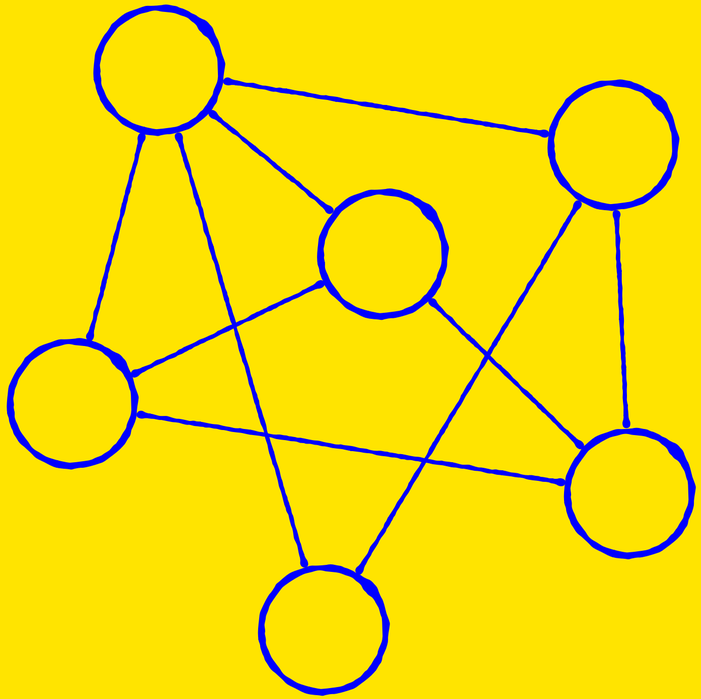
De Voorhoede

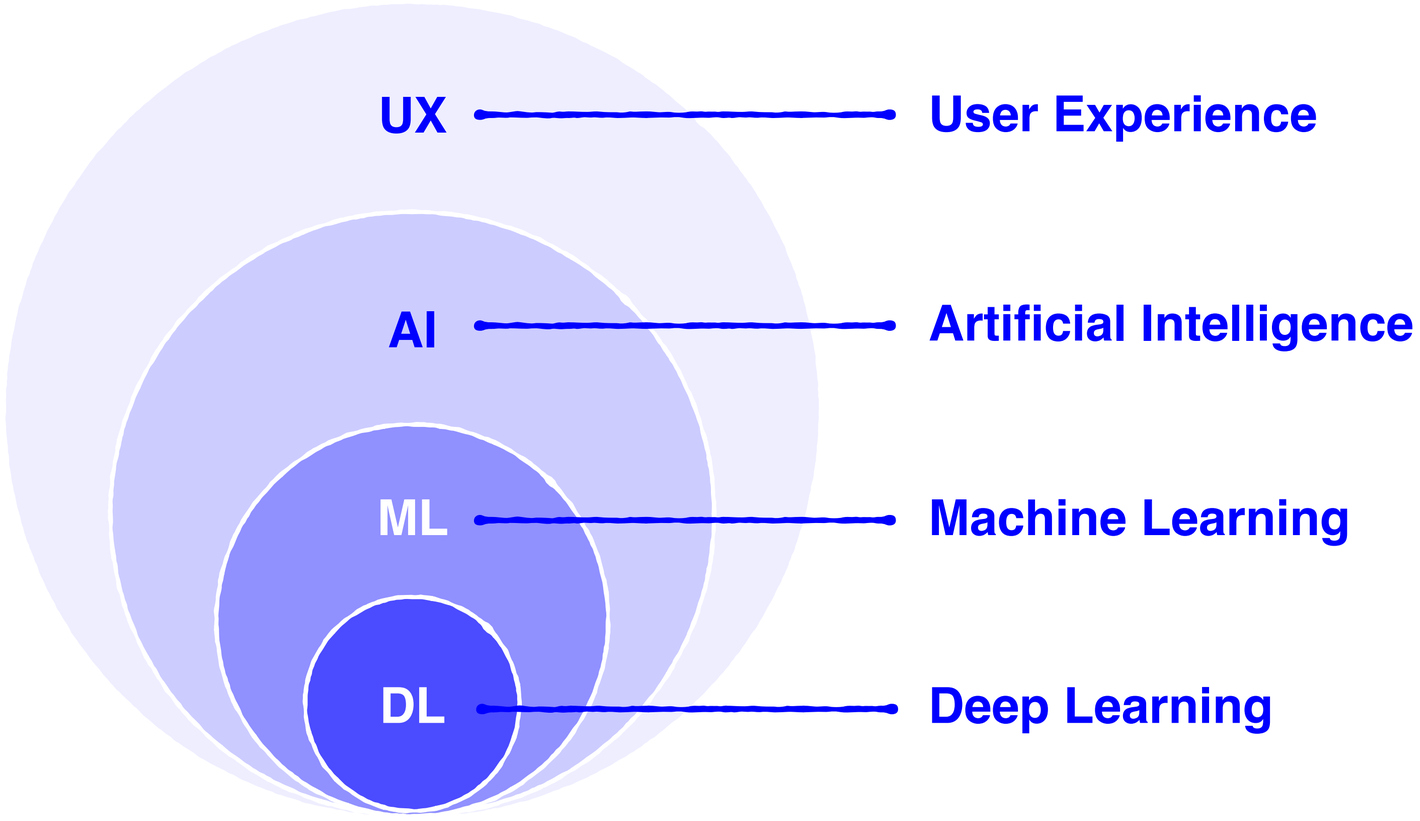
Delft Digital Meetup #2

AI in web applications

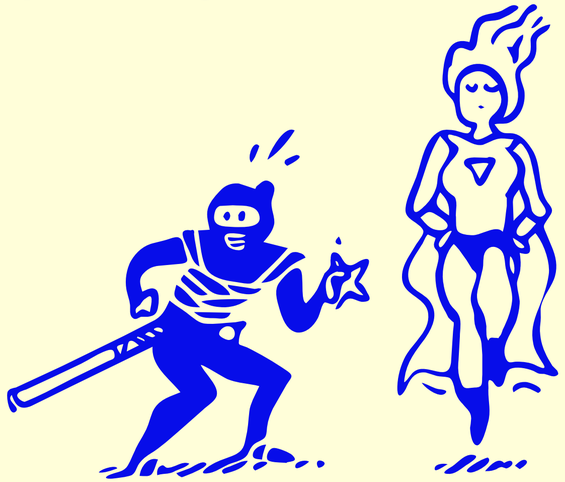


Jasper Moelker, Nov 2019
@jbmoelker

Wrapping AI in UX



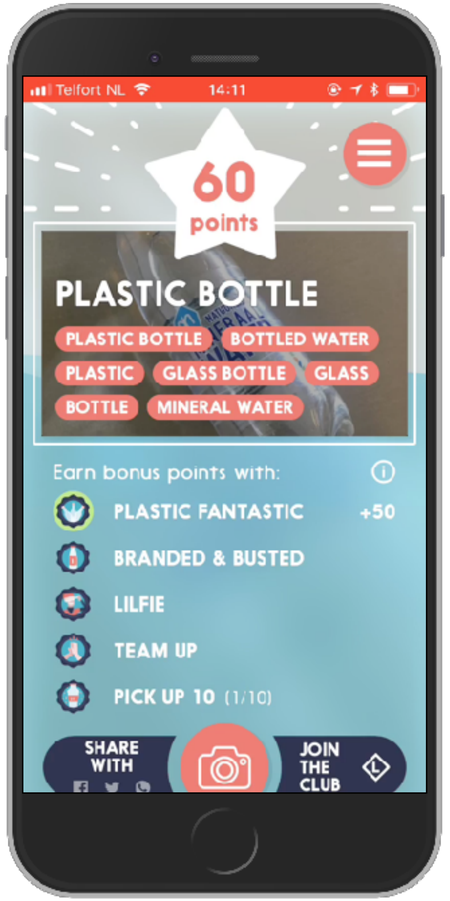
“The next step in human-machine interaction requires fitting user experience for humans”

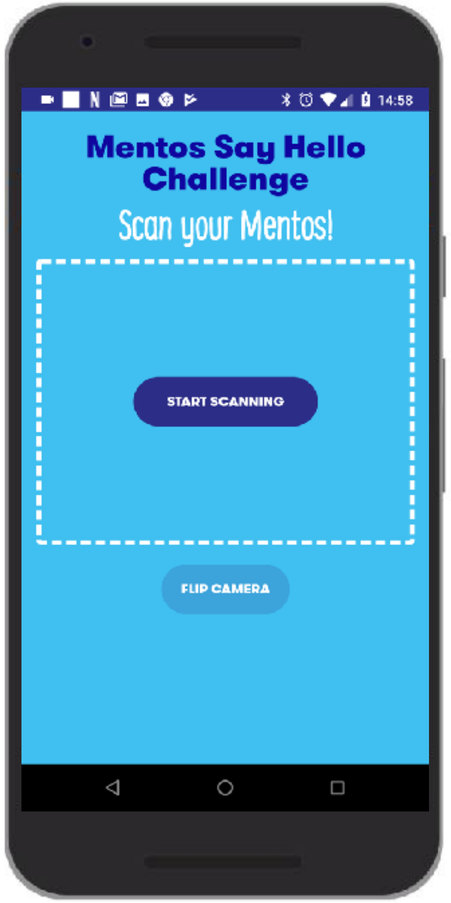


AI in Web Applications

#PickUp10

plastic litter recognition in a native-like app

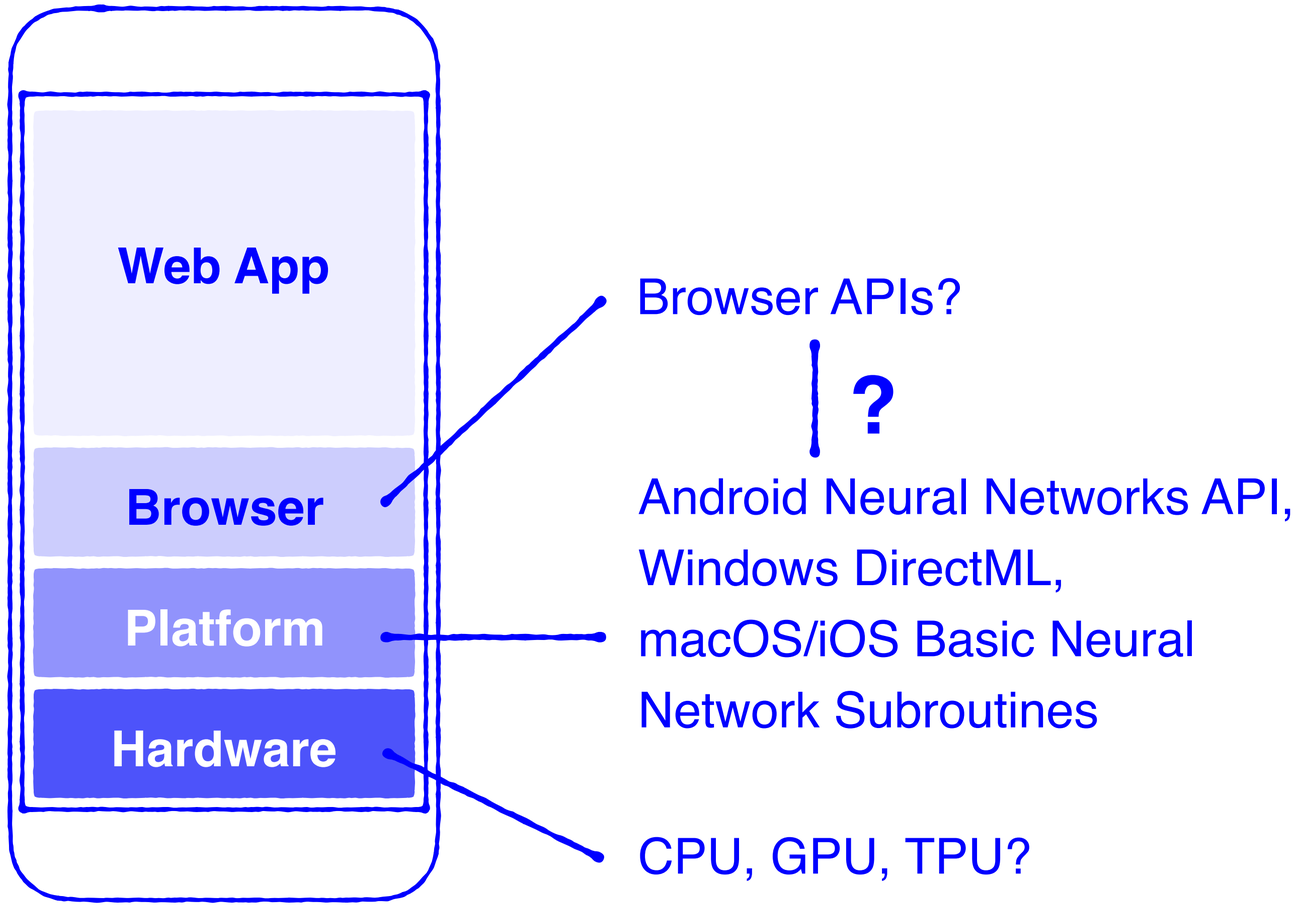




Mentos Say Hello

scan your mentos and play challenges

AI Hardware and Software



```
const nn = navigator.ml.getNeuralNetworkContext()

const TENSOR_DIMS = [2, 2, 2, 2]
const TENSOR_SIZE = 16
const float32TensorType = {
   type: 'tensor-float32',
   dimensions: TENSOR_DIMS
}

const tensor0 = nn.constant(float32TensorType,
       new Float32Array(arrayBuffer, 0, TENSOR_SIZE))
const tensor1 = nn.input(float32TensorType)
const tensor2 = nn.constant(float32TensorType,
  new Float32Array(arrayBuffer,
  TENSOR_SIZE * Float32Array.BYTES_PER_ELEMENT, TENSOR_SIZE))
const tensor3 = nn.input(float32TensorType)

const intermediateOutput0 = nn.add(tensor0, tensor1)
const intermediateOutput1 = nn.add(tensor2, tensor3)

const output = nn.mul(
   intermediateOutput0, intermediateOutput1)

const model = await nn.createModel([output])

// src: https://webmachinelearning.github.io/webnn/#examples
```

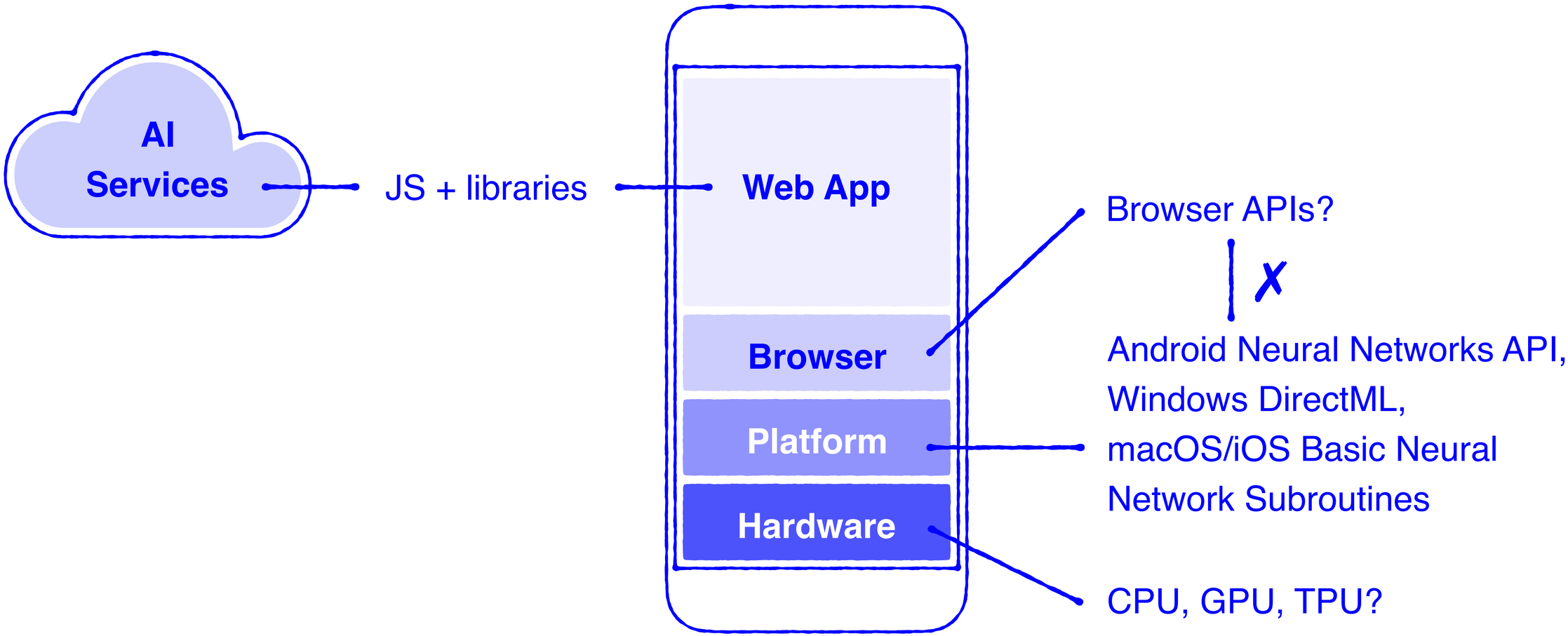
WebML Concept

The Machine Learning for the Web Community Group (WebML CG) aims to make Machine Learning a first-class web citizen.

The WebML CG is working on a **dedicated low-level Web API for neural network** inference hardware acceleration.

see https://www.w3.org/community/webmachinelearning/

AI Hardware and Software



Powering #PickUp10 with Google Vision

Plastic litter

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Google Vision

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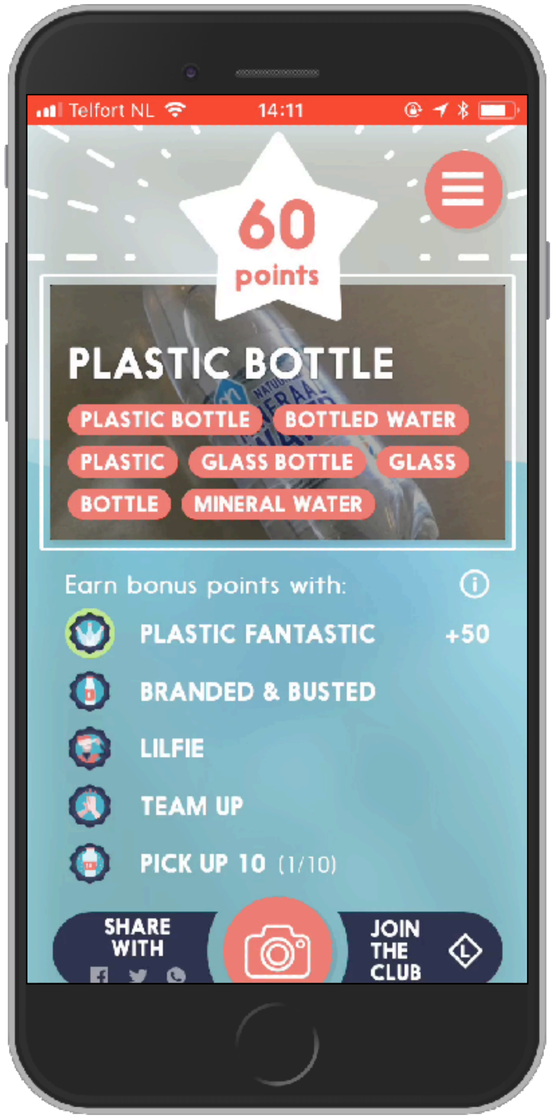
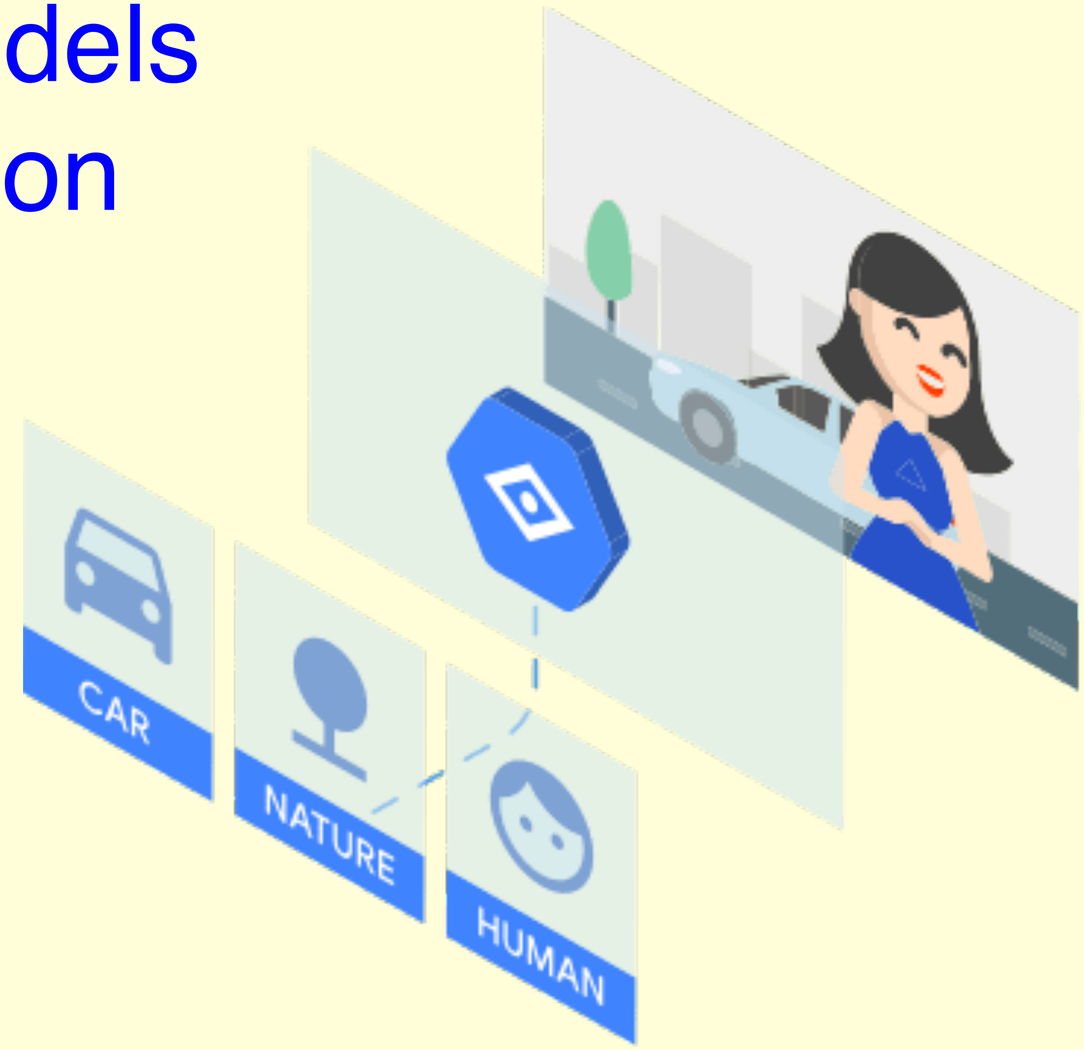


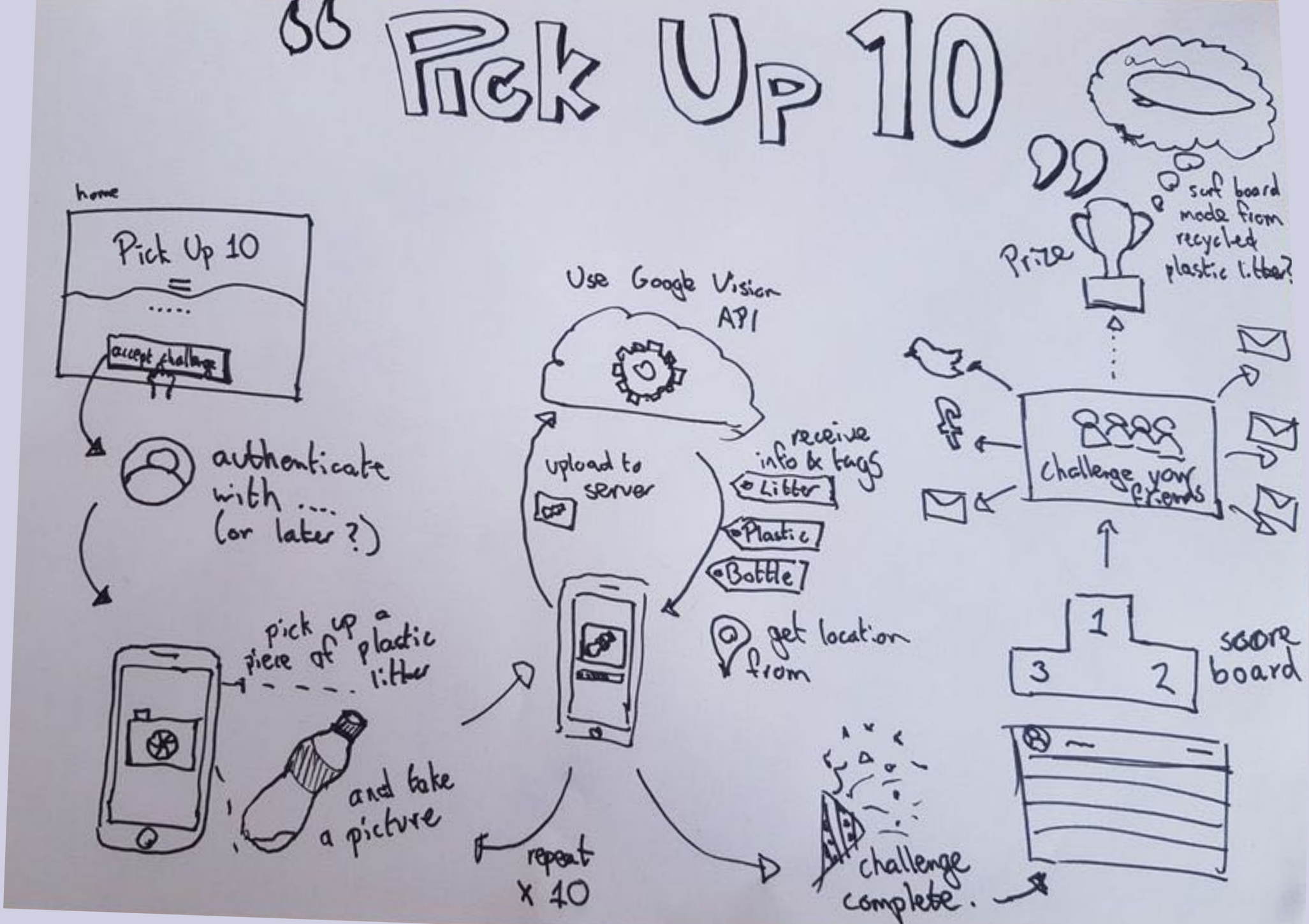
Pre-trained ML models for image recognition

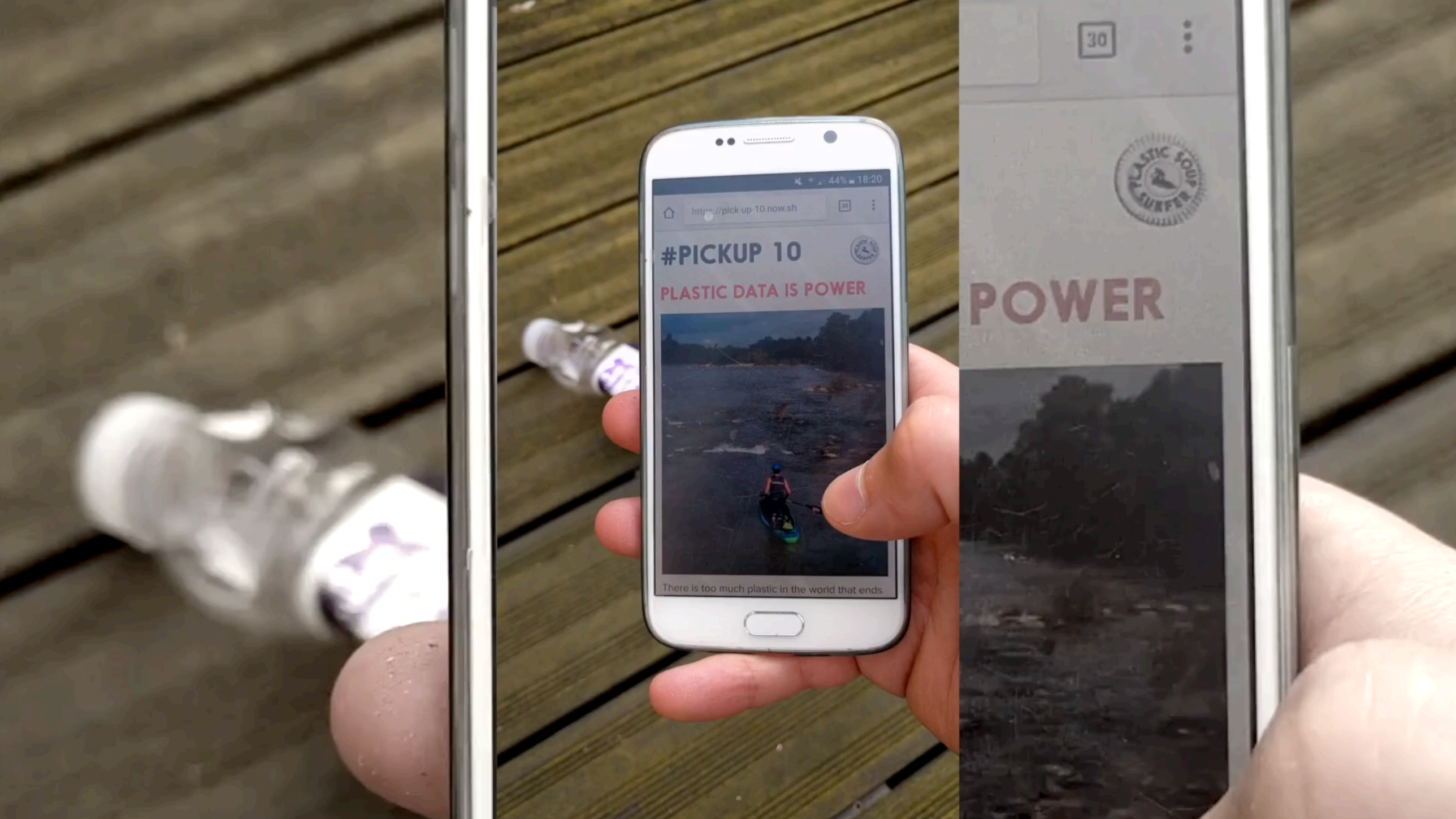
(demo)



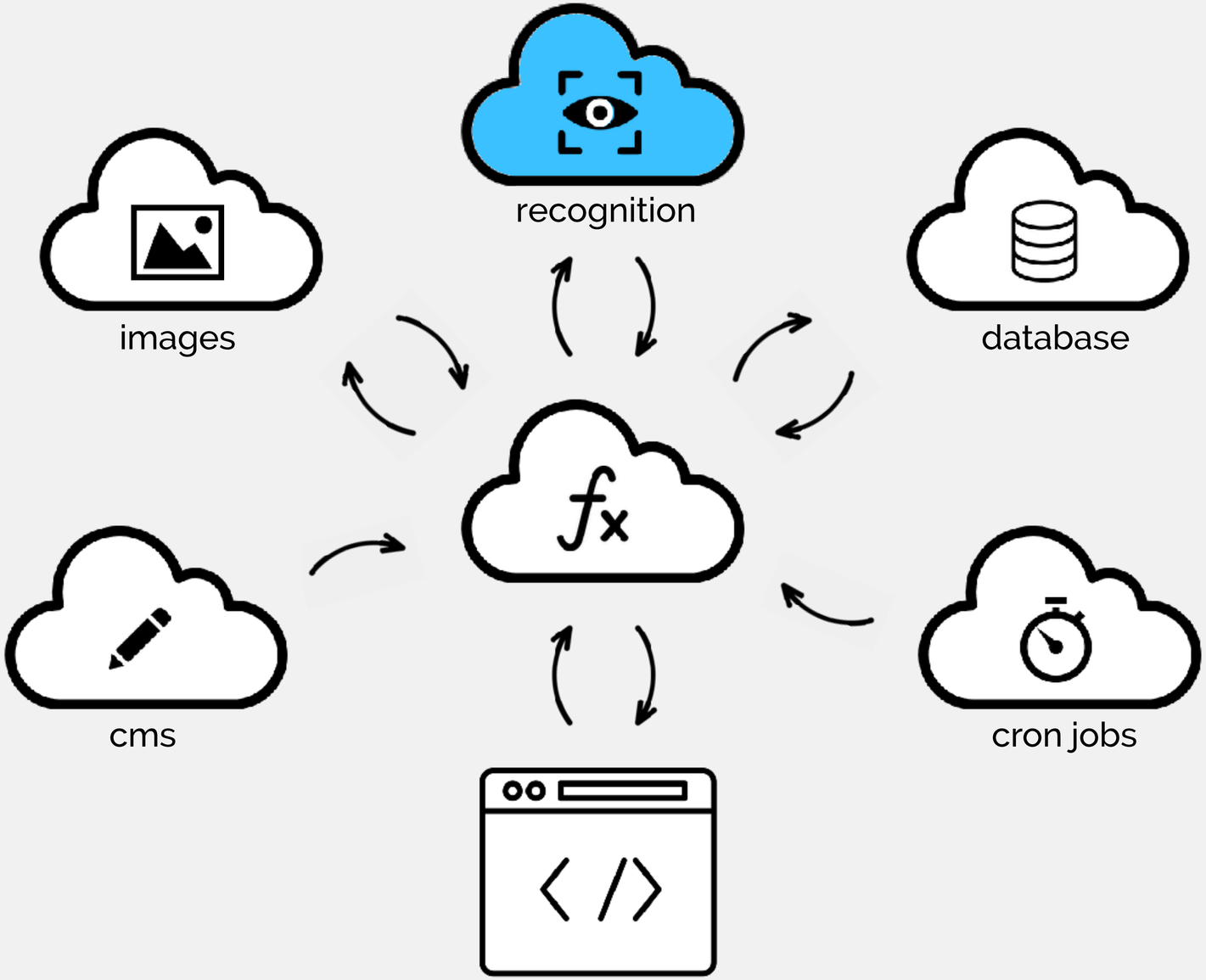
cloud.google.com/vision

Pick Up 10


home
Pick Up 10
accept challenge
authenticate with .... (or later?)
pick up a piece of plastic litter
and take a picture
repeat x 10
Use Google Vision API
upload to server
receive info & tags
Litter
Plastic
Bottle
get location from
challenge complete.
Prize
surf board made from recycled plastic litter?
challenge your friends
1
3
2
score board


44% 18:20
https://pick-up-10.now.sh
#PICKUP 10
PLASTIC DATA IS POWER
There is too much plastic in the world that ends
30
POWER

Connect app to Google Vision



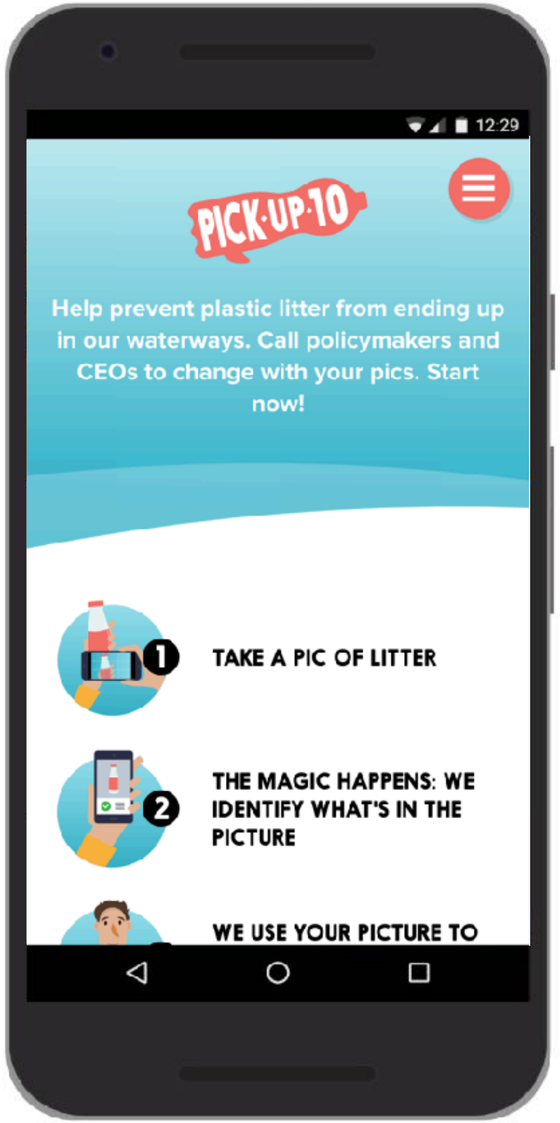
Using Vision Node.js client

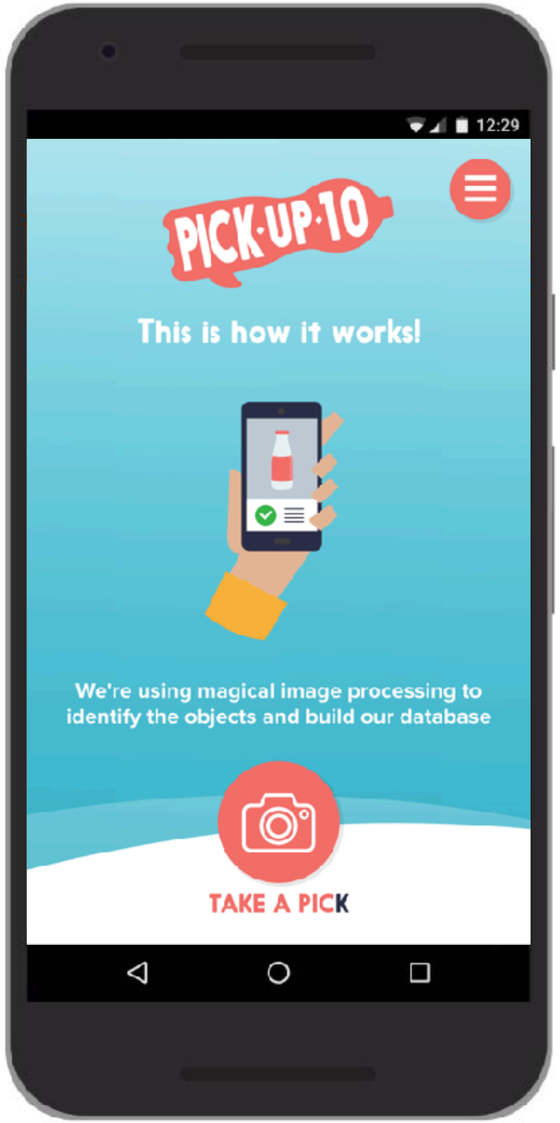
```
import vision from '@google-cloud/vision'

export const handler = (event, context, callback) => {
  const { imageUri } = event.queryStringParameters
  const client = new vision.ImageAnnotatorClient()

  Promise.all([
    client.faceDetection(imageUri),
    client.logoDetection(imageUri),
    client.webDetection(imageUri),
  ])
  .then(annotations => doMagic(annotations))
  .then(resData => callback(null, {
    statusCode: 200,
    body: JSON.stringify(resData)
  }))
}
```

Using Vision REST API

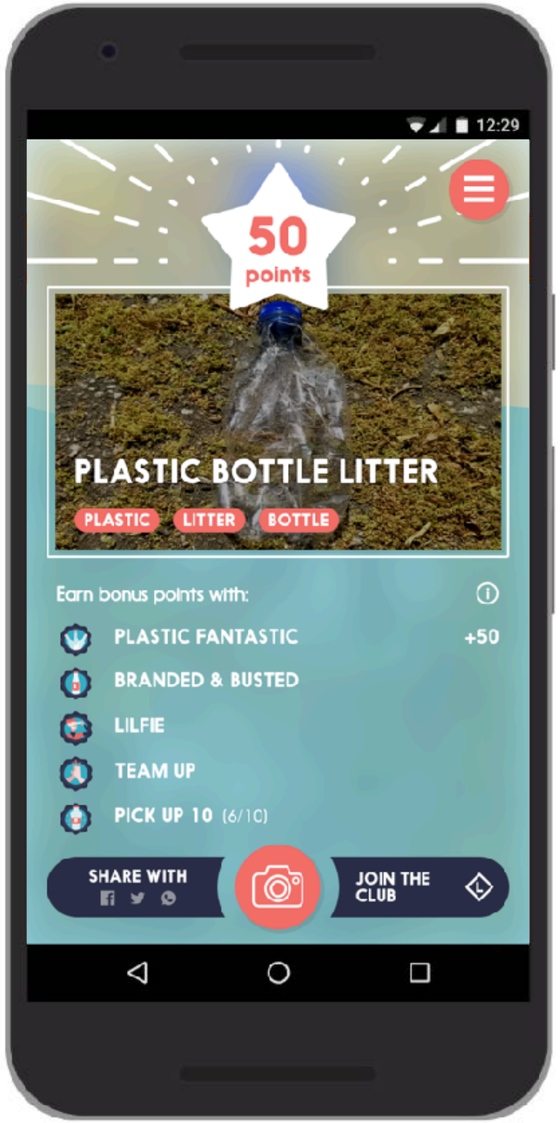
```
import request from ‘request-promise-native'

export const handler = ({ body }, context, callback) => {
  const { imageUri } = JSON.parse(body)
  request(`${VISION_API_URL}?key=${VISION_API_KEY}`, {
    method: 'POST', json: true, body: { requests: [{
        image: { source: { imageUri }, },
        features: [
          { type: 'FACE_DETECTION' },
          { type: 'LOGO_DETECTION' },
          { type: 'WEB_DETECTION' },
        ]
  }]}})
  .then(annotations => doMagic(annotations))
  .then(resData => callback(null, {
    statusCode: 200, body: JSON.stringify(resData)
  }))
}
```

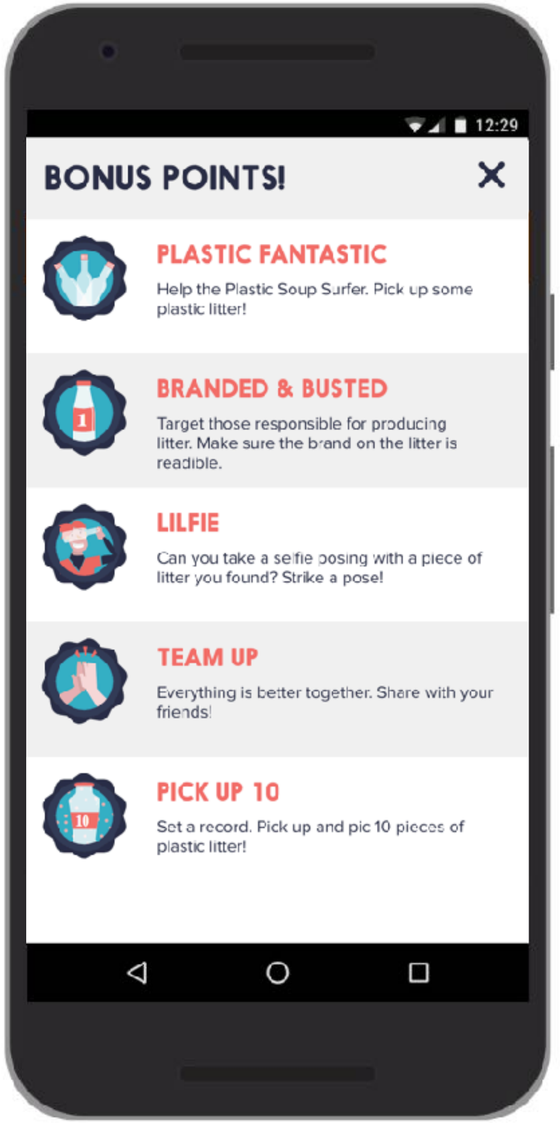
Introducing users to AI



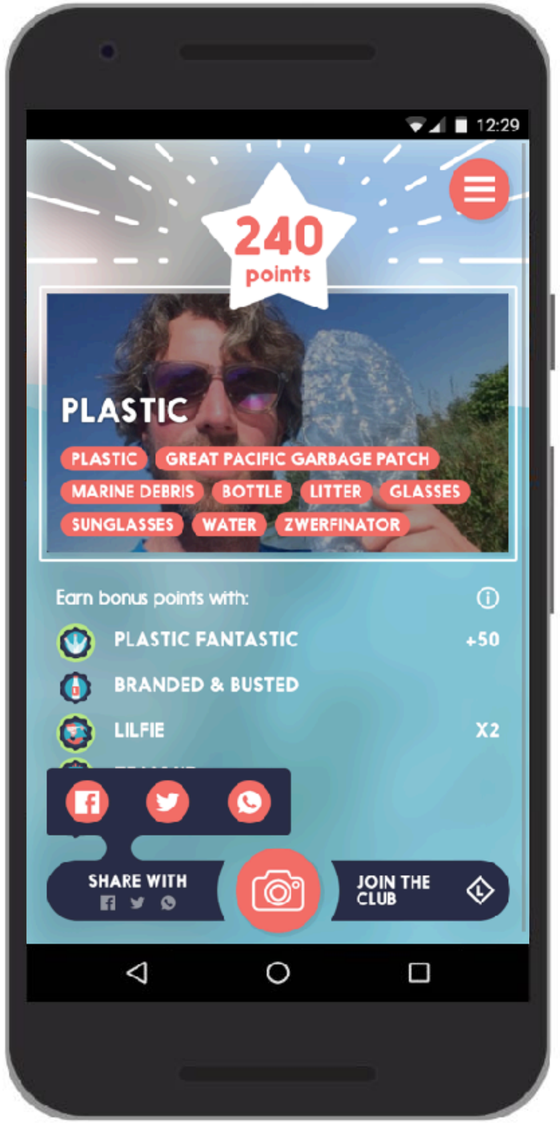


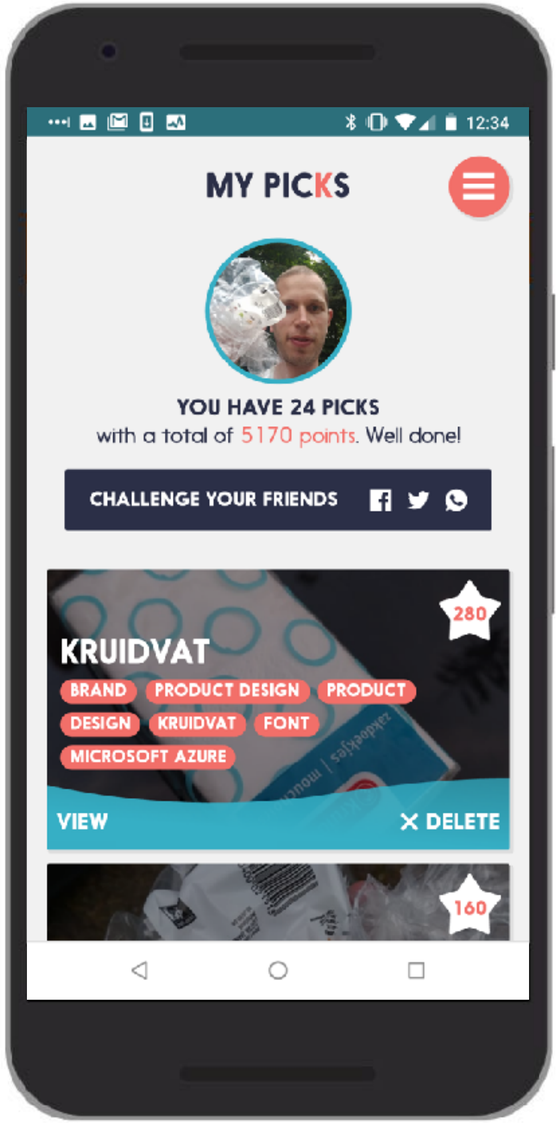
Fixing label mismatches

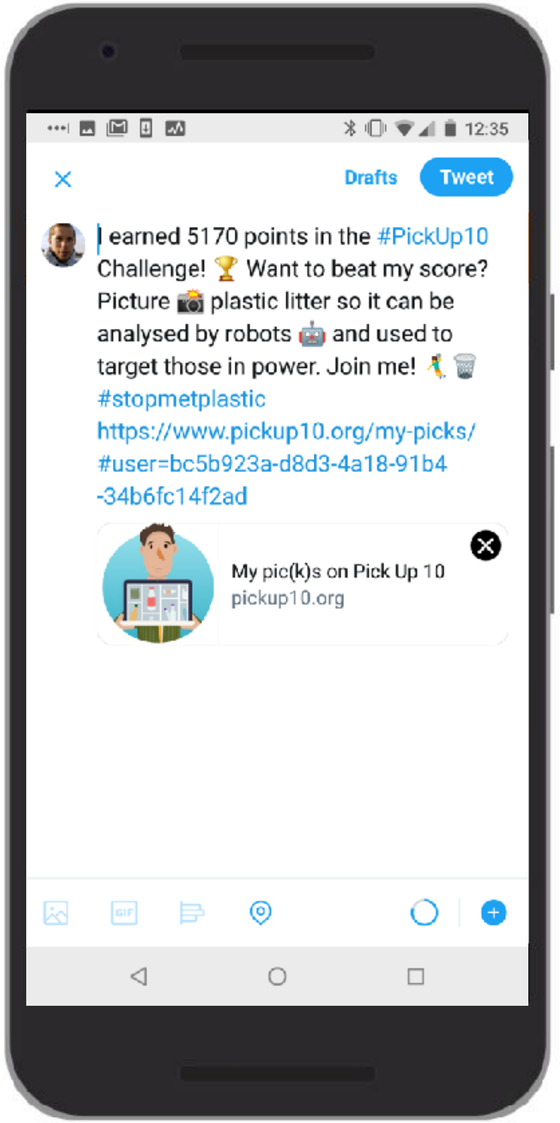




Using face detection







The result:
#PickUp10

Powering Mentos Say Hello with Google AutoML

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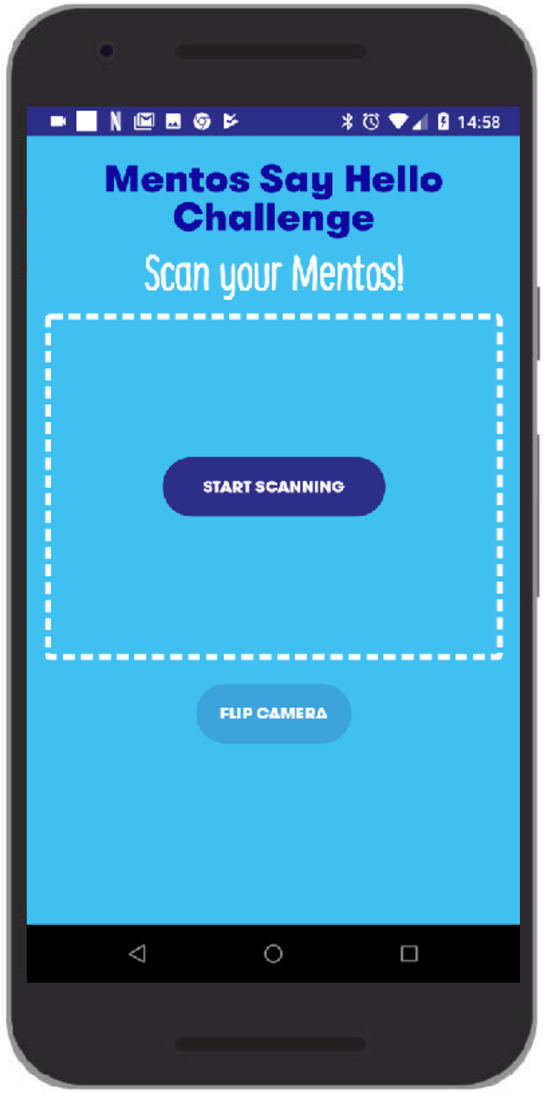
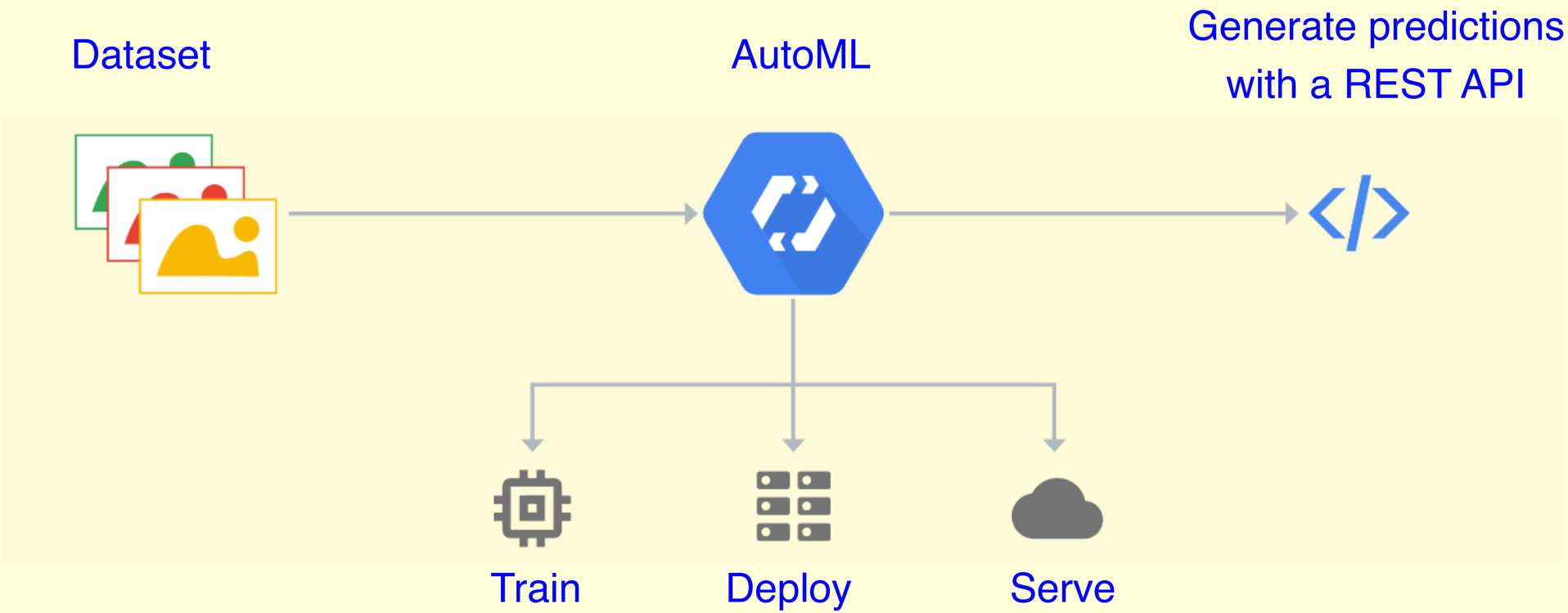


Mentos with print

Google AutoML

Training and using custom ML models



cloud.google.com/automl

AutoML Vision BETA | mentos | ADD IMAGES | LABEL STATS | EXPORT DATA | mentos-ml-exp-235009

IMAGES | TRAIN | EVALUATE | PREDICT

All images 1304
Labeled 1304
Unlabeled 0

Type to filter...

add_as_friend 297
blow_kisses 190
none_of_the_above 100
picnic 168
piggy_back 288
smile 261

Add label

Type to filter images...

Select all images

piggy_back

piggy_back

piggy_back

AutoML Vision BETA | mentos | ADD IMAGES | LABEL STATS | EXPORT DATA | mentos-ml-exp-235009

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blow_kisses 190
none_of_the_above 100
picnic 168
piggy_back 288
smile 261

Add label

Label: add_as_friend

Select all images

add_as_friend

AutoML Vision BETA | mentos | ADD IMAGES | LABEL STATS | EXPORT DATA | mentos-ml-exp-235009

IMAGES | TRAIN | EVALUATE | PREDICT

All images 1304
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Type to filter...

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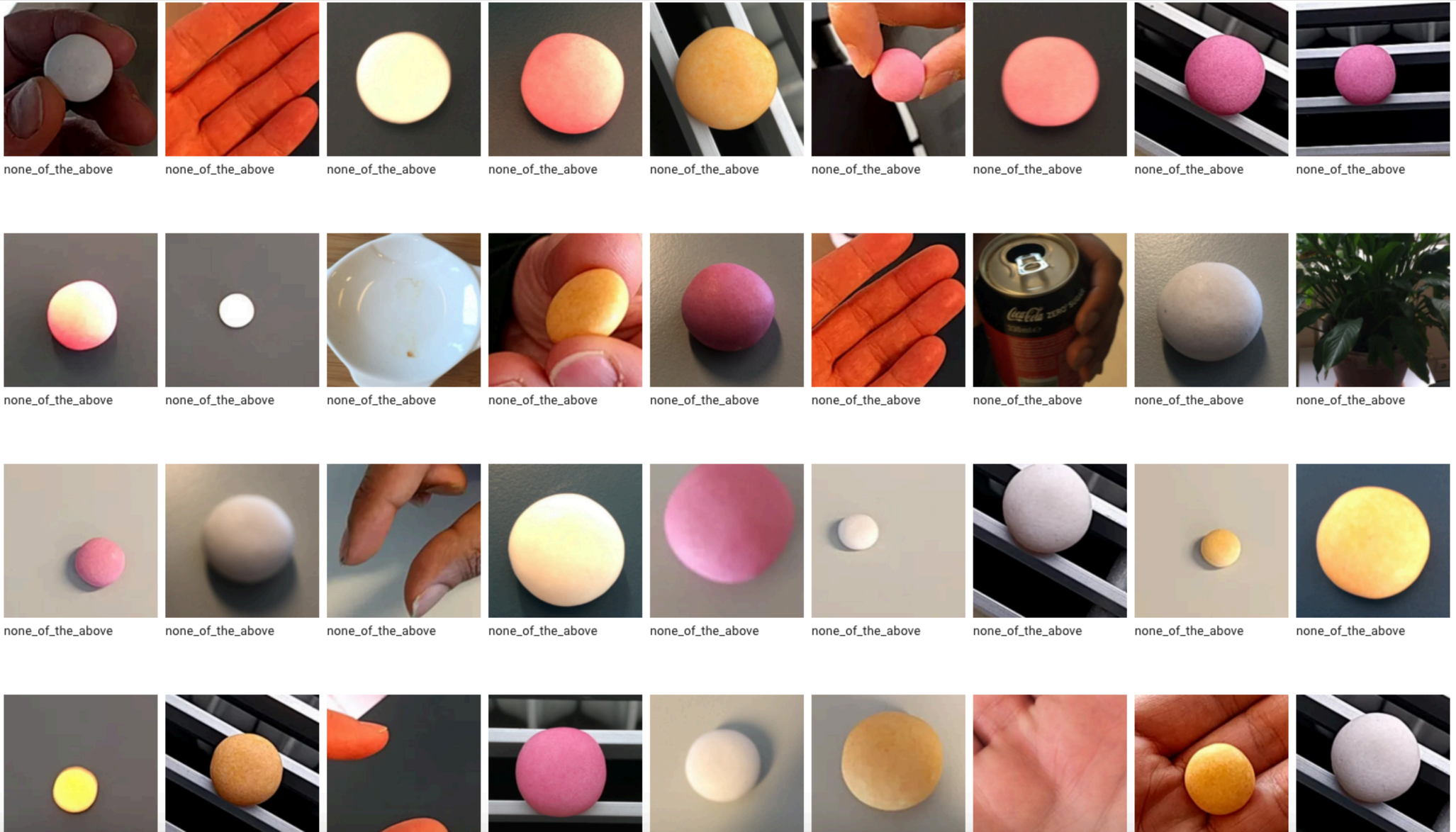
blow_kisses 190
none_of_the_above 100
picnic 168
piggy_back 288
smile 261

Add label

Label: none_of_the_above

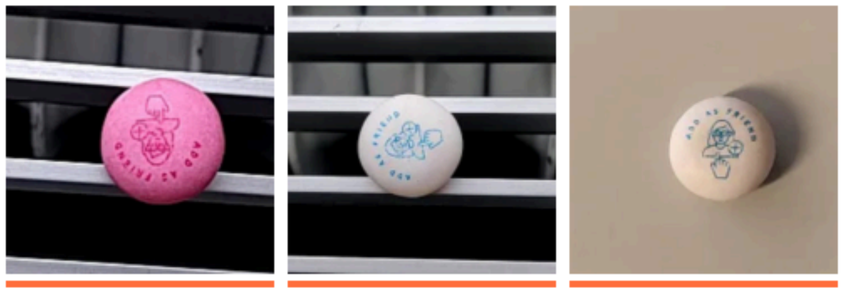


True positives

The model predicted **add_as_friend** correctly on these test images (at time of training)

False negatives

The model predicted **add_as_friend** correctly for these images, but scored less than 0.50.



False positives

The model predicted **add_as_friend** for these images, when it should have predicted:

PIGGY_BACK BLOW_KISSES

Confusion matrix

This table shows how often the model classified each label correctly (in blue), and which labels were most often confused for that label (in orange).

True label \ Predicted label	add_as_friend	smile	piggy_back	blow_kisses	picnic	none_of_the_above
add_as_friend	83.3%	16.7%	-	-	-	-
smile	-	92.0%	8.0%	-	-	-
piggy_back	7.1%	-	85.7%	7.1%	-	-
blow_kisses	4.3%	4.3%	8.7%	82.6%	-	-
picnic	-	-	-	10.0%	90.0%	-
none_of_the_above	-	-	-	-	-	100.0%

Confusion matrix

This table shows how often the model classified each label correctly (in blue), and which labels were most often confused for that label (in orange).

True label \ Predicted label	smile	blow_kisses	picnic	add_as_friend	none_of_the_above	piggy_back
smile	96.6%	3.4%	-	-	-	-
blow_kisses	-	100.0%	-	-	-	-
picnic	-	-	100.0%	-	-	-
add_as_friend	-	-	-	100.0%	-	-
none_of_the_above	-	-	-	-	100.0%	-
piggy_back	-	-	-	-	-	100.0%

“Large file size results in slow file upload, slow recognition speed and devour your data plan”

Resizing

Resizing reduces file size, which improves upload time and recognition time.

Resizing images with quality loss using Canvas element

Choose image
Choose file original.jpeg

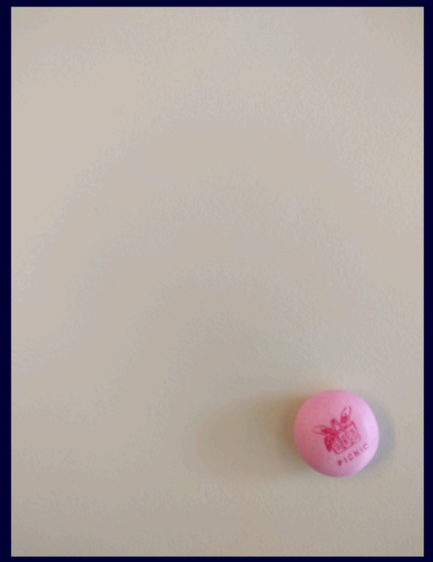
Max size
250

Quality
0,7

Resize

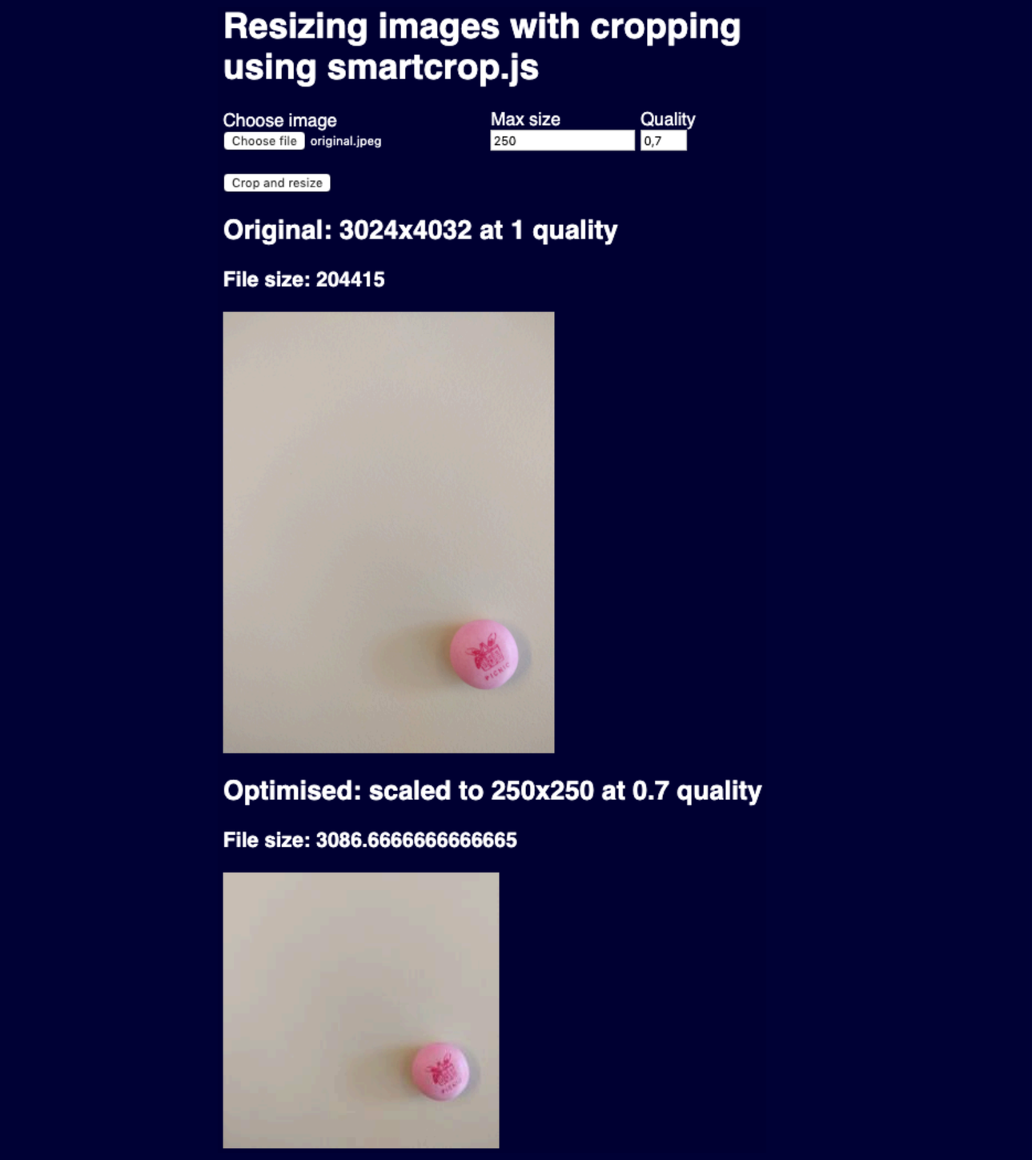
Original: 3024x4032 at 1 quality

File size: 204415



Optimised: scaled to 187.5x250 at 0.7 quality

File size: 2382.6666666666665



Cropping

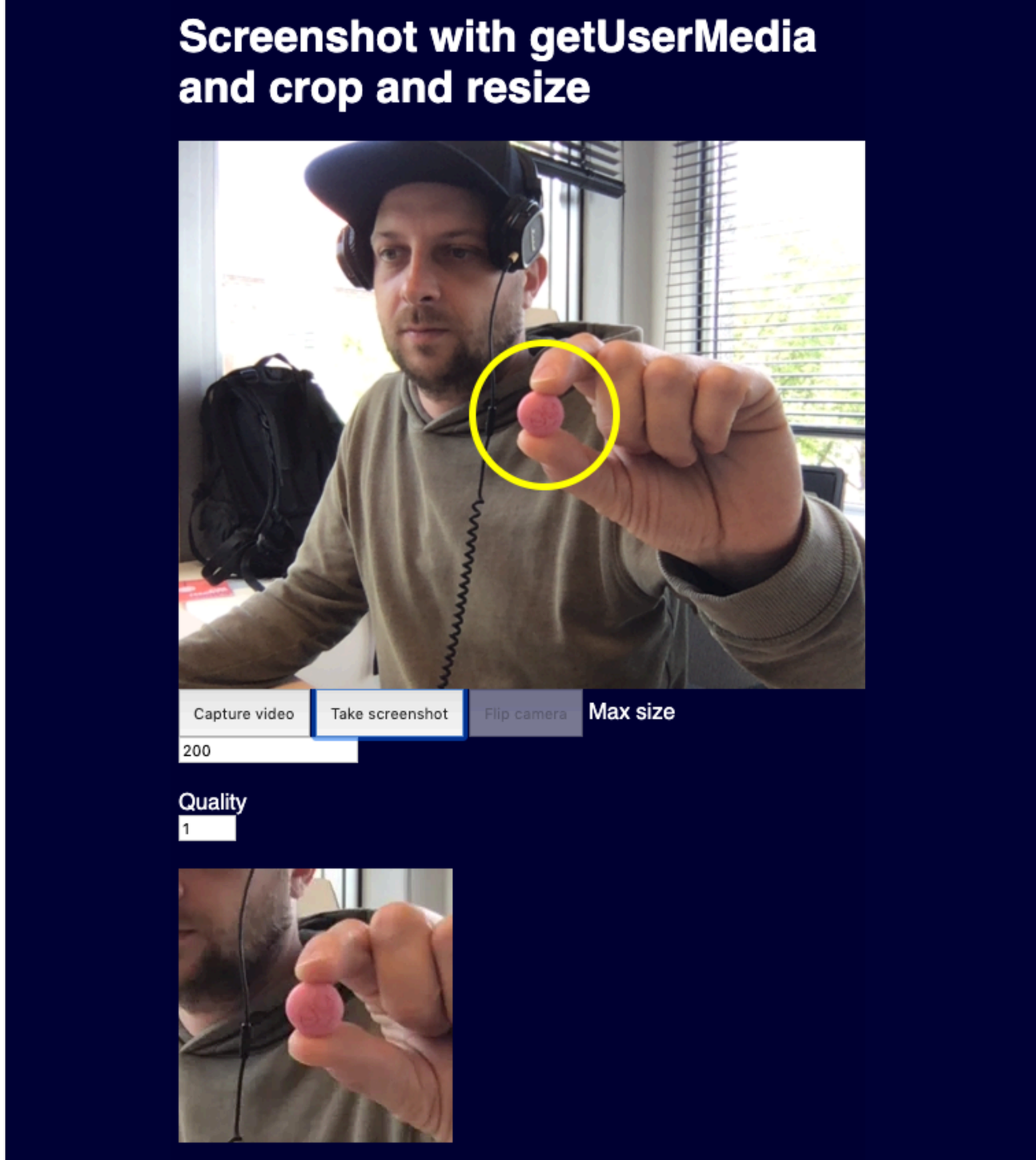
Detect the Mentos in the image and crop it out.

In-browser object detection performs poorly, but the effect on image size and reducing noise is great.

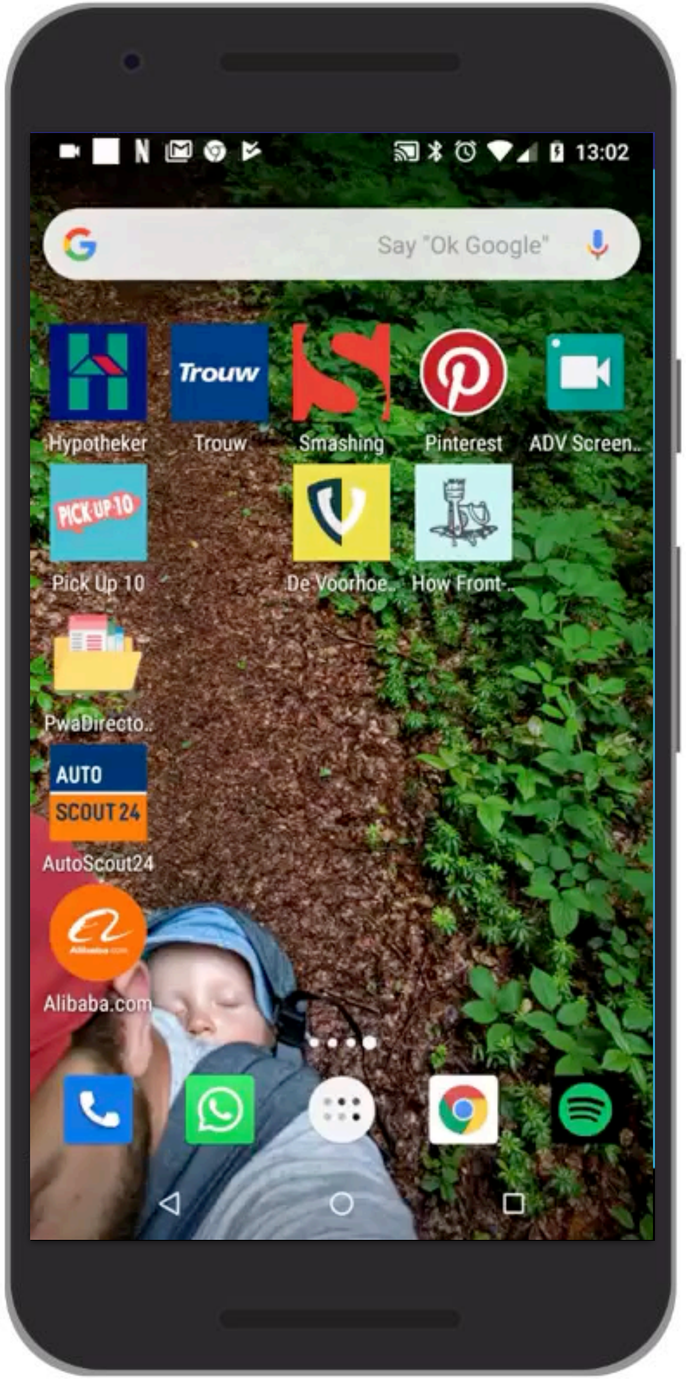
Steer the user

Steer the user and crop out the center of the image.

- No need to use AI for cropping.
- Reduces file size, which improves upload and recognition speed.
- Filters out background noise, which improves image recognition precision.

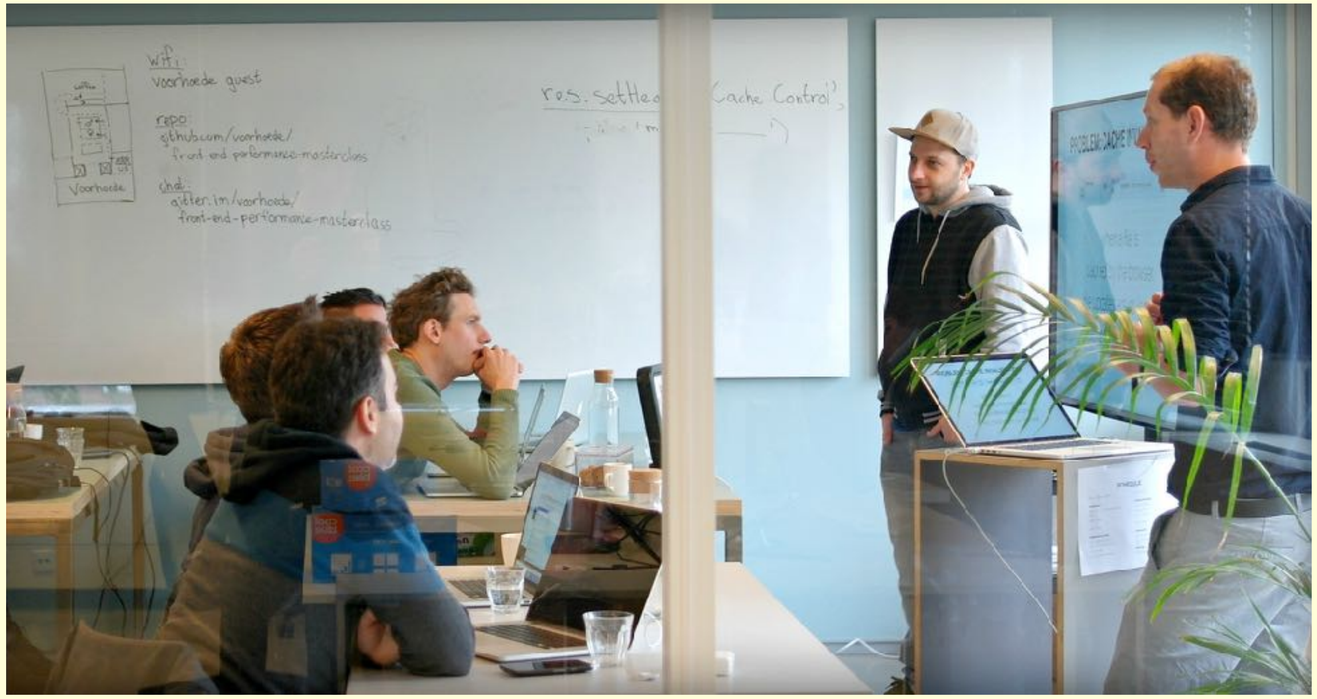


The result: Say Hello challenge



mentos
The Freshmaker

De Voorhoede



full-day hands-on PWA masterclass?

voorhoede.nl/**pwamaster**

use DELFTDIGITAL for 20% discount

thanks

Jasper Moelker

// @jbmoelker
// jasper@voorhoede.nl