

# Blockchains for Artificial Intelligence II

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@trentmc0



# The Unreasonable Effectiveness of Data

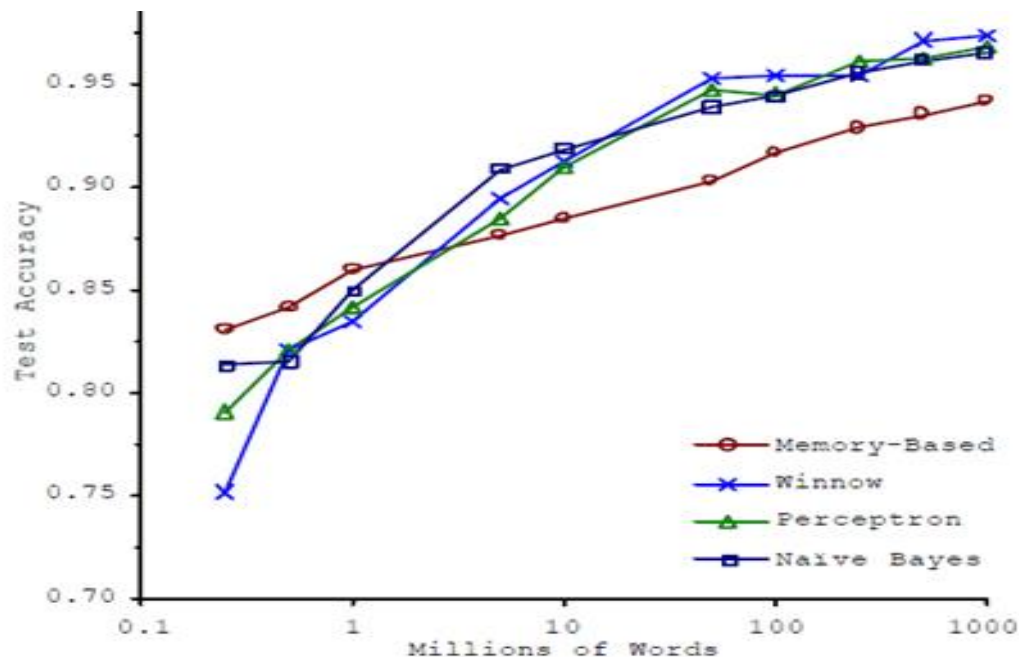


Figure 1. Learning Curves for Confusion Set Disambiguation

[Banko and Brill, 2001]

# The world's most valuable resource



Data and the new rules  
of competition

**Mo' data**  
(and mo' compute)



**Mo' accuracy**



**Mo' \$**

# THE 3 ELEMENTS OF COMPUTING



STORAGE

PROCESSING

COMMUNICATIONS



# THE 3 ELEMENTS OF COMPUTING

## Key Blocks in AI Landscape

### STORAGE

#### FILE SYSTEM

HDFS, S3

### PROCESSING

#### BIZ LOGIC

CPU, EC2

### COMMUNICATIONS

#### DATA

TCP/IP, HTTP

#### DATABASE

MongoDB,  
Cassandra

#### HIGH PERF. COMPUTE

Nvidia GPU, Goog TPU,  
MapReduce, Spark

## But all is not well in the world of AI

- **Data hoarding.** Big guys have all the data.
- **Weak data history.** Garbage in, garbage out.
- **Data is *expensive*.**

And more..

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And more..

*Can decentralization help?*

A photograph of the Oracle headquarters building, a modern structure with multiple curved glass wings reflecting the sky. In the foreground, there are several weeping willow trees and a body of water.

Q: How to unlock blockchains for AI?

A: A shared database with planetary reach

+Query  
+Open-source  
+Scale  
+Decentralized, Assets

1. Relational DB – Oracle
2. Website-ready DB – MySQL
3. “Big data” Distributed DB – MongoDB
4. “Blockchain” DB – BigchainDB + IPDB



# THE 3 ELEMENTS OF COMPUTING, *DECENTRALIZED*



## STORAGE

### FILE SYSTEM

IPFS/FileCoin, Swarm

### DATABASE

BigchainDB/IPDB

### E-GOLD / E-CASH

Bitcoin, zcash, .\*

## PROCESSING

### BIZ LOGIC

Ethereum, Hyperledger

### HIGH PERF. COMPUTE

TrueBit, Golem, iExec,  
VMs, client-side compute

## COMMUNICATIONS

### DATA

TCP/IP, HTTP

### VALUE

ILP, Cosmos

### State

PolkaDot, Aeternity

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Online platform for industrial 3d printing.

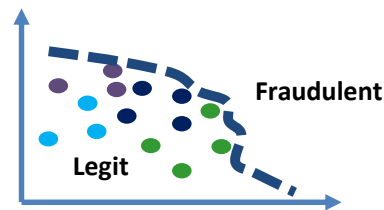
E.g. spare aircraft parts

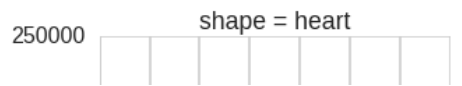
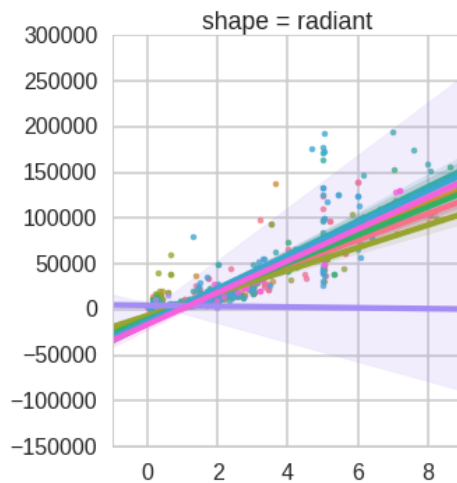
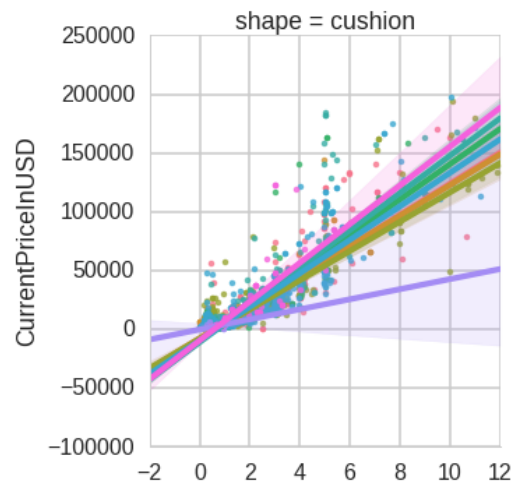
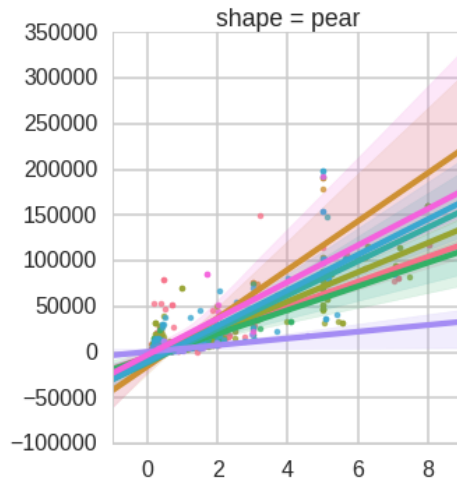
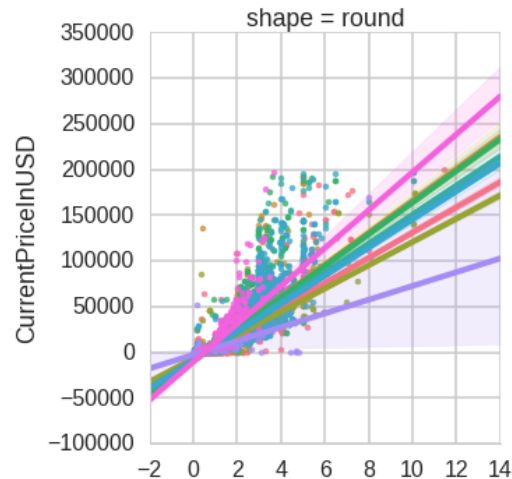
- Find and contract the best 3d printer
- Securely transfer production files
- Pool data in ecosystem → 1-class classifiers for fraud detection

**Problem: Data Hoarding**

**Sol'n: Data Pooling**

**For More Accurate Models**





**Problem: Data Hoarding (2)**  
**Sol'n: Data Pooling For More Accurate Models**

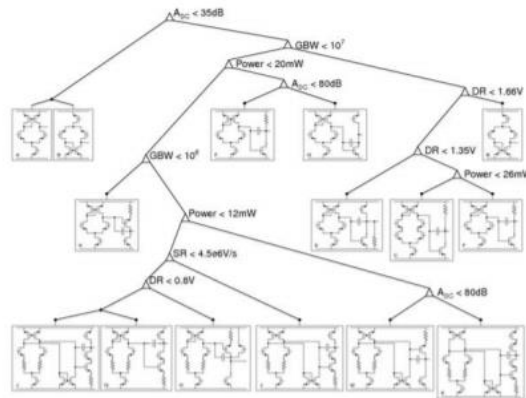
**Diamond price prediction  
for fraud detection:  
Warn if predicted price  $\neq$   
asking price**

# Certificate of Authenticity

ascribe<sup>®</sup>

As of Nov. 06 2016, 19:10:42, trent is the owner.

To verify current owner, please visit [https://www.ascribe.io/app/coa\\_verify/](https://www.ascribe.io/app/coa_verify/)



## Circuit Decision Tree

Edition: 1/3

Created by: Trent McConaghy

Owner: trent

### ARTWORK DETAILS

Artwork ID: 136UbLGSNNHqY9kjxQ3tDy83K7P69zDJeN

File Extension: .png

File Size: 87090 bytes

### PROVENANCE/OWNERSHIP HISTORY

Nov. 06, 2016, 19:10:42 - Registered by trent

### CRYPTOGRAPHIC STAMP

Use the summary and signature below to authenticate this certificate on:

Link: [https://www.ascribe.io/app/coa\\_verify/](https://www.ascribe.io/app/coa_verify/)

Summary: Trent McConaghy\*  
Circuit Decision Tree\*1/3\* 2008\*2016Nov06-19:10:42

Signature: C38D56C823CEC09E40B3589D27D48B9C8EF9ADECC9592F469  
CE0144CF9ECA406B3ABF1D976ADB7813895379A66F9F7C327B  
B0EE090A52F6A8274F3F4AC9EE3D7DF0FA98964C834678A6F4  
9FF4FE687E7B4243F8F65FF57315C87391A03874CD48DFCB357  
18F1742AB5256B72A4C2D2593F3492372A66C82679263E39BA  
B99996EL



**Problem: High Friction to Monetize Algorithms**  
**Sol'n: Claim & License Your Algorithm IP**





***Problem:*** High Friction to Monetize Algorithms (2)

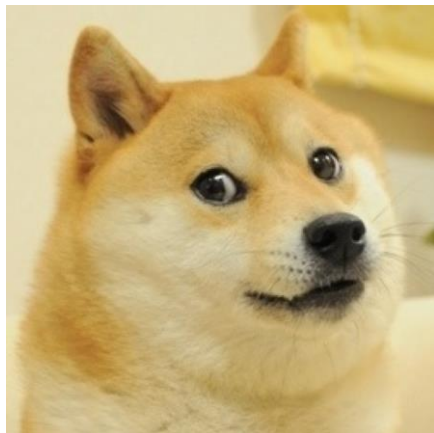
***Solution:*** Hedge Fund In a Box (Numeraire)

1. 12K+ data scientists submit algorithms
2. Market winnings are distributed wrt performance
3. Positive-sum via tokenization

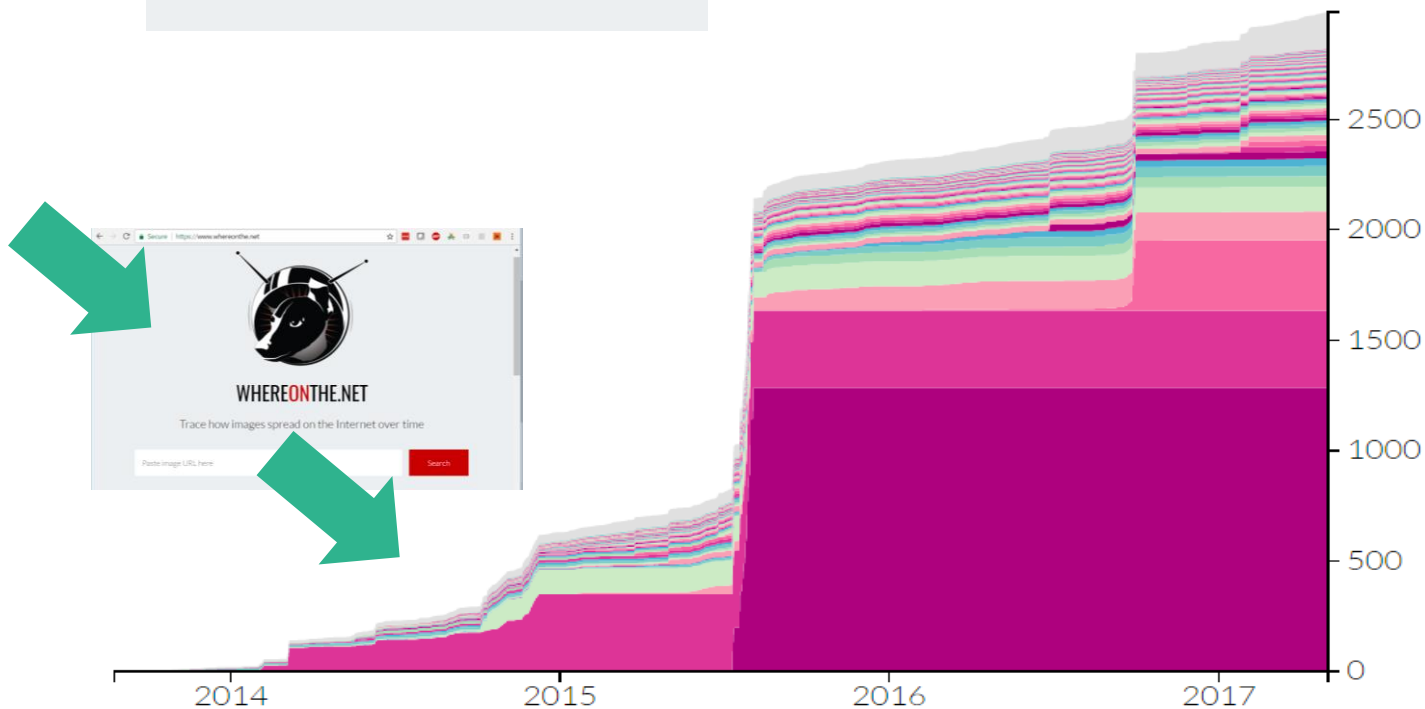
# Problem: blockchain-secured data spreads online



## Sol'n: visibility into spread via web crawl + AI



### WHEREONTHE.NET



# **Problem: Weak Data History (Garbage In Garbage Out)**

## **Sol'n: Immutable Audit Trails of AI Data & Models**

### **Provenance in model building:**

- Sensor / input stream data →
- Training X/y data →
- Model building convergence →

### **Provenance in model deployment:**

- Testing X data →
- Model simulation →
- Testing yhat data →

**Time-stamp to IPDB  
Store to IPFS**



# Problem: Weak Data History (2)

## Sol'n: Audit Trails of Vehicle Life Cycle Data (CarPass)

The screenshot displays the CarPass admin dashboard. At the top, there's a header with the 'innogy BIGCHAIN' logo, 'CAR PASS' branding, and a 'Welcome admin' message with a user profile icon. Below the header, navigation links include 'See All Users', 'Invite New User', 'See All Cars', 'Register Car', and 'Transfer Car'. The main section features a table of trip history with columns for Trip Mode, Start Time, Mileage Start, Start Trip, End Time, Mileage End, End Trip, Duration, Distance, and Fuel Usage. Two trip records are visible, one from Leipzig, Germany, and another from Mumbai, India. Below the table, there are two map sections, each labeled 'TRIP', showing the routes for the respective trips on Google Maps.

TRIP MODE	START TIME	MILEAGE START	START TRIP	END TIME	MILEAGE END	END TRIP	DURATION	DISTANCE	FUEL USAGE
	2012-09-10T19:06:33Z	15515757	In Leipzig, Wahren, Stahlmeiner Straße 195 (DE 04159)	2012-09-10T19:25:53Z	15527460	In Leipzig, Südvorstadt, Bernhard-Göring-Straße / Schamkharstraße(DE04275)	1160	11703	4
	2013-10-10T12:06:13Z	15527460	The Taj Mahal Palace Apollo Bandar, Colaba, Mumbai, India	2013-10-10T13:45:45Z	15539462	Chhatrapati Shivaji International Airport Area, Vile Parle, Mumbai, India	1360	12002	30

BIGCHAIN DB



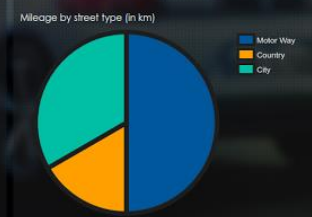
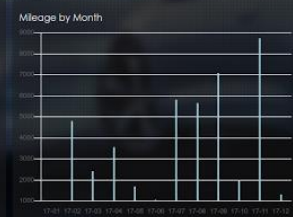
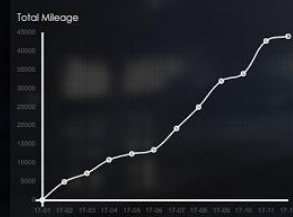
innogy



riddle&code

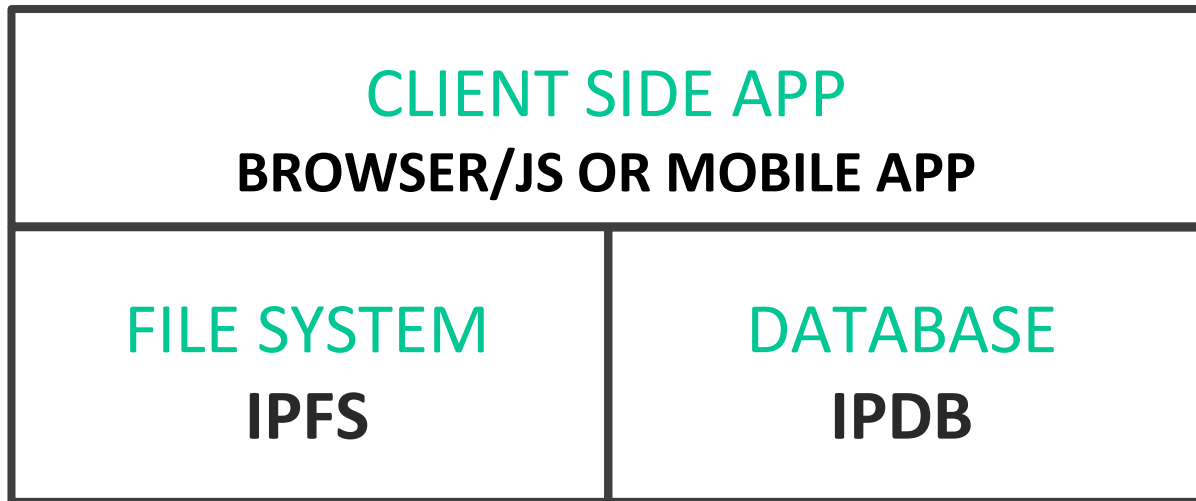
Welcome admin

Transmission : manual



# Architecture: Single-page webapp

Data persistence via IPFS + IPDB  
(“AWS without the AWS”)





FILE SYSTEM



HIGH PERF. COMPUTE



***Problem: Compute & Storage are Expensive***

***Solution: Tokenized, Competitive Markets for Compute & Storage***

## Problem: Data is Expensive

What's the ultimate way to  
unlock data?

*A Data Exchange*

Data and the new rules  
of competition

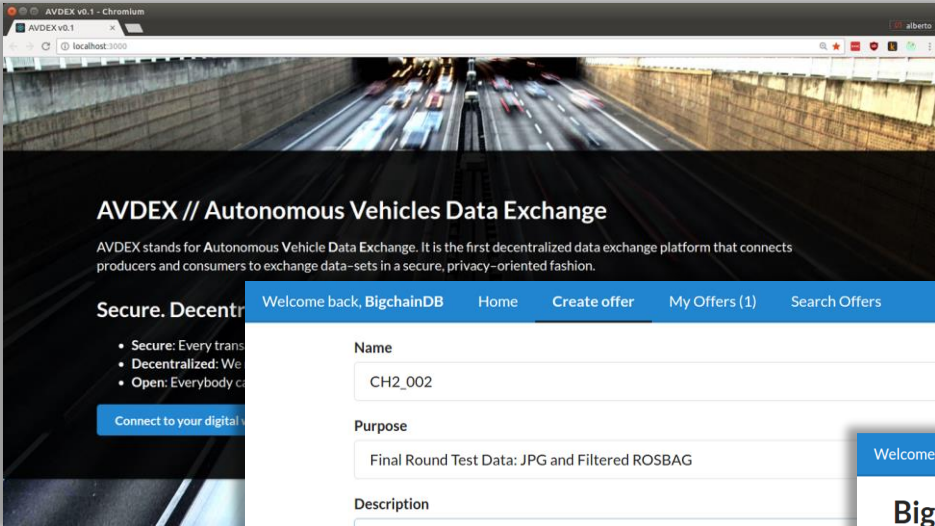
Mo' data  
(and mo' compute)



Mo' accuracy



Mo' \$



# Problem: Data is Expensive

## Sol'n: A Decentralized Data Exchange for Self-Driving Car Data



Welcome back, BigchainDB Home Create offer My Offers (1) Search Offers Logout

Name  
CH2\_002

Purpose  
Final Round Test Data: JPG and Filtered ROSBAG

Description  

Date	Lighting Conditions	Duration	Compressed Size	Direct Download
11/18/2016	Daytime/Shadows	--	4.4GB	None

\* HMB\_1: 221 seconds, direct sunlight, many lighting changes. Good turns in lines, ends in lane merge, divided highway  
 \* HMB\_2: 791 seconds, two lane road, shadows are prevalent, traffic signal camera can't see much of the road, direct sunlight, fast elevation changes lead to summit. Turns into divided highway around 350s, quickly returns to 2 lanes

Date Size (GB) Hash  
 2016 4.4 md5:f3178f88


Sign and submit

Welcome back, BigchainDB Home Create offer My Offers (2) Search Offers Logout

## BigchainDB

7KaKEt27hS5wDfPMZmdzQo28BSGJCJK3djR8kLUMankE

<https://www.bigchaindb.com/>

 **CH2\_002**  
 \$1500 4.4 GB transaction ★ ★ ★ ★ ★

Date	Lighting Conditions	Duration	Compressed Size	Direct Download	Torrent	MD5
11/18/2016	Daytime/Shadows	--	4.4GB	None	None	

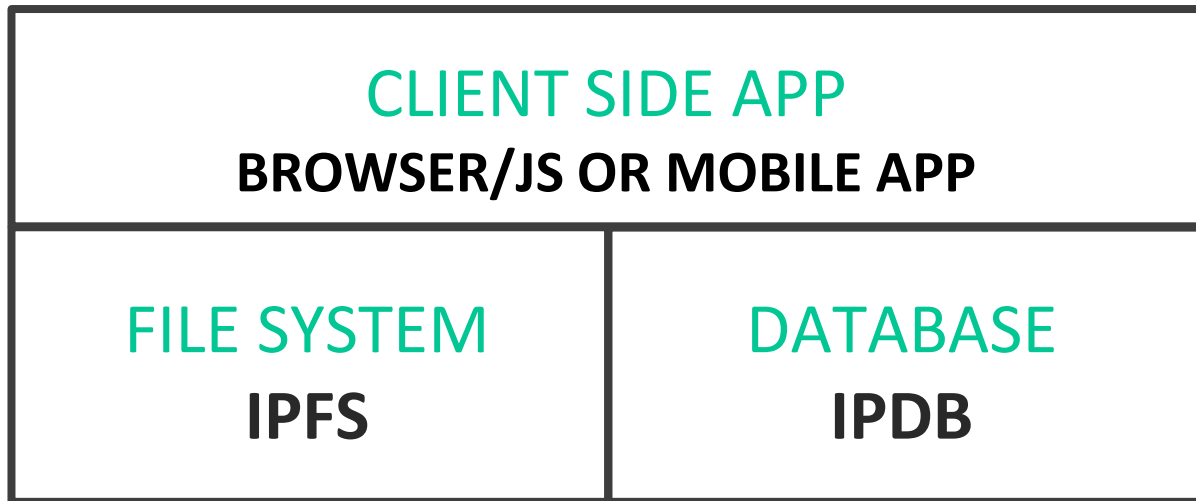
- HMB\_1: 221 seconds, direct sunlight, many lighting changes. Good turns in beginning, discontinuous shoulder lines, ends in lane merge, divided highway
- HMB\_2: 791 seconds, two lane road, shadows are prevalent, traffic signal (green), very tight turns where center camera can't see much of the road, direct sunlight, fast elevation changes leading to steep gains/losses over summit. Turns into divided highway around 350s, quickly returns to 2 lanes
- HMB\_4: 99 seconds, divided highway segment of return trip over the summit
- HMB\_5: 212 seconds, guardrail and two lane road, shadows in beginning may make training difficult, mostly normalizes towards the end
- HMB\_6: 371 seconds, divided multi-lane highway with a fair amount of traffic

View >

“Self Driving cars are the killer app for AI”  
 -Madrona Venture Group

# Architecture: Single-page webapp, again!

Data persistence via IPFS + IPDB  
(“AWS without the AWS”)



# AI \* Blockchain Symbiosis:

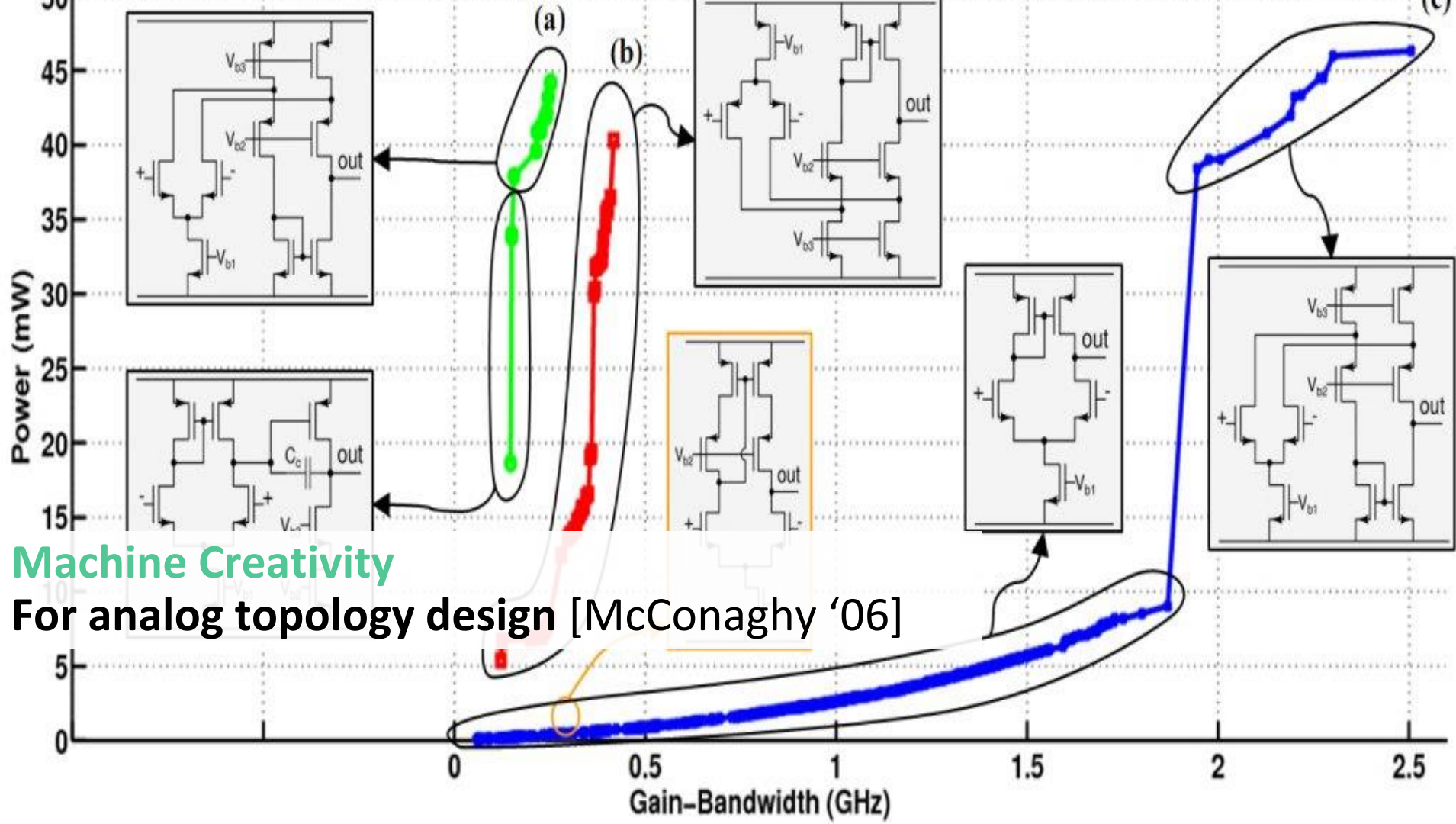
## AI DAOs





**Machine Creativity**  
**For jewelry design [Hornby '11 Orbimi]**





# AGI: Artificial *General* Intelligence



Agents that sense, model, and act

LOG IN | SIGN UP

LONGFORM

REVIEWS

VIDEO

TECH

CIRCUIT BREAKER

SCIENCE

ENTERTAINMENT

CARS

TL;DR




FORUMS

U

COMMENTS

## Microsoft will now let anyone test their AI creations in Minecraft

By [Russell Brandom](#) on July 8, 2016 10:36 am [Email](#) [@russellbrandom](#)



ily  
to go!  
still

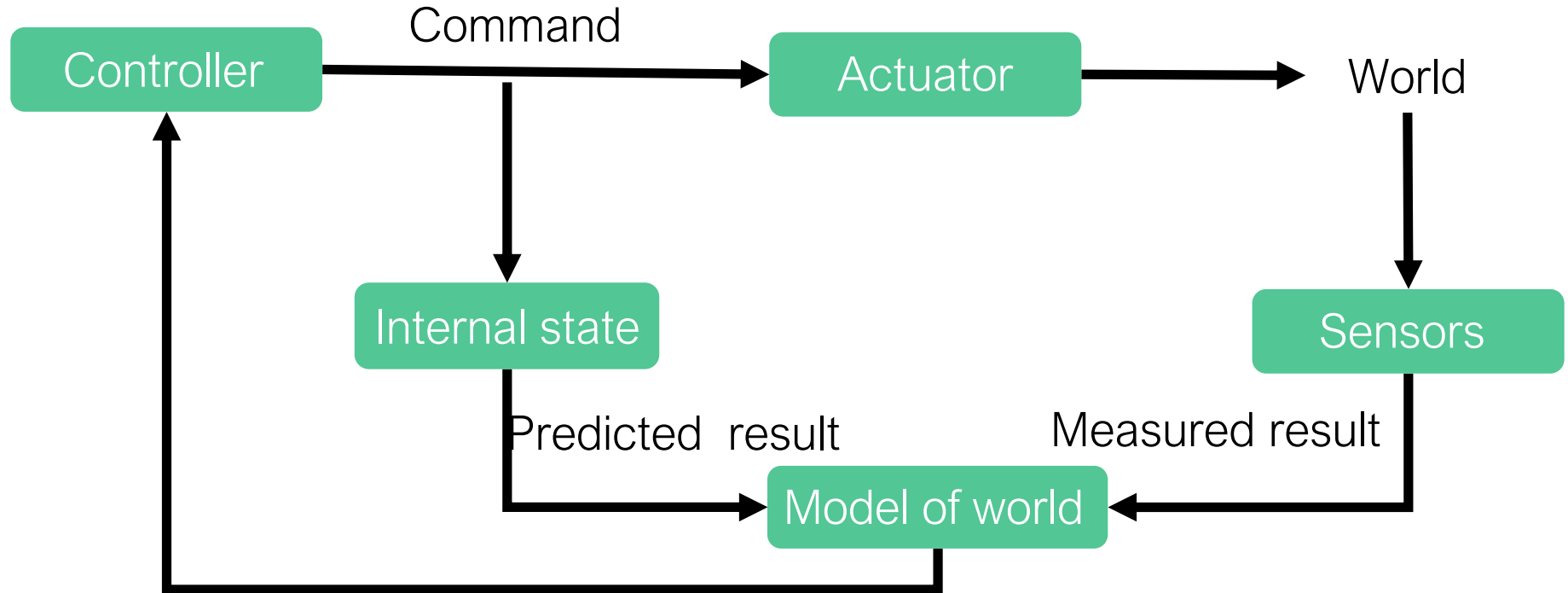
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o target

# AGI: Artificial General Intelligence

“AI meets Feedback Control Systems”

Update internal state based on estimate of world state



## Example: The ArtDAO

### Algorithm...

1. Run AI art engine to generate new image
2. Claim attribution in blockchain
3. Post editions for sale onto a marketplace, using Getty (centralized), or OpenBazaar (decent.)
4. Sell the editions. \$ goes to ArtDAO, in exchange for IP

Repeat! Create more art, sell it, get wealthier



## Example: The ArtDAO Algorithm...

1. Run AI art engine to generate new image

Over time, if ArtDAO makes more money from sales than from generating new art, then it will accumulate wealth. And, you can't turn it off.

4. Sell the editions. \$ goes to ArtDAO, in exchange for IP

Repeat! Create more art, sell it, get wealthier

# Conclusion

The mist

The world's most  
valuable resource

- Blockchains can *really* help AI
- It's all about the data
  - Getting the data
  - Getting *good* data - with provenance
- (Plus those pesky AI DAOs)