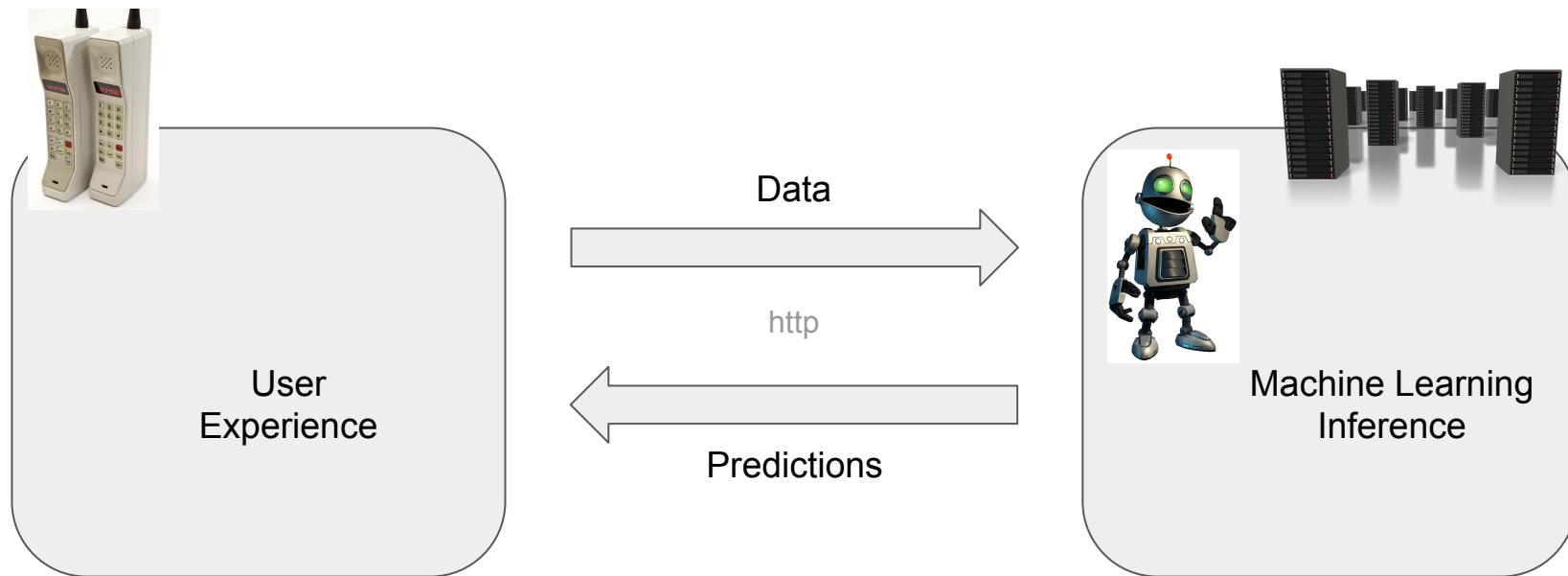# Machine Learning inference on a mobile device

Roman Popat
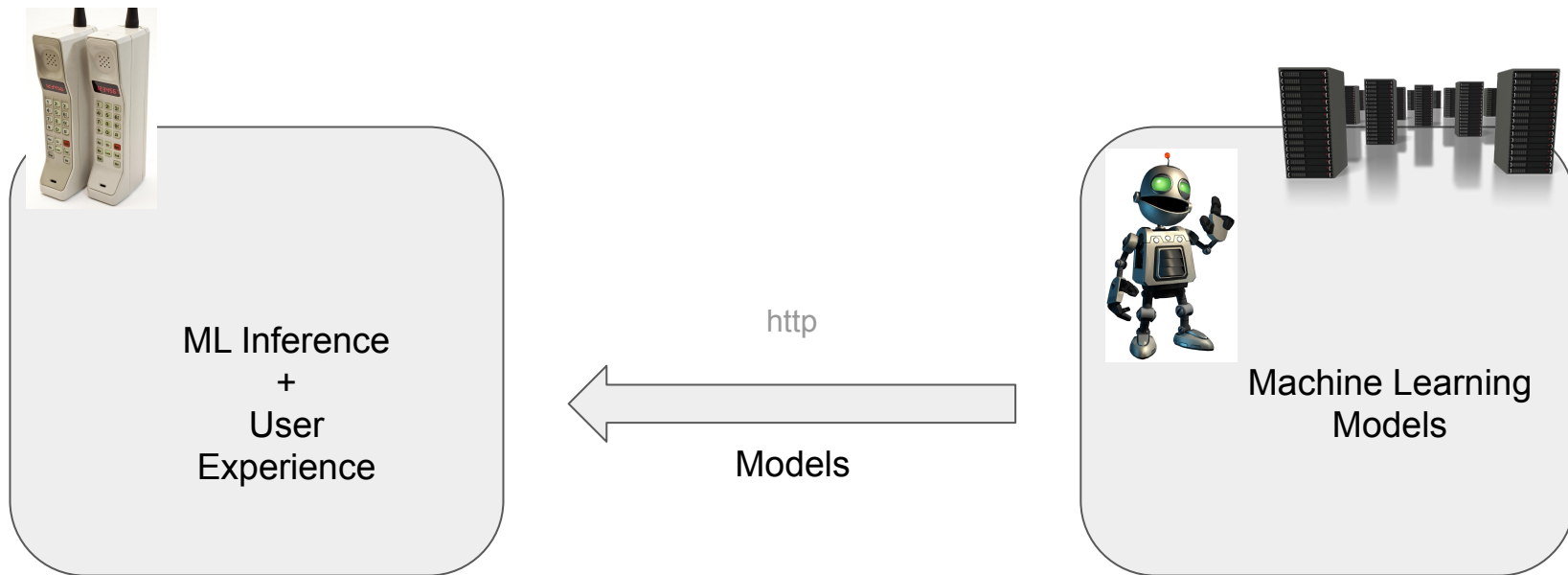
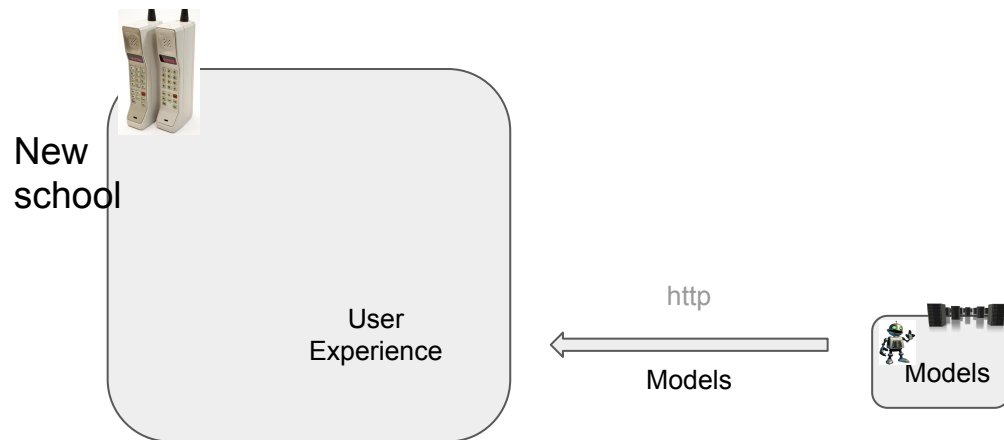# The most common method...

A possible alternative...

ML Inference
+
User
Experience

http

← Models

Machine Learning
Models

Why?

Old school

User Experience

Data →

← http

Predictions

Machine Learning Inference

New school

User Experience

http →

← Models

Models
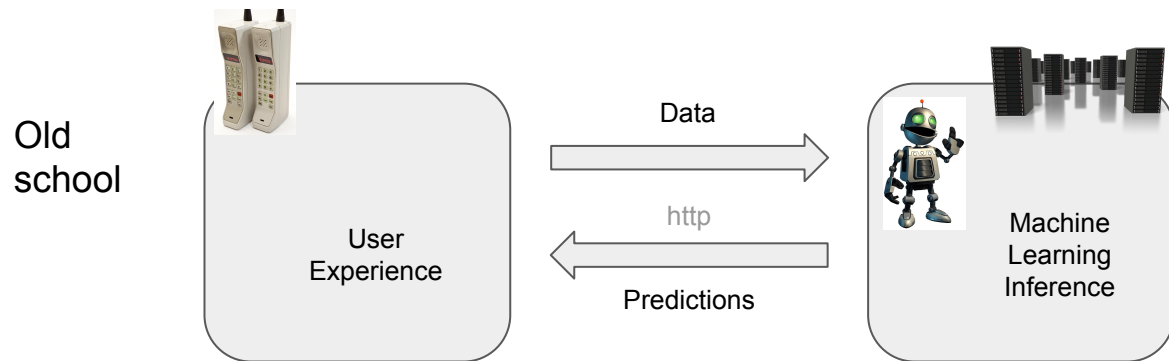
1. Much less data over the network

2. Much smaller architecture

The Problem

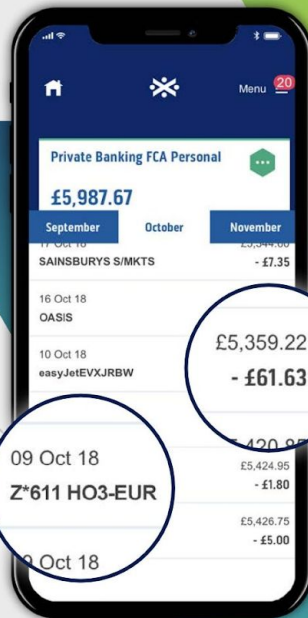Trying to understand what you bought, where and on which card is easy, right? **Wrong.**

Bank statements give very little data on purchases

and corresponding **email receipts** are normally buried under spam, phishing and promotional emails in your inbox.

Modern payments solutions don't provide data to banks on purchases and email apps were never designed as a Receipt bank.

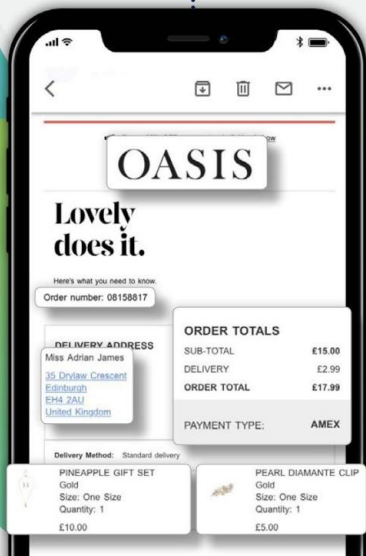**Private Banking FCA Personal**

£5,987.67

September | October | November

17 Oct 18
SAINSBURYS S/MKTS — £7.35

16 Oct 18
OASIS

10 Oct 18
easyJetEVXJRBW

£5,359.22
- £61.63

09 Oct 18
Z*611 HO3-EUR

£5,424.95
- £1.80

£5,426.75
- £5.00

09 Oct 18

The Solution

Use Machine Learning

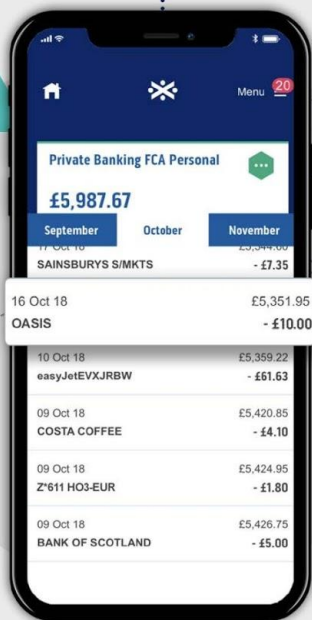**Extract data** from email receipts on a Smartphone

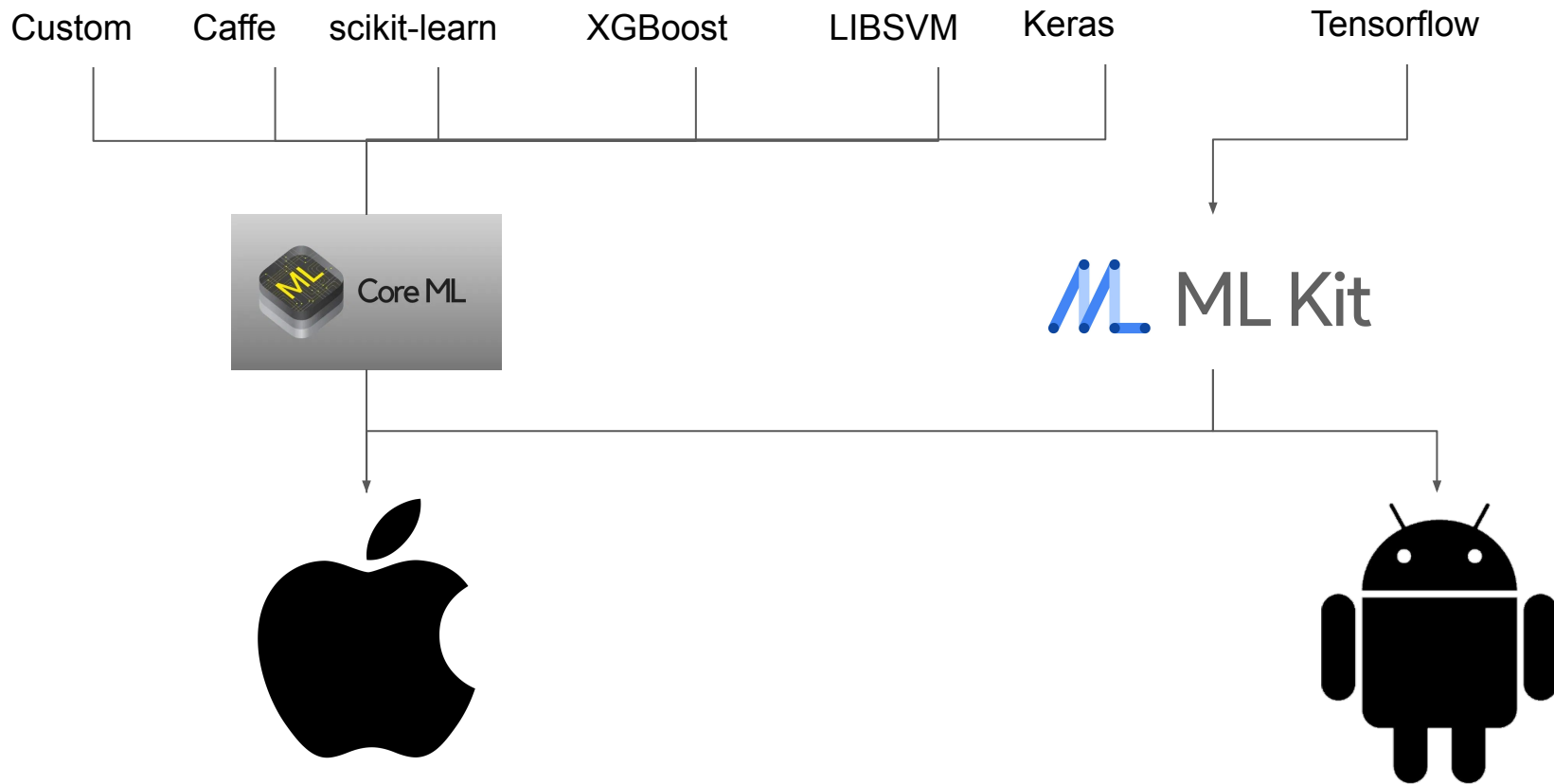**Enrich the corresponding Banking transaction** with details of the purchase using Open-banking

3 *Shoppa*

brings together all you email receipts and bank transactions in one place

1

OASIS

Lovely does it.

Here's what you need to know.

Order number: 08158817

DELIVERY ADDRESS
Miss Adrian James

35 Drylaw Crescent
Edinburgh
EH4 2AU
United Kingdom

ORDER TOTALS
SUB-TOTAL £15.00
DELIVERY £2.99
ORDER TOTAL £17.99

PAYMENT TYPE: AMEX

Delivery Method: Standard delivery

PINEAPPLE GIFT SET
Gold
Size: One Size
Quantity: 1
£10.00

PEARL DIAMANTE CLIP
Gold
Size: One Size
Quantity: 1
£5.00

+

2

Menu 20

Private Banking FCA Personal

£5,987.67

September | October | November

17 Oct 18 £5,344.00
SAINSBURYS S/MKTS - £7.35

16 Oct 18 £5,351.95
OASIS - £10.00

10 Oct 18 £5,359.22
easyJetEVXJRBW - £61.63

09 Oct 18 £5,420.85
COSTA COFFEE - £4.10

09 Oct 18 £5,424.95
Z*611 HO3-EUR - £1.80

09 Oct 18 £5,426.75
BANK OF SCOTLAND - £5.00

=

4:56

Shoppa

Red Jacket £77.00 — ASOS

Pink leather boots £65.00 — next

Stripped wool top £48.00 — TOPSHOP

Pineapple Gift Set £10.00 — OASIS

Checked blouse £58.99 — M&S

Blue trousers £41.99 — H&M

Evening dress £79.99 — ASOS

Orders 84 | Returnable 4 | Returned 6 | Refunded

Shoppa THE **ULTIMATE** ONLINE SHOPPING ASSISTANT

Best Option on Paper

Custom   Caffe   scikit-learn   XGBoost   LIBSVM   Keras   Tensorflow

An Example

```
import tensorflow as tf

converter = tf.lite.TFLiteConverter.from_saved_model(saved_model_dir)
tflite_model = converter.convert()
open("converted_model.tflite", "wb").write(tflite_model)
```

https://www.tensorflow.org/lite/convert/python_api

Problem...

TensorFlow saved model export conversion to tflite

Asked 1 year, 2 months ago   Active 21 days ago   Viewed 895 times

▲

0   **TLDR**: I get a `ValueError:` when running

```
tf.contrib.lite.TocoConverter.from_saved_model()
```

▼

Aims: I am trying to convert a TensorFlow saved model to tflite for deployment on mobile

▲

2   This issue is fixed on TensorFlow's `master` branch (in commit d3931c8). Reference the following documentation on TensorFlow's website to build a pip installation from GitHub: https://www.tensorflow.org/install/install_sources.
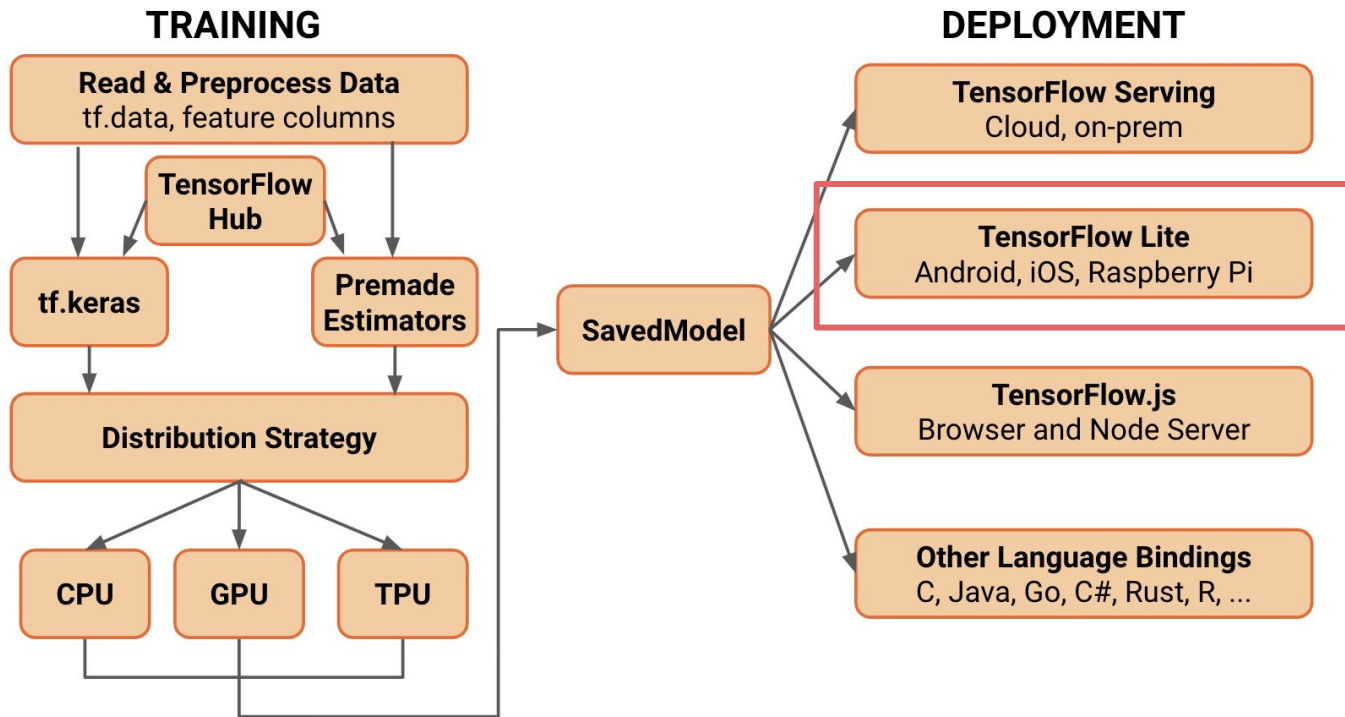
▼

share edit flag   answered Jun 29 '18 at 0:56

✓   Nupur Garg
   372 ● 1 ● 7

https://stackoverflow.com/questions/50910268/tensorflow-saved-model-export-conversion-to-tflite

Things have improved - TF 2.0

TRAINING

- **Read & Preprocess Data**
  tf.data, feature columns
- **TensorFlow Hub**
- **tf.keras**
- **Premade Estimators**
- **Distribution Strategy**
- **CPU**
- **GPU**
- **TPU**

SavedModel

DEPLOYMENT

- **TensorFlow Serving**
  Cloud, on-prem
- **TensorFlow Lite**
  Android, iOS, Raspberry Pi
- **TensorFlow.js**
  Browser and Node Server
- **Other Language Bindings**
  C, Java, Go, C#, Rust, R, ...

https://www.tensorflow.org/lite/guide/get_started#2_convert_the_model_format
https://medium.com/tensorflow/whats-coming-in-tensorflow-2-0-d3663832e9b8

Reasonable alternative
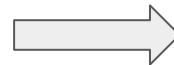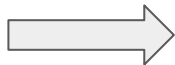
Our targets for clever things...

- Do we care about this email?

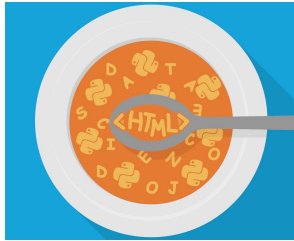- What type of email is this?
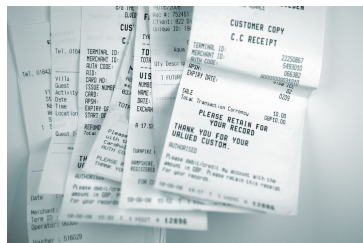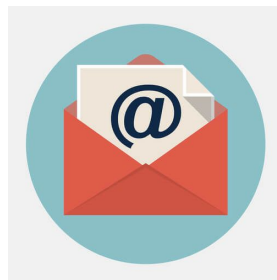
- Pick out important information in the receipt.

- Match purchases to bank transaction data.

Is this a purchase receipt?

1

Custom Cleanup
Beautiful Soup

1. Remove scripts,
   iframes, style etc

2. Extract text
   contents

2

PreProcess Data
CountVectorizer(
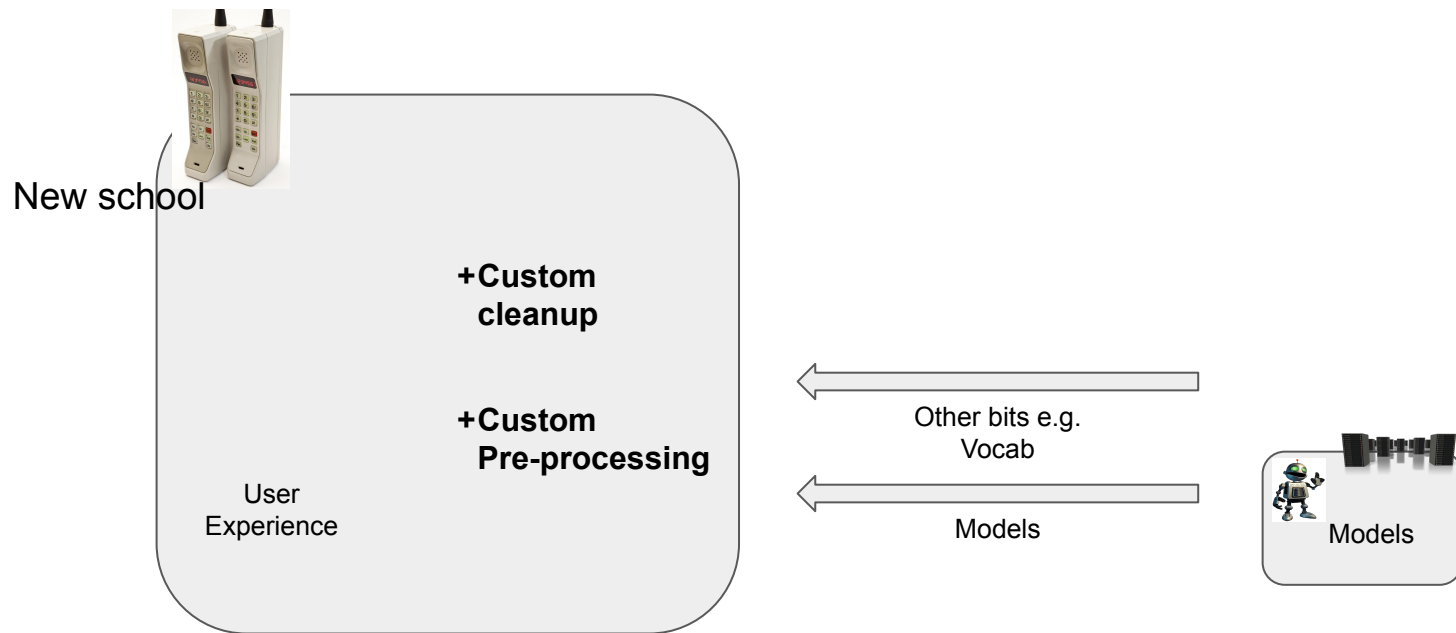)

3

Train Model
RandomForestClassifier(
)

coremltools

Burden on mobile dev

New school

+Custom cleanup

+Custom Pre-processing

User Experience

Other bits e.g. Vocab

Models

Models

Some thoughts on the tech so far...

We should all move in this direction...

more on this story

Mark Zuckerberg faces tough questions in two-day congressional testimony - as it happened

11 Apr 2018

Act on data privacy or we'll regulate, UK minister tells Facebook

11 Apr 2018

Christopher Wylie: Why I broke the Facebook data story - and what should happen now

7 Apr 2018

Mark Zuckerberg vows to fight election meddling in marathon Senate grilling

11 Apr 2018

Mark Zuckerberg in a booster seat? A tall tale, says Facebook

11 Apr 2018

❚❚ Zuckerberg got off lightly. Why are politicians so bad at asking questions?
Jonathan Freedland

11 Apr 2018   💬 484

❚❚ Are you ready? Here is all the data Facebook and Google have on you
Dylan Curran

30 Mar 2018   💬 3,024

How to check whether Facebook shared your data with Cambridge Analytica

10 Apr 2018   💬 39

Monily, Splinter and Shoppa

MON!LY

Managing all your online shopping can be painful

Shoppa lets you manage your shopping, view deliveries, check for better deals and see your refunds

Shoppa

Summary of recent order activity:

5 to arrive

2 recently received

4 recently refunded

Splinter

We mine the worlds largest receipt bank
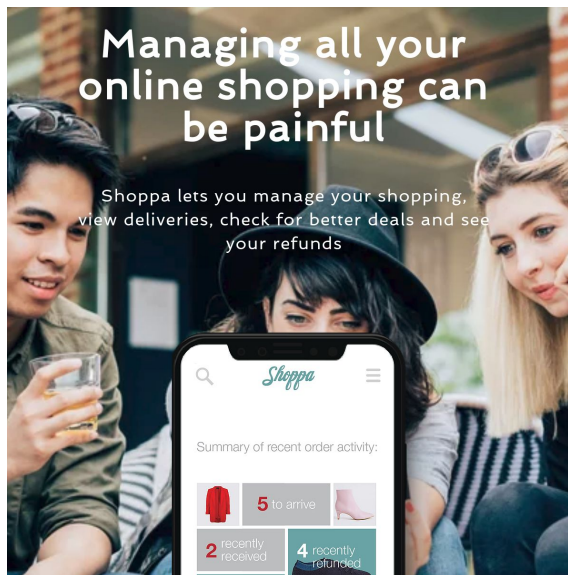
The Team

An **experienced** group of industry experts

Adrian James
CEO and Co-Founder

Experienced start-up founder and Former Oracle Executive

Andy McIntosh
Head of CX Co-founder

Successfully built and ran App design consultancy

Martin Langosch
CTO and Co-founder

15 years a Data Science Consultant in the Banking industry with leading data consultancies

Dr Roman Popat
CDO and Co-founder

Graduate from Oxford, an experienced Data Scientist of 10 years

Eric Ruck
Chief Engineer

Software Engineer of 25 years experience. Former US defence IT security expert

Ben Corrigan
Non Executive

Former CEO of Pouch, exited to Daily Mail

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Questions

Roman Popat - roman@moni.ly

https://www.monily.co/
https://www.shoppa.co.uk/