

# **fleshing out the bones**

**understanding the human remains trade  
with computer vision**

Shawn Graham & Damien Huffer  
@electricarchaeo @DamienHuffer  
follow along at [j.mp/sg-dh-qm18](http://j.mp/sg-dh-qm18)

MUSÉE BROCA



# Abraham Ulrikab



# How many other Abrahams are out there?



# Our project:

- seeks to map this trade
- uses tools of digital humanities to understand both text and visual materials

when people want to buy bones, where do they go?  
when people want to sell bones, where do they go?

*'I have a pile of teeny human skull scraps laying around. Due to etsys rules i cannot sell human bone or make a listing but id love to do custom orders for anyone interested in a pendant, ring, etc made from a human skull fragment. Dm me! #bone #bones #skull #humanbone #humanskull #fragment #skullfragment #oddities #oddity.'*

<https://www.instagram.com/p/znHyR7AbXS/>





FOLLOW

123 likes

1w

[REDACTED] Process 😊 #skull #Schedel #crâne  
#explodedskull #beaucheneskull

[REDACTED] ❤

"J'ai un ami à dîner ce soir..."

[REDACTED] hahaha 😂

[REDACTED] something  
special for dinner tonight? should add  
some vegetables 😅

[REDACTED] Soup from a skull?  
Fancy that!

[REDACTED]

[REDACTED] Dinner time Skull soup 👍

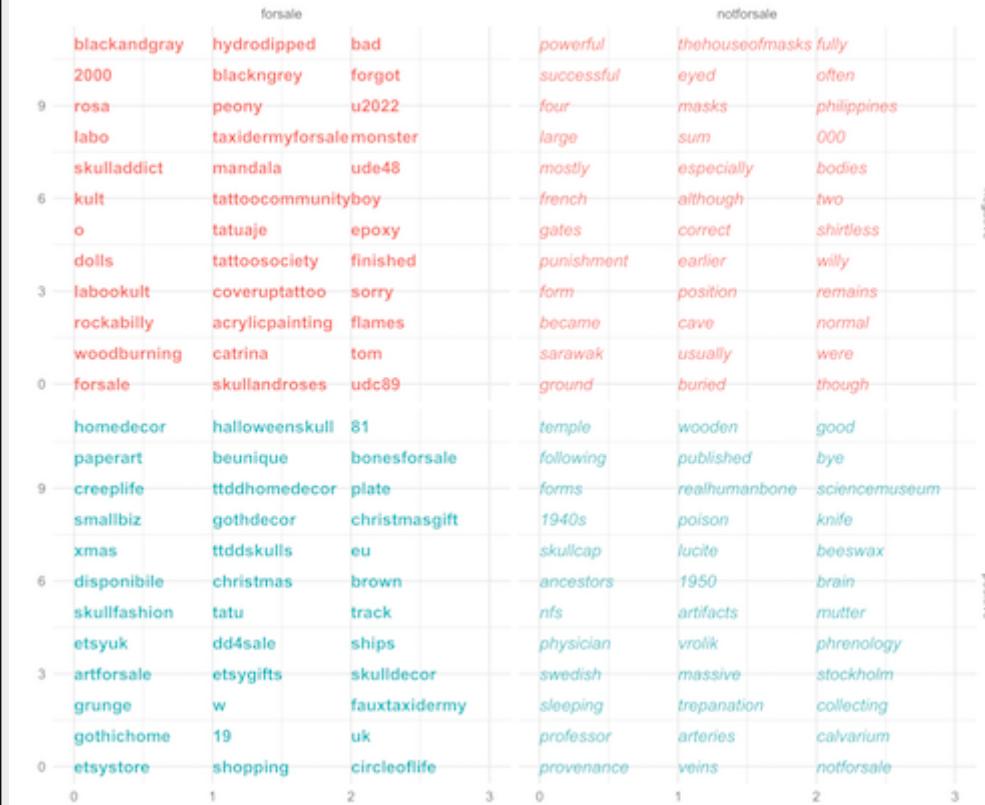
[REDACTED] ya des tutos pour monter des  
meubles ou cuisiner. et puis ya les tutos de  
eric

**digital archaeology**

**meets**

**digital humanities**

The top negative (red) and positive(blue)  
used with 'not for sale' (italics) and 'for sale'(bold) words

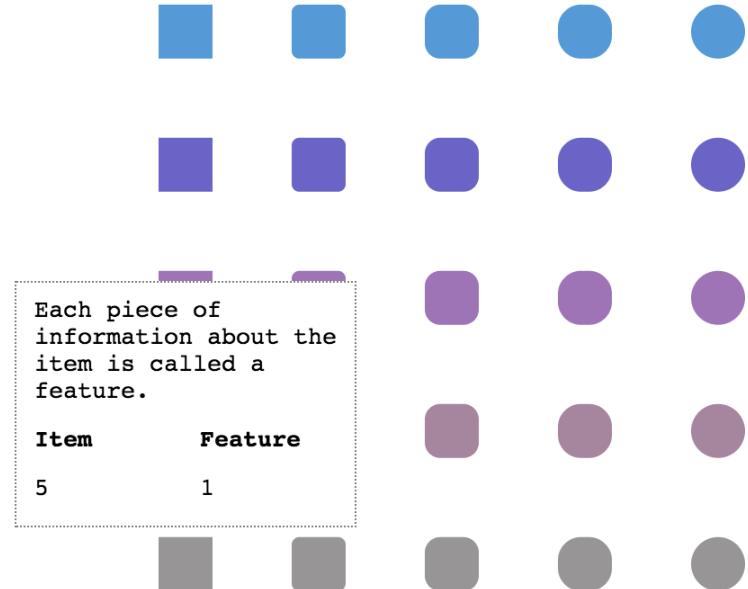


**so that's what we've  
done**

**here's where computer vision  
comes into it**

The machine is blind and we can consider the **feature matrix** its eye. It defines the signals that the machine perceives and attempts to make sense of. In practice it takes the form of a table of numbers, with one row for each item we ask the machine to look at and a column for each property of the item we can extract. These properties are known as features; a feature could be the color of a particular pixel in an image, or the timestamp on a photo. **Anything you can quantify** can be represented in the feature matrix.

What we choose to represent in a feature matrix is a critical decision in the creation of any machine perception or machine learning process. It is important to remember that it is a *decision*, as opposed to some “natural” state of our data, because we have complete flexibility in how we turn an item from our world into a row in the matrix. And our choices will often serve to amplify or dampen certain characteristics of our original items. Our goal is to construct the most useful feature matrix for our given task and constraints, and we often don't know exactly what that will be when we start.

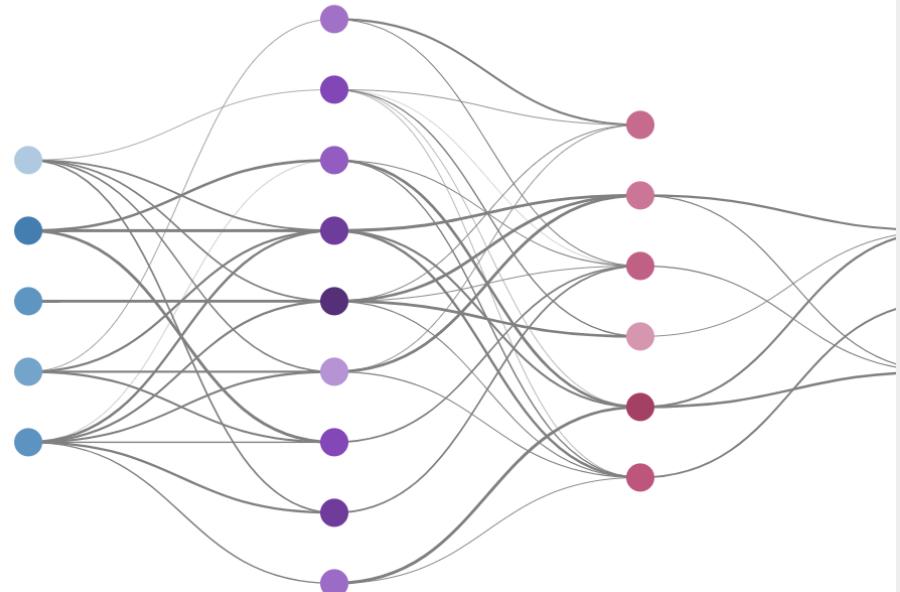


- Yannick Asogba, 'Machine Visions'

## 2. THE NEURAL NETWORK

If the feature matrix is like a eye, the **neural network** is akin to a brain. Neural networks are programs that can extract useful information from the input they are given to accomplish a particular task. The trick is that they are able **to learn what useful information to extract** just by being exposed to data and being told whether they are doing a good job or not. They in effect are able to **learn/construct a representation (i.e. a feature matrix)** of the input data that is useful for the task they are trained to perform.

Neural networks take their name from the biological metaphor on which they are loosely modeled. Neurons in our brain become nodes in the network; they are connected to each other in an arrangement determined by the programmer and architected to suit a particular task. Each neuron determines whether or not to pass a signal on to its neighbors and modulates how strongly that signal is passed along, filtering and



- Yannick Asogba, 'Machine Visions'



TEXTURE

COLOR

SHAPE

SIZE



- Tanz & Carter 2017

## HOTSPOTS



Boxers



Buildings



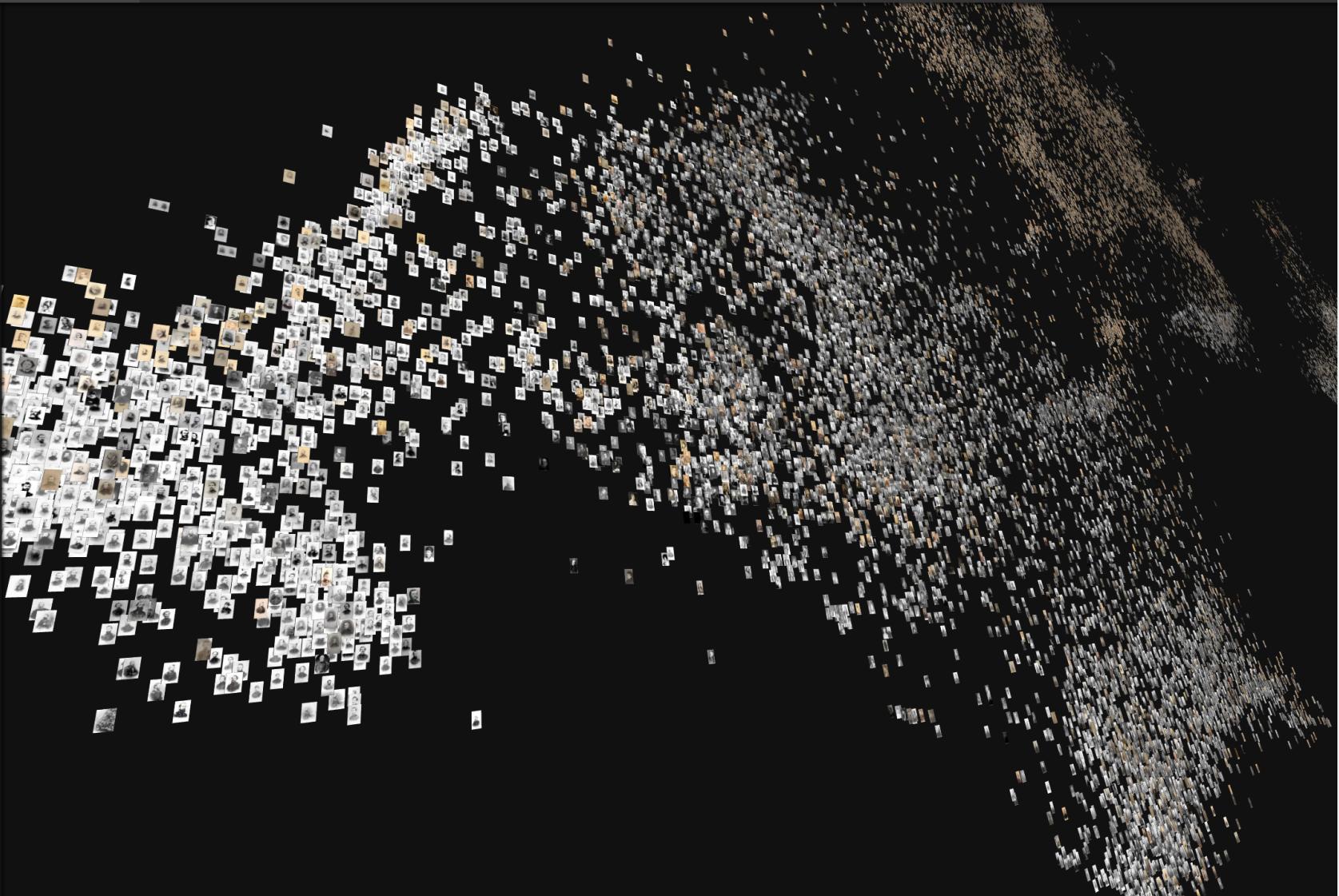
Buttons

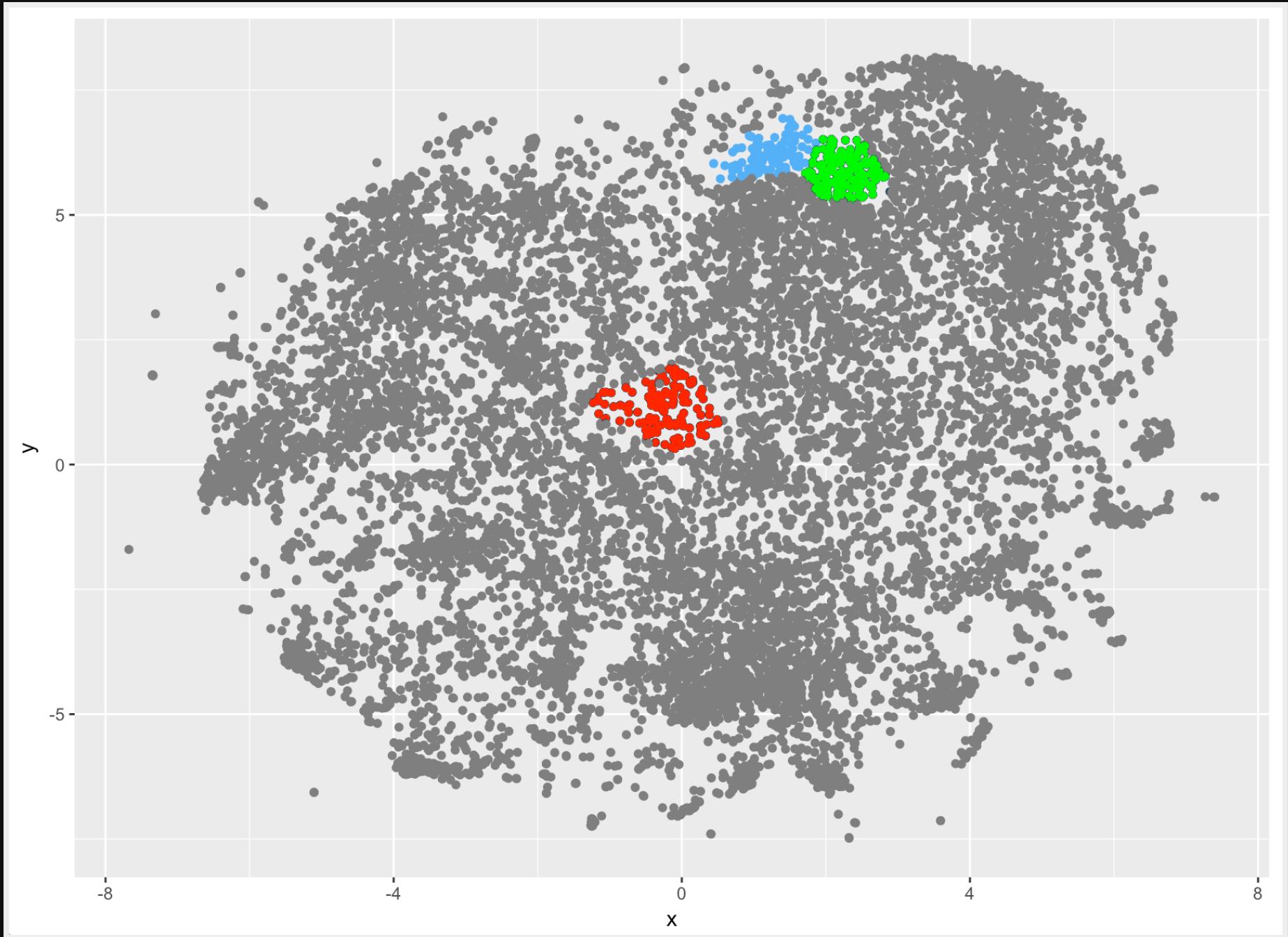


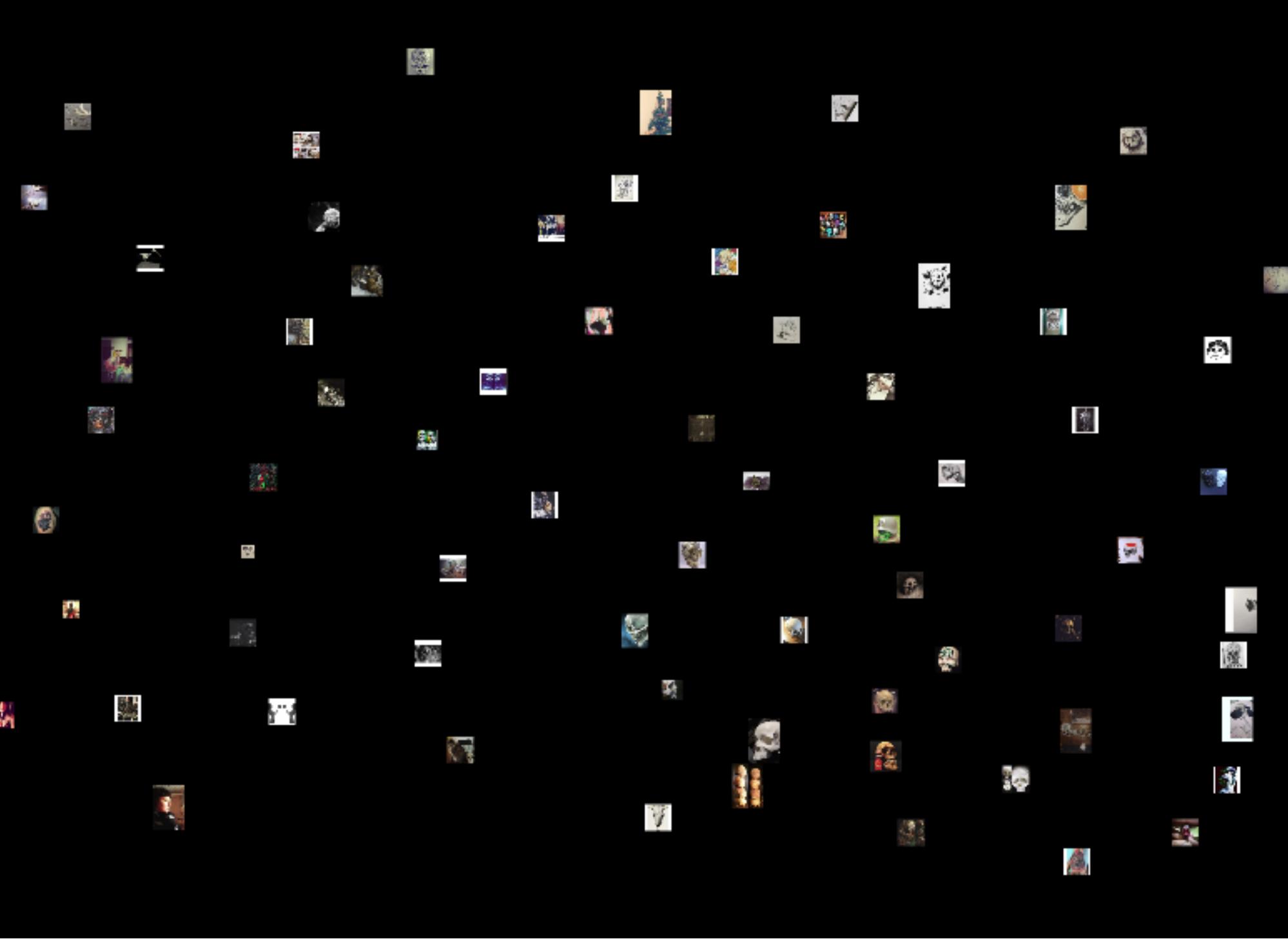
Chairs

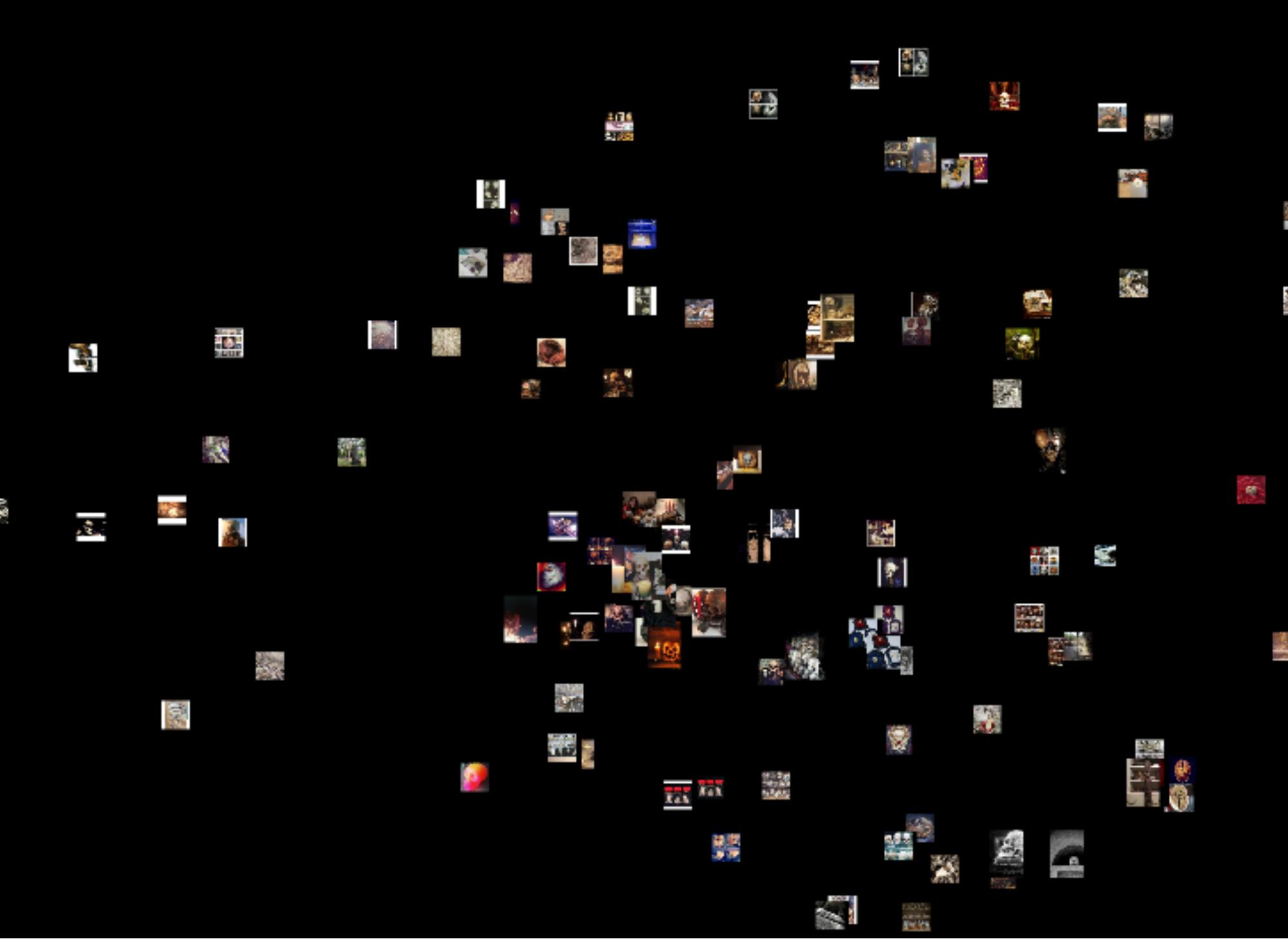


Gowns









# Training our own classifier



Build Your Own Classifier Tutorial

# Find a path through image-space

## Mechanical Kubler

Collecting different visual pathways through time, using the collection of the Rijksmuseum along with computer vision and nearest-neighbor searching. A site by @mdlindon.

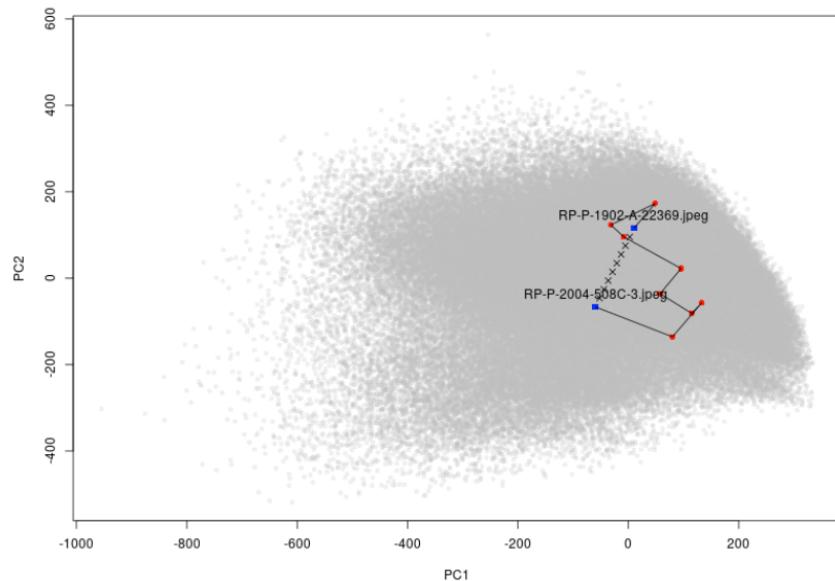
[View My GitHub Profile](#)

### Timeline: chronological-backwards



### Nearest-neighbor search path

[What is this?](#)





Ryan Baumann @ryanfb · 27 Oct 2015

About a day left for indexing of the Rijksmuseum images to finish. Duplicate detection seems to work well already!



GIF

1



1





Ryan Baumann @ryanfb · 28 Oct 2015

Final index of Rijksmuseum images: 1.8GB. Bouncing every image back through  
[#pastec](#) search to find all matches will take another 3-4 days.

- Ryan Baumann Finding Near-Matches in the Rijksmuseum with Pastec

# Ethically Troubling



## FACE ATTRIBUTE ANALYSIS

The service includes detection of gender, age, race, expression and face landmark. It can be used in many areas, such as photo refinement, avatar and predestination by photos.

## ABOUT FACEALL

Beijing FaceAll Co. is Beijing Software & High-Tech Enterprise, authorized by Beijing Government, China. It was founded at 2015, and is Angel invested by Huami(Xiaomi Bracelet) Co. in China at 2016, and is Pre-A invested by Qingdao Dingyuan Co. at 2017. We focus on the algorithmic core technology innovation of face recognition, image recognition and video retrieval by machine learning and especially deep learning algorithms. Many of our key members have working experiences at top 500 Enterprises in the world. Our vision is to develop the best **face recognition** and **image recognition** software services for related enterprises.

We have achieved many rewards in world-level multimedia retrieval, image recognition and face recognition benchmark challenges. The online API service have been developed for individuals and businesses, including face detection, face verification (1:1), face identification (1:N) , face landmark detection(5 points, 27 points, 68 points, 194 points), celebrity recognition, face attribute analysis(genders, age, races) and object/scene recognition.

**It's still early days.**

# thank you

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**boonetrade.github.io**

for technical details, see our paper in  
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Archaeology, DOI: 10.5334/jcaa.8

# Image Credits

- dramatization of Abraham Ulrikab - screenshot from CBC The Nature of Things, **Trapped in a Human Zoo**
- screenshot of museum exhibiting skeletons - screenshot from CBC The Nature of Things, **Trapped in a Human Zoo**
- Tanz& Carter, **GumGum Neural Networks Made Easy**
- sources for Instagram screenshots will not be shared in public

# Credits for Code & Demos & Screenshots

- Finding Near-Matches in the Rijksmuseum with Pastec **Ryan Baumann**
- Identifying Similar Images with Tensorflow **Douglas Duhaime**
- Mechanical Kubler **Matthew Lincoln**
- Machine Visions **Yannick Asogba**
- PixPlot visualization **Yale DH Lab**
- Tensorflow for Poets **Peter Warden/Google Codelabs**