arm

4 June 2018

Data Science Africa, Nyeri, Kenya

Deploying models

Damon Civin

Principal data scientist

@DCivin

With many thanks to Gen-Tao Chiang and Vikas Kache

Confidential Restricted © 2017 Arm Limited

My bio in 5 photos

MSc in applied maths and noise punk in South Africa

PhD in maths at Cambridge

Drove from Cambridge to Mongolia in a tiny car

Developer at a cyber-security startup

Data Science strategy at ARM

Confidential Restricted © 2017 Arm Limited

Outline

About me

Why do we do data science?

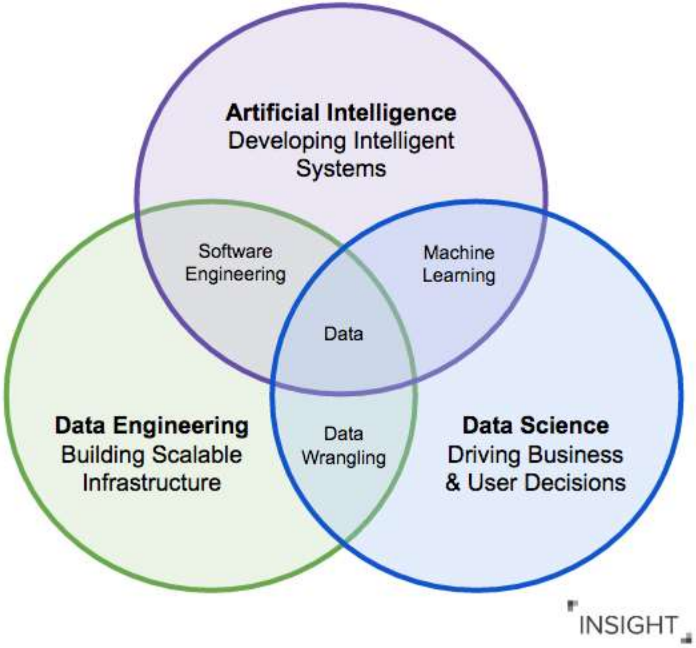
Making the promise of ML real: deployment (systems)

Demo: Clipper (RISE)

Best practices

 Confidential Restricted © 2017 Arm Limited

What is Data Science?



Confidential Restricted © 2017 Arm Limited

Why do we do data science?

New features

Optimising features

Dashboards for decision making

Ad-hoc analysis

Confidential Restricted © 2017 Arm Limited

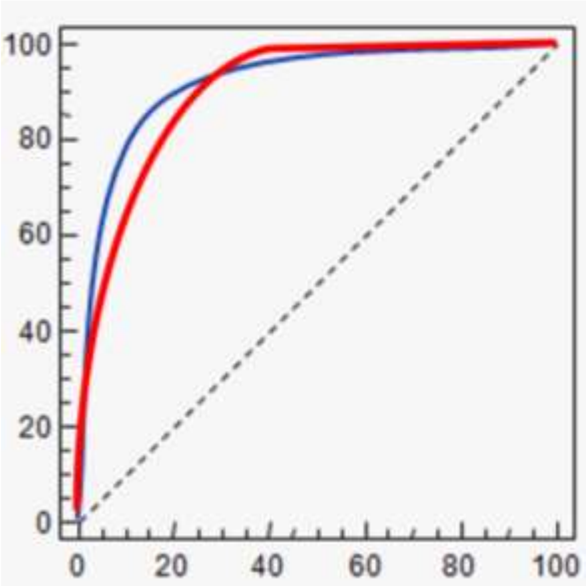
Why do we do data science?

Confidential Restricted © 2017 Arm Limited

Why do we do data science?

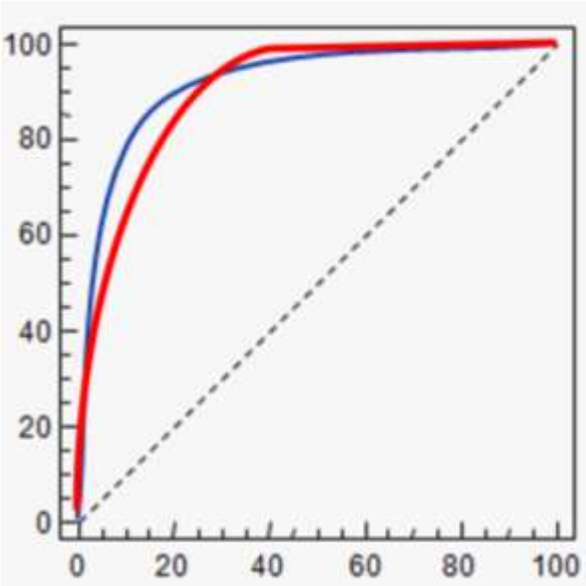
Confidential Restricted © 2017 Arm Limited

Why do we do data science?



Confidential Restricted © 2017 Arm Limited

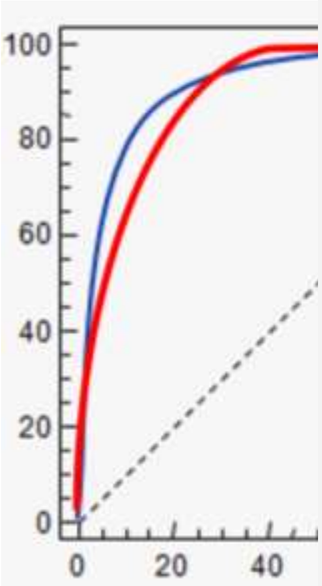
Why do we do data science?

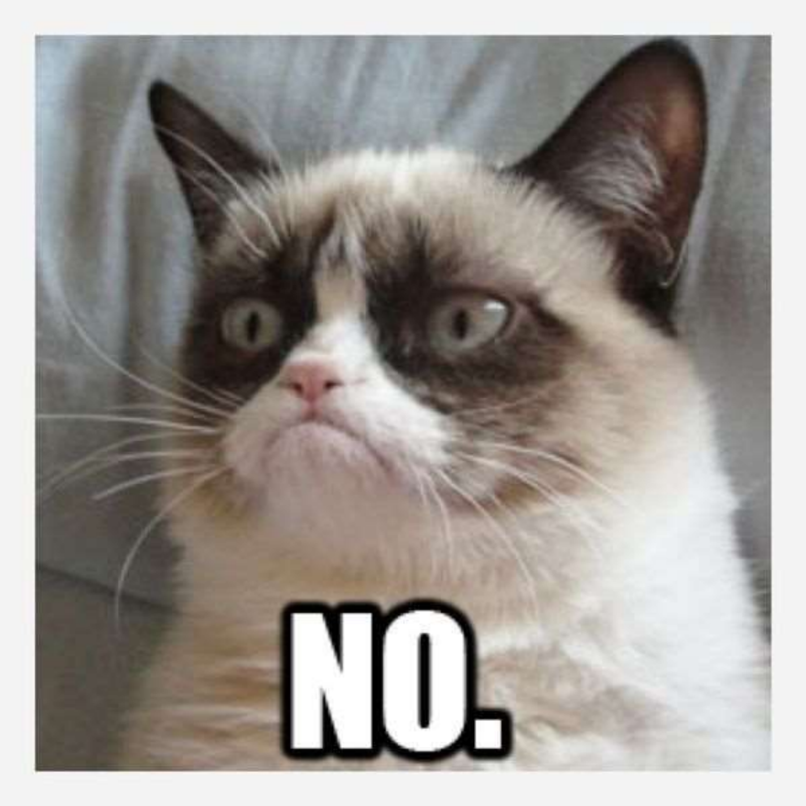


 Confidential Restricted © 2017 Arm Limited

arm

Why do we do data science?



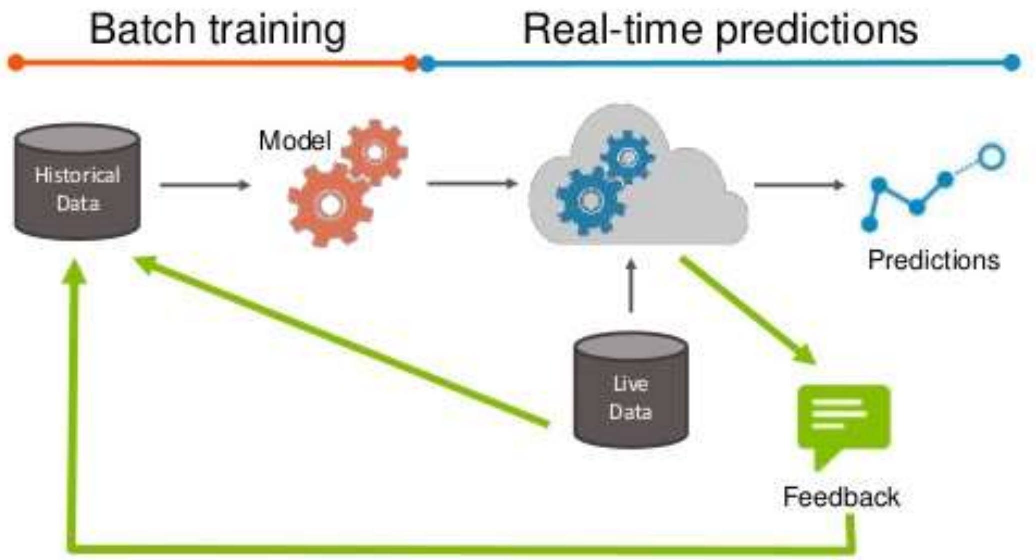


Confidential Restricted © 2017 Arm Limited

Deployment makes the promise of ML real

 Confidential Restricted © 2017 Arm Limited

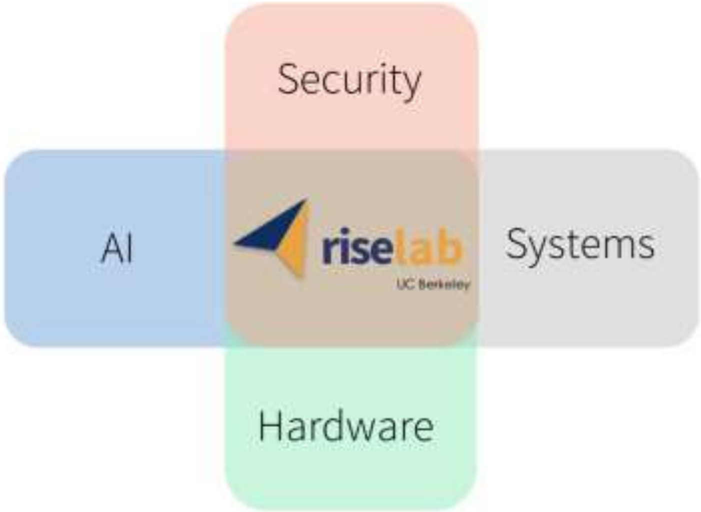
Deployment makes the promise of ML real



 Confidential Restricted © 2017 Arm Limited

arm

riselab
UC Berkeley



 Confidential Restricted © 2017 Arm Limited

arm

Simplifies integration of ML in apps
Clipper makes product teams happy.

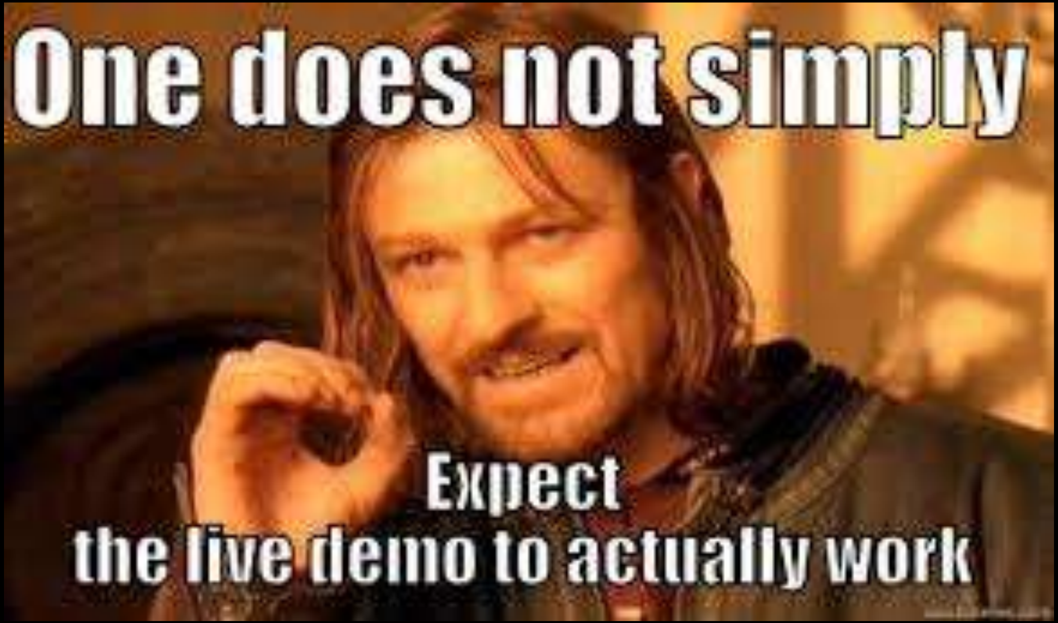
Simplifies model deployment
Clipper makes data scientists happy.

Throughput:
Clipper makes the infra-team less unhappy.

Accuracy:
Clipper makes users happy.

 Confidential Restricted © 2017 Arm Limited

Model deployment demo



 © 2017 Arm Limited

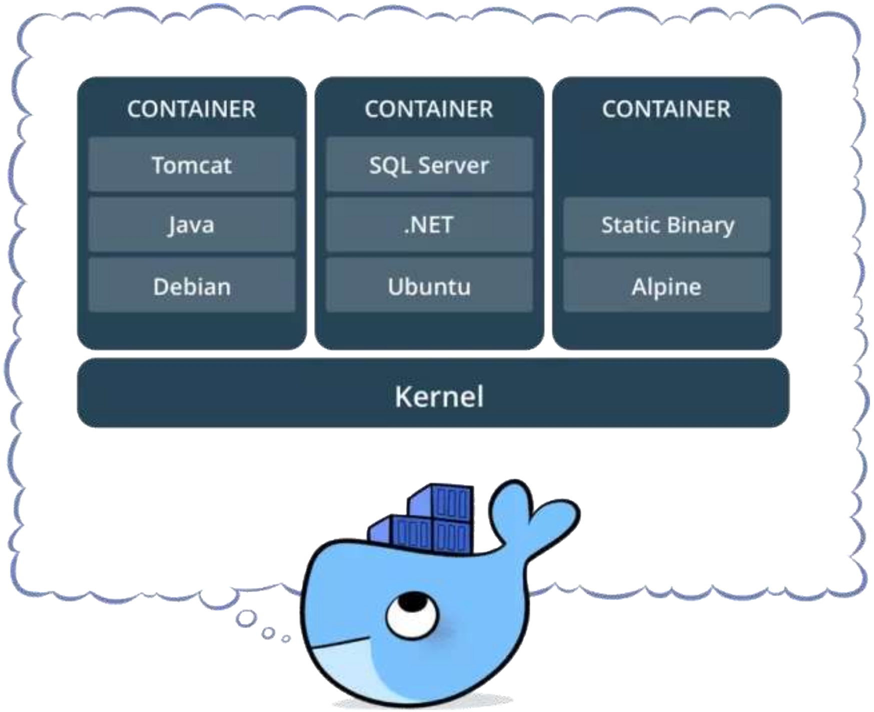
Try it!


```
curl -X POST -d '{"input": [4.3, 2.0,1.0, 0.1]}' 172.16.34.147:1337/iris/predict
```


Confidential Restricted © 2017 Arm Limited


I HAVE ONE QUESTION
HOW?!?

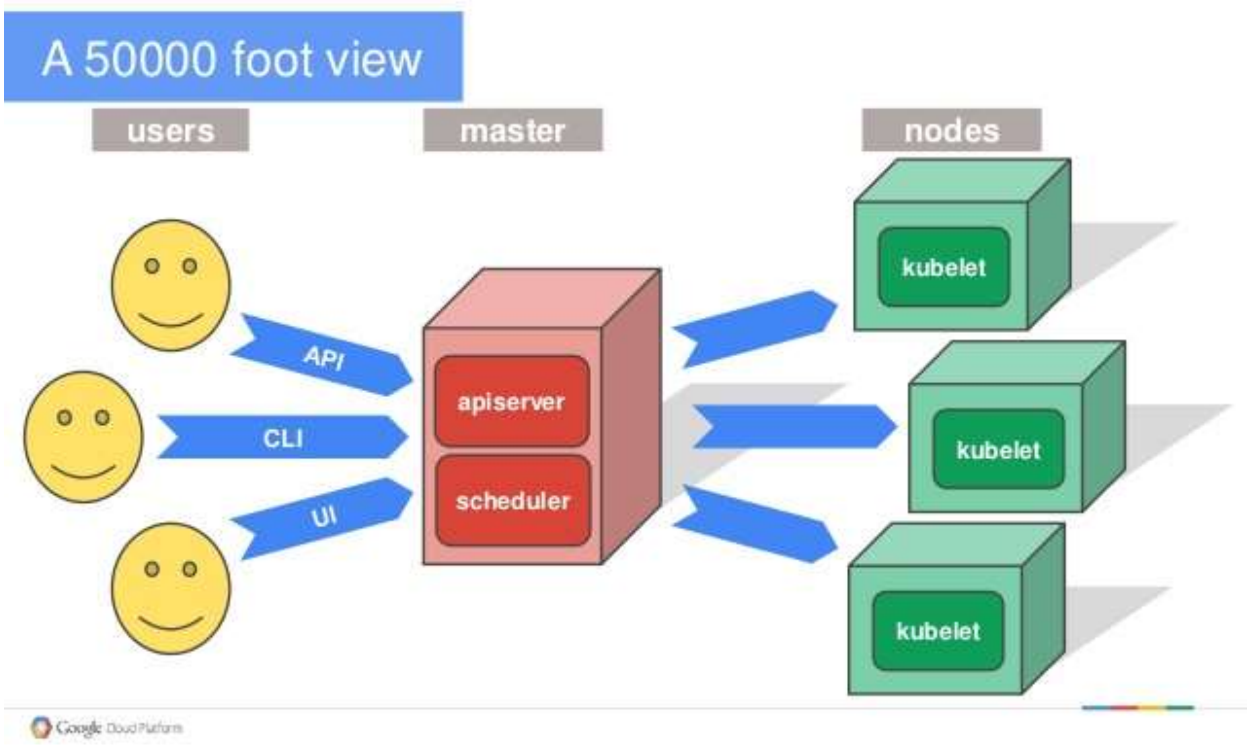
Containers & docker



- Standardized packaging for software and dependencies
- Isolate apps from each other
- Share the same OS kernel
- Works with all major Linux and Windows Server

 Confidential Restricted © 2017 Arm Limited

Scaling with Kubernetes



Confidential Restricted © 2017 Arm Limited

Clipper docs - http://clipper.ai/

Best Practices

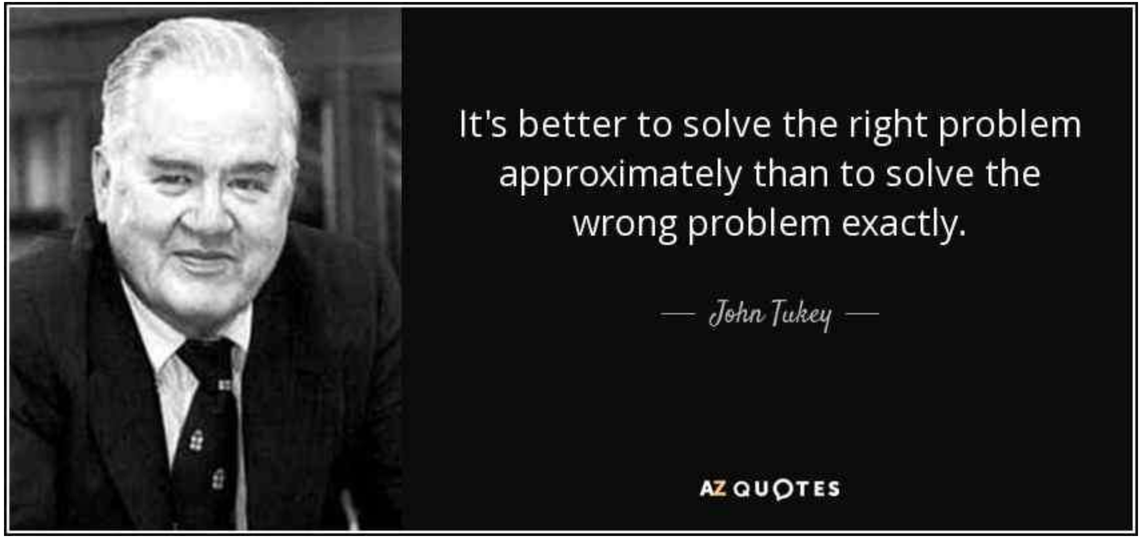
Learn from the mistakes of others!

 Confidential Restricted © 2017 Arm Limited

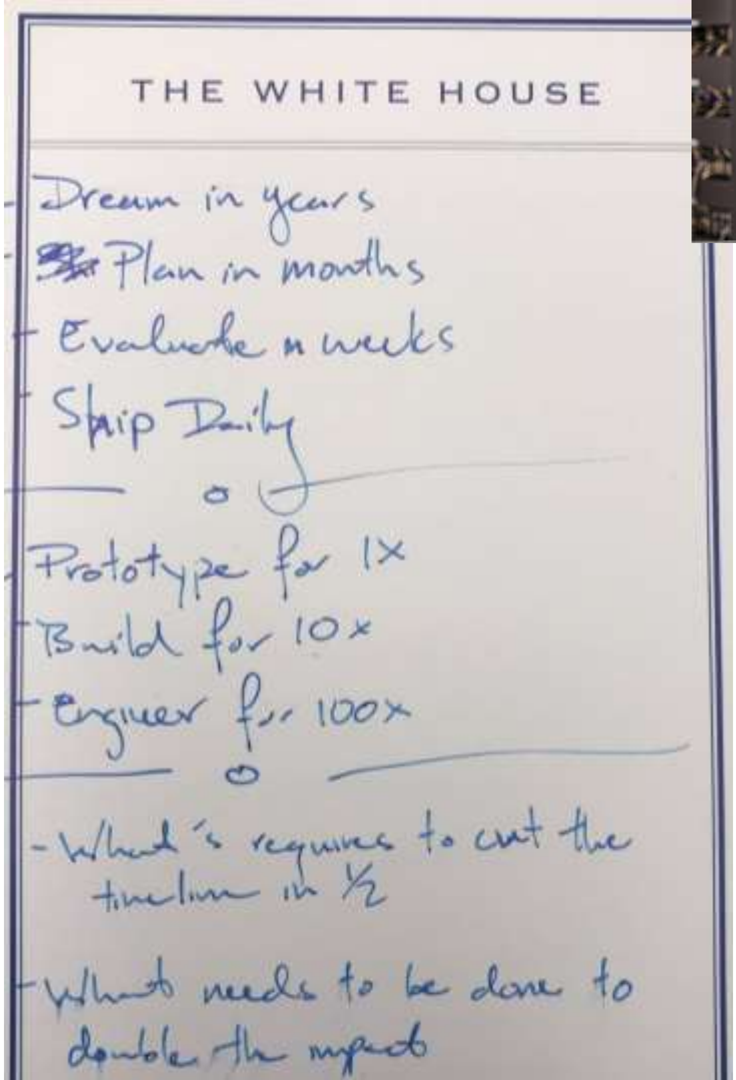
1. Solve the right problem
2. Fail better every day
3. Data quality matters
4. Simplicity is your friend
5. Debugging makes you a wizard
6. Fairness & privacy are not dirty words

 Confidential Restricted © 2017 Arm Limited

What is your problem?



What is your problem?



DJ Patil

US Chief Data Scientist

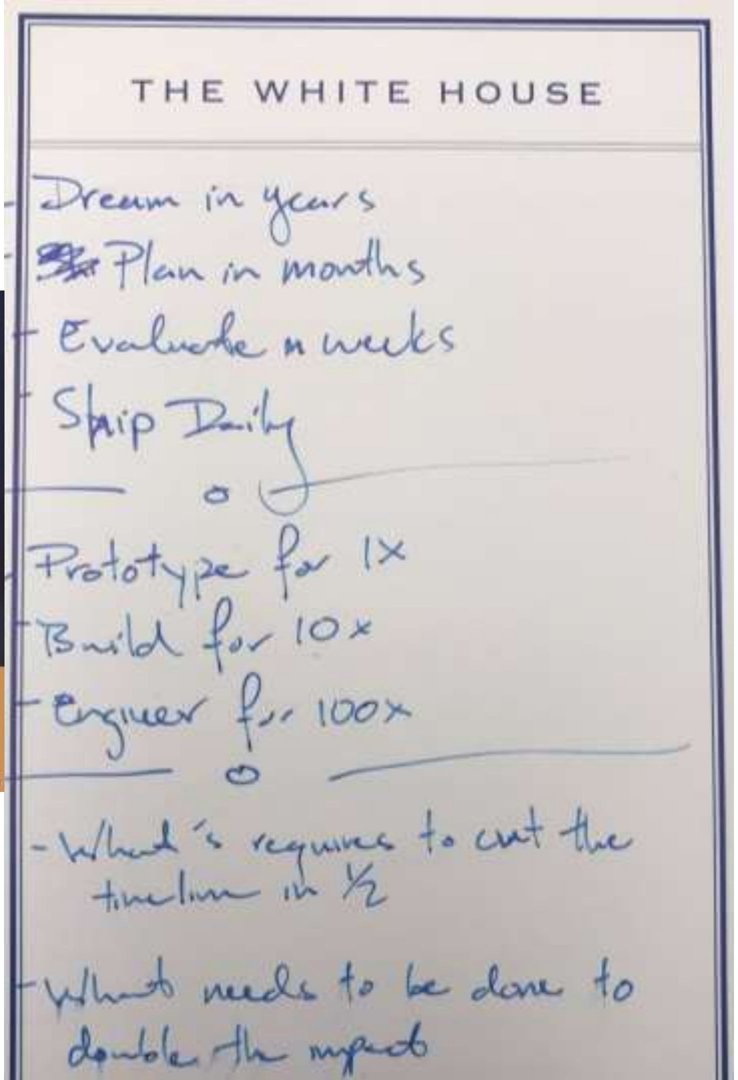
 Confidential Restricted © 2017 Arm Limited

arm

What is your problem?

Sheryl Sandberg

COO Facebook



 Confidential Restricted © 2017 Arm Limited

arm

Failure

 Confidential Restricted © 2017 Arm Limited

Failure

Failure

 Confidential Restricted © 2017 Arm Limited

Failure

 Confidential Restricted © 2017 Arm Limited

Data quality

 Confidential Restricted © 2017 Arm Limited

Data quality

 Confidential Restricted © 2017 Arm Limited

Data quality

Data quality

Data quality

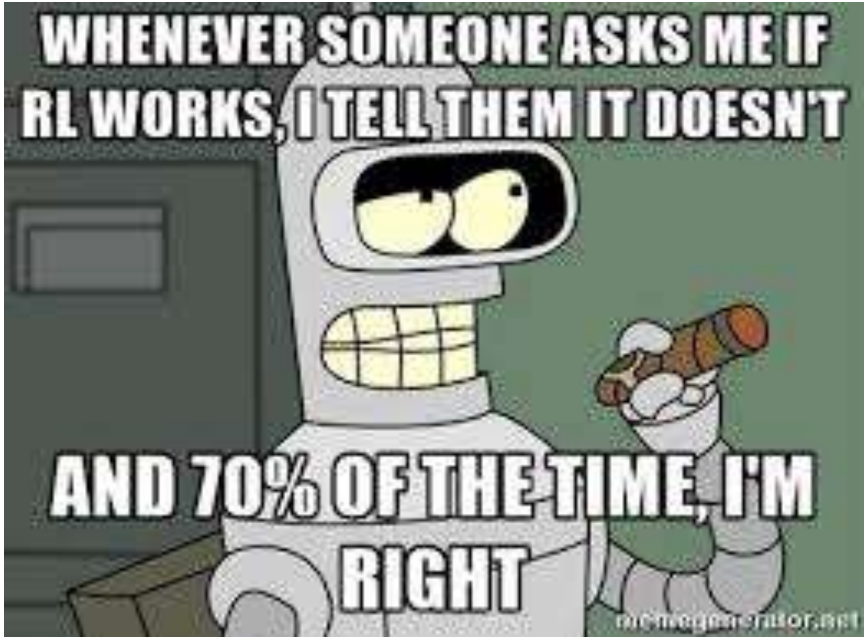
Data quality

Confidential Restricted © 2017 Arm Limited

Data quality

 Confidential Restricted © 2017 Arm Limited

Simplicity



Confidential Restricted © 2017 Arm Limited

Simplicity

"There is a lot of value in combining many different datasets and computing simple stats "

-- John Quinn, DSA2017

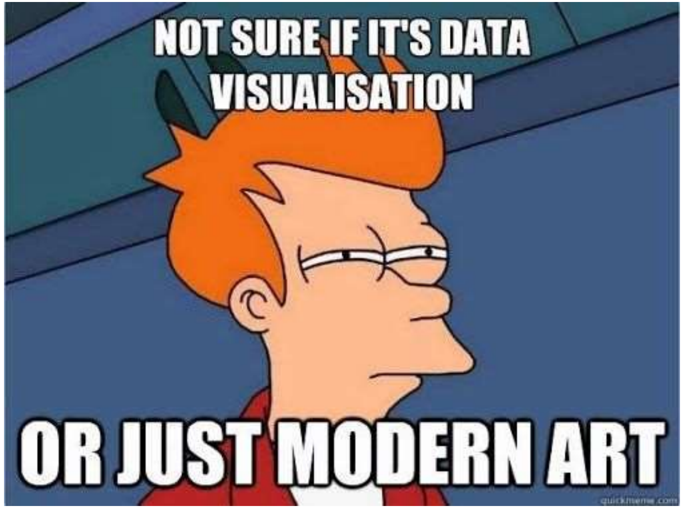
 Confidential Restricted © 2017 Arm Limited

Simplicity

Visualisation

Linear models

Rules (gross!)



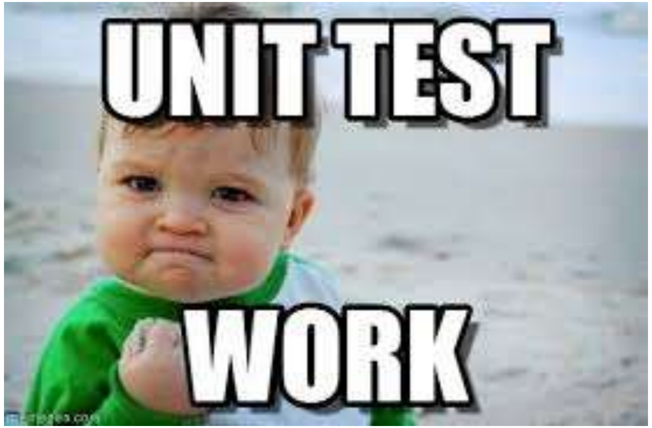
 Confidential Restricted © 2017 Arm Limited

Simplicity

- Very soon, your simple prototype will become a complex system
- You are uncertain at the beginning of a project, so capture that!
- Simple models can be a baseline to measure complex models later

 Confidential Restricted © 2017 Arm Limited

Want to be a wizard? Get debugging!



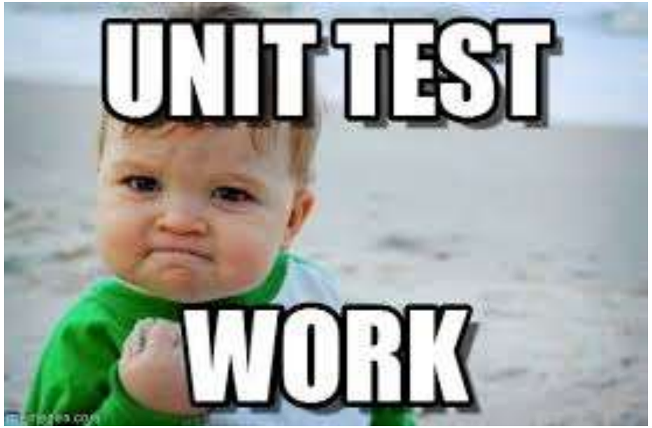

```python
from unnecessary_math import multiply

def test_numbers_3_4():
    assert multiply(3,4) == 12

def test_strings_a_3():
    assert multiply('a',3) == 'aaa'
```

http://pythontesting.net/framework/nose/nose-introduction/

 Confidential Restricted © 2017 Arm Limited

arm

Want to be a wizard? Get debugging!



http://pythontesting.net/framework/nose/nose-introduction/

```python

from unnecessary_math import multiply

def test_numbers_3_4():
    assert multiply(3,4) == 12

def test_strings_a_3():
    assert multiply('a',3) == 'aaa'

```

```
> nosetests test_um_nose.py
..
----------------------------------------------------------------------
Ran 2 tests in 0.000s

OK
```

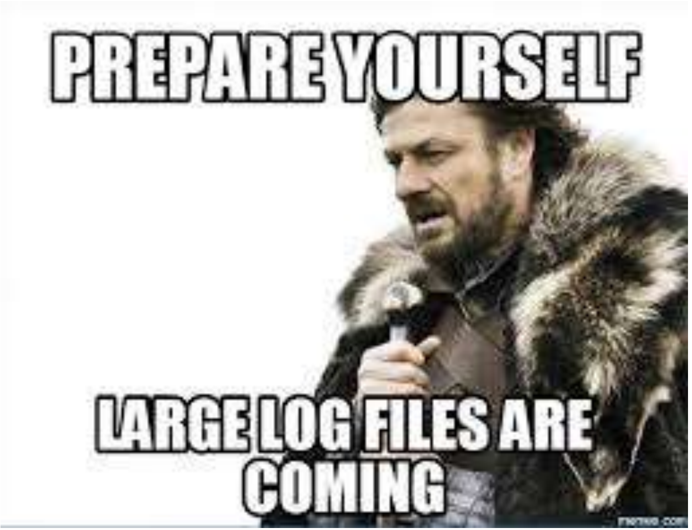
 Confidential Restricted © 2017 Arm Limited

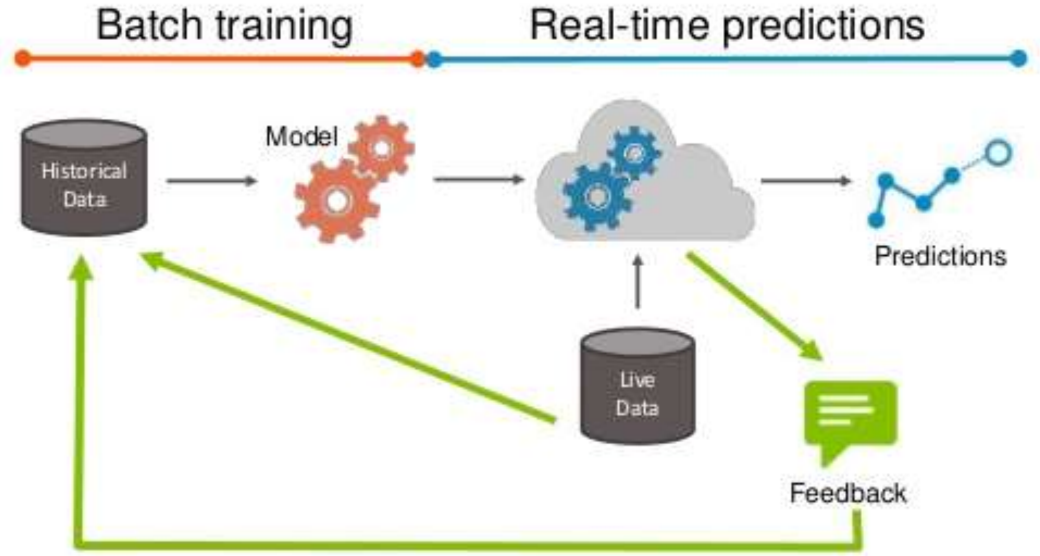
Want to be a wizard? Get debugging!

 Confidential Restricted © 2017 Arm Limited

arm

Deployment makes the promise of ML real





 Confidential Restricted © 2017 Arm Limited

arm

Want to be a wizard? Get debugging!

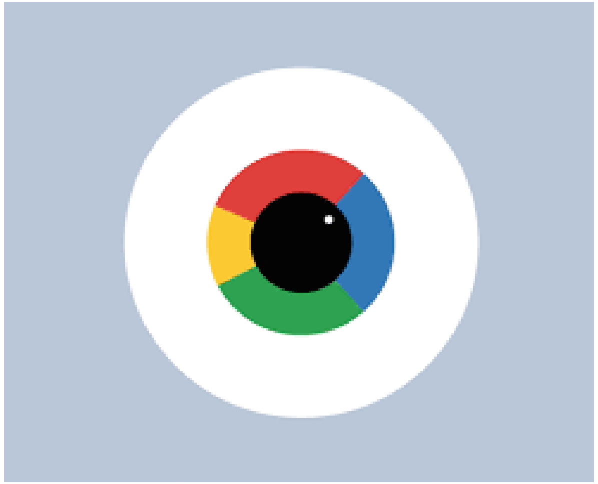
- how asking dumb questions is actually a superpower
- how you can read the source code to programs when all other avenues fail
- debugging tools that make you FEEL like a wizard
- Understanding what your _organization_ needs can make you amazing

-- Julia Evans

https://jvns.ca/blog/so-you-want-to-be-a-wizard/

Confidential Restricted © 2017 Arm Limited
arm

Fairness & Privacy



Surveillance or Assistance?

 Confidential Restricted © 2017 Arm Limited

Fairness & Privacy

 Confidential Restricted © 2017 Arm Limited

Can we use the tools above to build fair ML?

1. Solve the right problem
2. Fail better every day
3. Data quality matters
4. Simplicity is your friend
5. Debugging makes you a wizard

1. Thresholds the same for all groups?
2. Commit to fix fairness issues
3. Bias is in the data, not the algorithms
4. Easier to interpret at first
5. **Unit test for fairness**

 Confidential Restricted © 2017 Arm Limited

Further reading

[Martin Zinkevitch – Rules of ML for Google engineers]

[Andrew Ng -- ML systems at NIPS 2016]

[Peter Warden – How and why to improve your training data]

[Michael Jordan – The AI revolution hasn't happened yet]

[Lydia Liu et al – delayed impact of fairness in ML]

[My more detailed notes on data science projects]

[Jason Brownlee – Concept Drift Info]

[Katie Malone -- Picking data science projects]

@DCivin

 Confidential Restricted © 2017 Arm Limited

arm