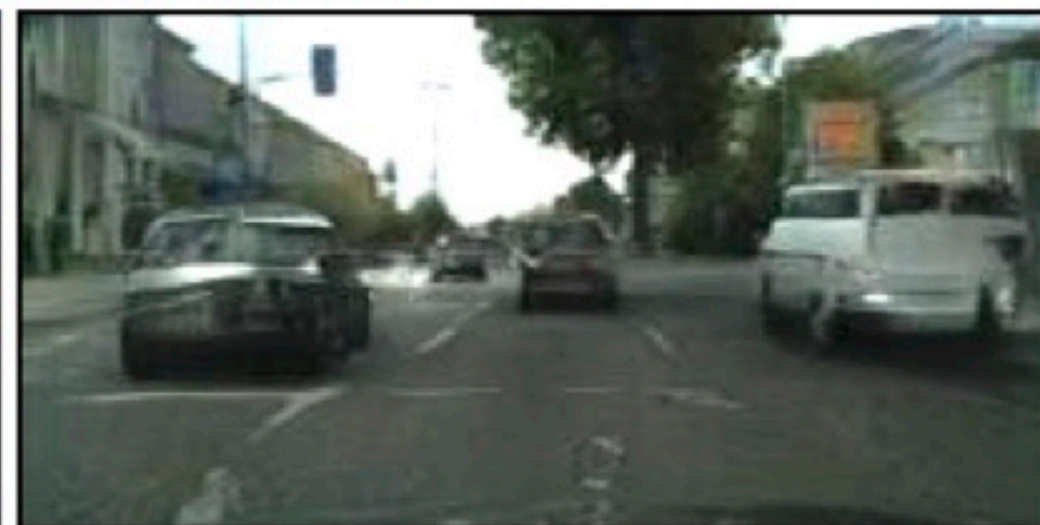
#pix2pix

How does **pix2pix** work?

Labels to Street Scene

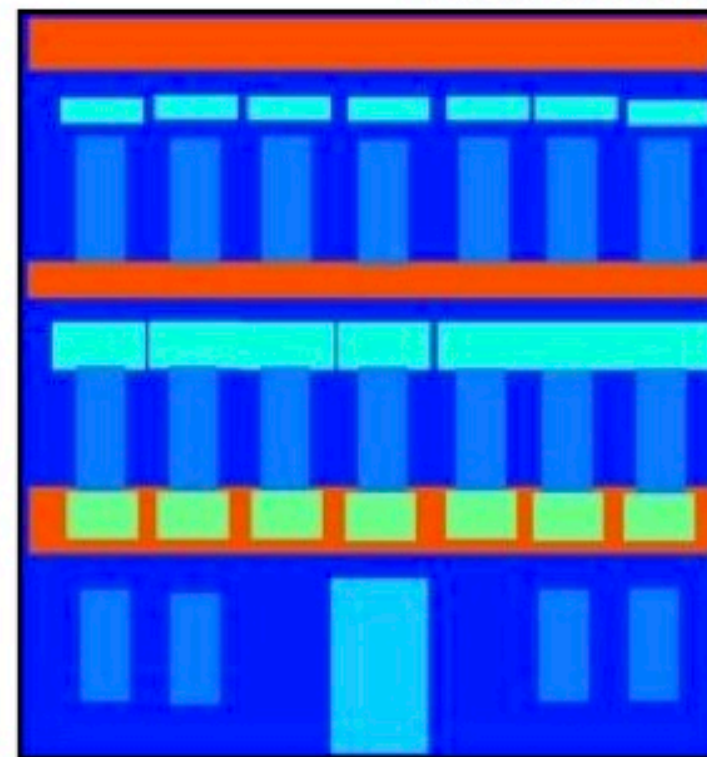


input



output

Labels to Facade



input

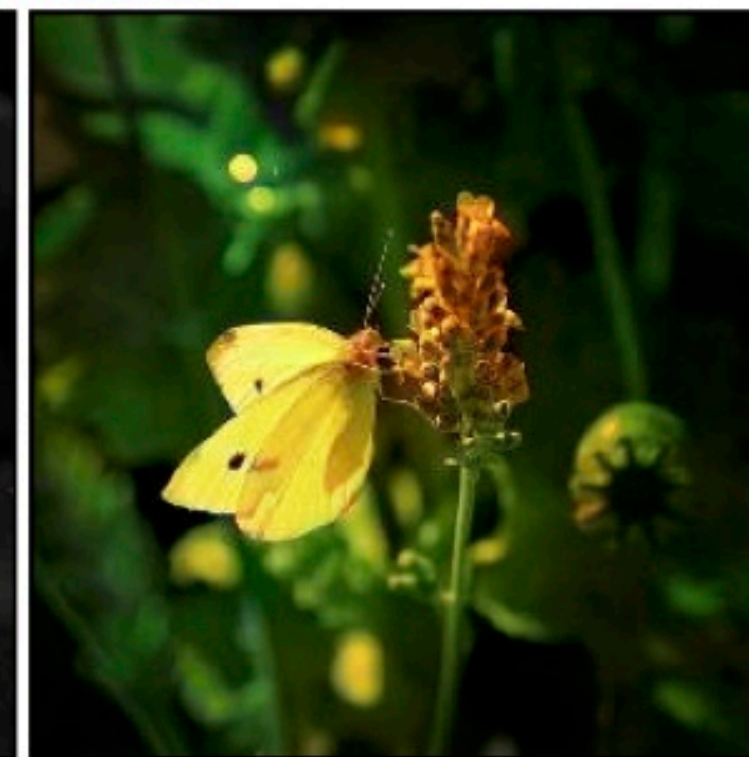


output

BW to Color

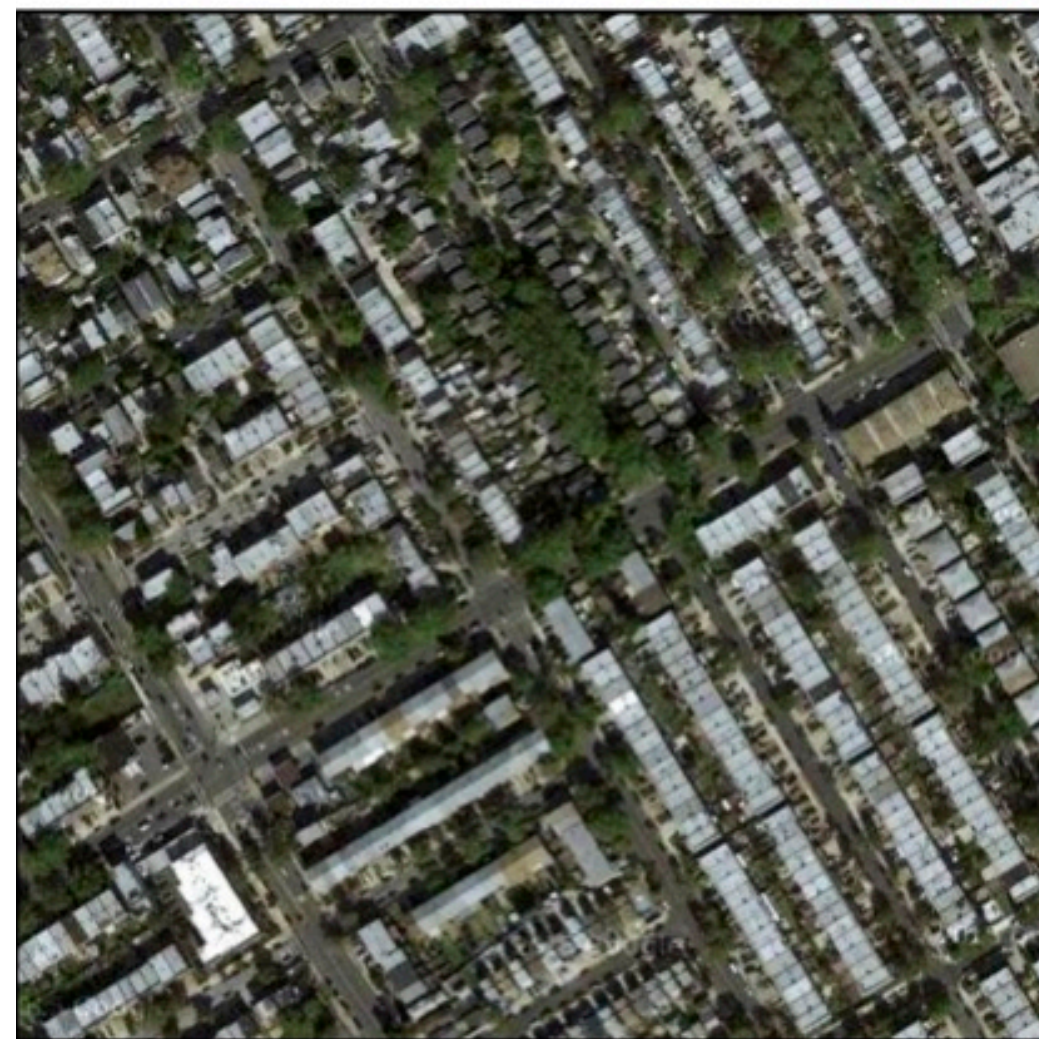


input



output

Aerial to Map

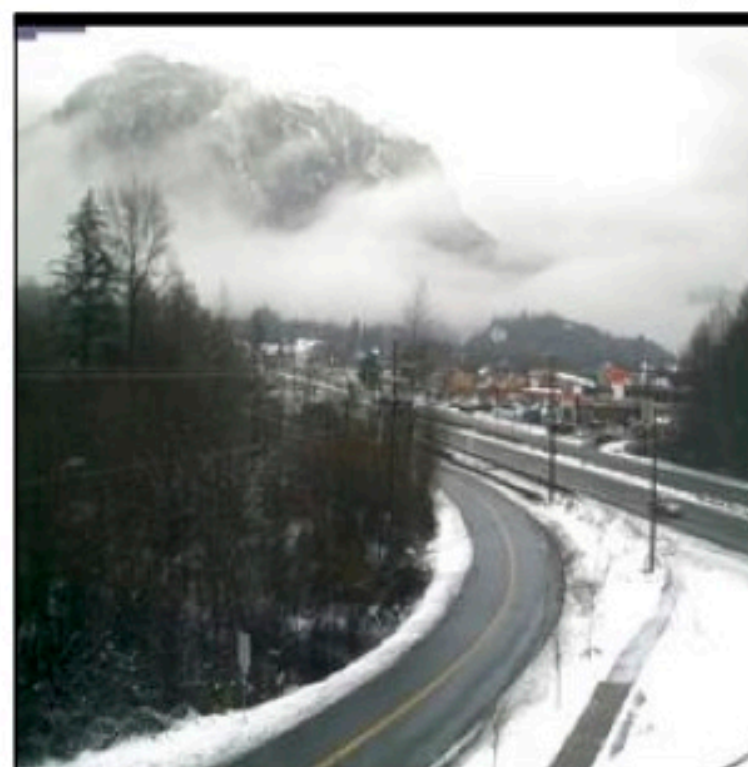


input



output

Day to Night



input



output

Edges to Photo

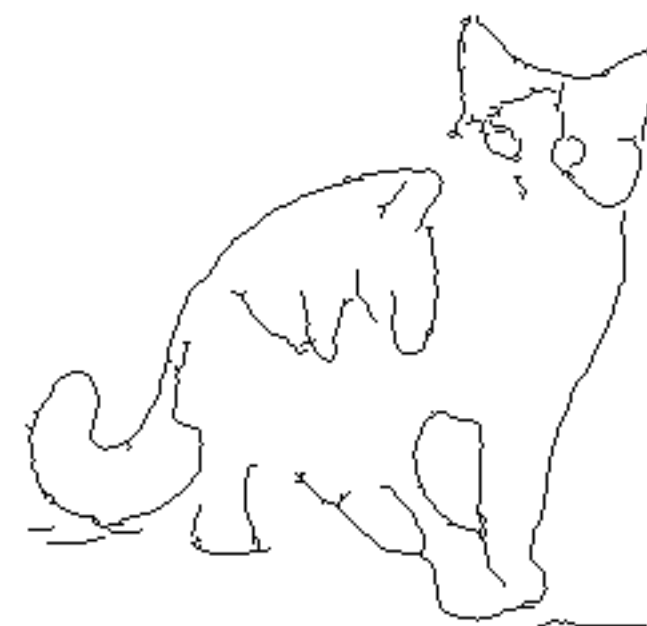
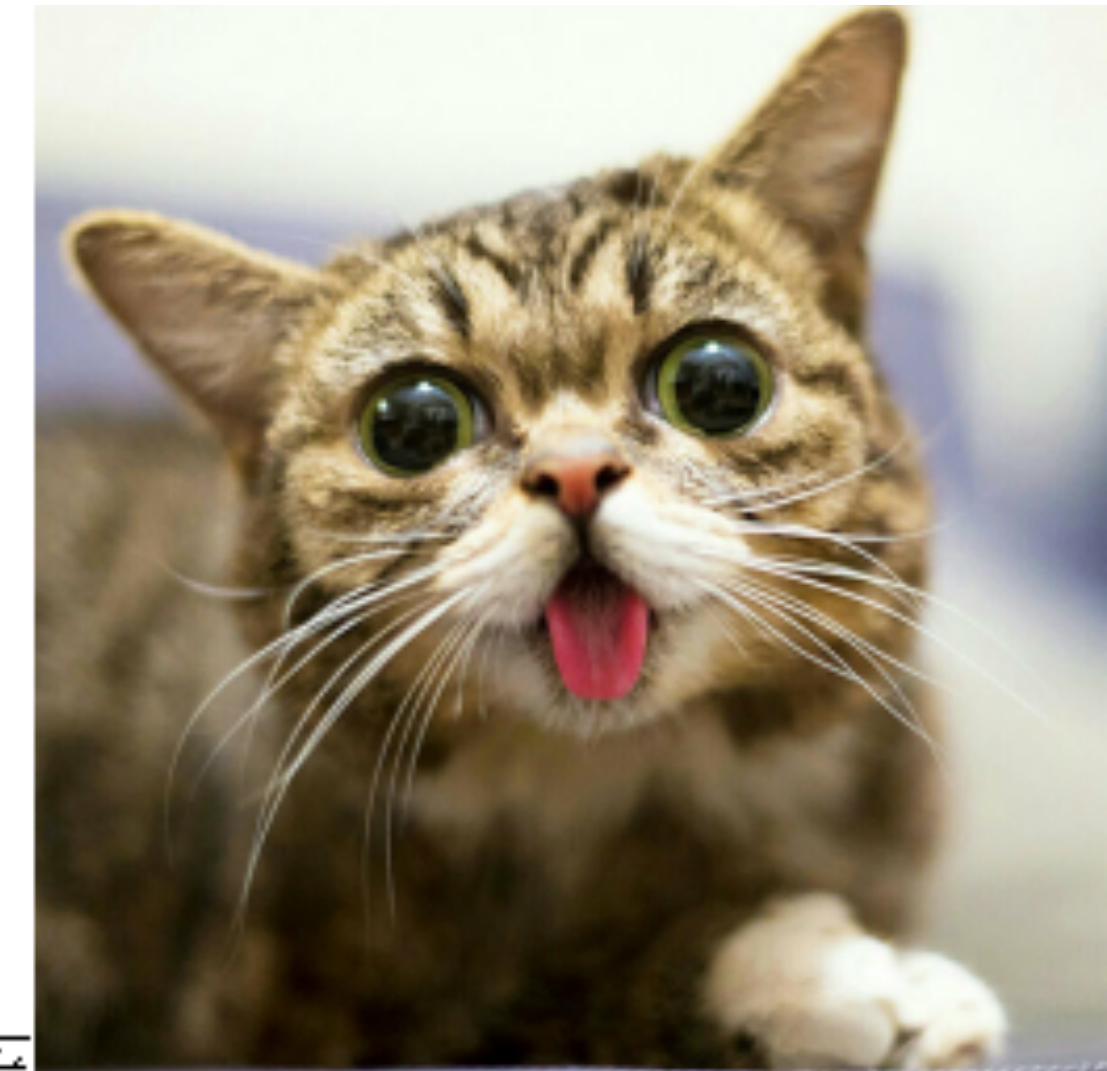


input



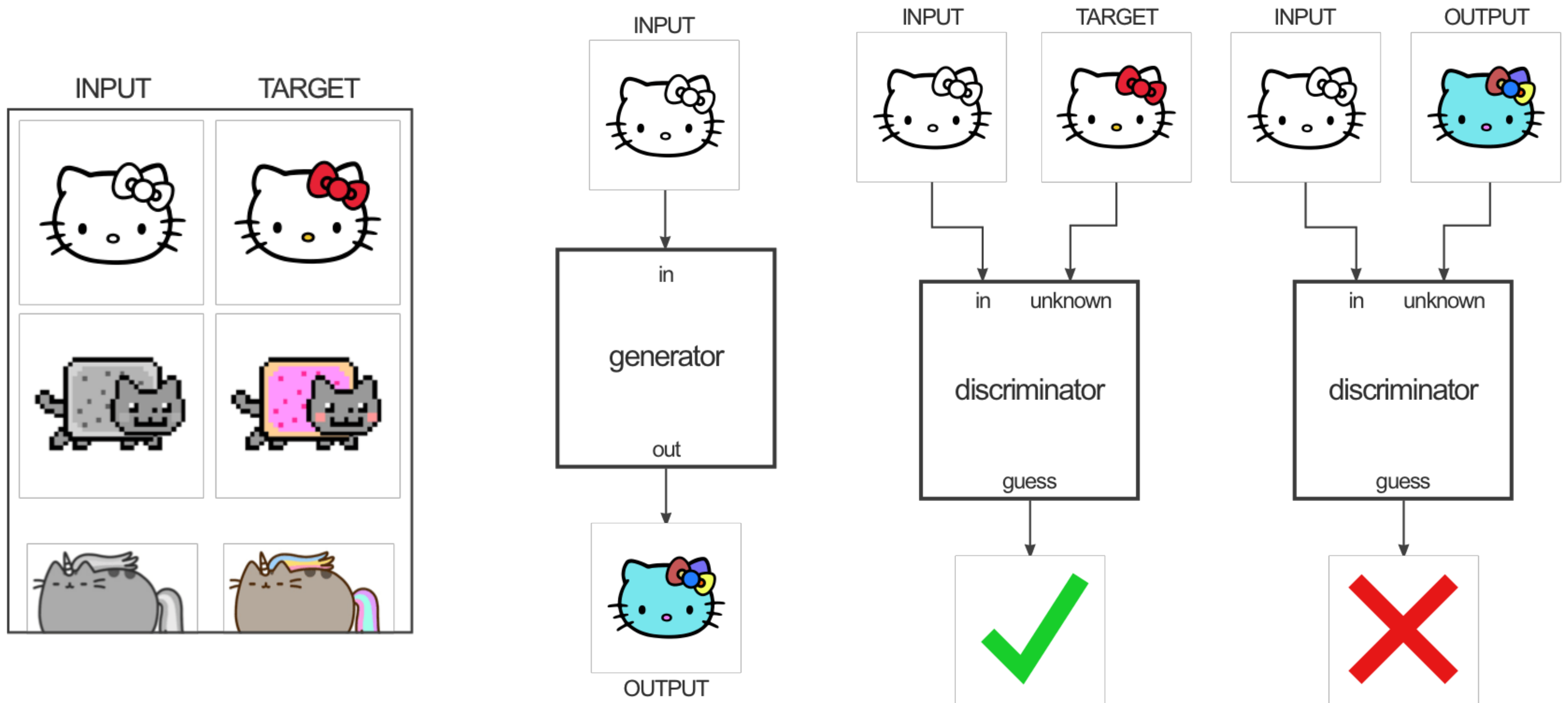
output

How does pix2pix work?



Source: <https://affinelayer.com/pix2pix/>

How does pix2pix work?



Source: <https://affinelayer.com/pix2pix/>

workflow

Train > Convert > Integrate



Train > Convert > Integrate

On device ML is important

Low latency, no server calls

Works offline, no connection needed

Privacy, data stays on device



Train > **Convert** > Integrate



Converter
TensorFlow Lite
Format

Interpreter Core

~75 KB vs 1.1 MB in TF

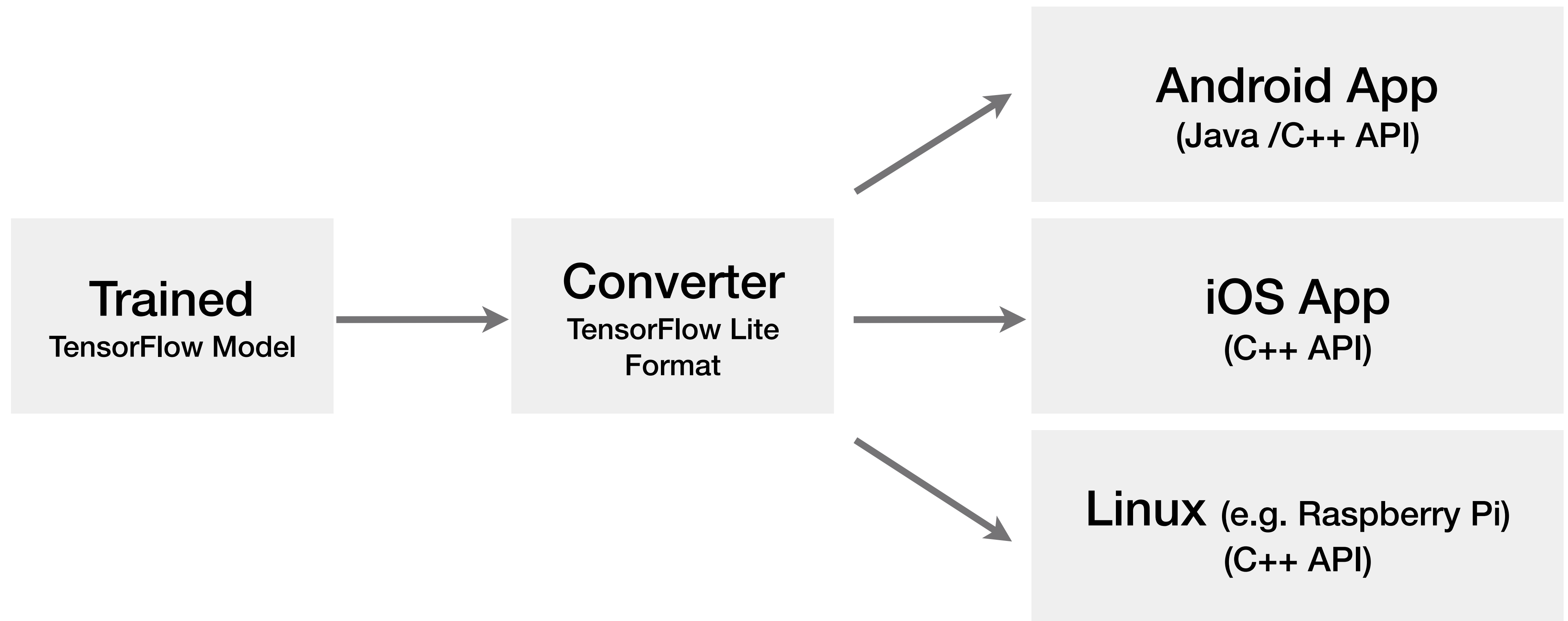
**Operation
Kernels**

**Hardware
acceleration**

~2.4 MB vs 22.3 MB in TF Android

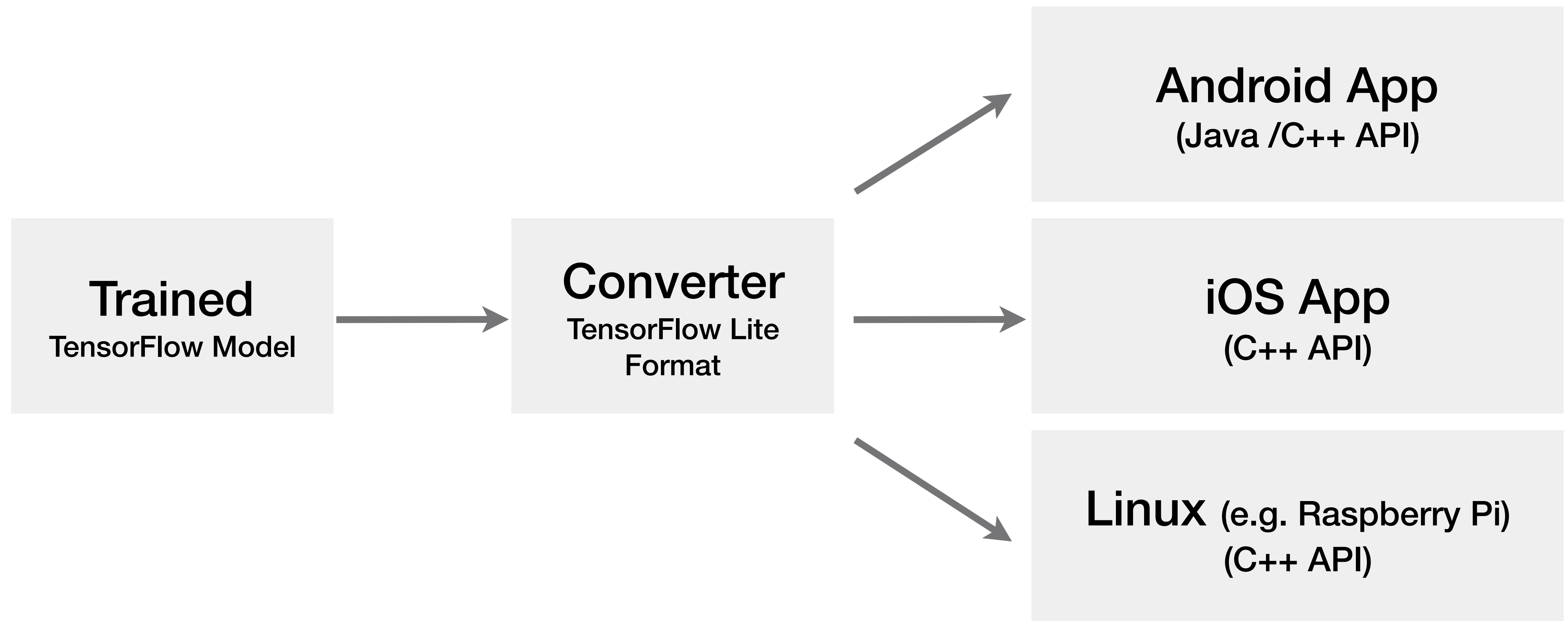


TensorFlow Lite



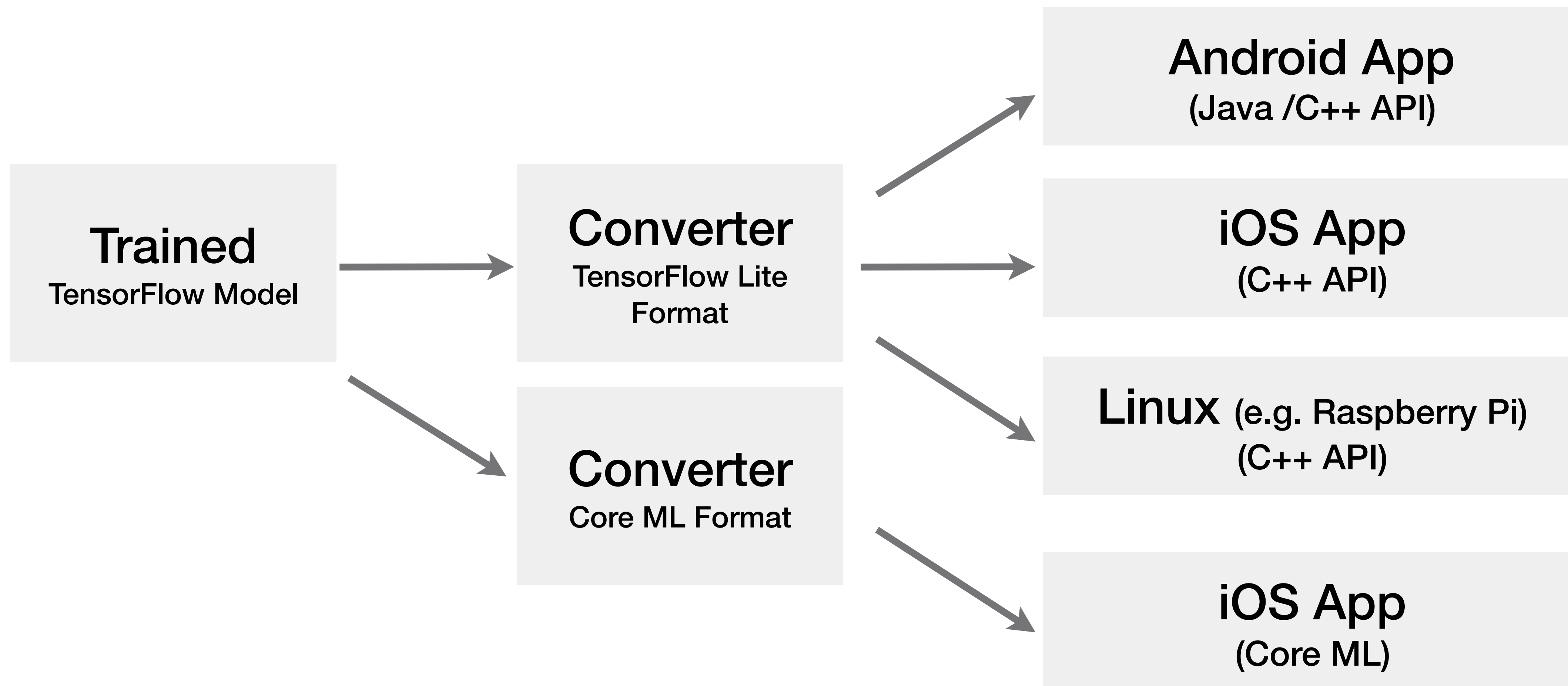


TensorFlow Lite



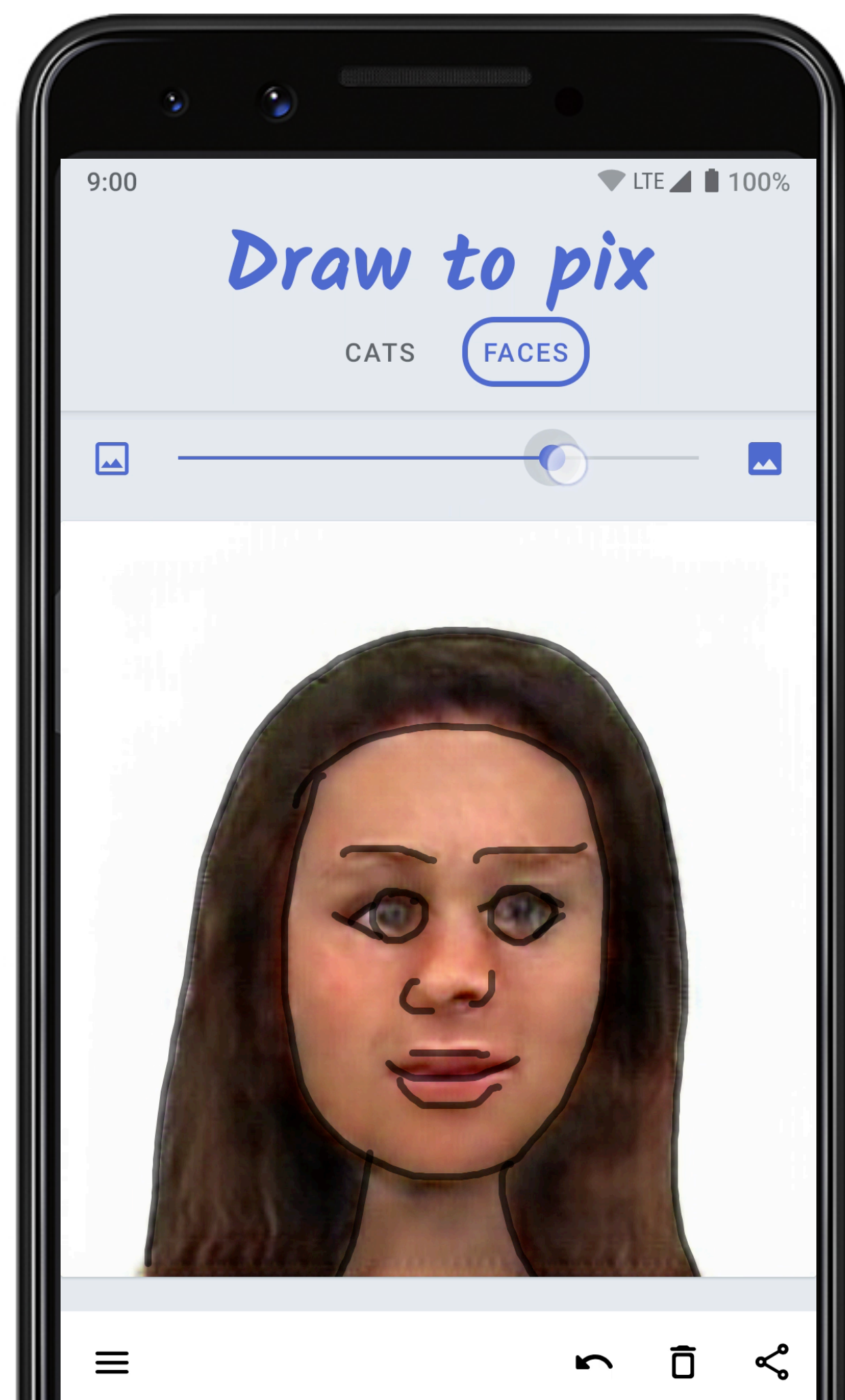
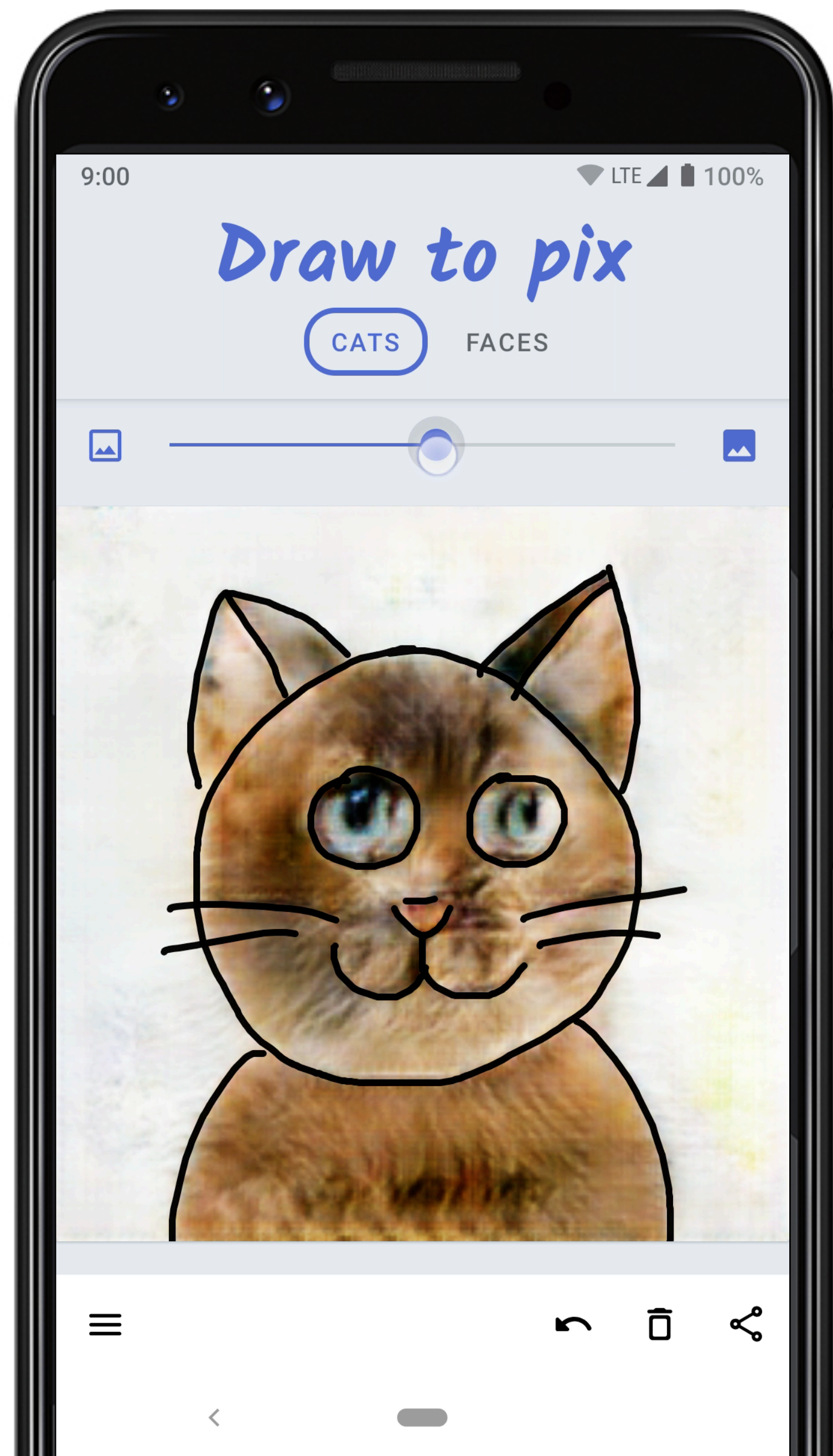


TensorFlow Lite




```
val interpreter = Interpreter(  
    File(Uri.create("file://android_asset/frozen_model.tflite"))  
)  
  
inputValues = generateInput(inputDrawing)  
  
interpreter.run(inputValues, outputValues)  
  
val result = generateBitmapFromOutput(outputValues)
```

Train > Convert > **Integrate**



Demo

Machine learning is NOT
just for **experts**

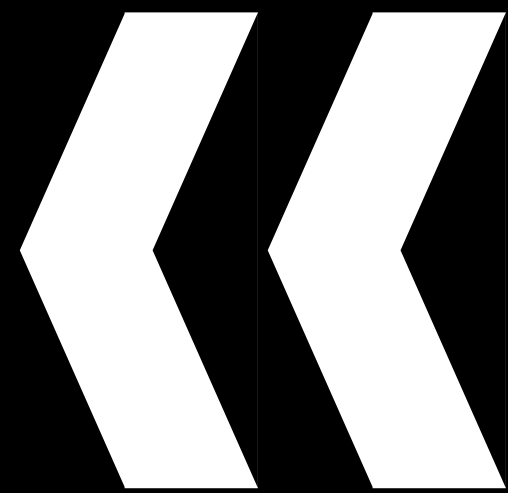
Machine learning is NOT just for **experts**



Firebase
ML Kit

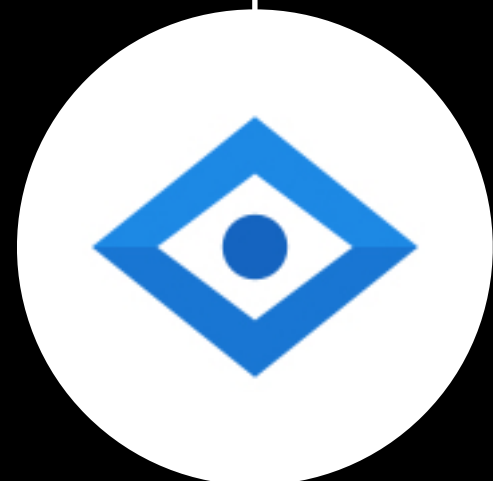
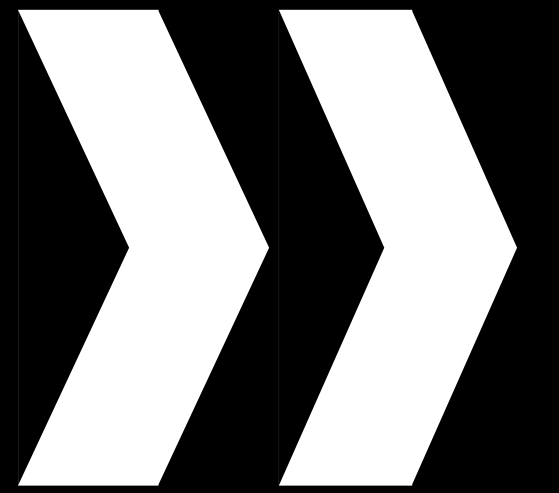


TensorFlow
Lite



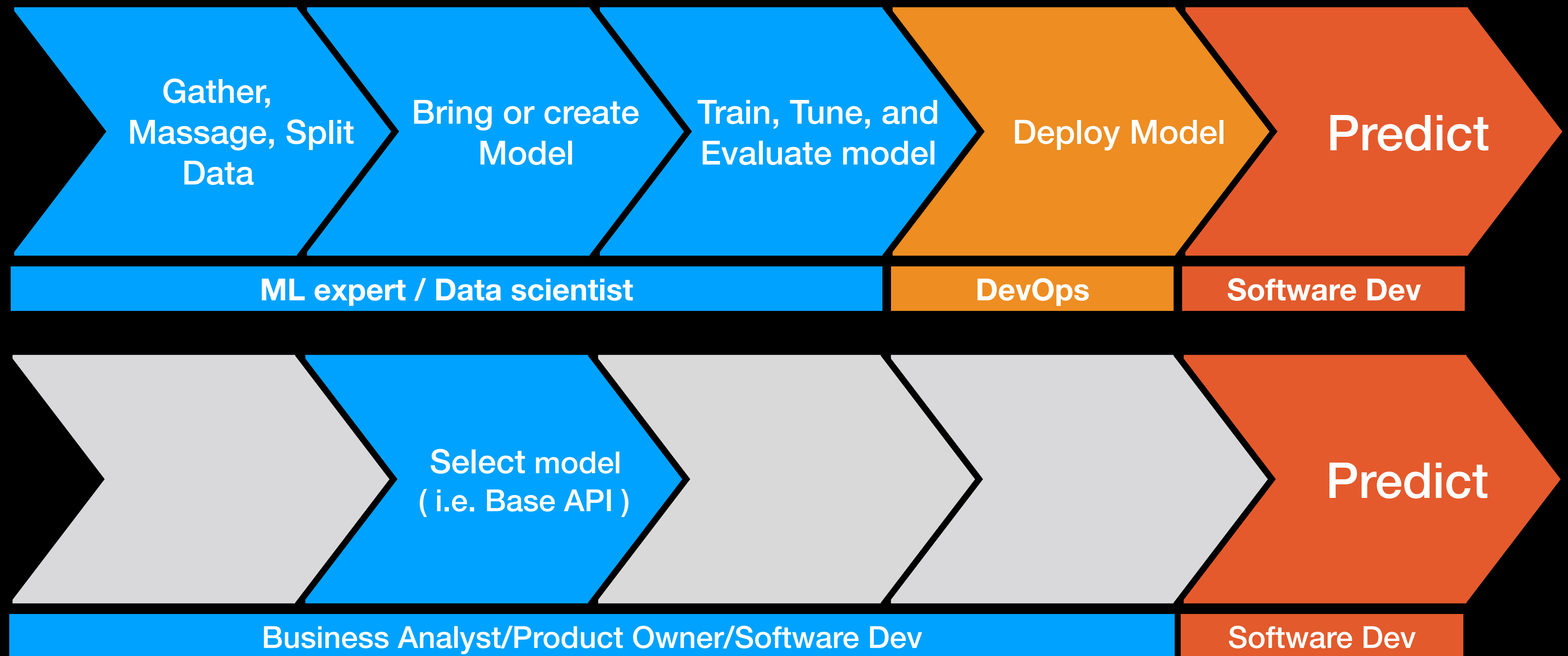
Application
Developer

ML Practitioner
Data Scientist



Machine Learning
APIs

ML Kit Simplifies Machine Learning



Machine learning is NOT just for **experts**

ML Kit Demos
bit.ly/MLKitDemo

Pix2Pix Model Implementation
bit.ly/pix2pixModel

TensorFlow Lite Codelab
bit.ly/tfLiteCodeLab

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