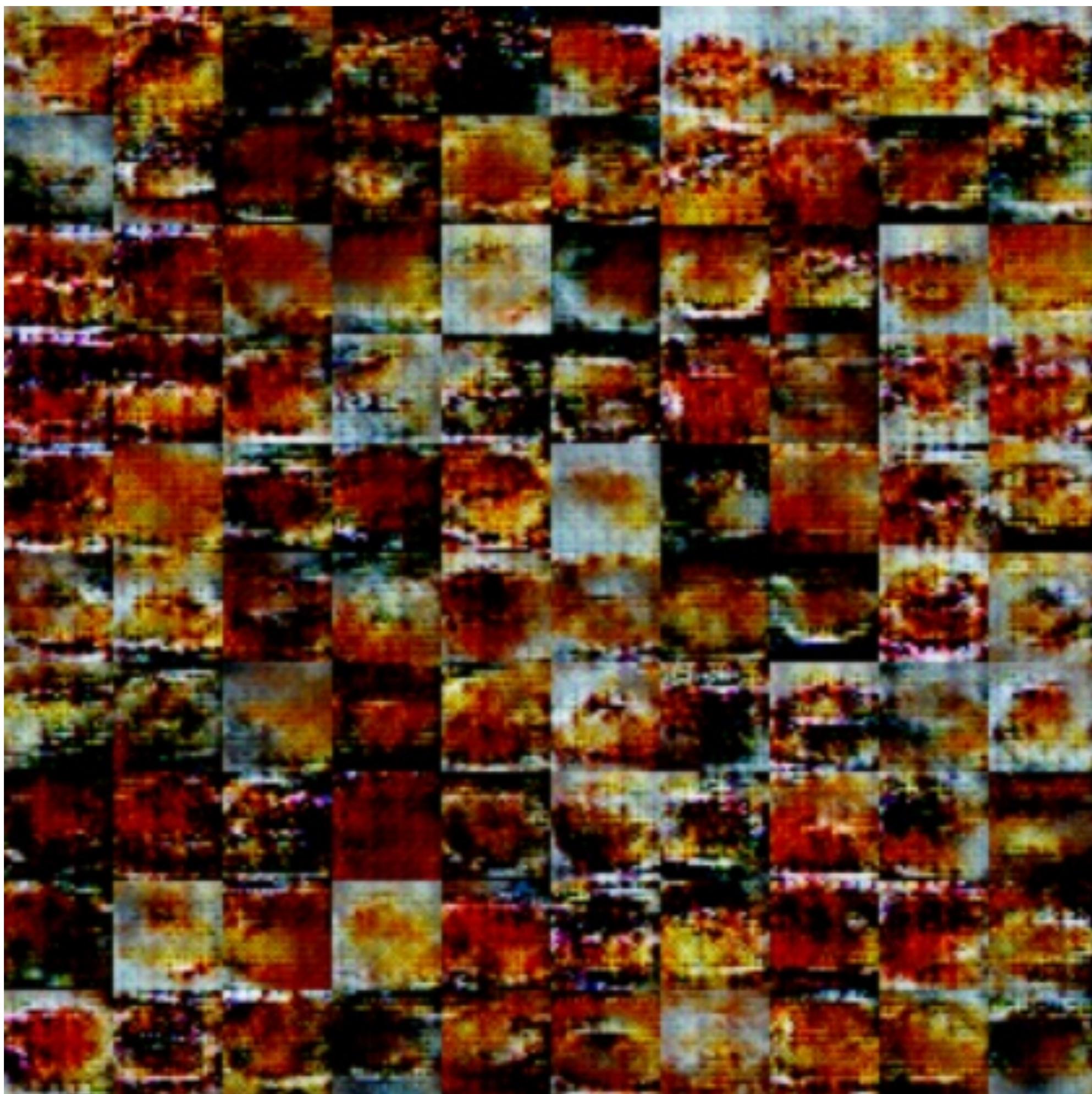


Can You CAN?



By Carin Meier @gigasquid
Cognitect



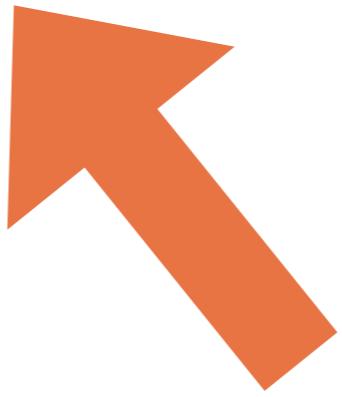


Why Flan?

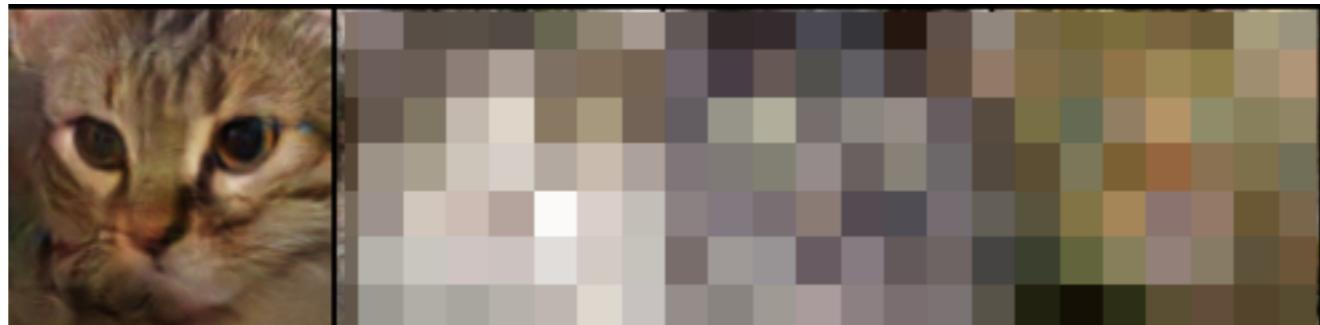
Why Flan?

*Because it rhymes with
GAN*

**Mom, do you talk to
people at work enough?**



Real Cat



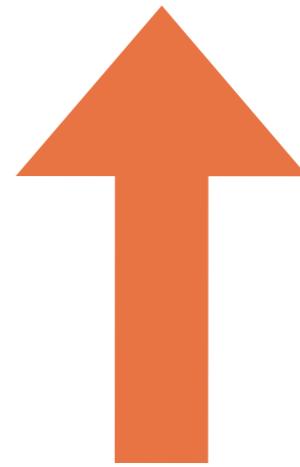
Is this a real cat?



Is this a real cat?

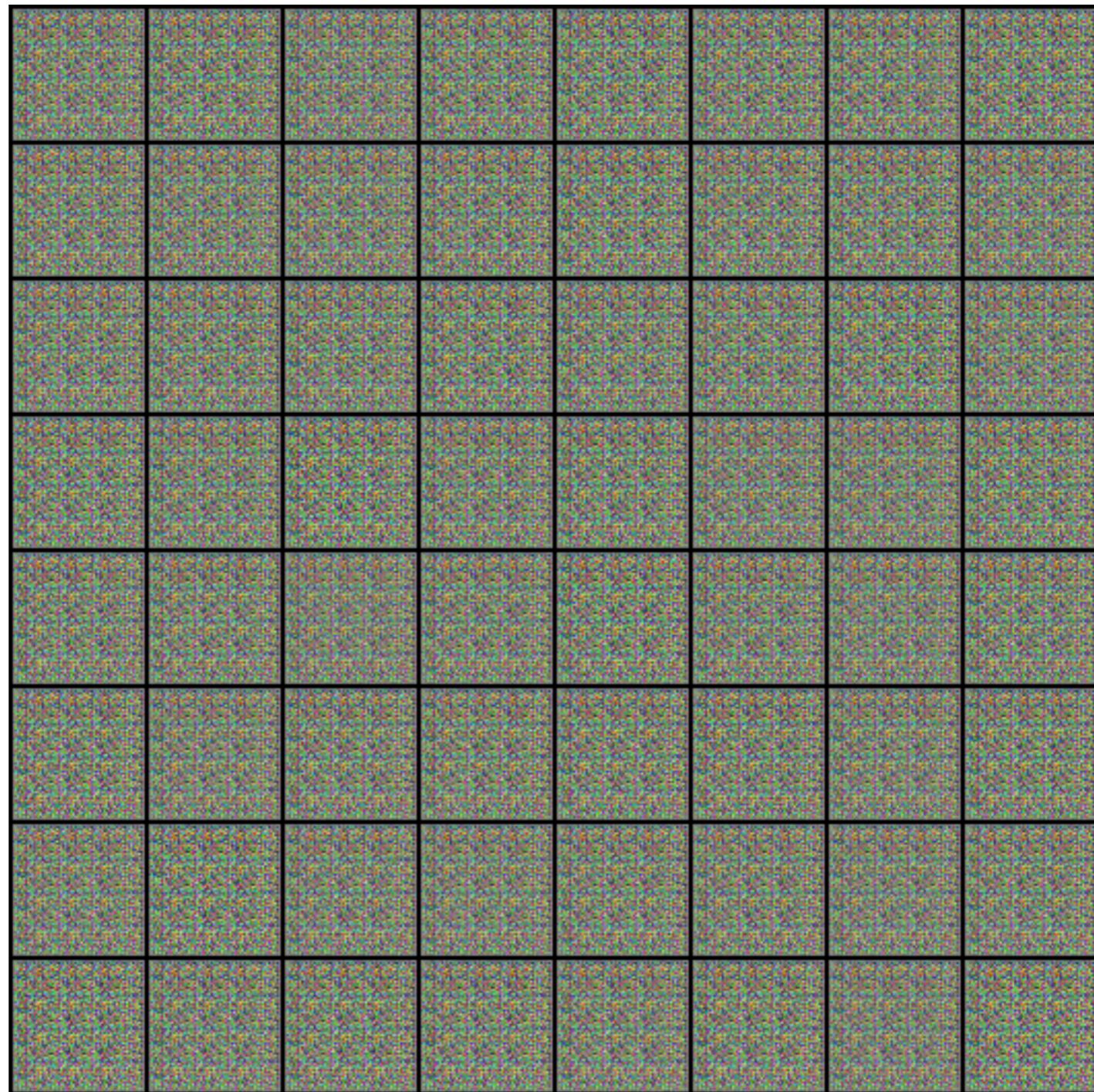


Is this a real cat?



Is this a real cat?





**This makes
no sense.**

Tell me what

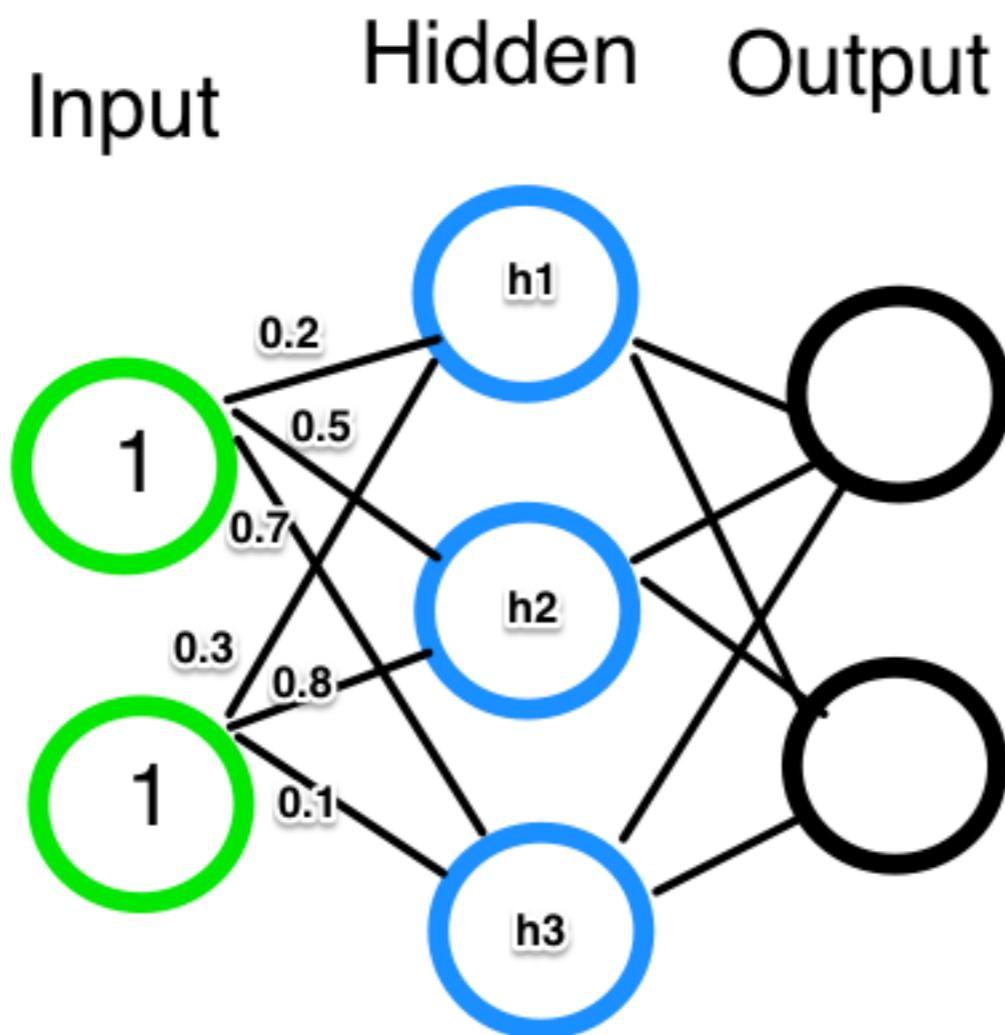
this GAN thing is?



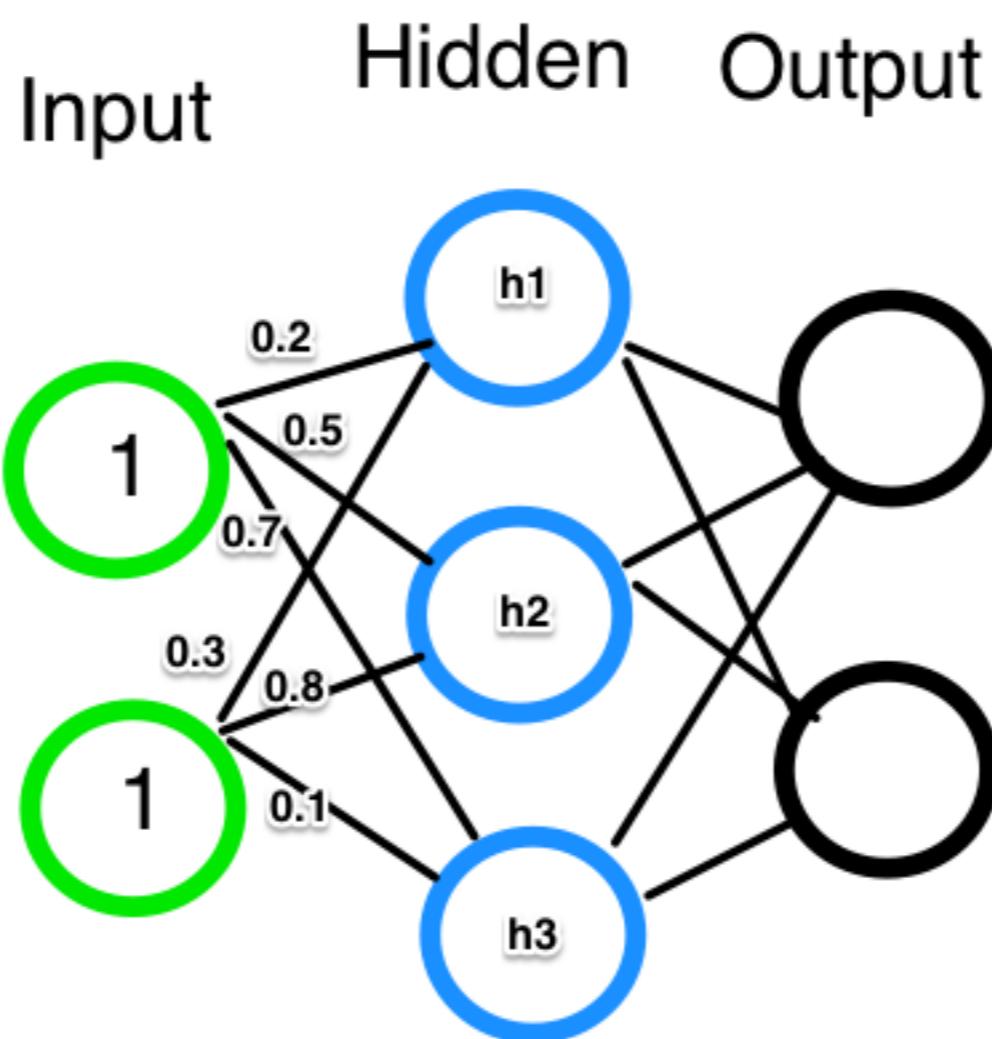
A GAN is a
Generative
Adversarial
Network



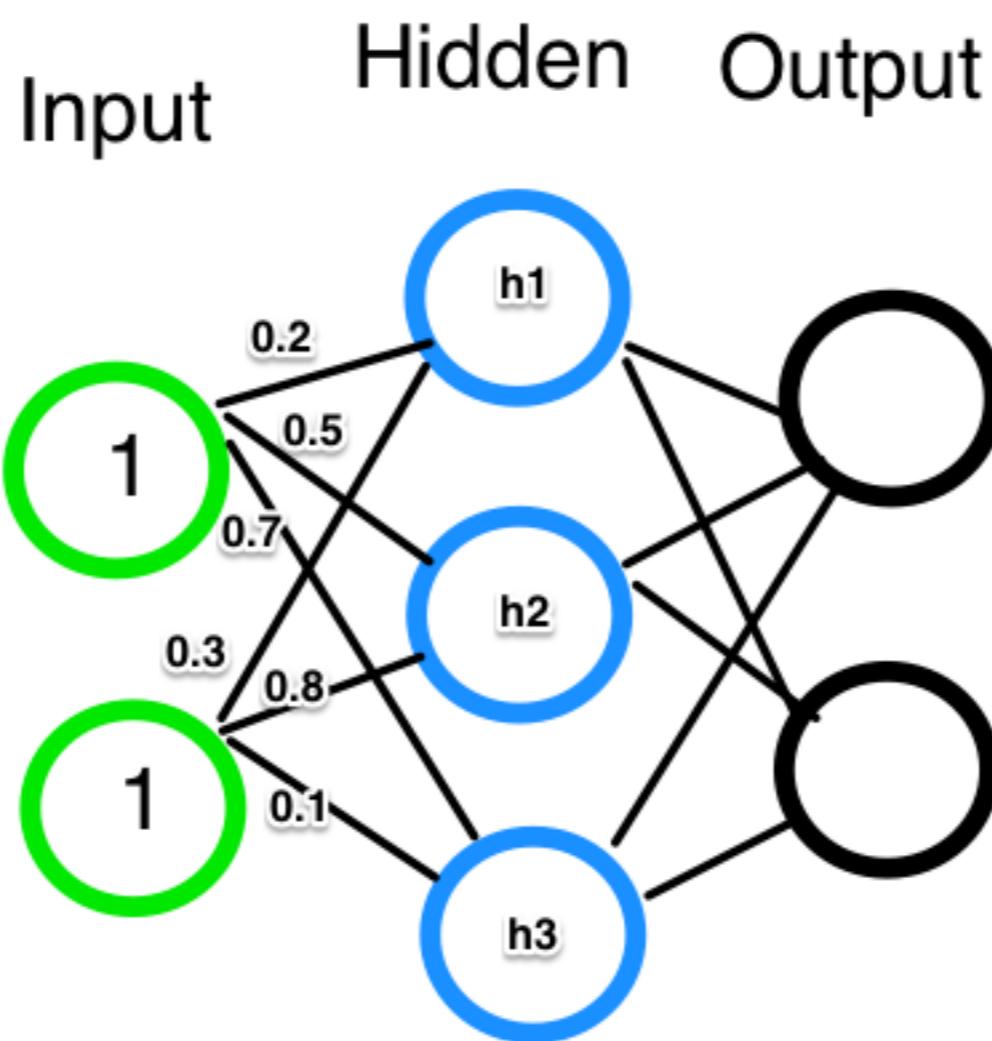
Generative Adversarial (Neural) Network



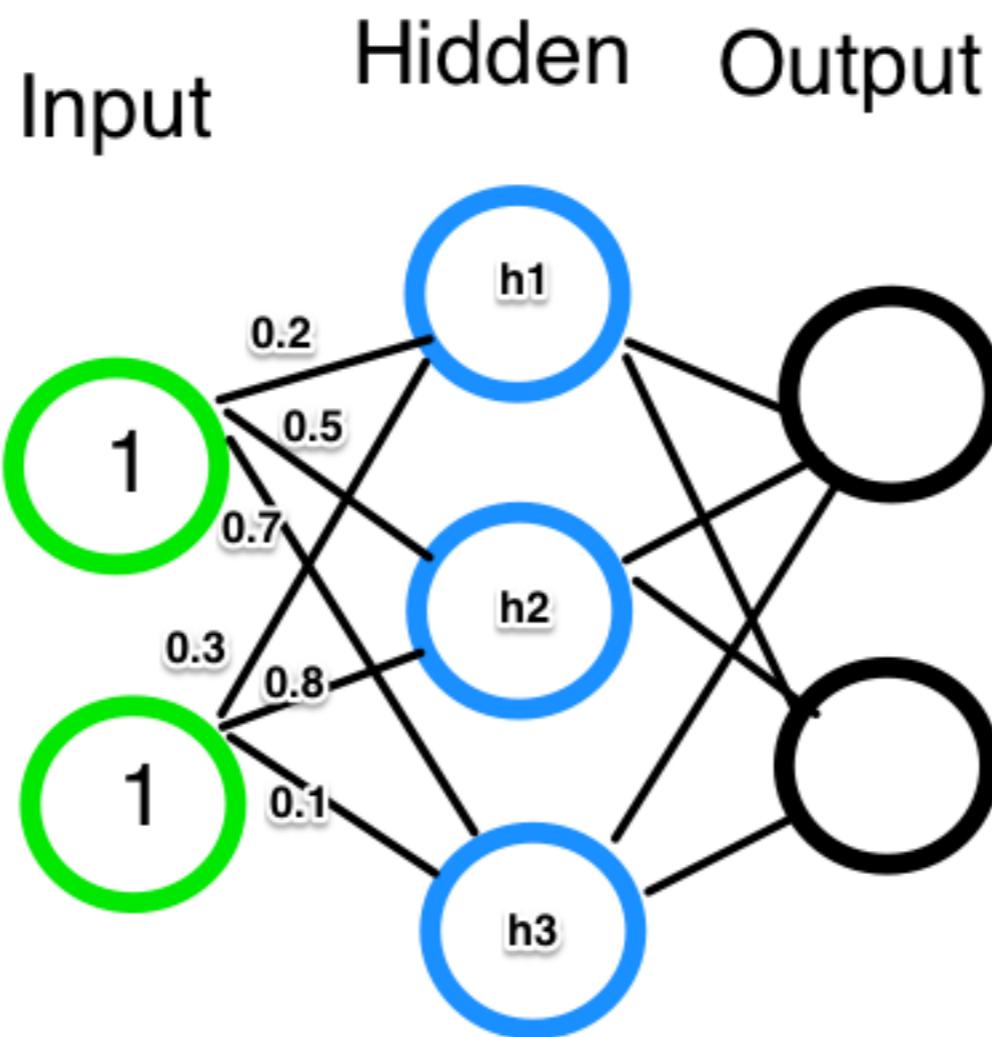
$$h1 = 1 * 0.2 + 1 * 0.3 = 0.5$$



$$h2 = 1 * 0.5 + 1 * 0.8 = 1.3$$



$$h3 = 1 * 0.7 + 1 * 0.1 = 0.8$$



Next we need some nonlinearity



**Next we need
some nonlinearity**



Activation Functions

**Next we need
some nonlinearity**



RELU

**Next we need
some nonlinearity**



RELU

$$f(x) = \max(0, x)$$

RELU

very popular

inexpensive

good at finding solutions

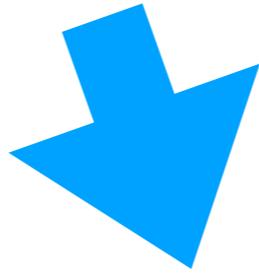
Why nonlinearity ?

Why nonlinearity ?



Universality!!!

Why nonlinearity ?



Universality!!!

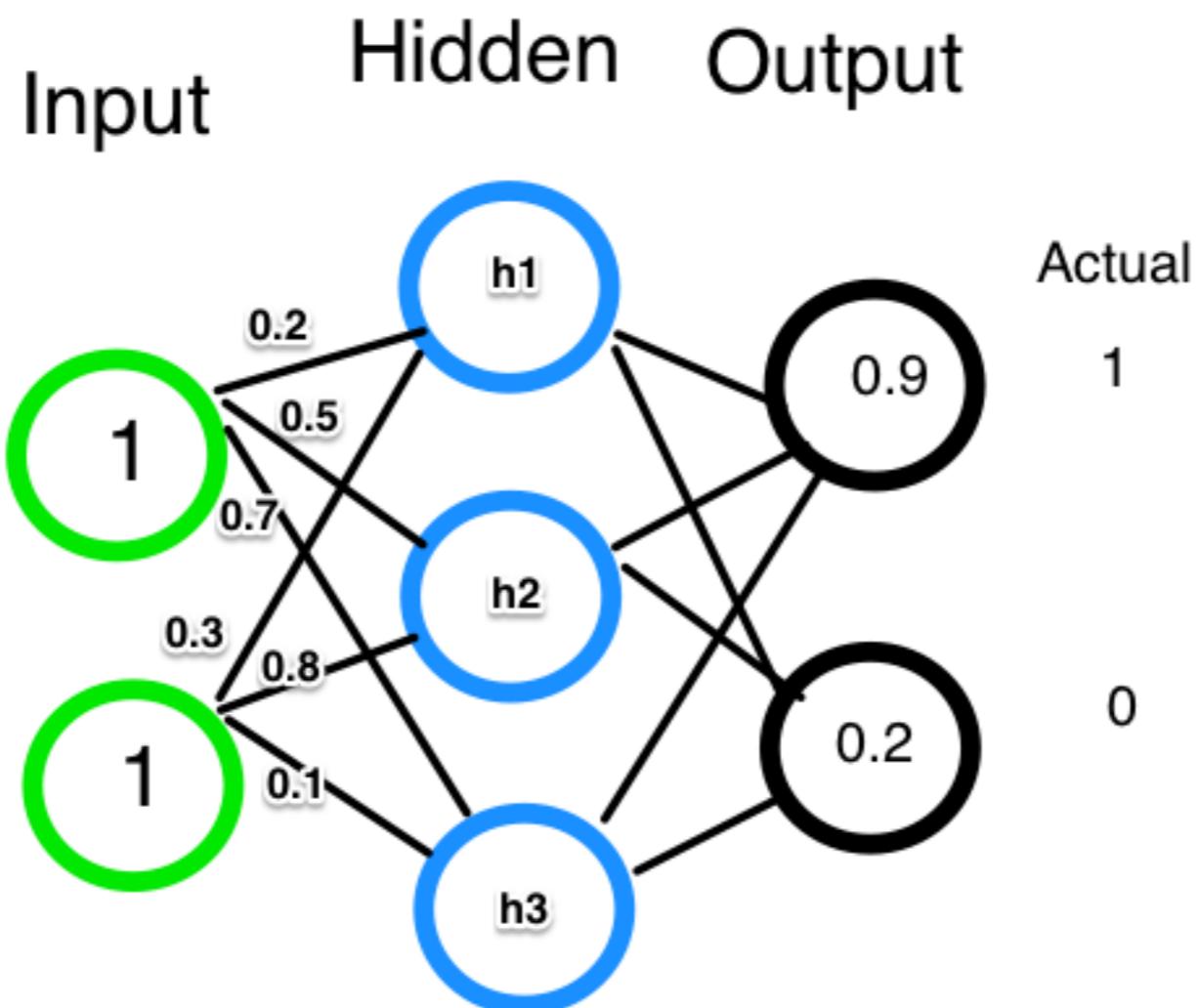


**With it a neural network can be proven able to
approximate any function!**



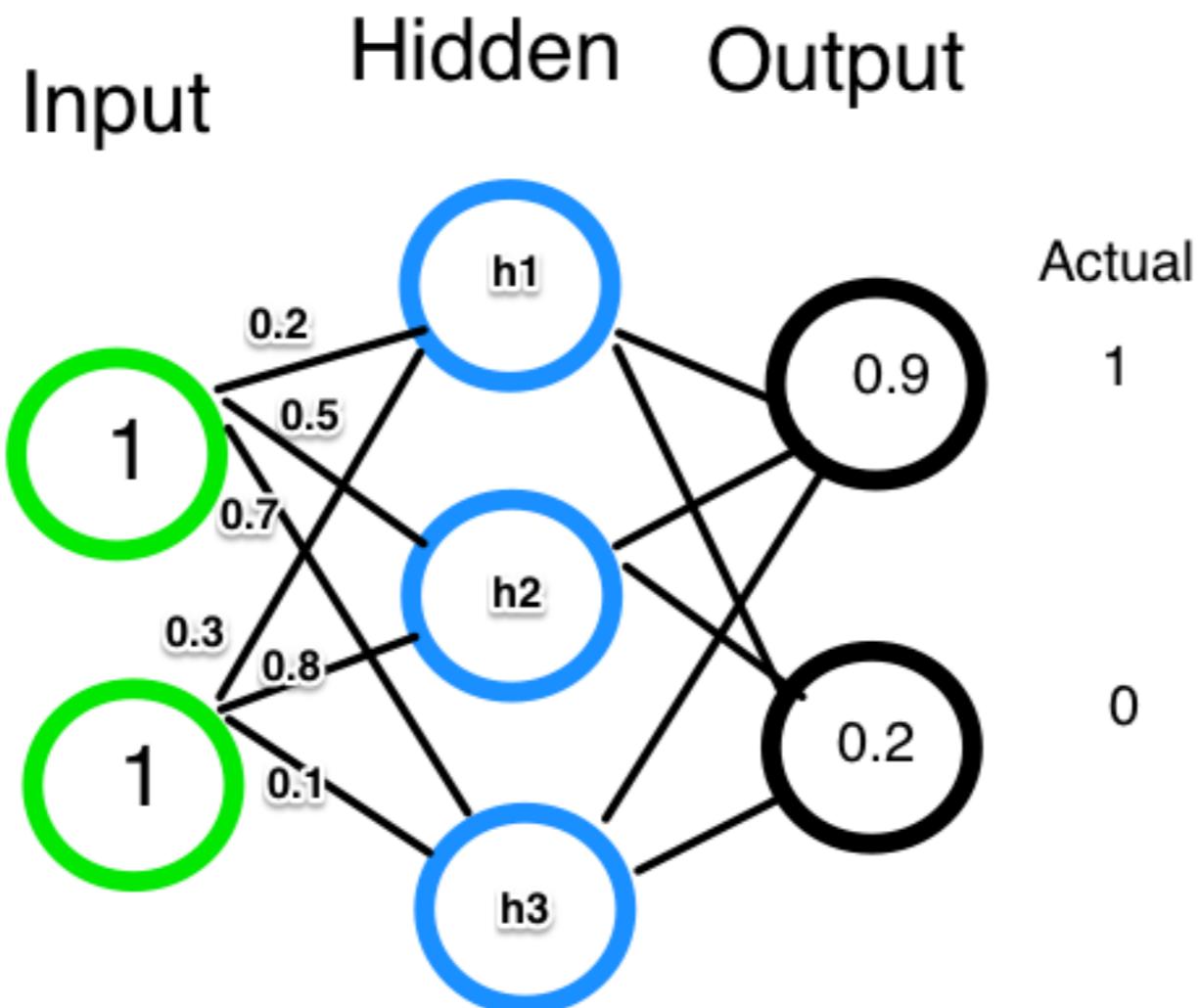
Back Propagation

Find out what went wrong



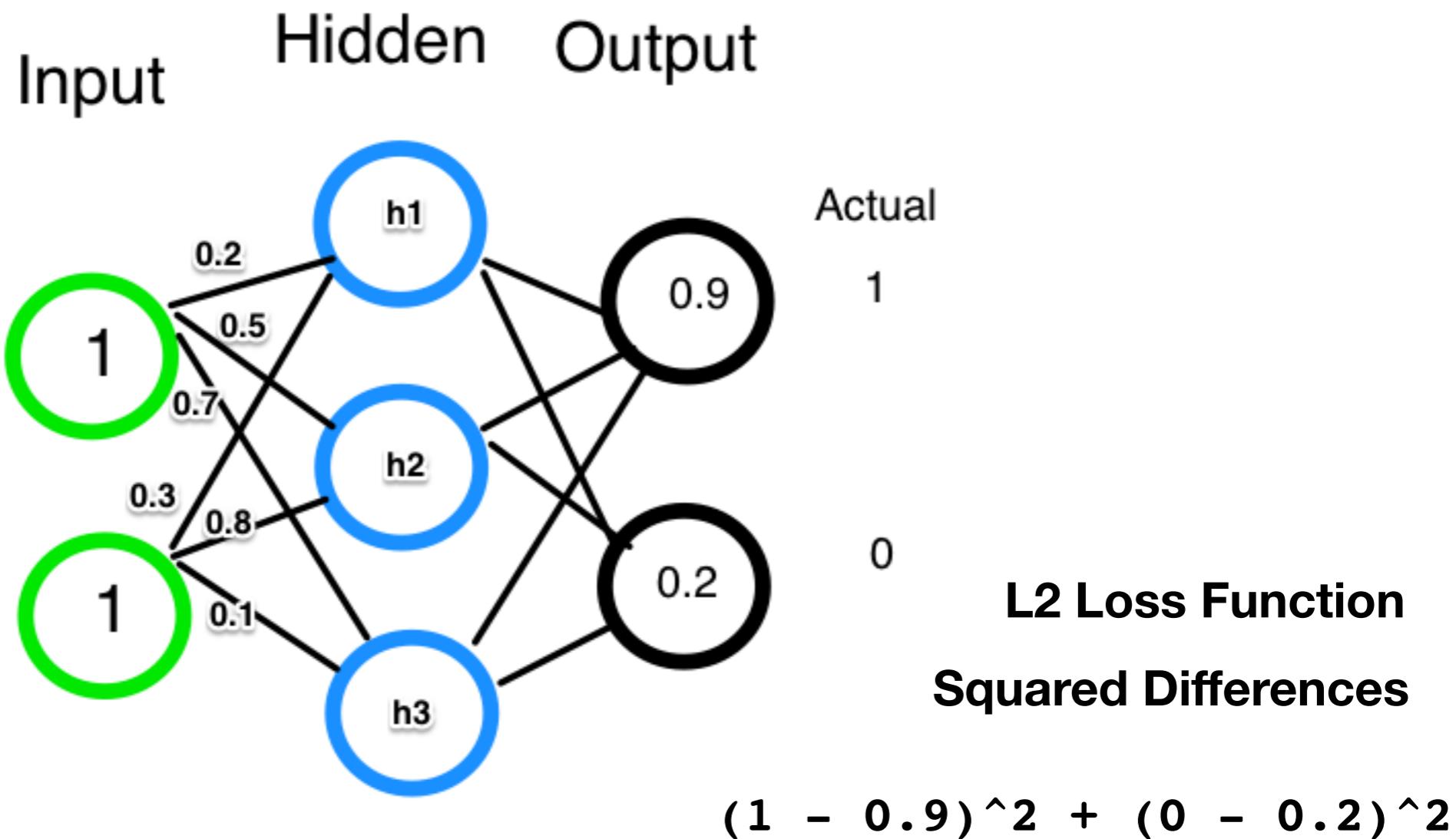
Back Propagation

How far were they from the actual value?



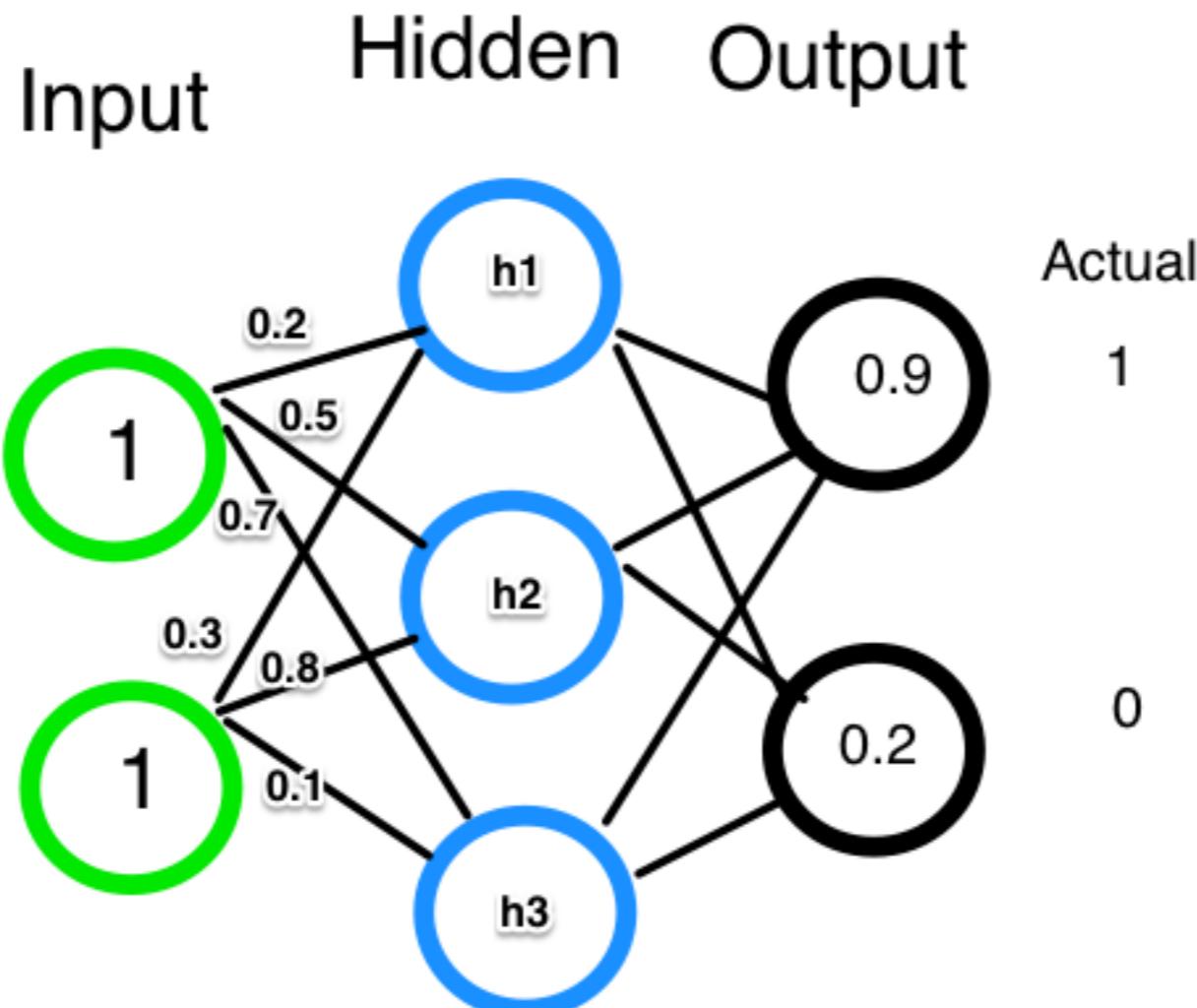
Back Propagation

How far were they from the actual value?



Back Propagation

Now Adjust all the weights for a better answer next time!



Optimization!

Network

Network

Network

Network

Network



Lith. de Dr. Grignot. Suze de Longjumeau.

Henry Monnier

Deep Learning

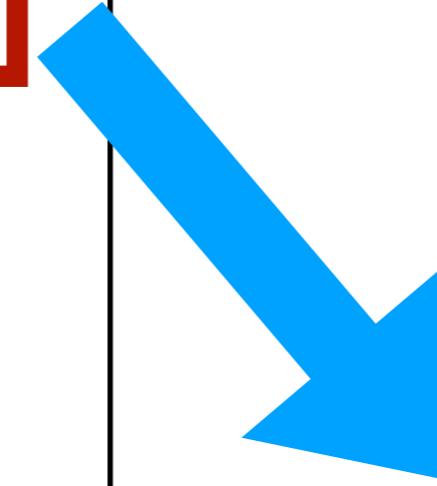
Network

Network

Network

Network

Network



Convolutions

Deep Learning

Convolutions

**Convolutions are to extract features
from an
image matrix**

Convolutions

1	1	1	0	0
0	1	1	1	0
0	0	1	1	1
0	0	1	1	0
0	1	1	0	0

1	0	1
0	1	0
1	0	1

Convolutions

1 <small>x1</small>	1 <small>x0</small>	1 <small>x1</small>	0	0
0 <small>x0</small>	1 <small>x1</small>	1 <small>x0</small>	1	0
0 <small>x1</small>	0 <small>x0</small>	1 <small>x1</small>	1	1
0	0	1	1	0
0	1	1	0	0

Image

4		

Convolved
Feature

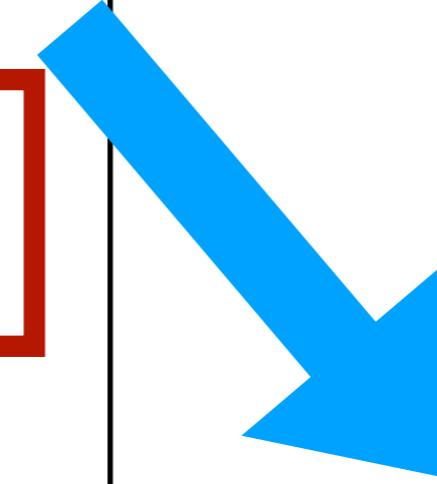
Network

Network

Network

Network

Network



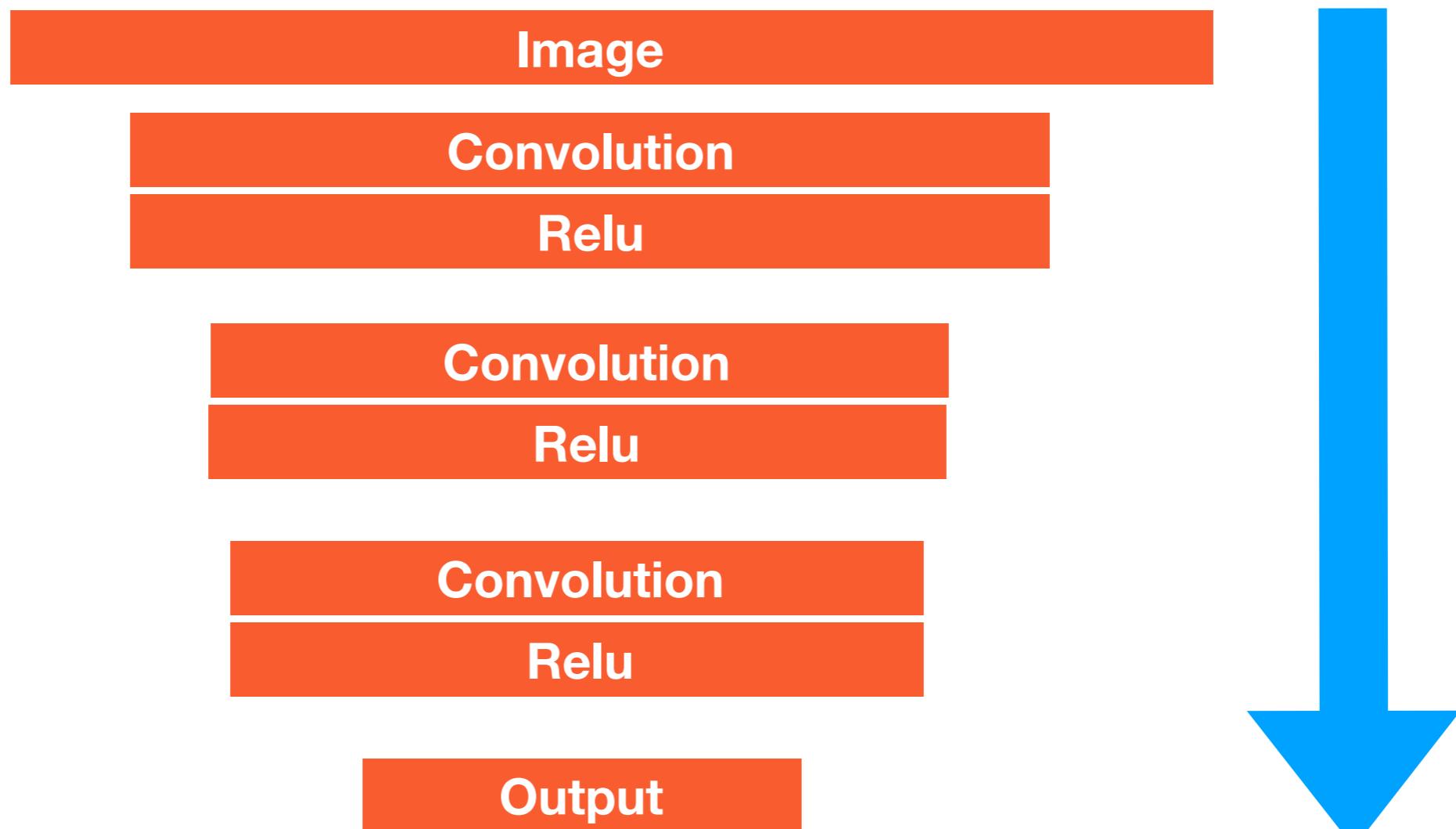
RELU

Deep Learning

Generative Adversarial

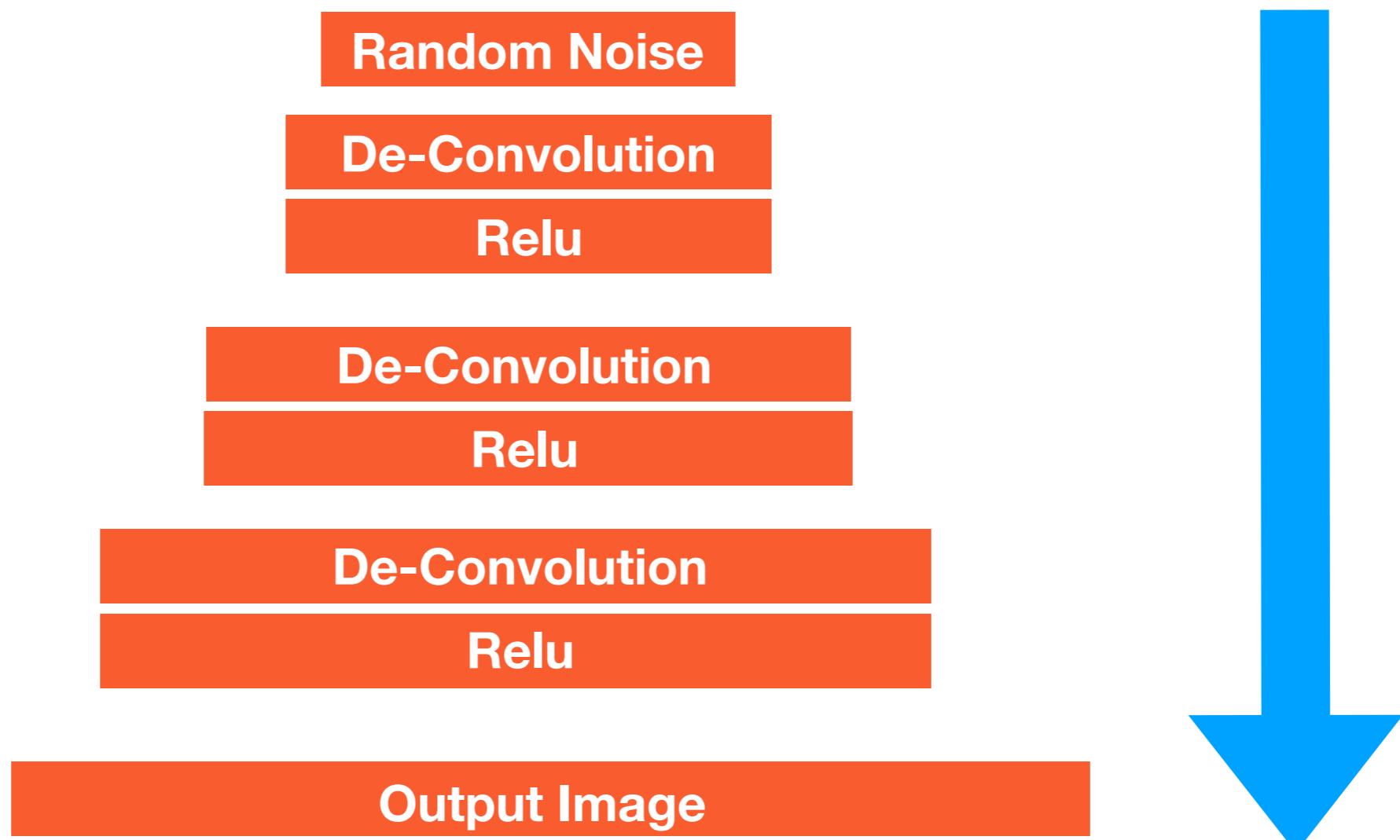


Discriminator



Real or Fake?

Generator



GAN



Discriminator

Generator

Learning Tied Together



Can we GAN?



Can we GAN?



YES!

Apache MXNet (Incubating)

A flexible and efficient library for
deep learning.

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Deep Learning Library

AWS supports it as their choice

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Apache Project

← → ⌂ i mxnet.incubator.apache.org

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Group ID	Artifact ID	Latest Version	Updated	Download
org.apache.mxnet.contrib.clojure	clojure-mxnet-linux-gpu	1.3.0 (1)	14-Sep-2018	
org.apache.mxnet.contrib.clojure	clojure-mxnet-linux-cpu	1.3.0 (1)	14-Sep-2018	
org.apache.mxnet.contrib.clojure	clojure-mxnet-osx-cpu	1.3.0 (1)	14-Sep-2018	

Items per page: 20 1 - 3 of 3 [!\[\]\(eea5f6a264472e39aece1729f972da28_img.jpg\)](#) [!\[\]\(2840c5af97db2d9254a91c01e6cb2abe_img.jpg\)](#)[Apache Maven Resources](#) | [About Sonatype](#) | [Privacy Policy](#) | [Terms Of Service](#)

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Let's GAN Flan!



Ingredients:

1000 flan pics



Ingredients:

1000-5000 flan pics



Ingredients:

1000-5000 flan pics

The screenshot shows a GitHub repository page for the project 'scrapers' owned by 'montoyamoraga'. The repository has 11 commits, 1 branch, 0 releases, and 1 contributor. The latest commit was made on Oct 26. The repository is licensed under MIT. The README.md file contains instructions for building your own image databases using scrapers, scrape, scraping, and selenium.

scrapers for building your own image databases

scraper scrape scraping selenium

Branch: master	New pull request	Create new file	Upload files	Find file	Clone or download
11 commits	1 branch	0 releases	1 contributor	MIT	
make the closing of the popup more defensive with try except Latest commit 6703665 on Oct 26					
scraper-bing-images	make the closing of the popup more defensive with try except				a month ago
scraper-captcha	change captcha README				a month ago
scraper-google-images	update readme				3 months ago
scraper-instagram	add old scrapers				3 months ago
scraper-mugshots	add mugshots scraper				3 months ago
.gitignore	add scrapers				3 months ago
LICENSE	Initial commit				3 months ago
README.md	add scrapers				3 months ago
README.md					

<https://github.com/montoyamoraga/scrapers>

Directions

1000-5000 flan pics



Take all your flan pictures and put them
in a directory

Directions

1000-5000 flan pics



Run a tool to turn them into an optimized
image record iterator for MXNet

```
python3 im2rec.py --resize 28 root flan
```

Directions

1000-5000 flan pics



Load your flan image record iterator
with MXNet and generate flans!

<https://github.com/gigasquid/mxnet-gan-flan>

Directions

Load the Iterator

```
(def flan-iter (mx-io/image-record-iter {:path-imgrec "flan-128.rec"  
                                         :data-shape [3 128 128]  
                                         :batch-size batch-size  
                                         :shuffle true}))
```

|

Directions

Define a Discriminator

```
(as-> (sym/variable "data") data
  (sym/convolution "d2" {:data data :kernel [4 4]
                        :pad [3 3]
                        :stride [2 2]
                        :num-filter (* 2 ndf)
                        :no-bias true})
  (sym/batch-norm "dbn2" {:data data :fix-gamma true :eps eps})
  (sym/leaky-re-lu "dact1" {:data data :act_type "leaky" :slope 0.2}))
```

...

Directions

Define a Generator

```
1 (as-> (sym/variable "rand") data
2   (sym/deconvolution "g1" {:data data :kernel [4 4]
3                         :pad [0 0]
4                         :stride [1 1]
5                         :num-filter (* 4 ndf)
6                         :no-bias true})
7   (sym/batch-norm "gbn1" {:data data :fix-gamma true :eps eps})
8   (sym/activation "gact1" {:data data :act-type "relu"}))
9
```

...

Directions

Reduce over the iterator

```
(mx-io/reduce-batches
  flan-iter

  (fn [n batch]

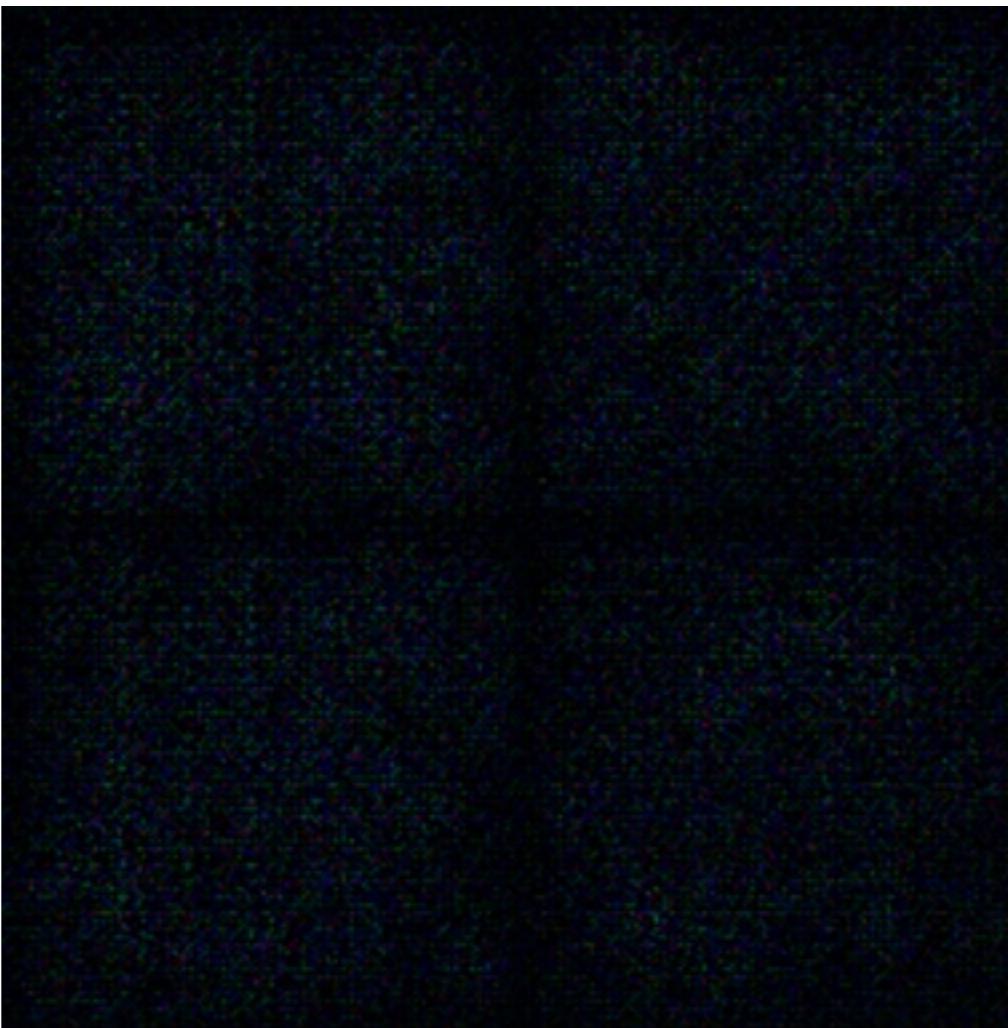
    (let [rbatch (mx-io/next rand-noise-iter)
          dbatch (mapv normalize-rgb-ndarray (mx-io/batch-data batch))
          out-g (-> mod-g
                  (m/forward rbatch)
                  (m/outputs)))
        ...]
```

Directions

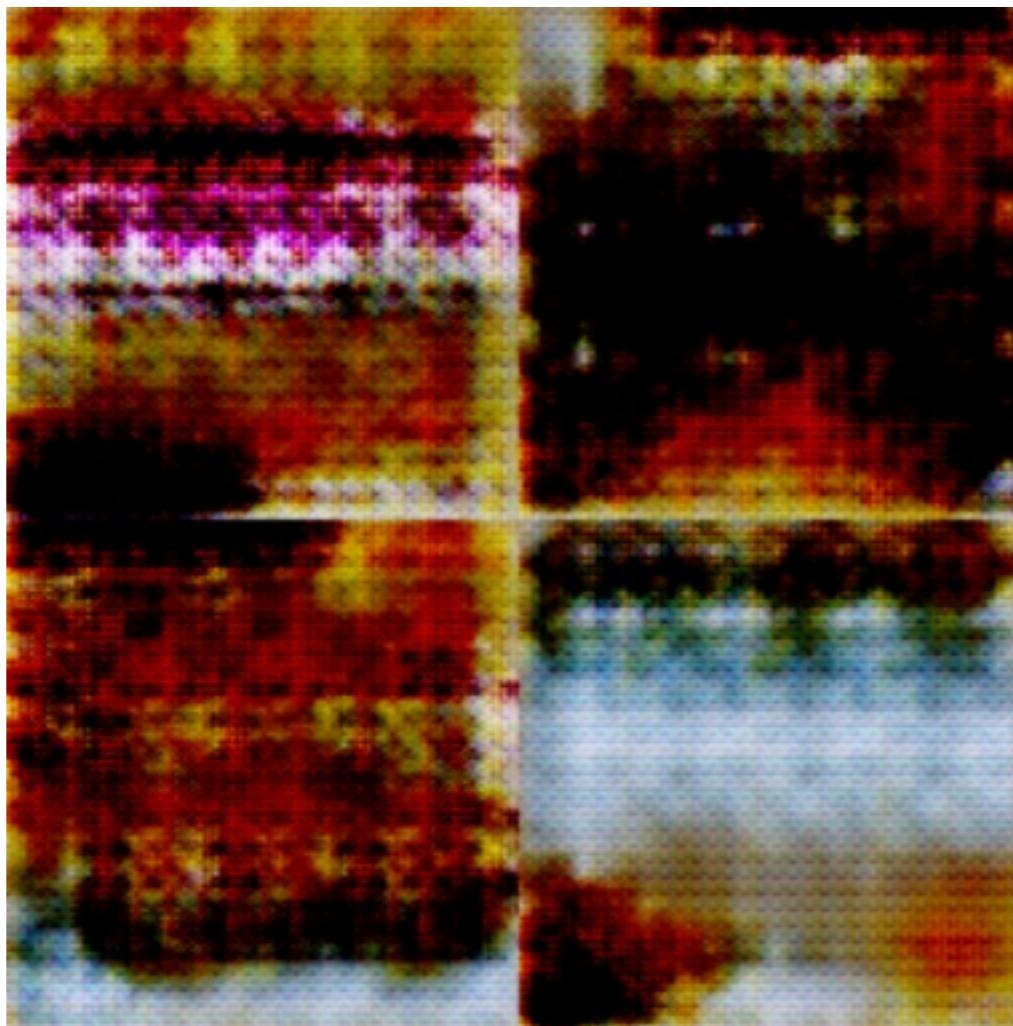
Turn on the Oven and Bake!

...
.

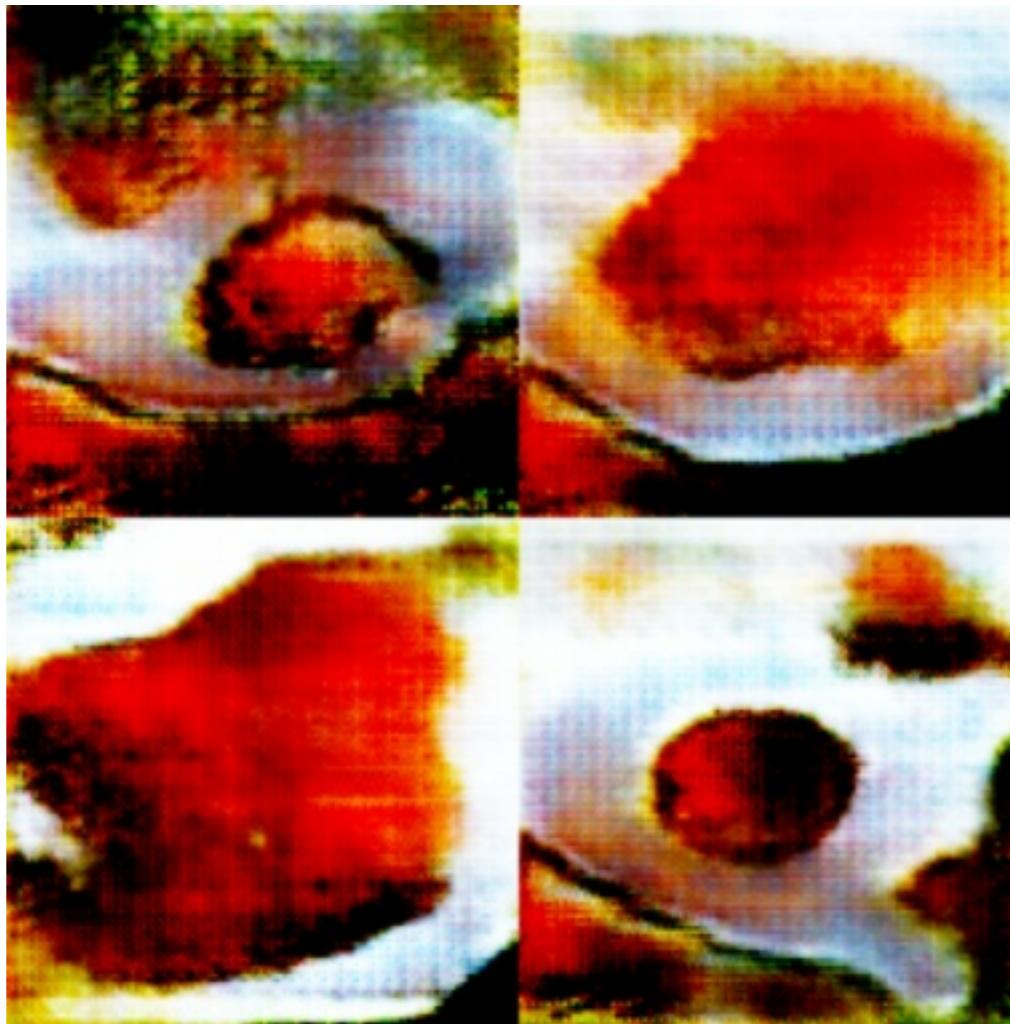
Epoch 0



Epoch 10



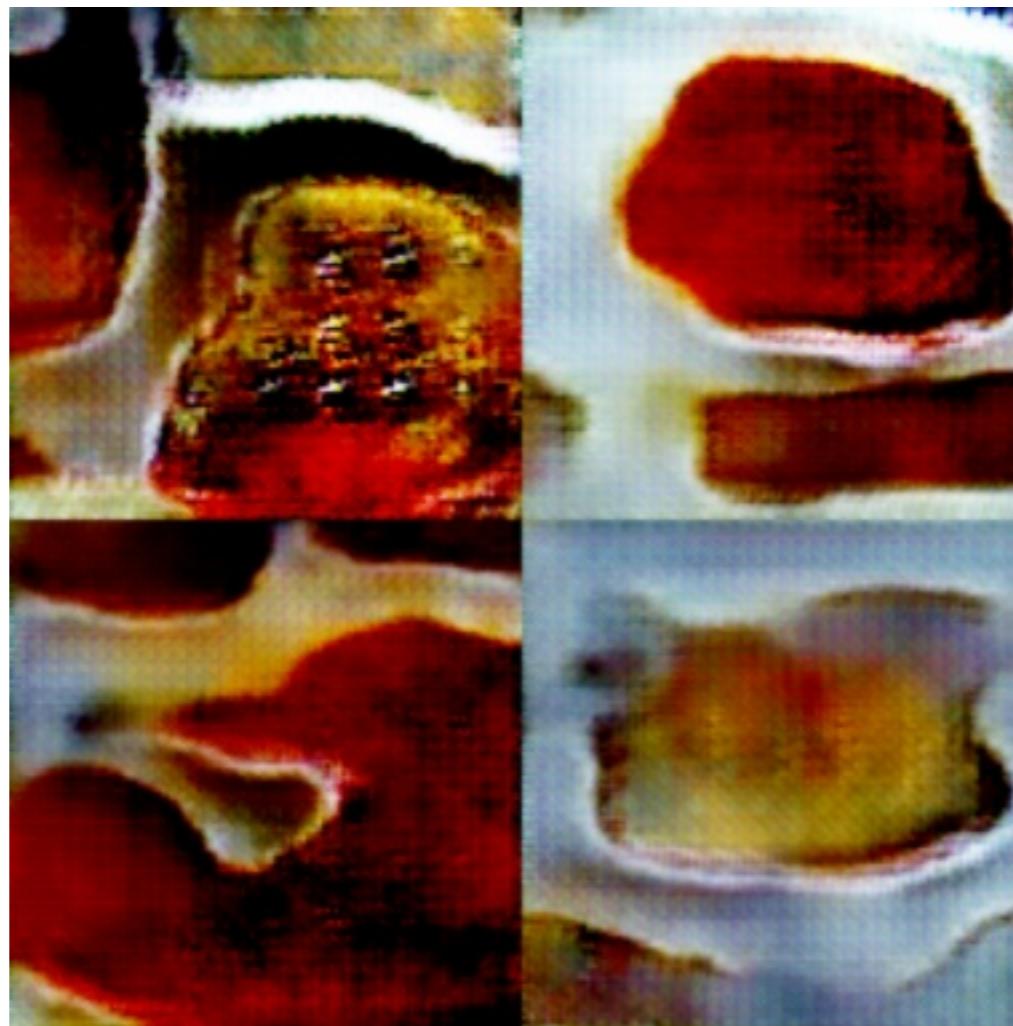
Epoch 23



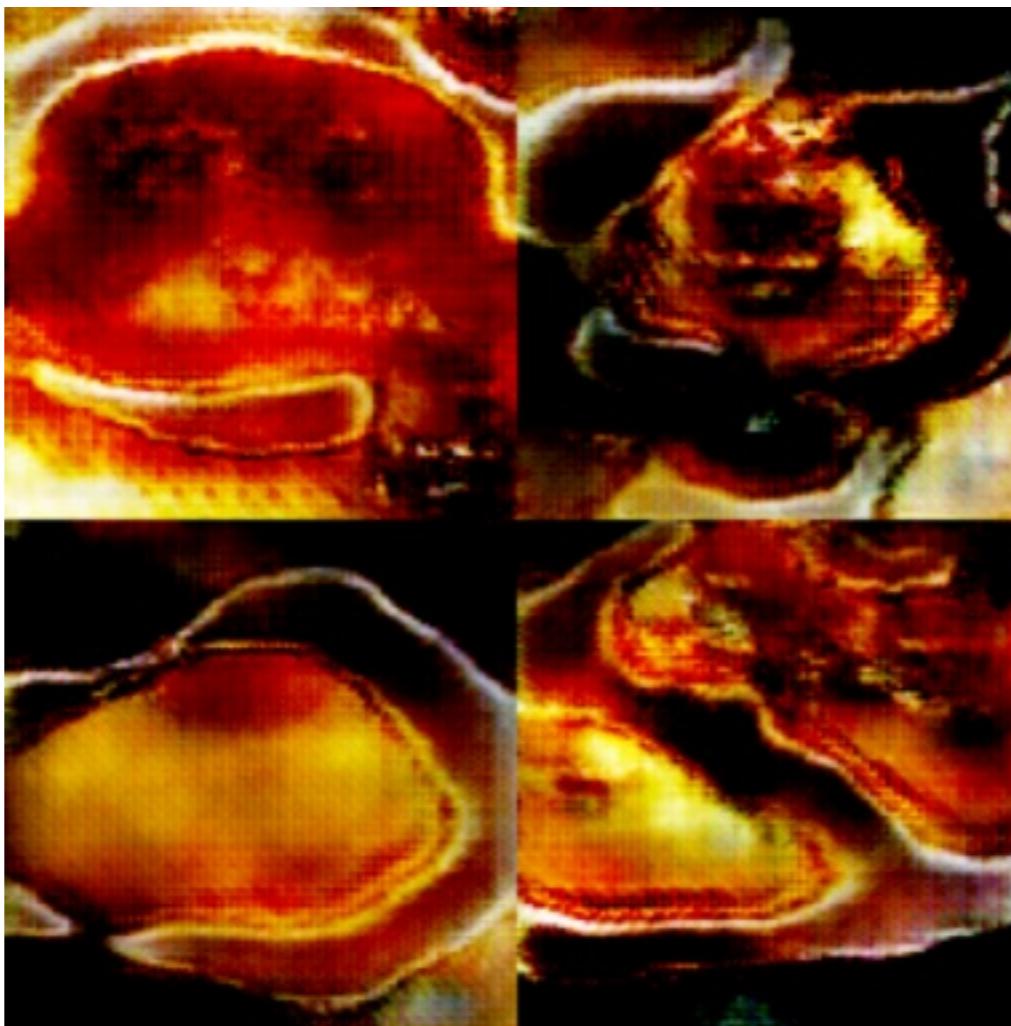
Epoch 33



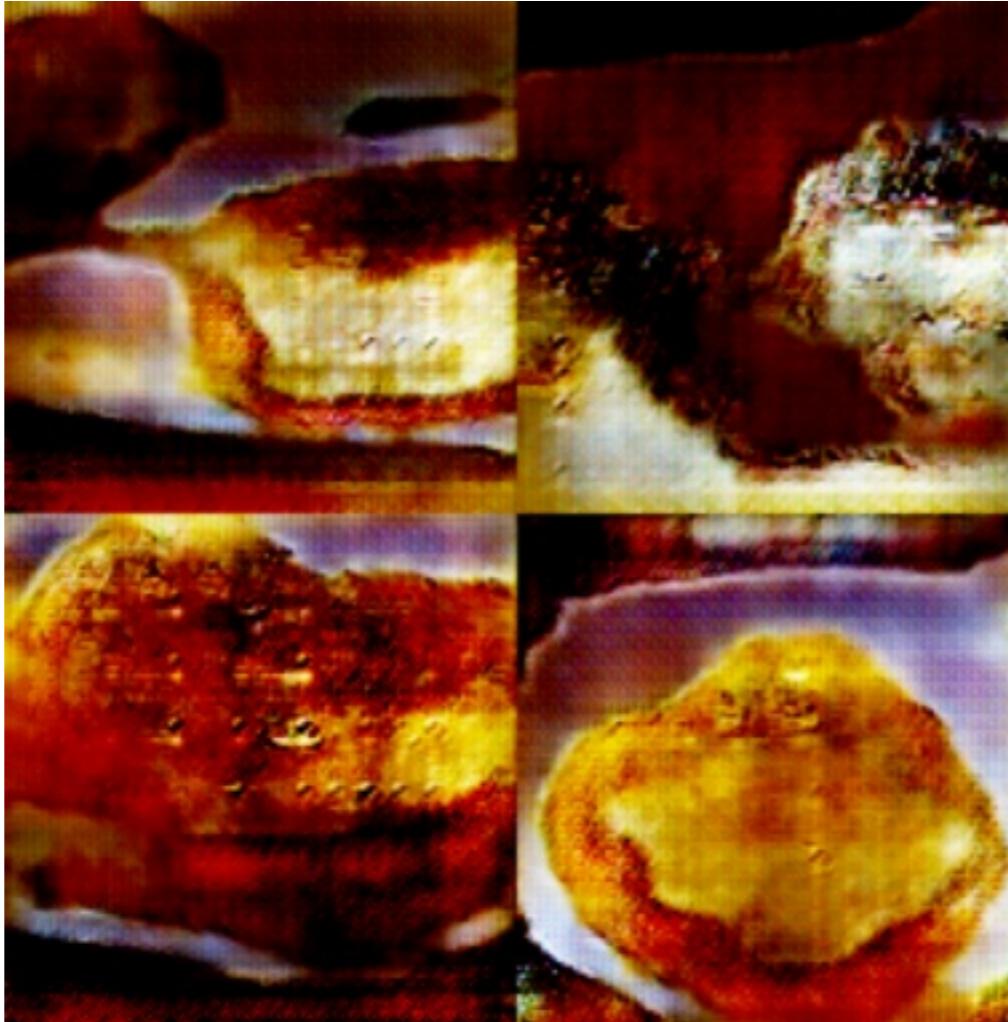
Epoch 45



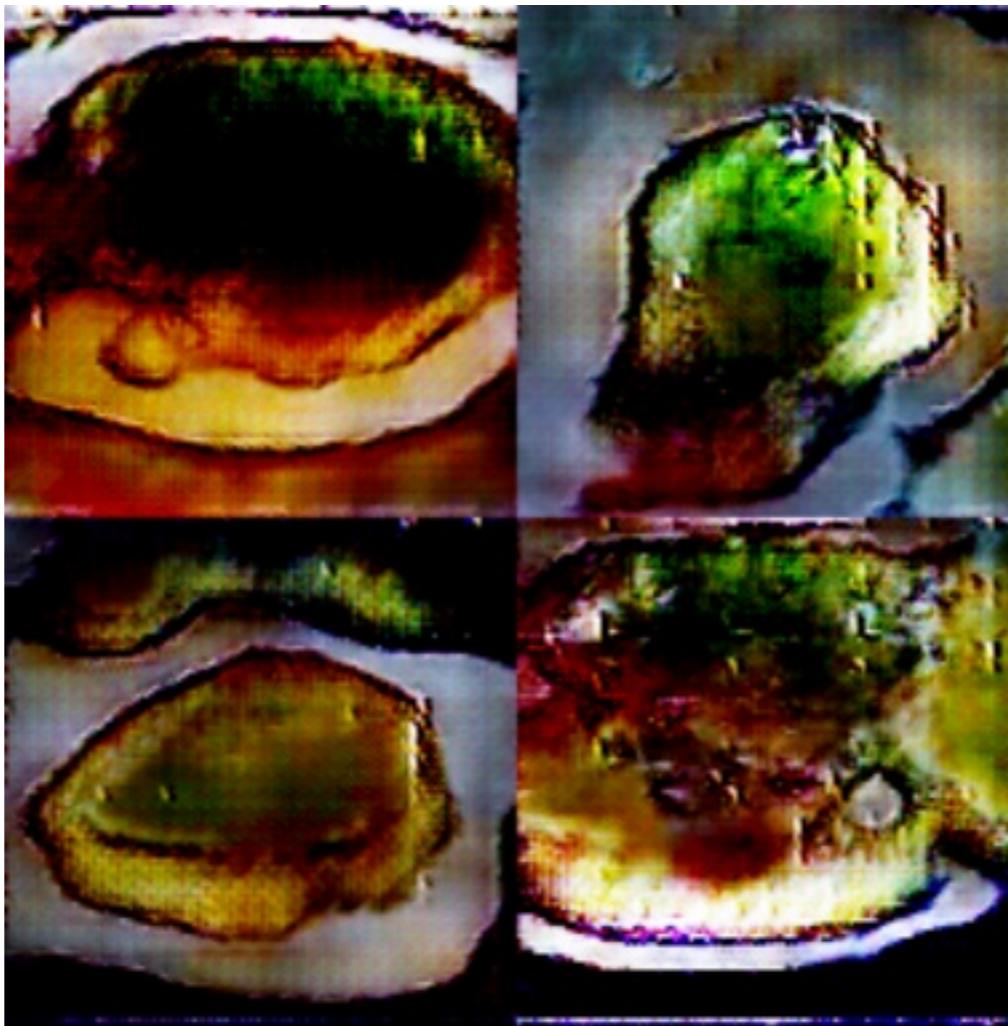
Epoch 68



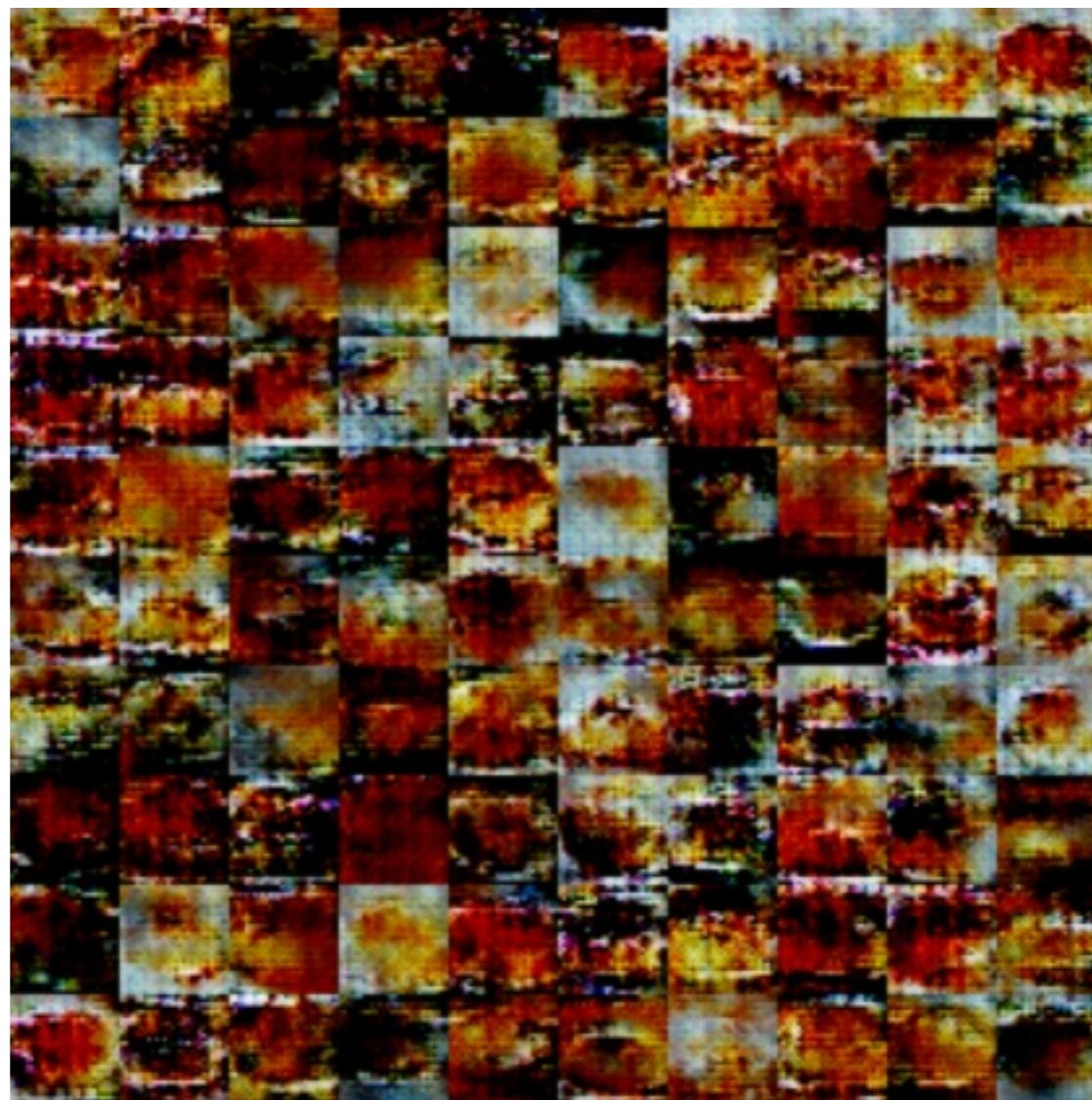
Epoch 161



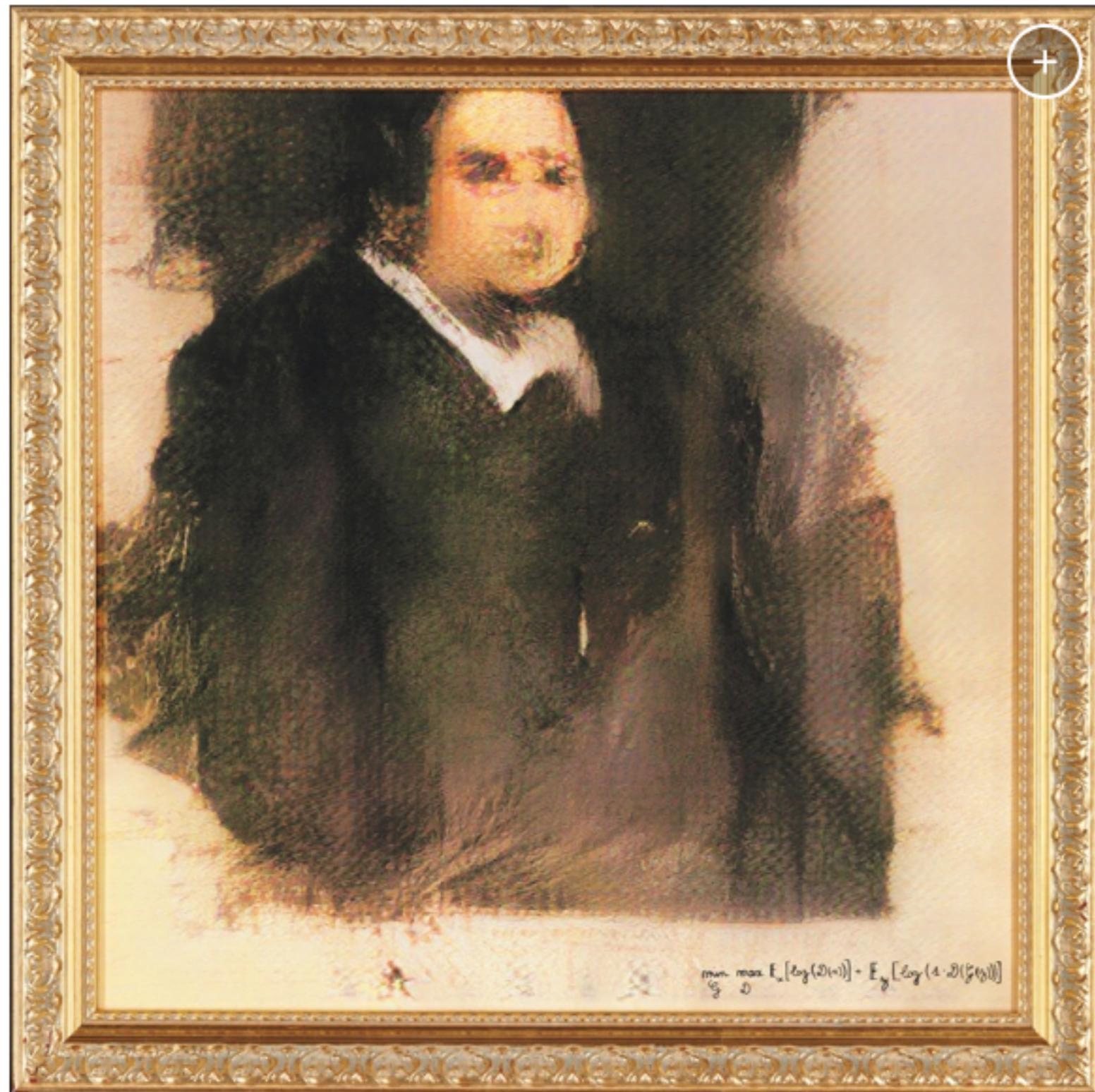
Epoch 170



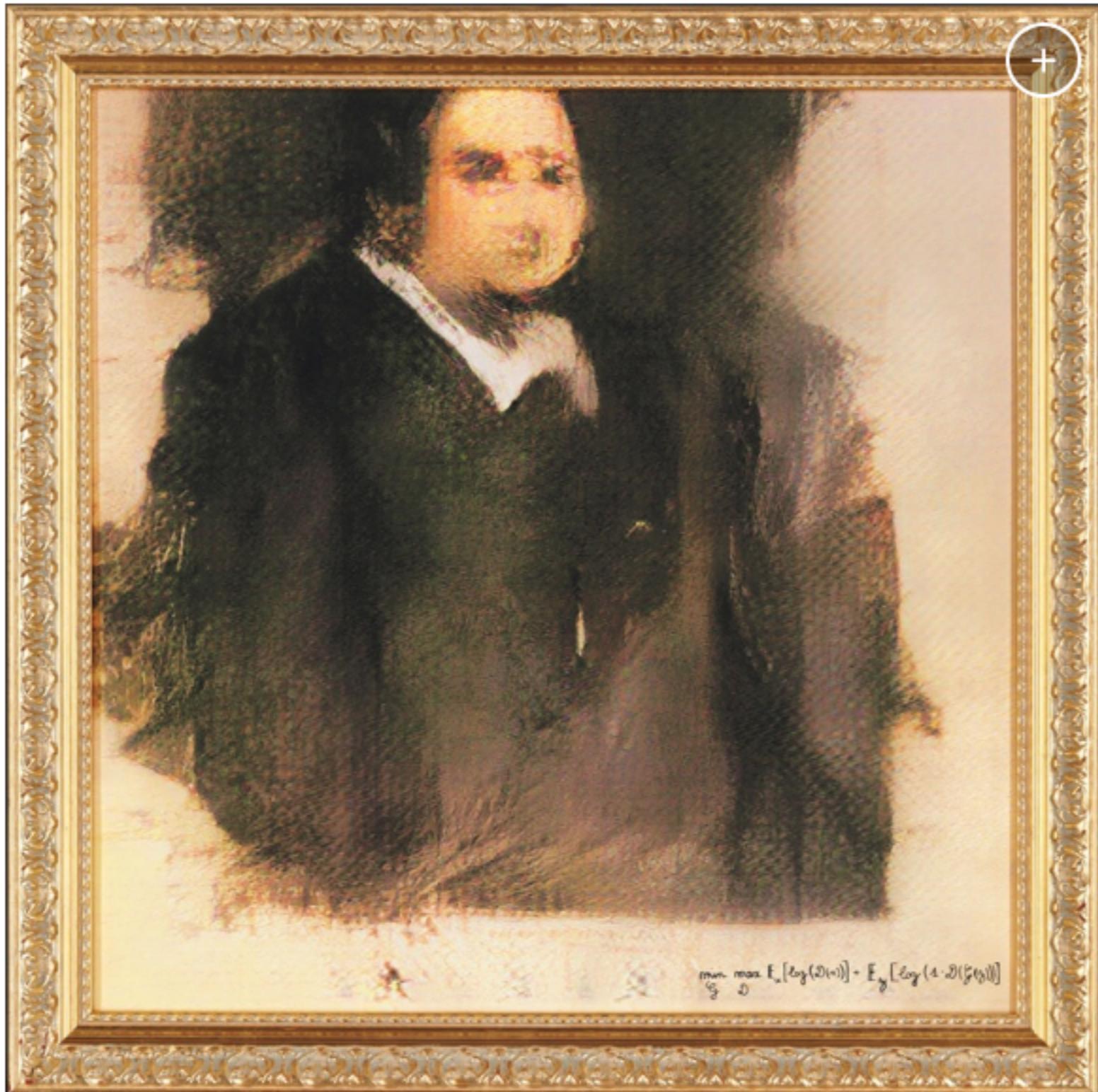
Celebrate!



Christie's Auction



\$432,500



$$\min_{\mathcal{D}} \max_{\mathcal{G}} E_x[\log(\mathcal{D}(x))] + E_y[\log(1 - \mathcal{D}(\mathcal{G}(y)))]$$

BIG GAN



Cornell University
Library

[arXiv.org](#) > cs > arXiv:1809.11096

Computer Science > Machine Learning

Large Scale GAN Training for High Fidelity Natural Image Synthesis

[Andrew Brock](#), [Jeff Donahue](#), [Karen Simonyan](#)

(Submitted on 28 Sep 2018)

Despite recent progress in generative image modeling, successfully generating high-resolution, diverse samples from complex datasets such as ImageNet remains a challenge. To this end, we train Generative Adversarial Networks at the largest scale yet attempted, and study the instabilities specific to such scale. We find that the generator's architecture is key to its success. In particular, we find that the generator renders it amenable to a simple "truncation trick", allowing fine control over the trade-off between sample fidelity and variety.

BIG GAN

https://colab.research.google.com/github/tensorflow/hub/blob/master/examples/colab/biggan_generation_with_tf_hub.ipynb#scrollTo=46M8prJPDEsV

Explore BigGAN samples of a particular category

Try varying the `truncation` value.

(Double-click on the cell to view code.)



Category-conditional sampling

`num_samples:`

`truncation:`

`noise_seed:`

`category:` 933) cheeseburger



BIG GAN

https://colab.research.google.com/github/tensorflow/hub/blob/master/examples/colab/biggan_generation_with_tf_hub.ipynb#scrollTo=46M8prJPDEsV



Future Exciting

and

maybe a bit worrying...

Wrap Up



Wrap Up

Deep Learning Networks
are made up of **layers**



Wrap Up

Deep Learning Networks
are made up of **layers**

GANs are a network
that combines
a **discriminator** and a **generator**



Wrap Up



GANs can help humans
explore and create

Wrap Up

YES!

You Can GAN!



mxnet

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Apache MXNet (Incubating)

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Credits/ References

<http://neuralnetworksanddeeplearning.com/chap4.html>

<https://www.boredpanda.com/animal-lego-sculpture-11>

<https://www.oldbookillustrations.com/titles/the-chicken-market-and-other-fairy-tales/>

<http://cs231n.github.io/convolutional-networks/#conv>

<https://github.com/AlexiaJM/Deep-learning-with-cats>

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