E2E Computer Vision models using TensorFlow

Google Developers

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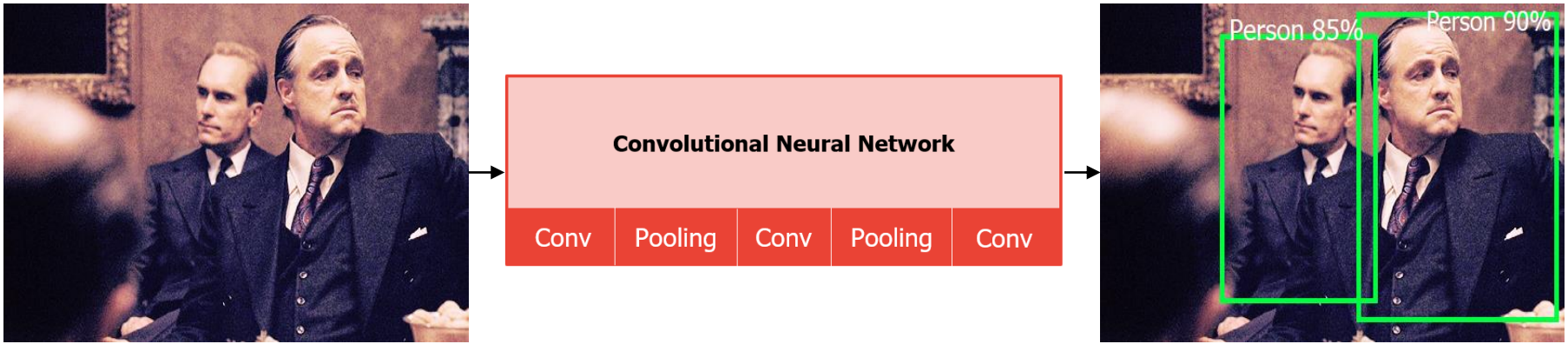
Introduction to Object Detection

Object Detection is a Computer Vision technique to identify and locate objects in images and videos.

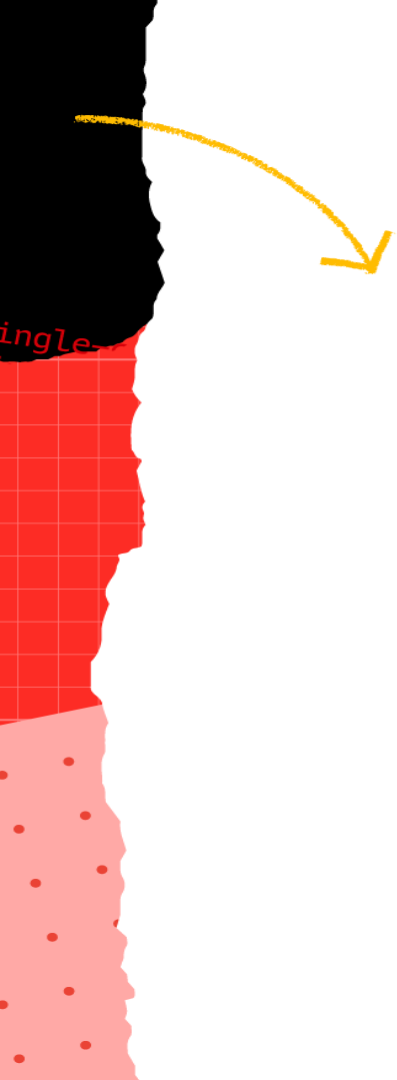
Object Detection = Image Classification + Localization



Original Image (input)

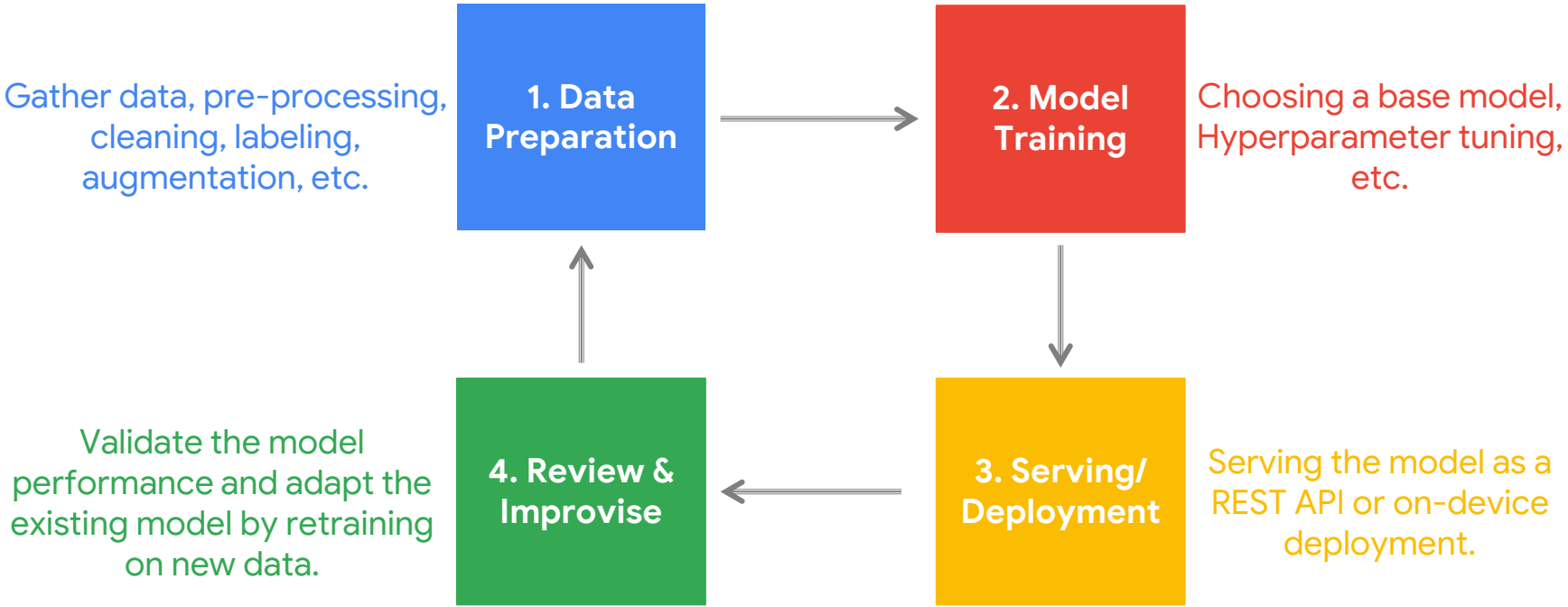
Image with detection (output)

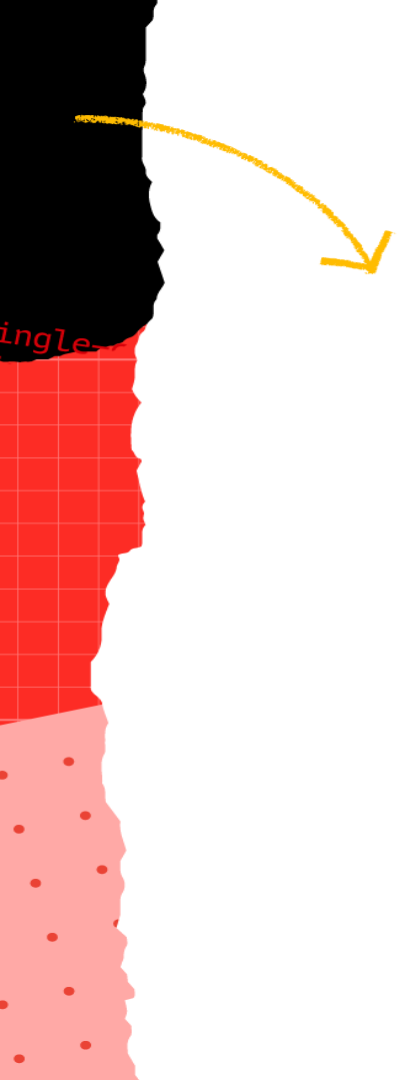
- **Convolution Layer:** Detects the important features in the input image.
- **Pooling layer:** Reduces the size of the image while retaining the features.
- There are multiple convolutional and pooling layers in a CNN.
- Input tensor: [n x n x 3] image pixels
- Output tensor: [(labels), (bounding box coordinates), (confidence), (no. of detections)]



The Building Blocks of an ML application

ML Lifecycle



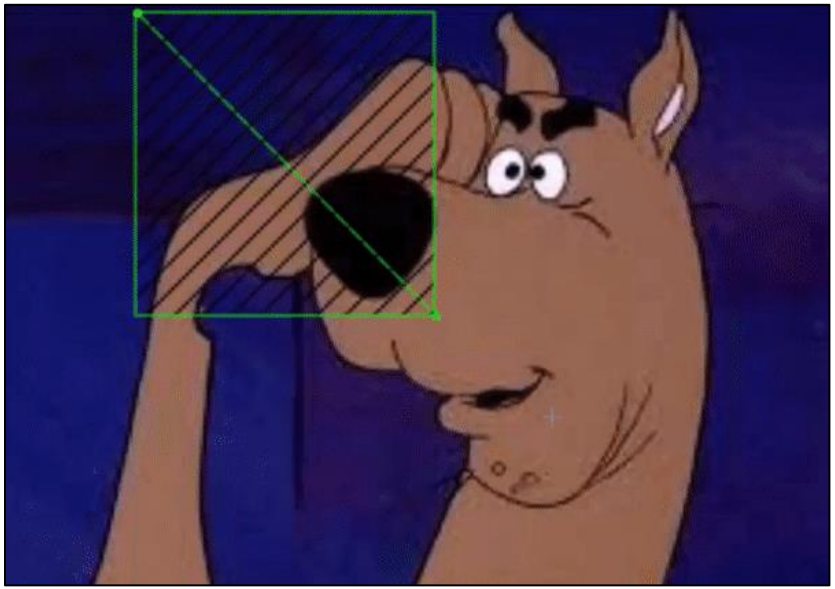


Building your custom object detector

Custom Cartoon Detector

Data Preparation:

1. **Collection:** Collect data from different sources such as Google Images, web scraping, etc.
2. **Pre-processing:** Cleaning, transformation
3. **Augmentation:** Generate new data by rotating, scaling, adding/removing noise, etc.
4. **Annotation:** Labelling the images with relevant tags/classes.



Image

```
<?xml version="1.0"?>
- <annotation>
    <folder>dataset_PASCAL VOC</folder>
    <filename>cartoon108.jpg</filename>
    <path>F:\Cartoon Object Detection\dataset_PASCAL VOC\cartoon108.jpg</path>
  - <source>
      <database>Unknown</database>
    </source>
  - <size>
      <width>300</width>
      <height>168</height>
      <depth>3</depth>
    </size>
    <segmented>0</segmented>
  - <object>
      <name>mrbean</name>
      <pose>Unspecified</pose>
      <truncated>1</truncated>
      <difficult>0</difficult>
    - <bndbox>
        <xmin>107</xmin>
        <ymin>20</ymin>
        <xmax>222</xmax>
        <ymax>168</ymax>
      </bndbox>
    </object>
</annotation>
```

Annotation file (XML)

Model Training:

Choose a base model (EfficientDet-Lite2 is an object detection model for Android/IoT devices)

```
spec = model_spec.get('efficientdet_lite2')
```

Load the train and test dataset

```
train_data = object_detector.DataLoader.from_pascal_voc(path_to_train_images,
path_to_train_annotations, labels)

test_data = object_detector.DataLoader.from_pascal_voc(path_to_test_images,
path_to_test_annotations, labels)
```

Define the hyperparameters

```
model = object_detector.create(train_data, model_spec=spec, batch_size=4,
train_whole_model=True, validation_data=test_data)
```

Evaluate the model

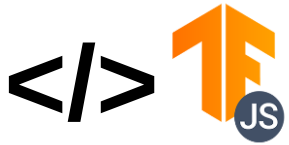
```
model.evaluate(validation_data)
```

Complete Colab notebook:
https://github.com/NSTiwari/Custom-Object-Detection-on-Android-using-TF-Lite

Serving/Depoyment:

- Any ML workflow is incomplete without the deployment of the model.
- TensorFlow models can be of the following formats depending upon where they need to be deployed.

Standalone Desktop Application
(TensorFlow)



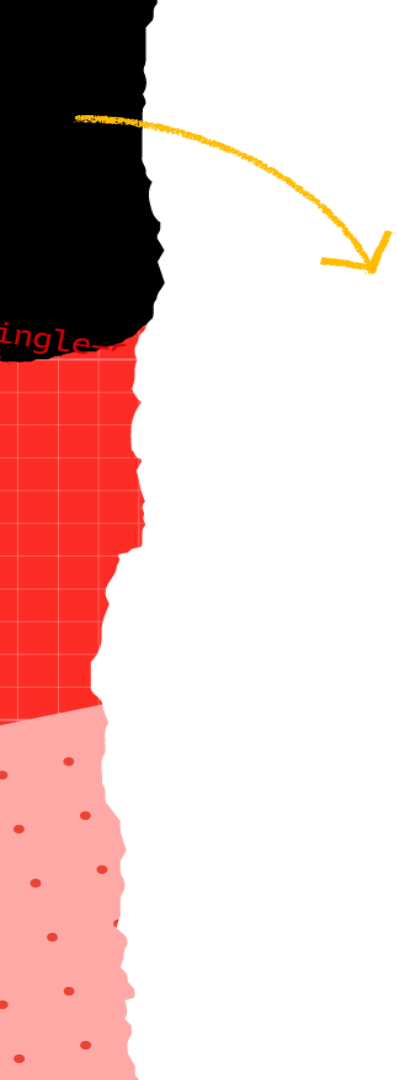
Browser/Web Application
(TensorFlow.js)

Mobile/IoT Devices
(TensorFlow Lite)

```
converter = tf.lite.TFLiteConverter.from_keras_model(model)
tflite_float_model = converter.convert()

with open('model.tflite', 'wb') as f:
f.write(tflite_float_model)
```

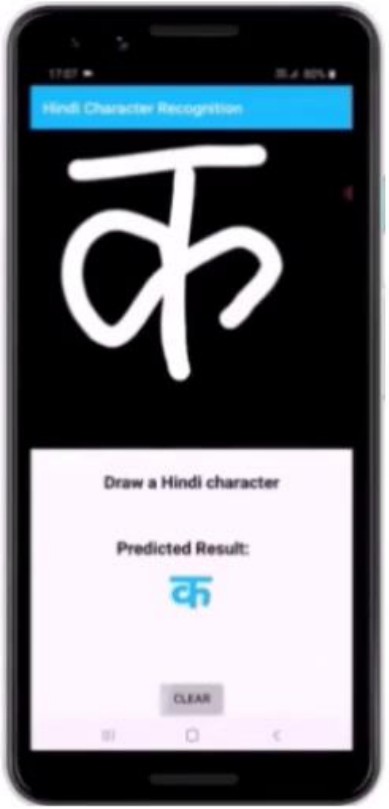
E2E Flow: The final TF Lite model is deployed on an Android application.



examples

Pose Classifier-based Video Game Controller – Ashes Cricket 2009

Real-time object detection – GTA Vice City



Hindi Character Recognizer


SO YA
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GOT ANY QUESTIONS?

Thank you.

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Experts

Machine Learning