



Serverless Machine Learning



Yufeng Guo

@YufengG

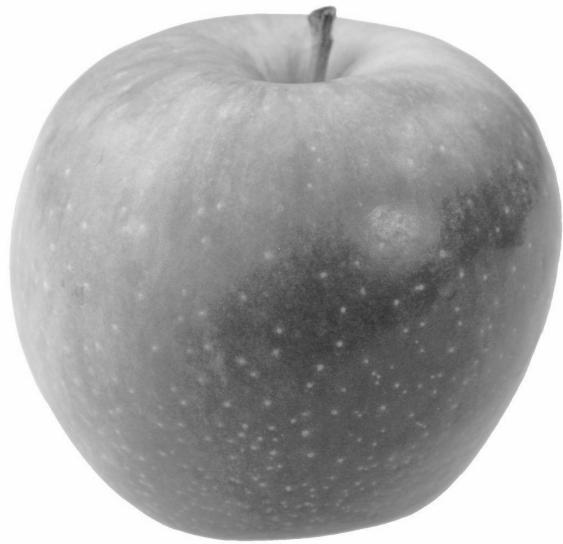
Developer Advocate, Machine Learning

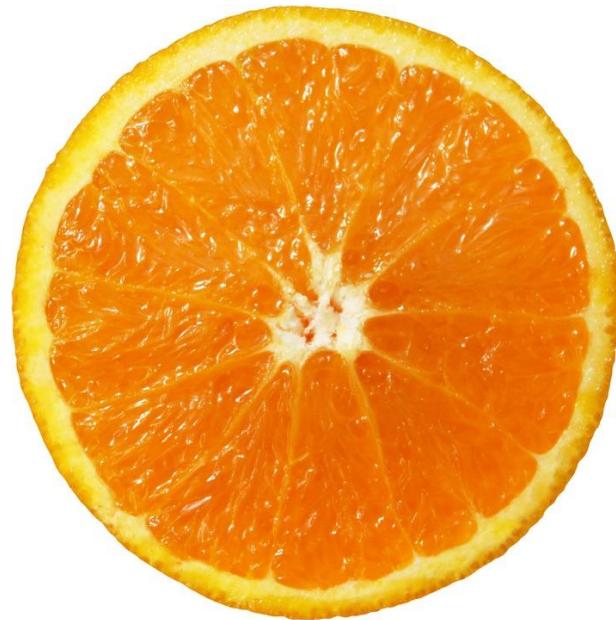
yufengg.com

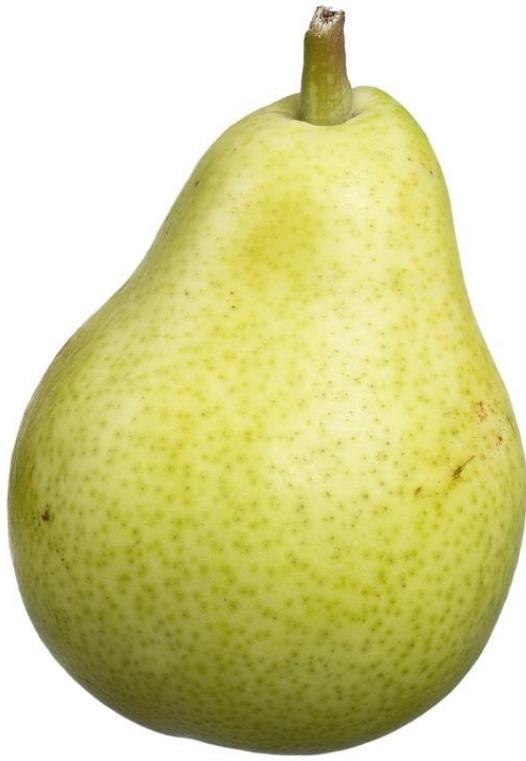
Machine Learning
is
using many **examples**
to ***answer questions***

Let's try some
human-powered image
detection









An easy example



Puppy
or
muffin?



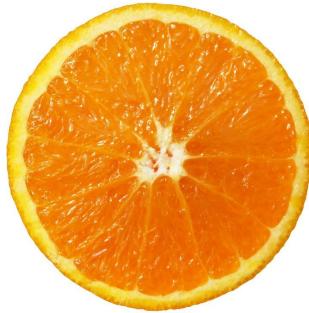
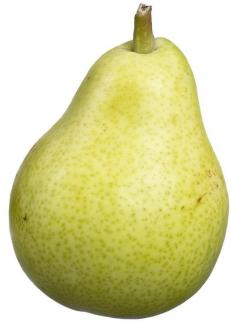
source: boredpanda.com



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Sloth or
chocolate
croissant?





Training

many
examples

Prediction

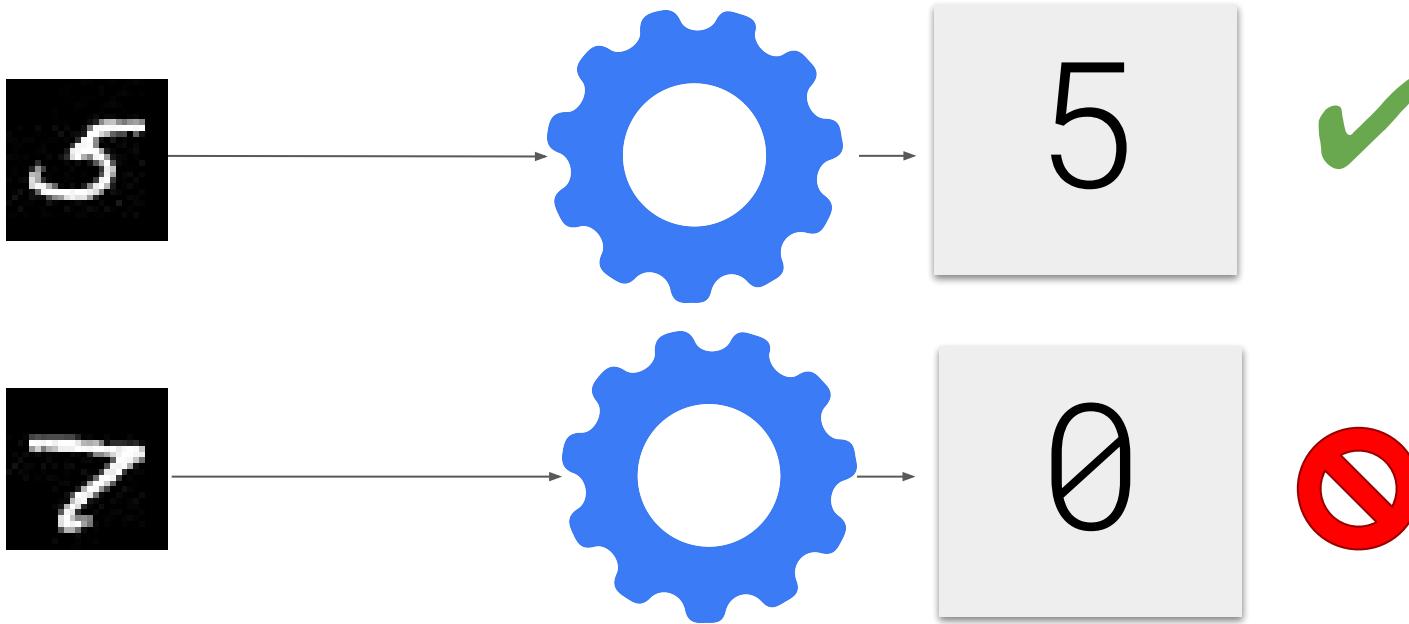
***answer
questions***



Training
many
examples

Prediction
answer
questions

Serverless Machine Learning Demo



Training new models today
is
complicated and manual.

We want:

Add files -> train models

Machine Learning **training workflow**

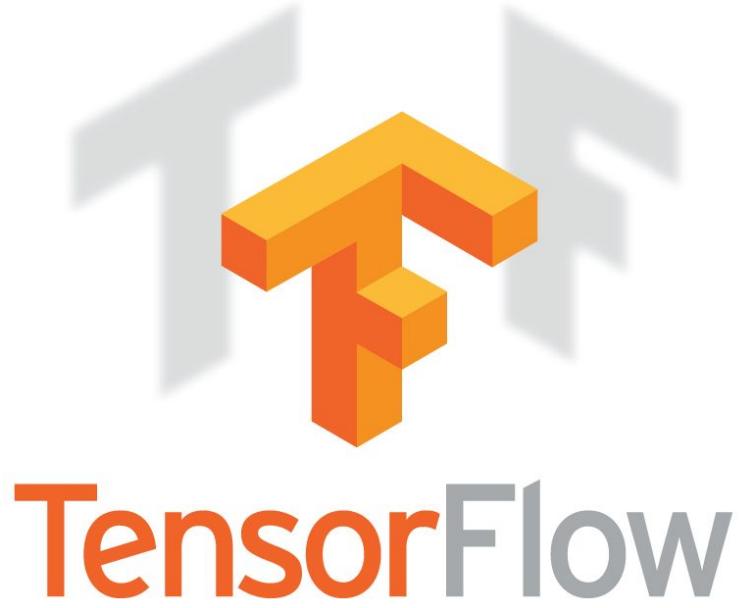
1. Process/clean data
2. Store data for training
3. Update trained model
4. Deploy new model

Write and test locally

Deploy and run with
serverless pipeline

What library to use for machine learning?

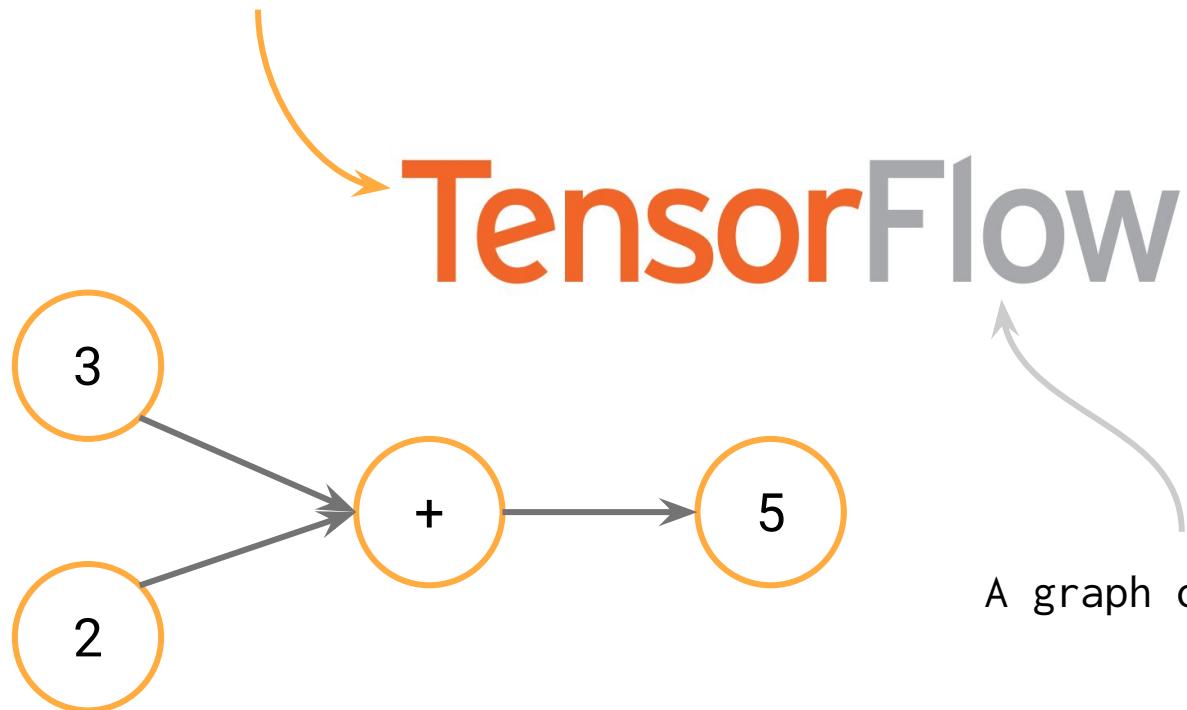




- Fast, flexible, and scalable open-source machine learning library
- For research and production
- Distributed training and serving predictions
- Apache 2.0 license

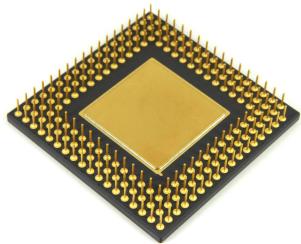
<https://research.googleblog.com/2017/02/announcing-tensorflow-10.html>

A multidimensional array.



A graph of operations.

TensorFlow Supports Many Platforms...



CPU



GPU



TPU



Android



iOS



Raspberry
Pi

To the code!



Write a regex to create a tag group × Split on underscores Data download linksTooltip sorting method: **default** Smooth: 

Horizontal Axis

STEP RELATIVE WALL

Runs

Write a regex to filter runs

- model_WIDE_AND_DEEP_1491606384
- model_WIDE_AND_DEEP_1491606384 /eval
- model_WIDE_AND_DEEP_1491615704
- model_WIDE_AND_DEEP_1491615704 /eval
- model_WIDE_AND_DEEP_1491918397
- model_WIDE_AND_DEEP_1491918397 /eval
- model_WIDE_AND_DEEP_1491921074
- model_WIDE_AND_DEEP_1491921074 /eval
- model_WIDE_AND_DEEP_1491921647
- model_WIDE_AND_DEEP_1491921647 /eval
- model_WIDE_AND_DEEP_1491969471

accuracy

3

auc

1

dnn

5

global_step

1

input_producer

1

label

2

loss

1

precision

1

recall

1

tensorboard --logdir=models/



Where do we run our machine learning?



Cloud Machine Learning Engine





Training
many
examples

Prediction
answer
questions

Our application



Serverless

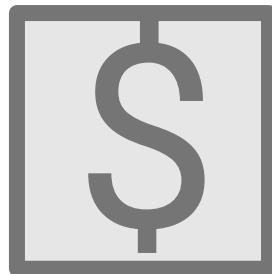
No managing
servers



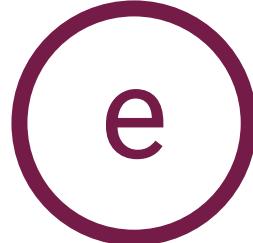
Automatic
scaling



Only pay for what
you use



Event-driven

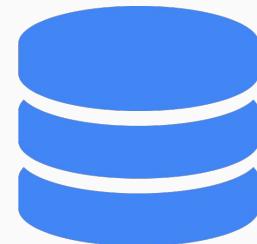




How to glue our pieces together?



Cloud Functions



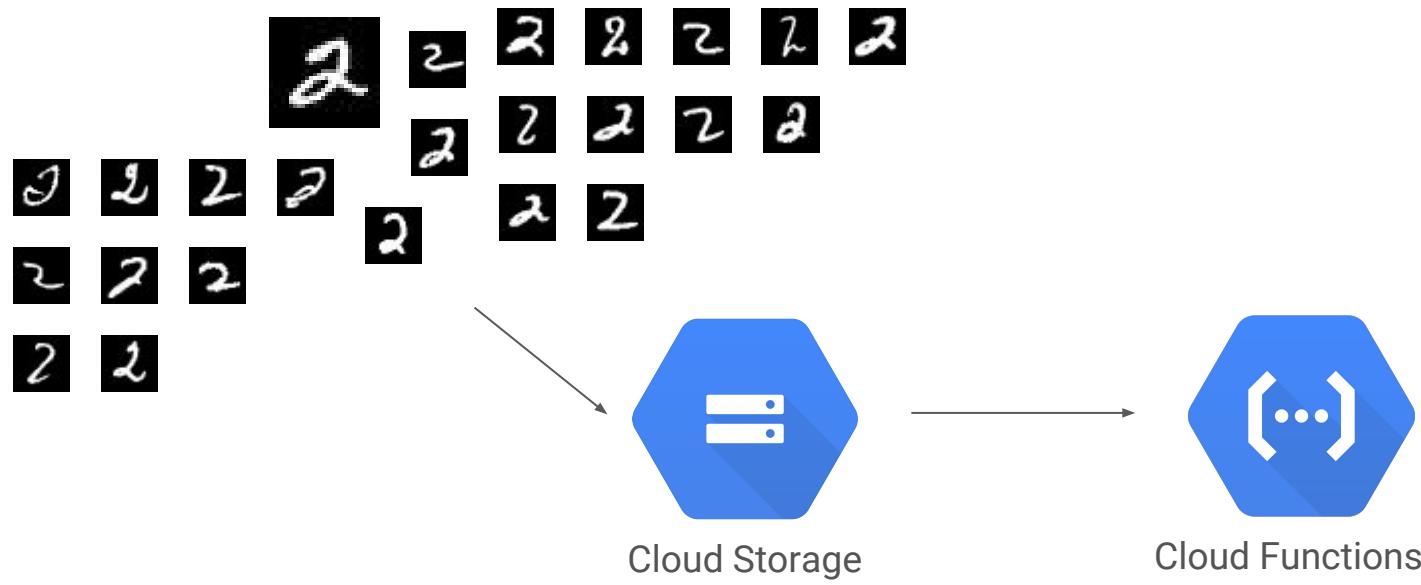
Phase 1: Training

Serverless training pipeline

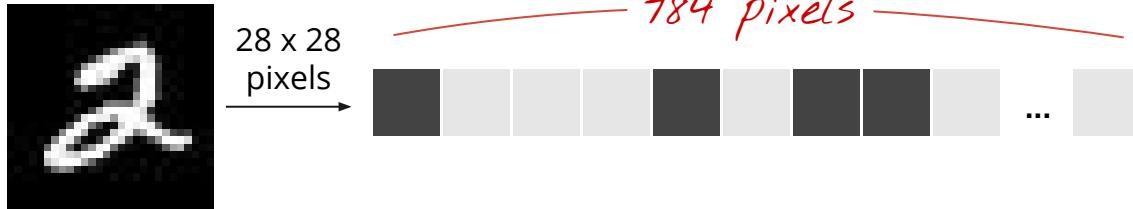


1. Preprocess data
2. Save to database
3. Batch new data
4. Train on new batch & deploy

Drop a bunch of images into Cloud Storage

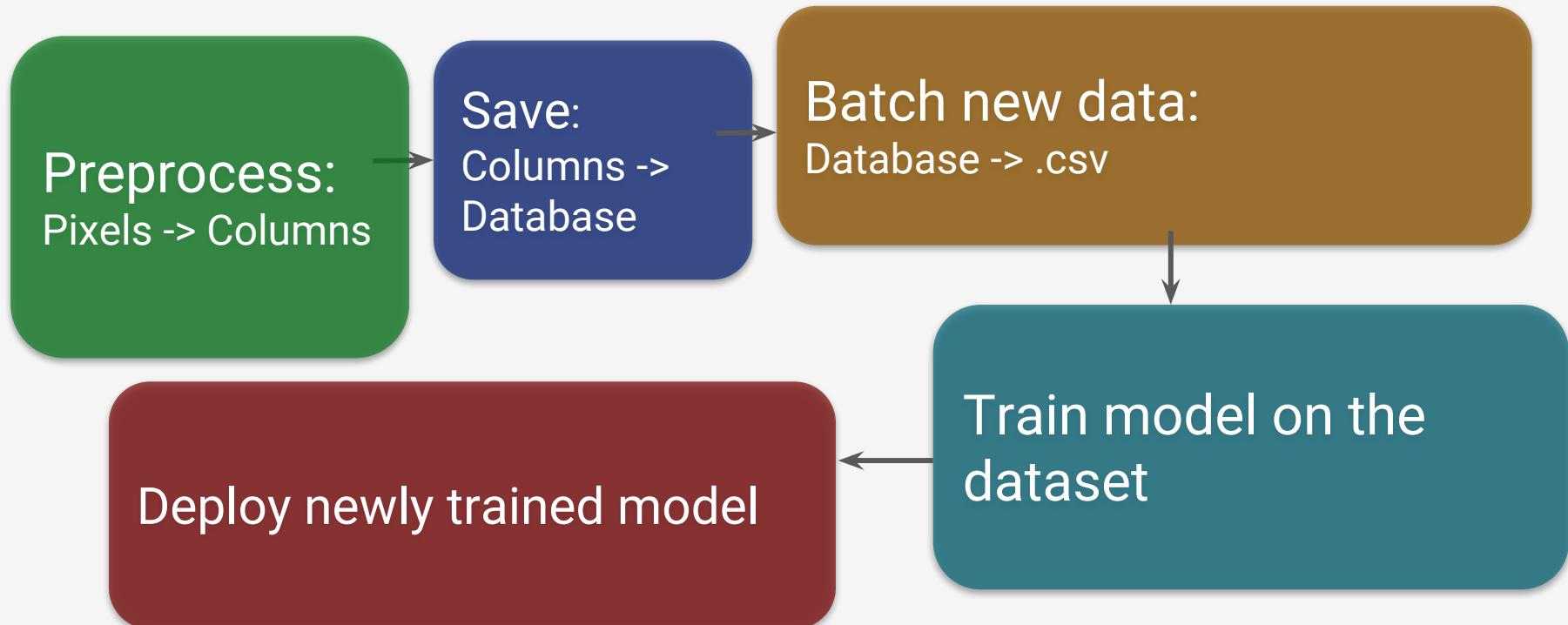


Preprocess data: extract image properties

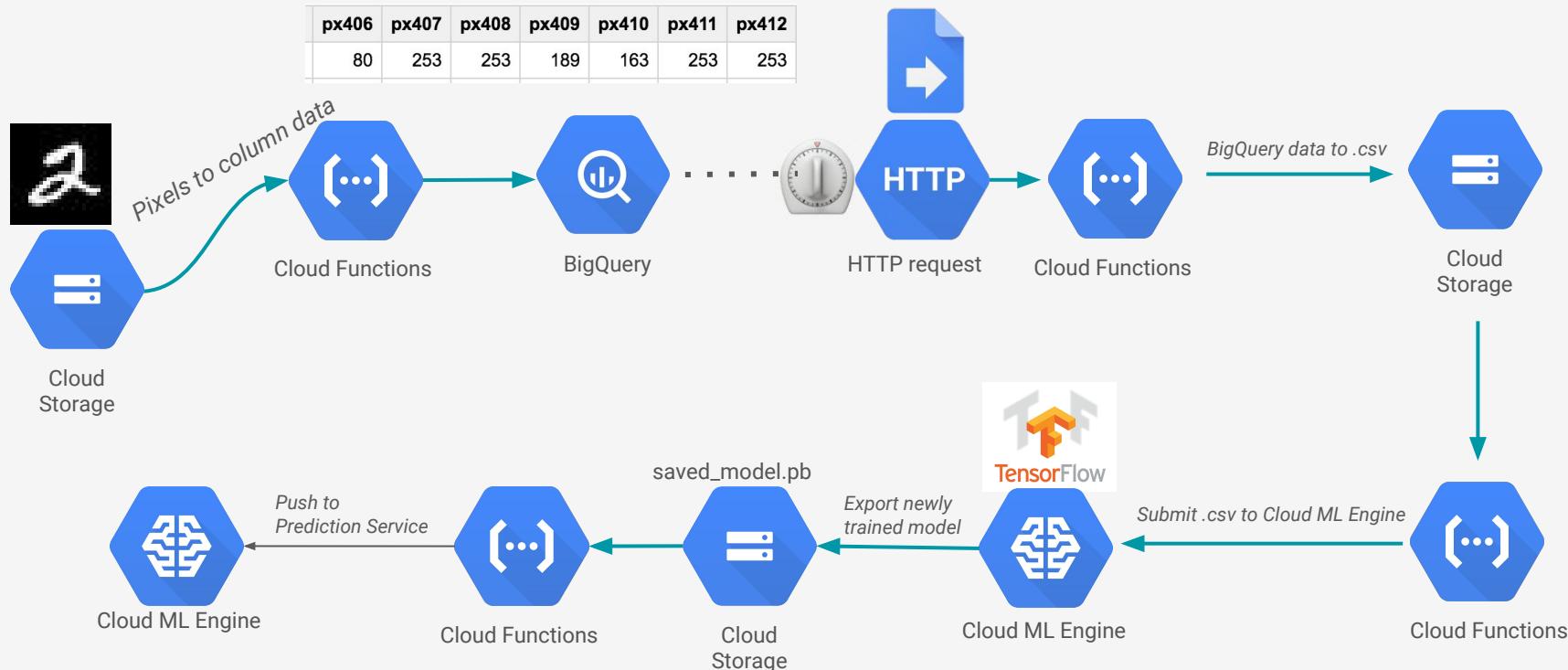


Row	digit	time	filename	px0	px1	px395	px396	px397	px398	px399	px400	px401	px402	px403	px781	px782	px783	
1	2	2017-06-15 10:40:24 UTC	/tmp/27472.png	0	0	0	87	253	253	253	58	0	0	0	0	0	0	
2	2	2017-06-15 10:41:38 UTC	/tmp/5191.png	0	0	0	0	10	217	253	253	148	0	0	0	0	0	0
3	2	2017-06-15 10:40:19 UTC	/tmp/25683.png	0	0	0	117	253	253	229	25	0	0	17	0	0	0	
4	2	2017-06-15 10:40:01 UTC	/tmp/20289.png	0	0	0	66	248	253	253	55	0	0	0	0	0	0	0
5	2	2017-06-15 10:41:11 UTC	/tmp/43133.png	0	0	58	253	253	253	193	0	0	0	0	0	0	0	0
6	2	2017-06-15 10:41:42 UTC	/tmp/53239.png	0	0	0	58	253	253	253	96	0	0	0	0	0	0	0
7	2	2017-06-15 10:41:52 UTC	/tmp/56821.png	0	0	197	253	208	60	0	0	0	0	0	0	0	0	0
8	2	2017-06-15 10:41:55 UTC	/tmp/57899.png	0	0	0	255	215	0	0	0	0	0	0	0	0	0	0
9	2	2017-06-15 10:41:28 UTC	/tmp/47036.png	0	0	3	175	253	253	253	253	202	26	0	0	0	0	0
10	2	2017-06-15 10:41:11 UTC	/tmp/43105.png	0	0	255	255	0	0	0	0	0	0	0	0	0	0	0

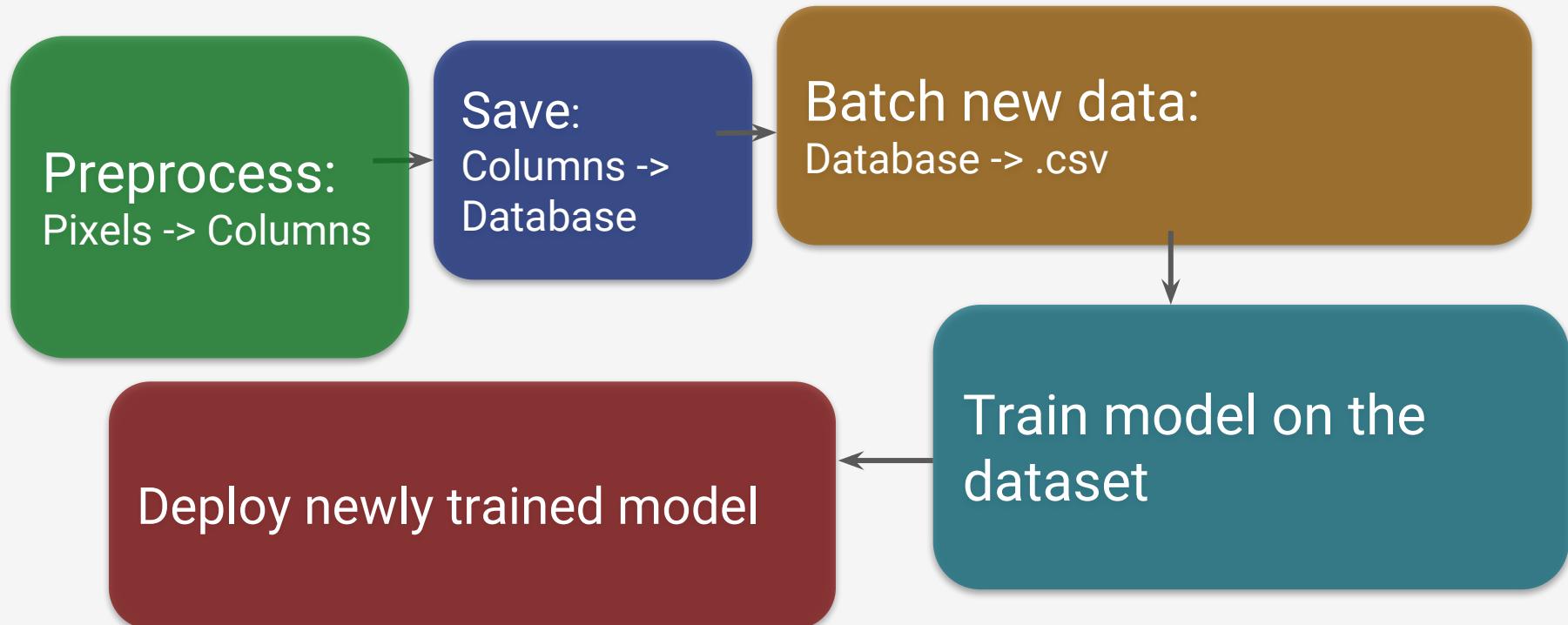
Serverless training pipeline



Serverless training pipeline

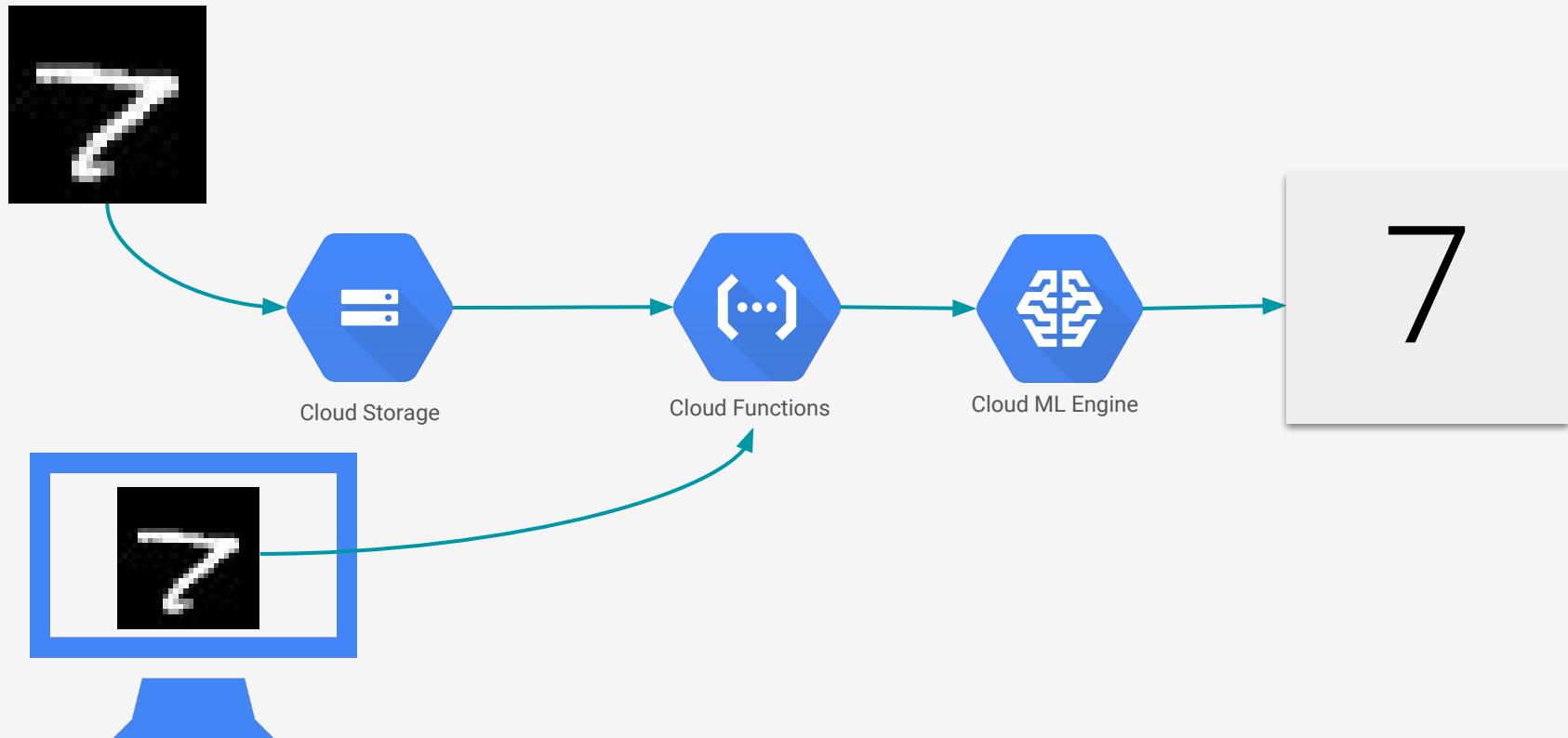


Serverless training pipeline



Phase 2: Prediction

Serverless prediction pipeline



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Do we know what
7s looks like?



Google Cloud

AI Adventures

Presents:

What is Machine Learning?

Yufeng Guo

Developer Advocate



bit.ly/ai-adventures

Exploring the art, science, and tools of machine learning

Thank you!



Yufeng Guo
@YufengG

Resources:

Cloud Machine Learning Engine
cloud.google.com/ml-engine

Cloud Functions
cloud.google.com/functions

TensorFlow
Tensorflow.org

Cloud AI Adventures Videos
bit.ly/ai-adventures



The End