



Applied Artificial Intelligence for Better Health Solutions

Better Health – Better Life – Live Well

Presented by Precise Software Innovation Team

Ben Duan, PHD
Chief Technology Officer

Ellen Crayton, MBA
Executive Enterprise
Architect

Xin Liu, MD
Technical Director



Overview - Introduction



- **Precise Software Solutions Inc.**, is a nimble and fast-growing SBA 8(a) certified small business focusing on strategy and IT consulting services to public sector customers.
- Precise presents applications to **empower consumers and government** agencies to **take actions** necessary for **better health and better life**.
- **Precise** is taking the lead in 4IR (the Fourth Industrial Revolution) technologies such as AI and Blockchain.





Applied Artificial Intelligence for Better Health Solutions

'Better Health, Better Life and Live Well'

Precise Software presents the following applications to **empower consumers and government** agencies to **take actions** necessary for **better health and better life**.

PillSafe with Google AutoML

Pill Recognition and Adverse Event Alert



AI/ML Use Case:

PillSafe with Google AutoML

It is reported that **roughly 125,000 Americans die every year as a result of adverse events**; for example, **50% don't take their drugs** as prescribed or take the wrong meds.

Precise responded with **PillSafe**, an application that promotes drug adverse event awareness, drug interaction awareness among patients leveraging **big data analytics, image recognition, mobile** and **cloud technologies**.



PILLSAFE



Prescription Drug Challenges

187M

Americans use
prescription
drugs

58%

Americans on
at least one
drug

110M

Prescriptions per
year that are never
picked up

50%

Don't take
medicines as
prescribed

125K

Americans die
every year as a
result



PillSafe

1

Medication
Management

2

Drug Recall, Blackbox,
Interaction and
Dosage Alert

3

Adverse Event
Reporting

4

Clinical Trial, Generic Drug
and Therapeutic group
Information

5

Social Media for
Epidemic
Awareness



Pill Recognition

1

Identify drug name
by [taking pictures](#)
of the pill

2

Identify drug
which is not in the
[personal drug list](#)

3

Provide [drug information](#)
such as dosage and drug
interaction

4

Replenish NIH drug
[image library](#)

AutoML Vision Process for Model Training

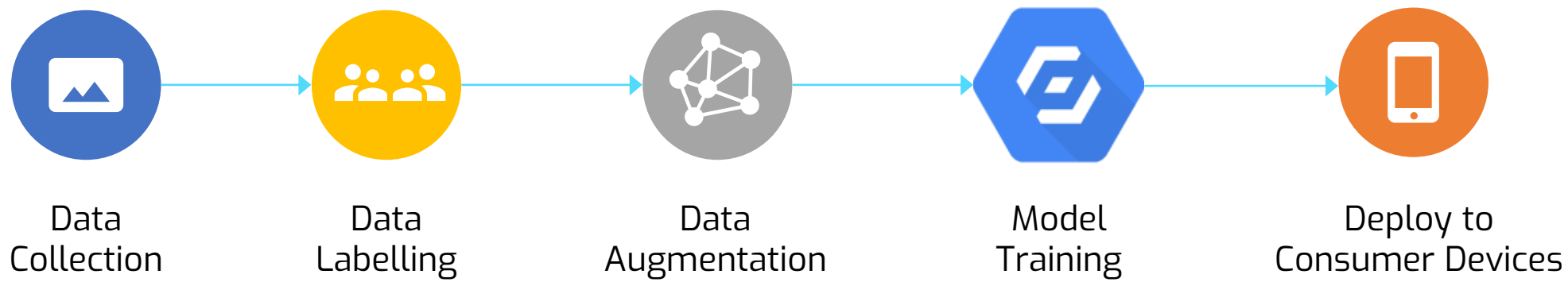
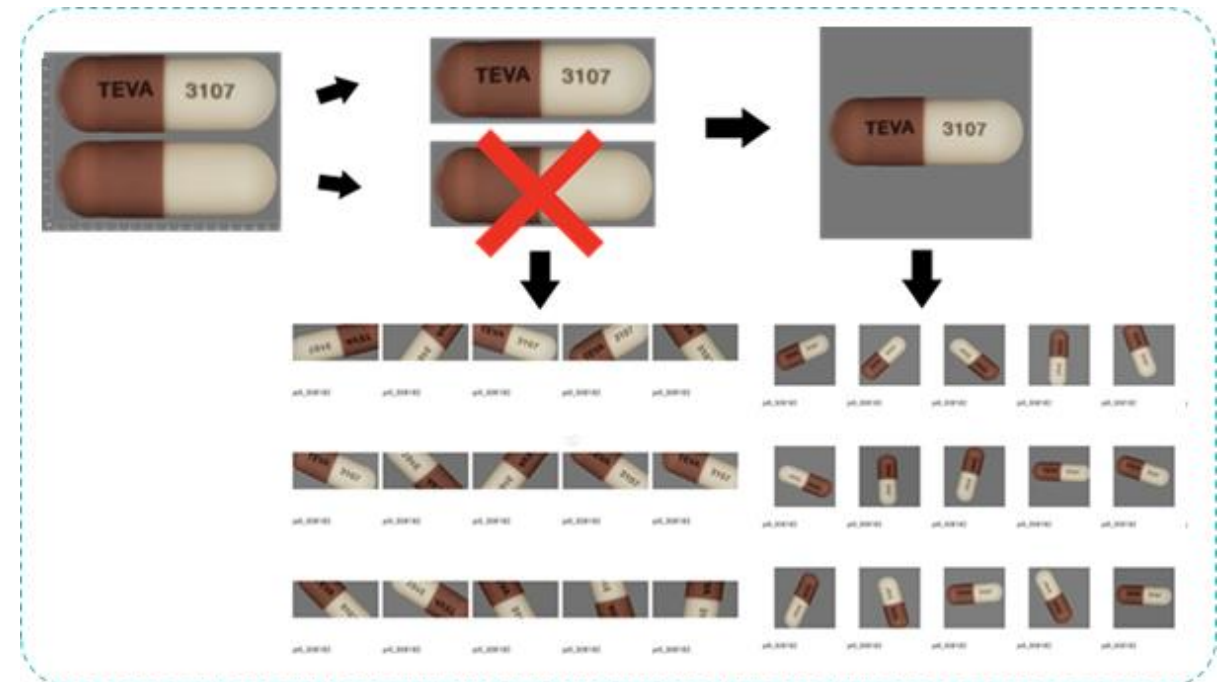


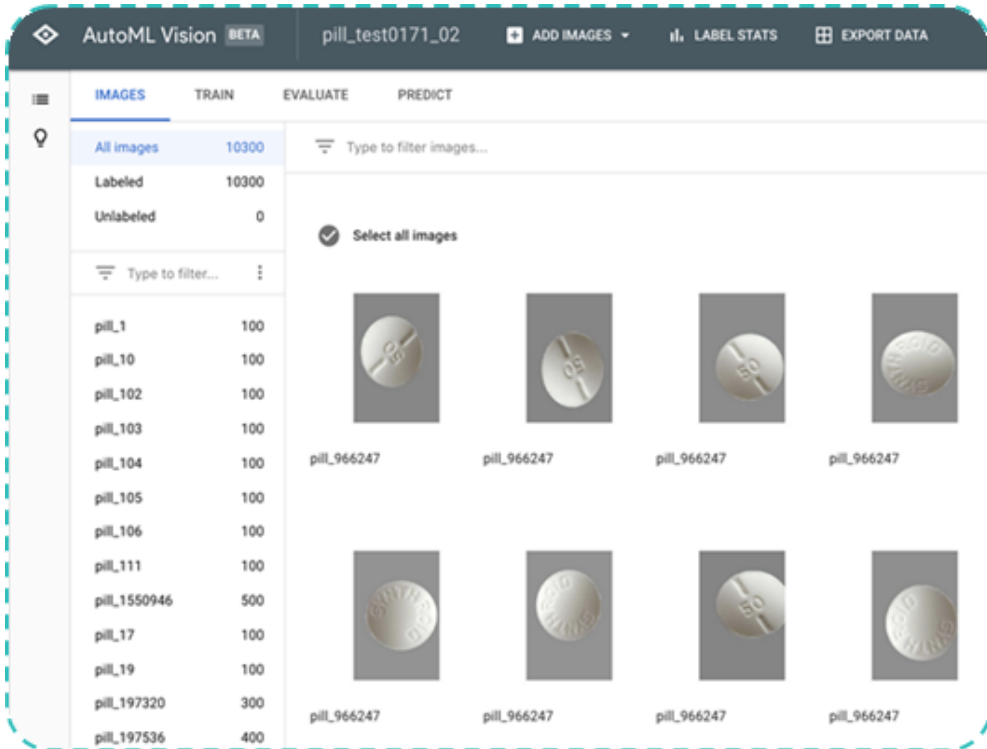


Image Augmentation

Image augmentation helps to [generate more training data](#) based on original image data. It includes three transformations :

- ✓ Cropping the image
- ✓ Rotating the image
- ✓ Zooming in and out on the image





AutoML Vision BETA pill_test0171_02 ADD IMAGES LABEL STATS EXPORT DATA

IMAGES TRAIN EVALUATE PREDICT

All images 10300
Labeled 10300
Unlabeled 0

Type to filter images...

Select all images

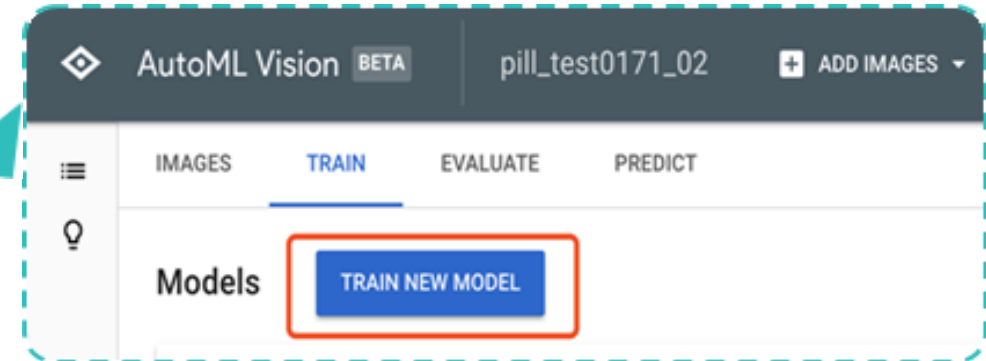
Type to filter...

Label	Count
pill_1	100
pill_10	100
pill_102	100
pill_103	100
pill_104	100
pill_105	100
pill_106	100
pill_111	100
pill_1550946	500
pill_17	100
pill_19	100
pill_197320	300
pill_197536	400

pill_966247 pill_966247 pill_966247 pill_966247

pill_966247 pill_966247 pill_966247 pill_966247

Step 1: Prepare Images



AutoML Vision BETA pill_test0171_02 ADD IMAGES

IMAGES TRAIN EVALUATE PREDICT

Models **TRAIN NEW MODEL**

Step 2: Train Model



Test your model on new images

Test your model on new images

Test your model on new images

pill_856892 0.975

pill_210673 0.975

pill_250mg 0.975

Step 3: Predict

Pill Safe Using AutoML Vision

Key User Activities

- ✓ Take photo and automatically identify pill
- ✓ Get information about medication (dosage, description, warnings etc)
- ✓ Add to regular medication schedule

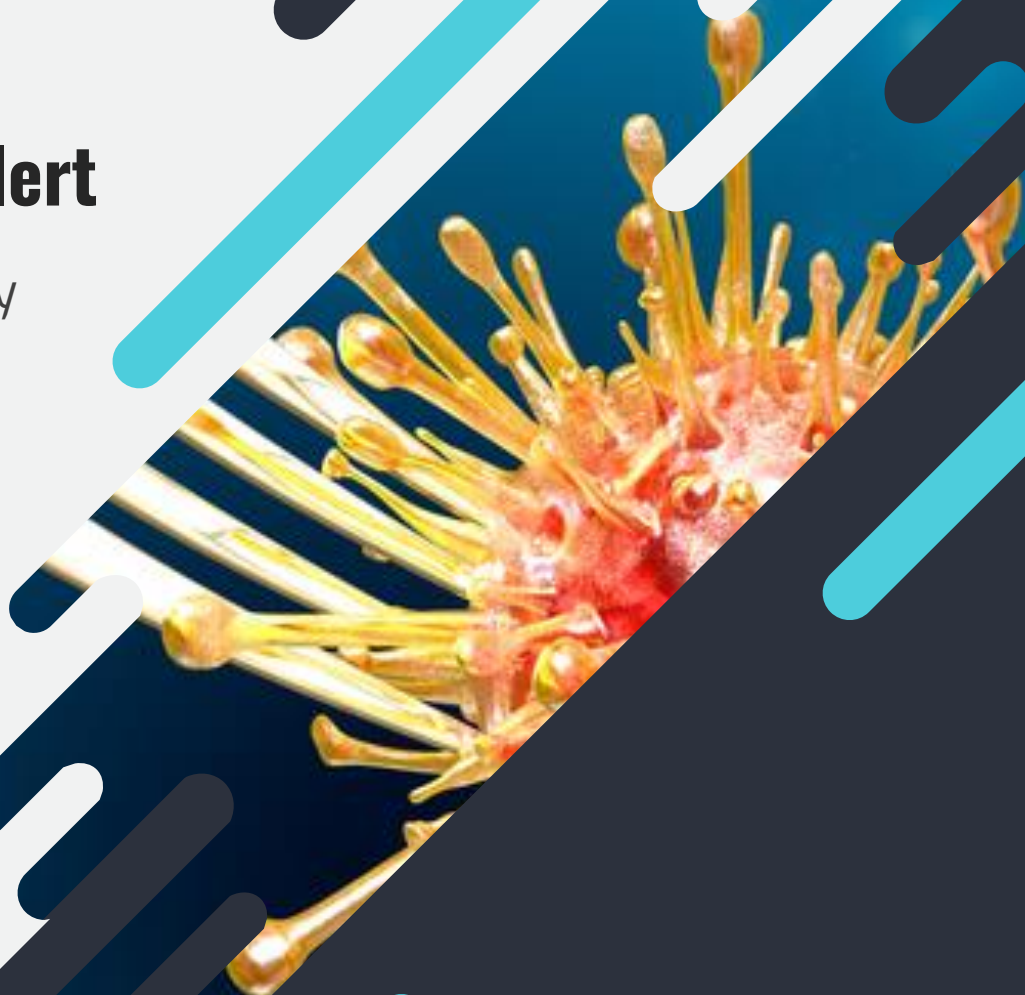


Pill Safe Mobile App Demo

Food Outbreak Signal Alert

Social Media Alert for Community
Food Safety

'Beyond Our Innovation Lab'

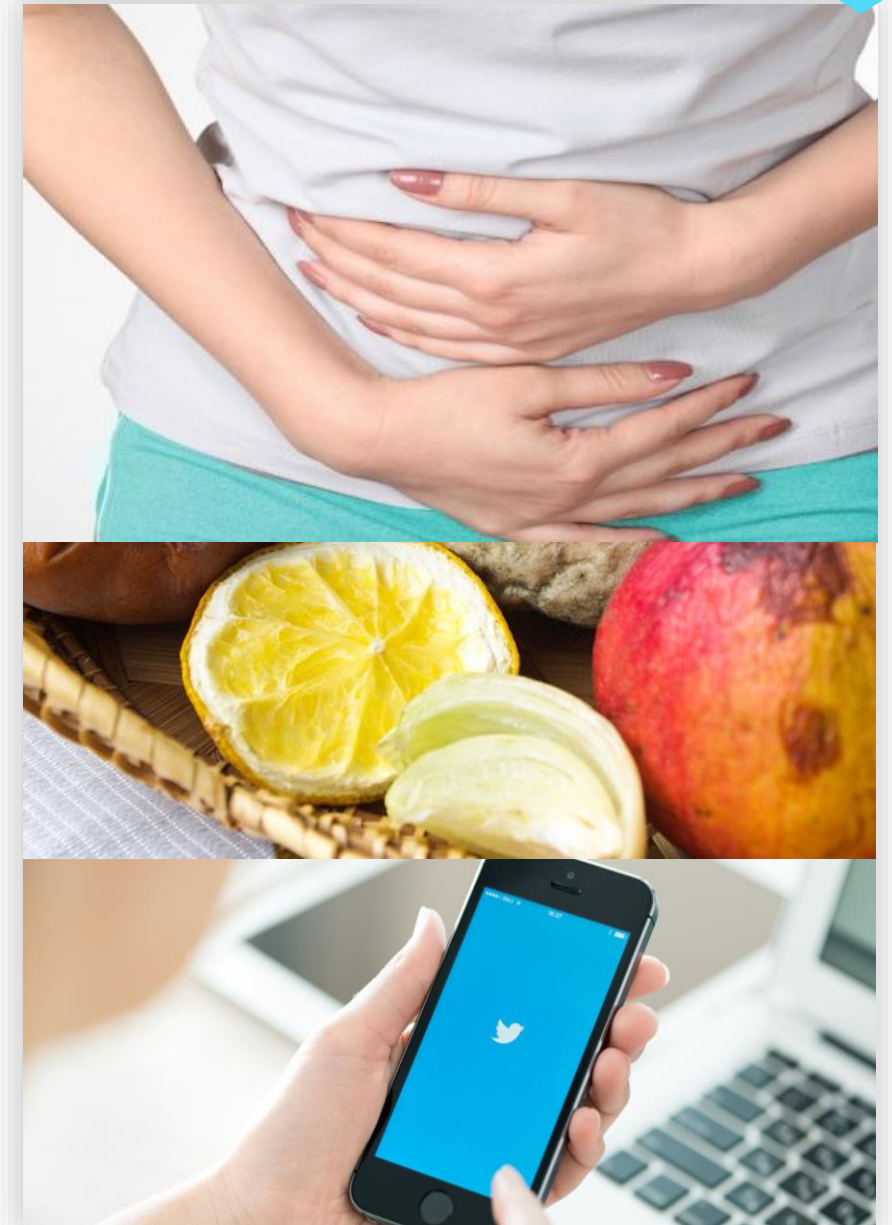


AI/ML Use Case Using Twitter:

Food Outbreak Signal Detection

Food safety concern: The potential risk and outbreak of the food safety or food poisoning problems is a serious national crisis that affects public health as well as social and economic welfare.

Food outbreak signal detection application has the capability of finding potential signals from social media. Solution is driven by **Google's latest Nature Language Model BERT** which provides a better understanding of the human spoken words.

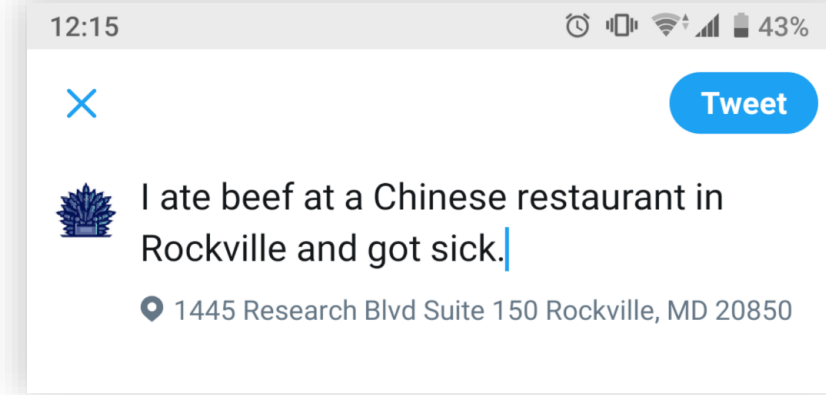


Solution – How It Works

Food Outbreak Detection - **Google's latest Nature Language Model BERT**



Eat poisonous food



Post On Twitter

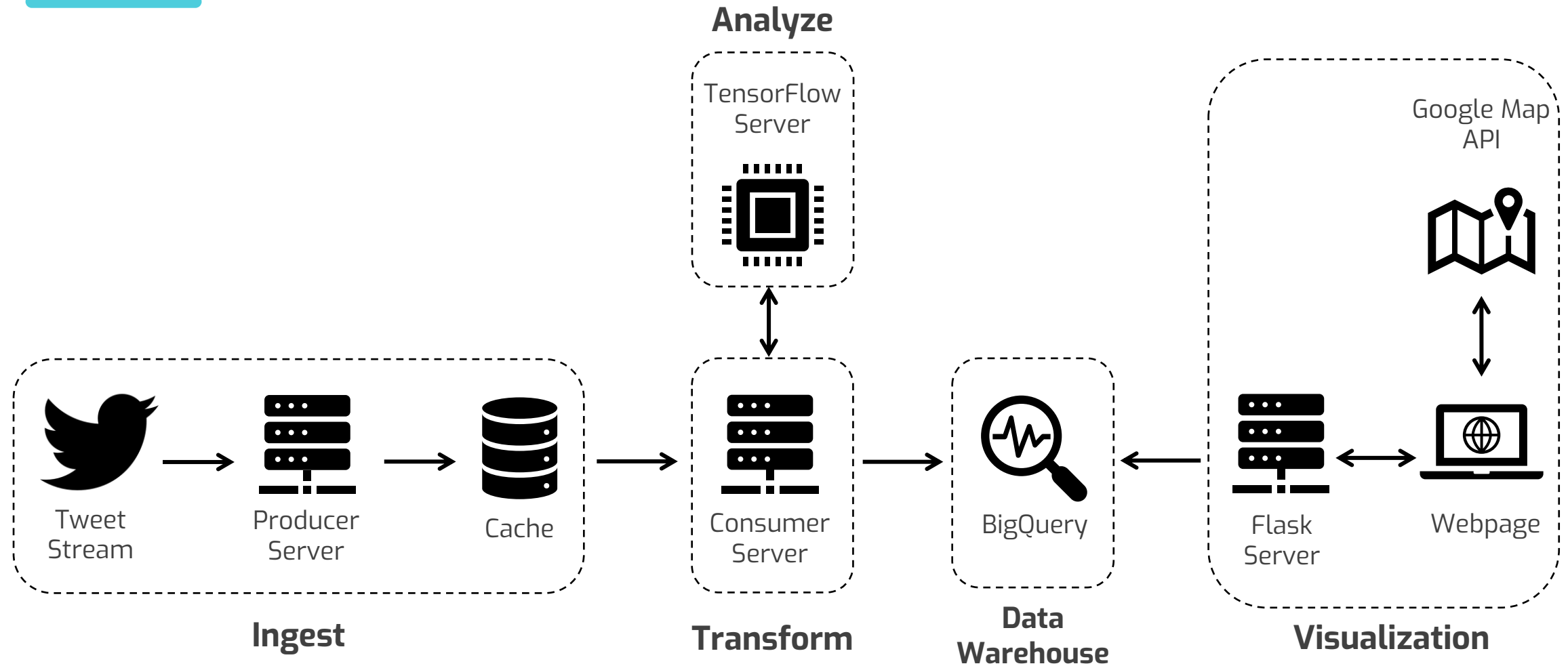


Capture and Display on the map



Report Statistics of Food Poisoning Around the country

System Flowchart



Counterfeit Drug Detection

Counterfeit Drug Detection with
Google Machine Learning



AI/ML Use Case:

Counterfeit Drugs Problems

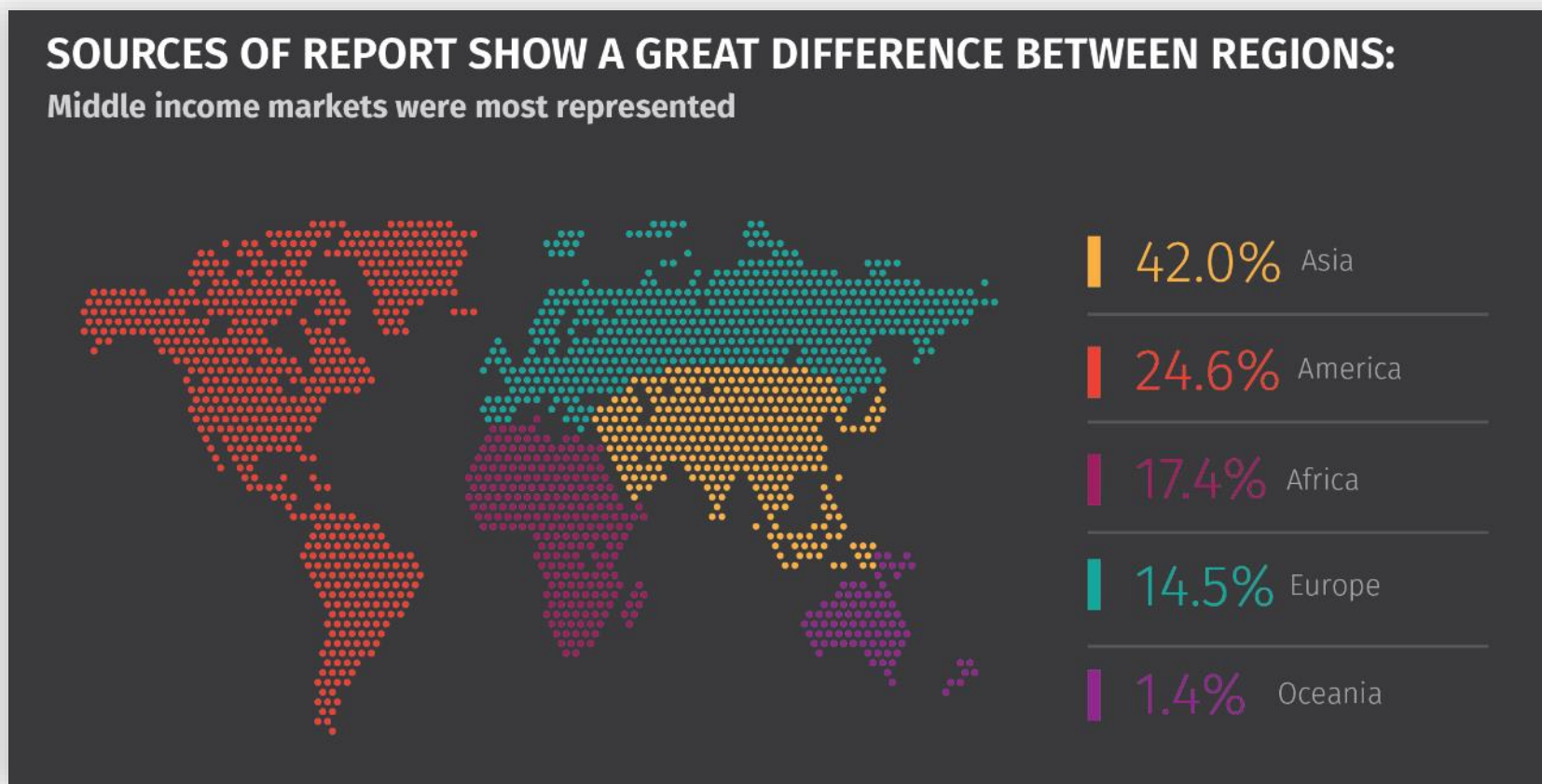
Counterfeit drugs problem: Misuse of counterfeit drugs that may contain the wrong active ingredients, harmful ingredients, or even poisons is a serious public threat. Furthermore, the new online pharmacies that sell drugs from other countries increase the risk. It is very difficult for consumers to distinguish the counterfeit drugs and authentic drugs.

Counterfeit drug detection project aims to help consumers, pharmacists and regulatory agencies detect counterfeit drugs in the market to ensure public health.



Problem

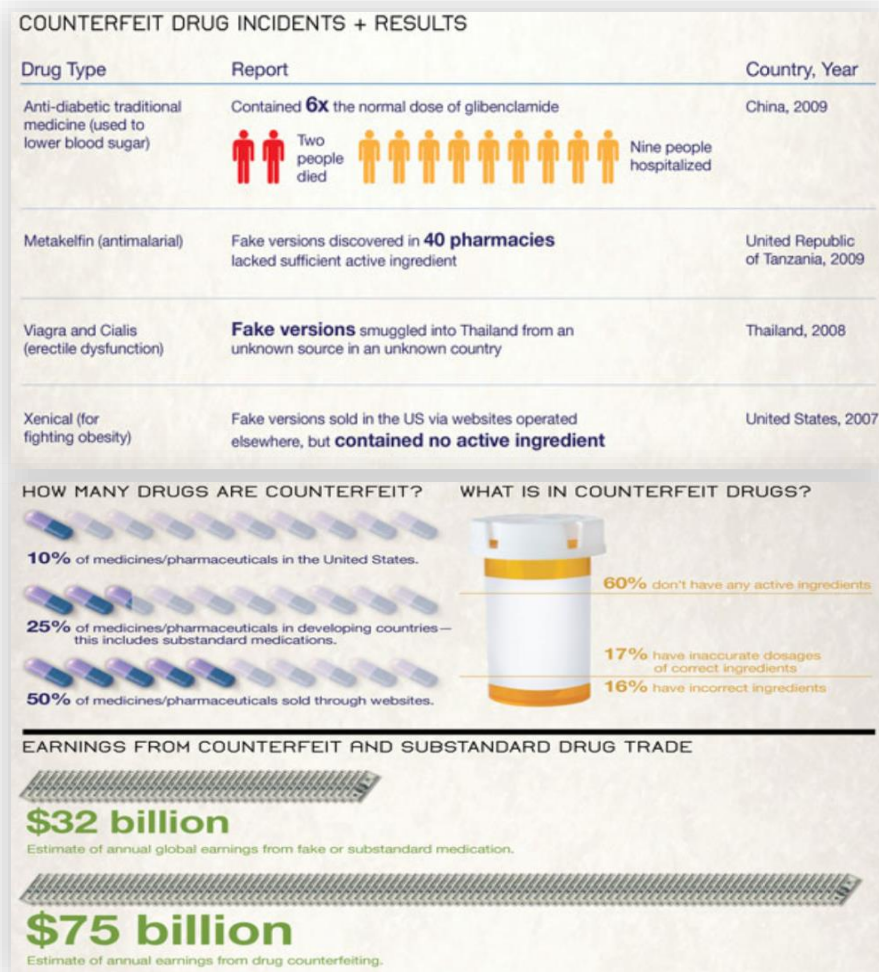
Counterfeit Detection



Mackey, Tim K et al. "Counterfeit drug penetration into global legitimate medicine supply chains: a global assessment." *The American journal of tropical medicine and hygiene* vol. 92,6 Suppl (2015): 59-67. doi:10.4269/ajtmh.14-0389

Problem

Counterfeit Detection



1

Human Health Risk

2

Huge Market Impact

3

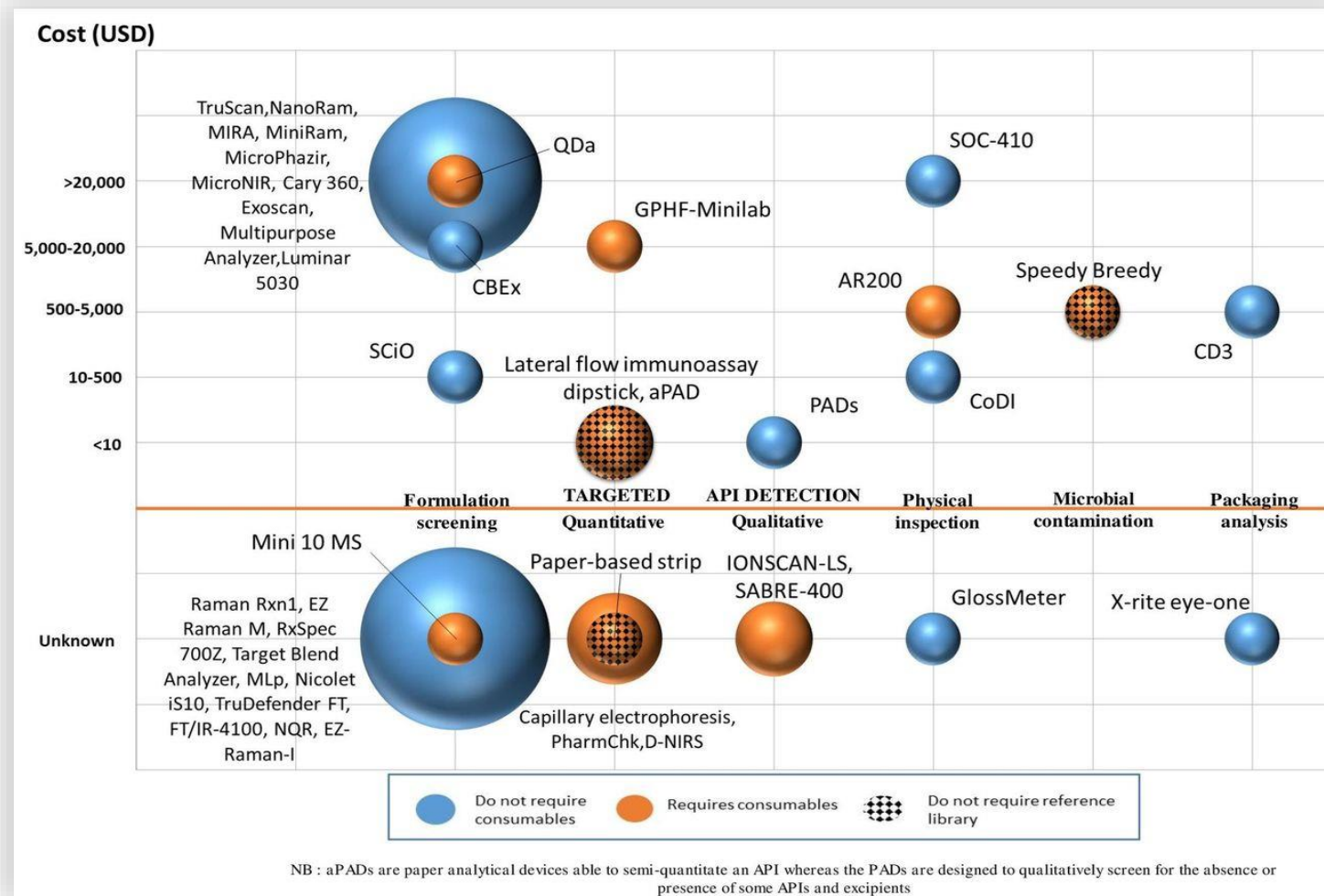
Legitimate Company Loss

4

World Wide Influence

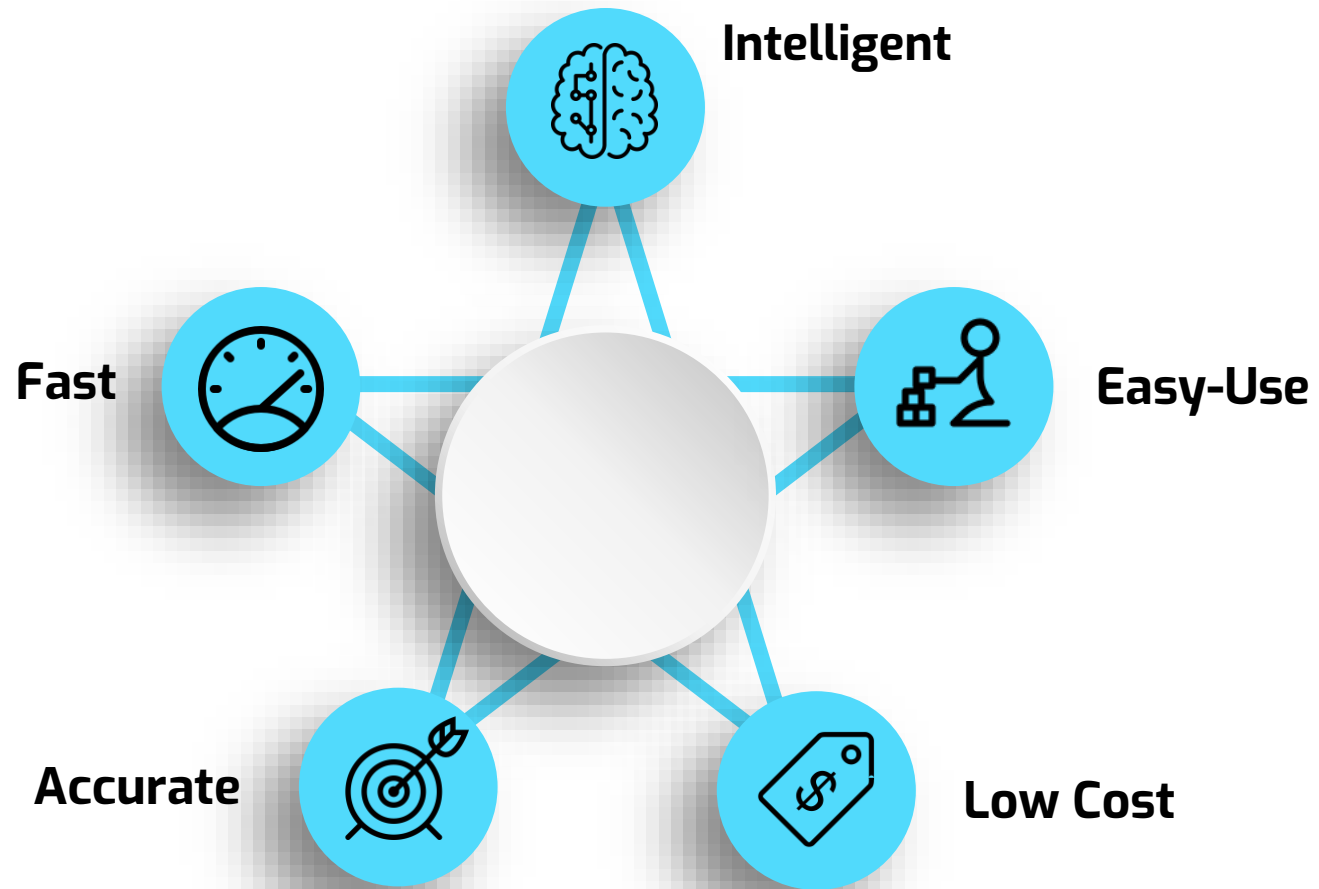
Market Survey

Counterfeit Detection



Target

Counterfeit Detection



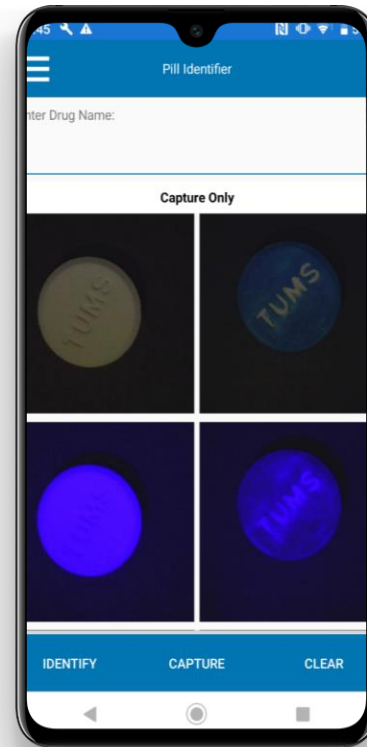
Solution – How It Works

Counterfeit Drug Detection – Google's Tensorflow Process Unit (TPU)



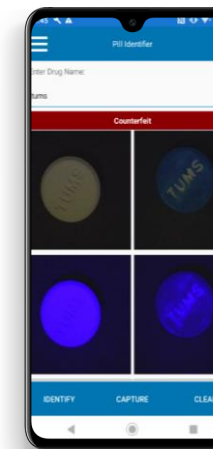
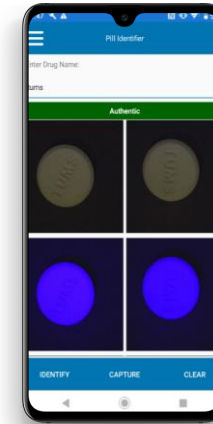
Step 1

Put drugs in the black box



Step 2

Open the app and type in the drug name.
Then click "identify" to start detection

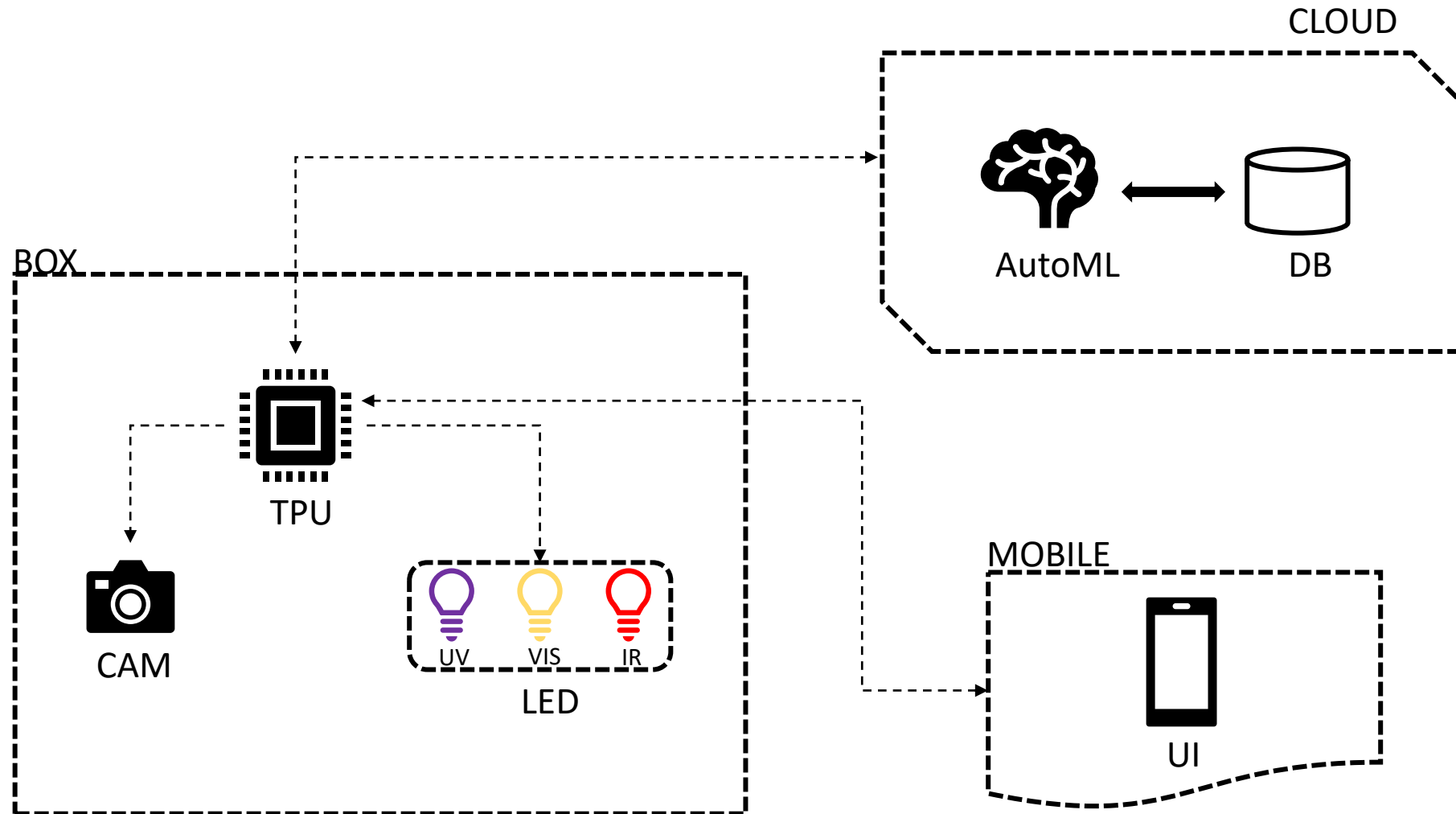


Step 3

Get the result

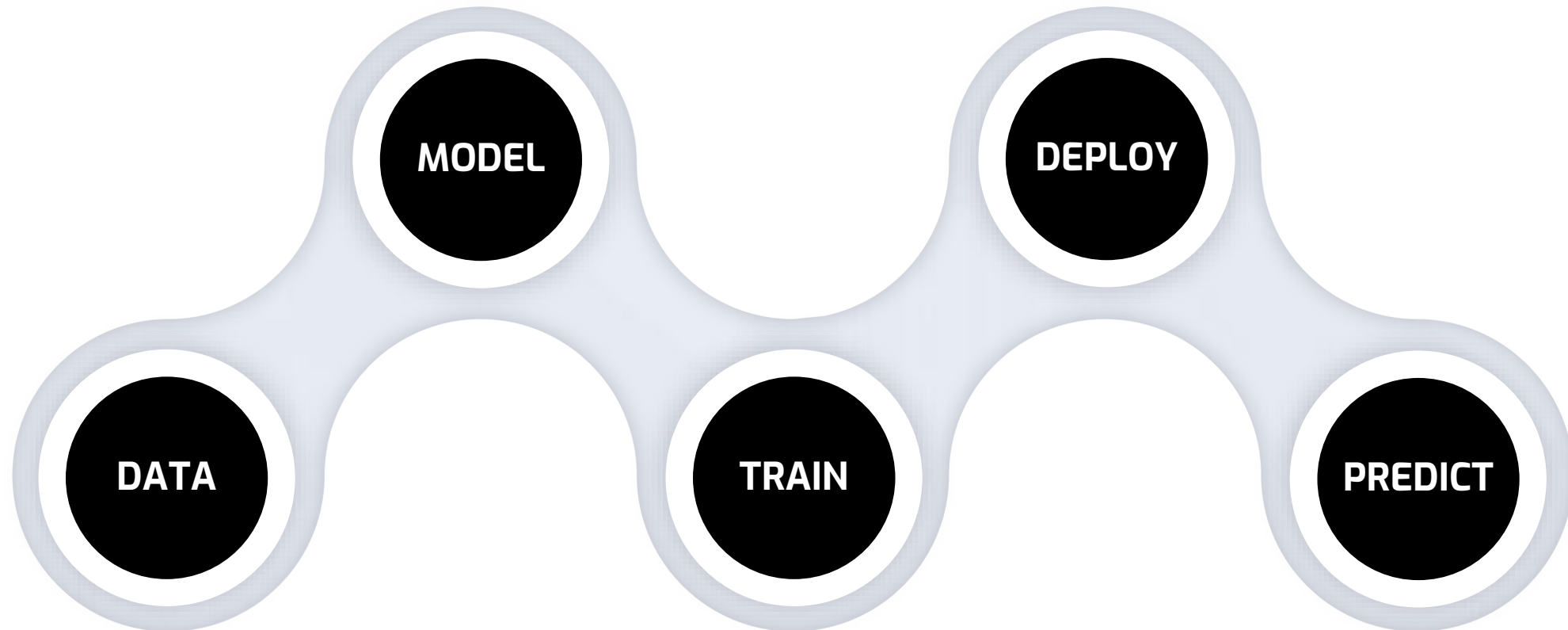
Architecture

Counterfeit Detection



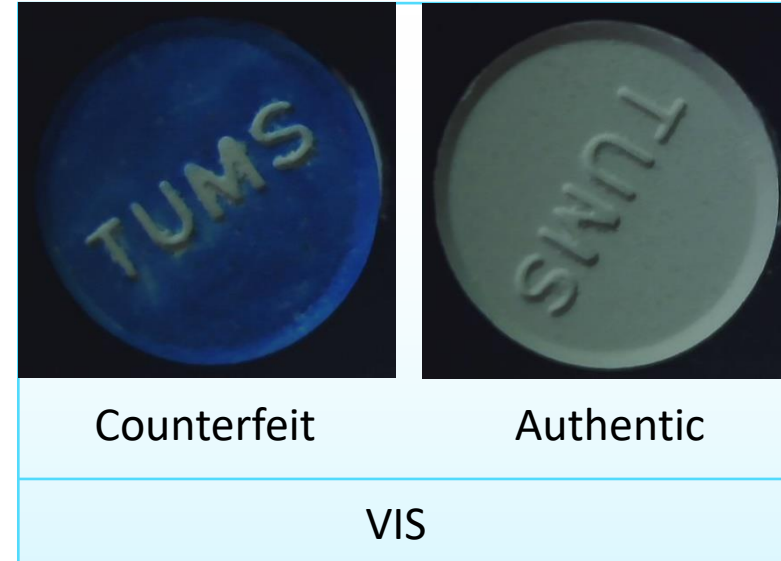
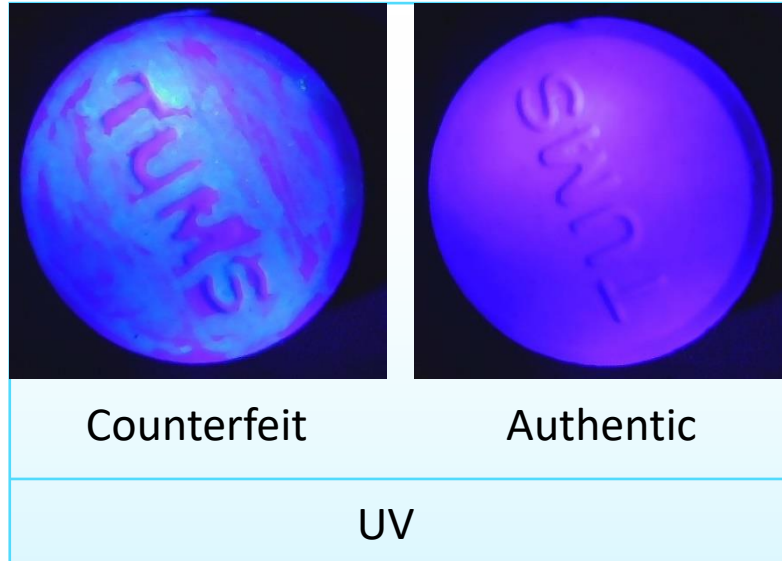
Workflow

Counterfeit Detection



Images

Counterfeit Detection



AutoML

Counterfeit Detection

AutoML Vision **BETA** TUMS_VIS_V4 **+** ADD IMAGES **||** LABEL STATS **⌘** EXPORT DATA counterfeit-detection **▾**

IMAGES TRAIN EVALUATE **PREDICT**

Model
TUMS_VIS_V4 **▾**

Test your model on new images

If your model will be used to make predictions on people, test your model on images that capture the diversity of your userbase. [Learn more](#) **▯**

UPLOAD IMAGES

Use your Edge model

TF LITE CONTAINER EDGE DEVICES GOOGLE CLOUD

1. Download a sample camera app from the TF Lite documentation site: [Android](#) **▯** [iOS](#) **▯**
2. Export your model as a TF Lite package.
Destination folder on Cloud Storage
<gs://counterfeit-detection-vcm/models/edge/1CN4412522880183034881/> **▯**

EXPORT

AutoML

Counterfeit Detection

AutoML Vision **BETA** TUMS_VIS_V4 + ADD IMAGES LABEL STATS EXPORT DATA counterfeit-detection

IMAGES TRAIN EVALUATE PREDICT


All images 7000
Labeled 7000
Unlabeled 0

Type to filter images...

Type to filter... :

Authentic 5000
Counterfeit 2000
[Add label](#)

Type to filter images...



Counterfeit Counterfeit Counterfeit Counterfeit Counterfeit Counterfeit

Counterfeit Counterfeit Counterfeit Counterfeit Counterfeit Counterfeit

AutoML

Counterfeit Detection

The screenshot displays the AutoML Vision interface for a project named "TUMS_VIS". The top navigation bar includes "AutoML Vision BETA", "TUMS_VIS", "ADD IMAGES", "LABEL STATS", and "EXPORT DATA". The current view is "counterfeit-detection". The main navigation tabs are "IMAGES", "TRAIN", "EVALUATE", and "PREDICT", with "TRAIN" selected. A "Models" section contains a "TRAIN NEW MODEL" button. The model "TUMS_VIS_v20190620195546" is shown with the following details:

Created	Analyzed	Edge	Avg precision	Precision	Recall
Jun 20, 2019 1 compute hour	7000 images 2 labels, 679 test images	Higher accuracy 105 msec, 5.6 MB	1.0	100.0%	100.0%

Precision and recall are based on a score threshold of 0.5.

Buttons at the bottom: [SEE FULL EVALUATION](#), [RESUME TRAINING](#), and a help icon.

Detection

Counterfeit Detection

1 cfdd capture

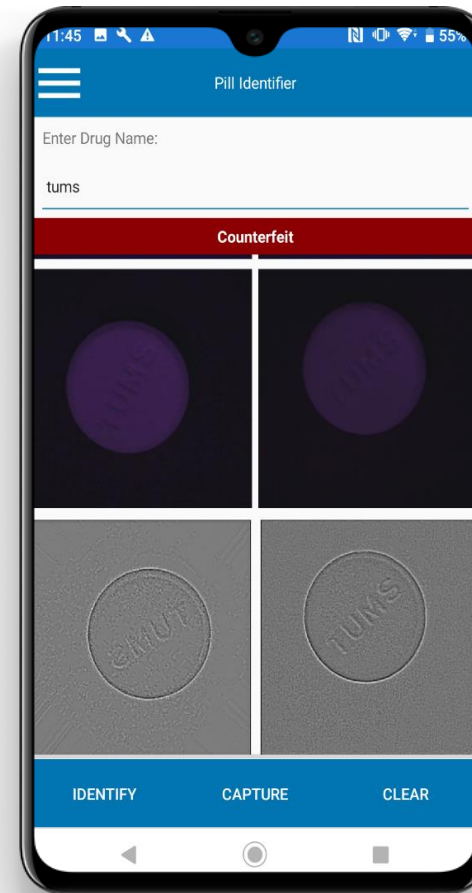
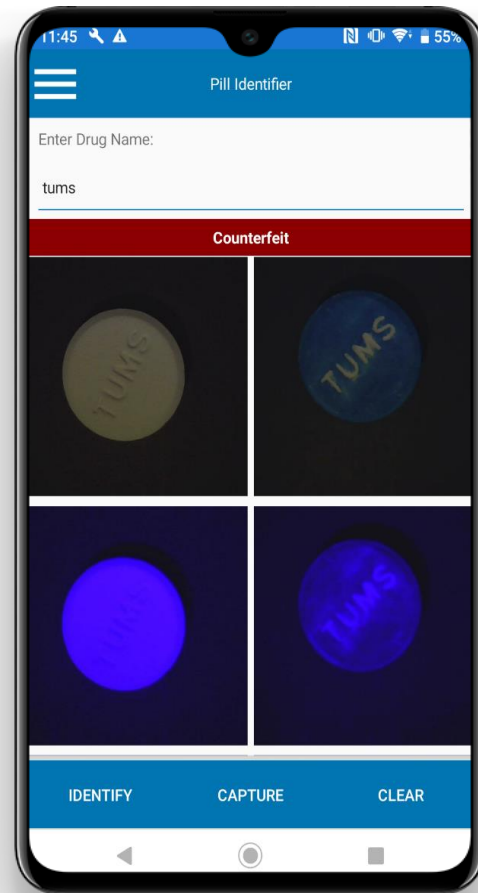
2 cfdd detect tums



```
mendel@zippy-finch:~$ sudo cfdd detect tums
start detection...
Saved to: /tmp/cfdd_outputs/cfdd_capture_20190724-172834.jpg
Saved to: /tmp/cfdd_outputs/cfdd_capture_20190724-172835.jpg
Saved to: /tmp/cfdd_outputs/cfdd_capture_20190724-172836.jpg
UV detection finished.
-----
authentic
Score : 0.917969
VIS detection finished.
-----
authentic
Score : 0.578125
-----
counterfeit
Score : 0.421875
IR detection finished.
-----
authentic
Score : 0.789062
-----
counterfeit
Score : 0.210938
Imp detection finished.
-----
authentic
Score : 0.960938
Final result: authentic
done.
```

Interface

Counterfeit Detection



Innovation Use Cases

Summary of Applications

Pill Recognition Adverse Event Alert

It is reported that roughly 125,000 Americans die every year as a result of adverse events; 50% don't take drug as prescribed or take the wrong meds. Precise responded with PillSafe, an application that promote drug adverse event awareness, drug interaction awareness among patients leveraging big data analytics, image recognition, mobile and cloud technologies.

Food Outbreak Signal Alert

Food safety outbreak detection application has the capability of identifying and alerting potential food outbreak signals from social media analysis using the latest Nature Language Processing (NLP) model and Google Map.

Counterfeit Drugs Detection

Misuse of counterfeit drugs that may contain the wrong active ingredients, harmful ingredients, or even poisons is a serious public health threat. Our Counterfeit drug detection project aims to help consumers, pharmacists and regulatory agencies detect counterfeit drugs in the market to ensure public health using the all-spectrum image recognition and hardware-based real-time ML technologies.

Thank you!

Q&A

PRESENTERS/FACILITATORS:

Ben Duan, Phd., Chief Technology Officer

Xin Liu, MD, Technical Director

Ellen Crayton, MBA, Executive Enterprise Architect