# HI && AI

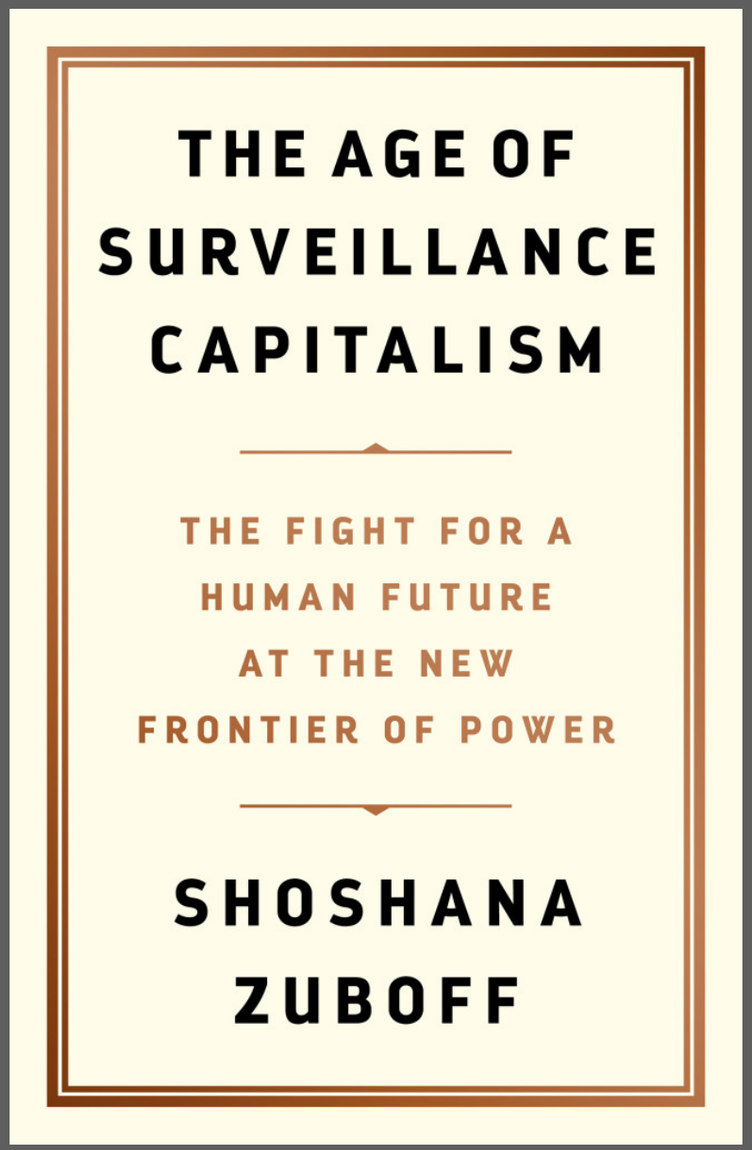
Kyle Oba

@mudphone

pas de chocolat

**local clients**
**local solutions**

# the unprecedented



# the unprecedented

**“The unprecedented is necessarily unrecognizable. When we encounter something unprecedented, we automatically interpret it through the lenses of familiar categories, thereby rendering invisible precisely that which is unprecedented.”**

Shoshana Zuboff
*The Age of Surveillance Capitalism*

EMERGENCY ALERTS

**Emergency Alert**

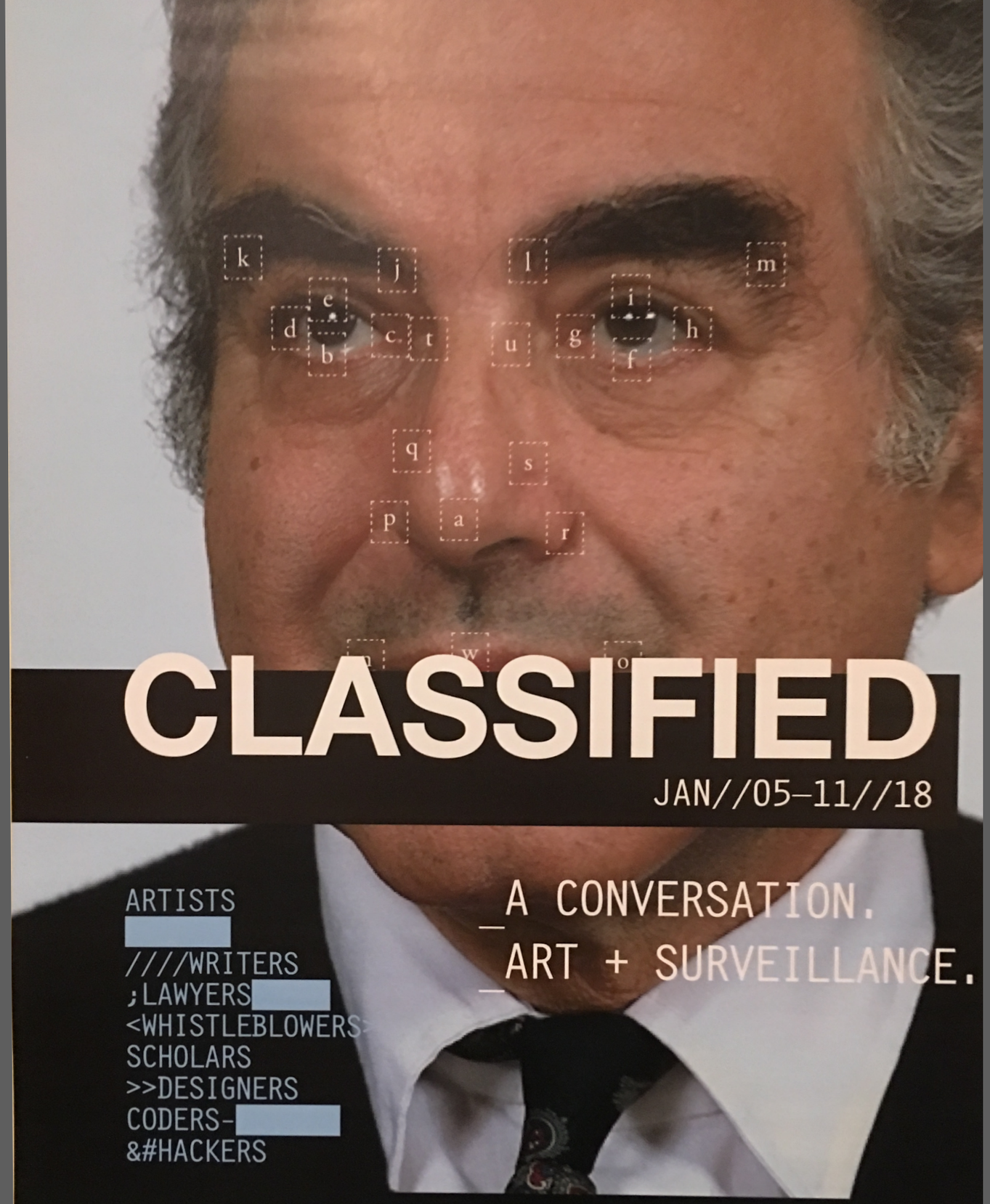
BALLISTIC MISSILE THREAT INBOUND TO HAWAII. SEEK IMMEDIATE SHELTER. THIS IS NOT A DRILL.

Settings

# How is this relevant?

**As builders and designers we need to create this new lens for ourselves.**


# Honolulu Musuem of Art




# CLASSIFIED

JAN//05–11//18

ARTISTS
////WRITERS
;LAWYERS
<WHISTLEBLOWERS>
SCHOLARS
>>DESIGNERS
CODERS-
&#HACKERS

_A CONVERSATION.
_ART + SURVEILLANCE.

Honolulu
Museum of Art
Doris Duke Theatre

**See the schedule at myhoma.org/classified**

*It Began as a Military 2017 Experiment, 2017*
Set of 10 pigment prints 13 ⅛ × 10 ½ in.

# My Profile Tour

## Goals

**Raise awareness of…**

- **Surveillance technology**
- **Face recognition**
- **Data privacy issues**
- **“ML & AI” definitions**

# My Profile Tour

## What we built

- **Individualized tours based on a guest's face, matched to art currently on display in the museum**

59%
match

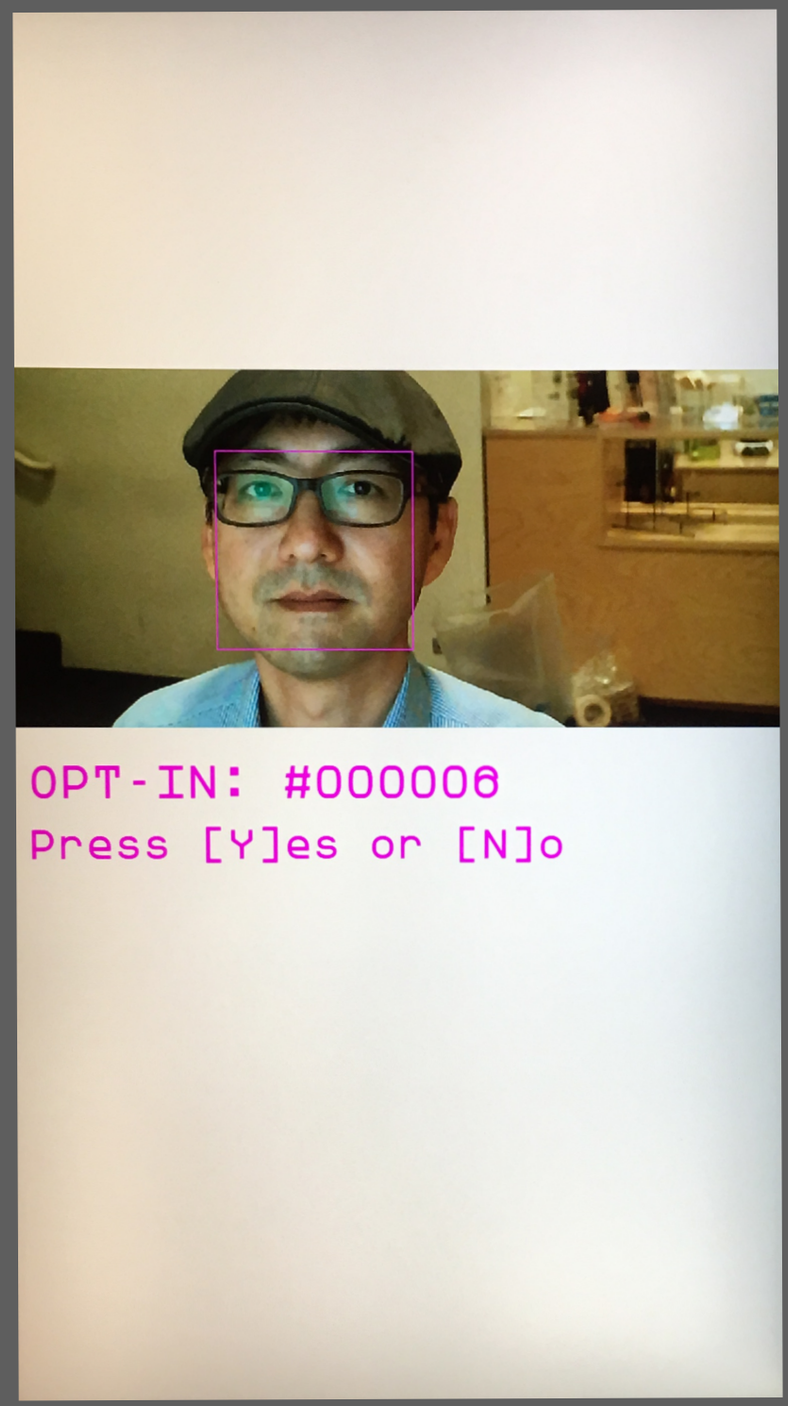
## Portrait

Mohammed Al Mazrouie


https://twitter.com/kumailn/status/952329304259489793

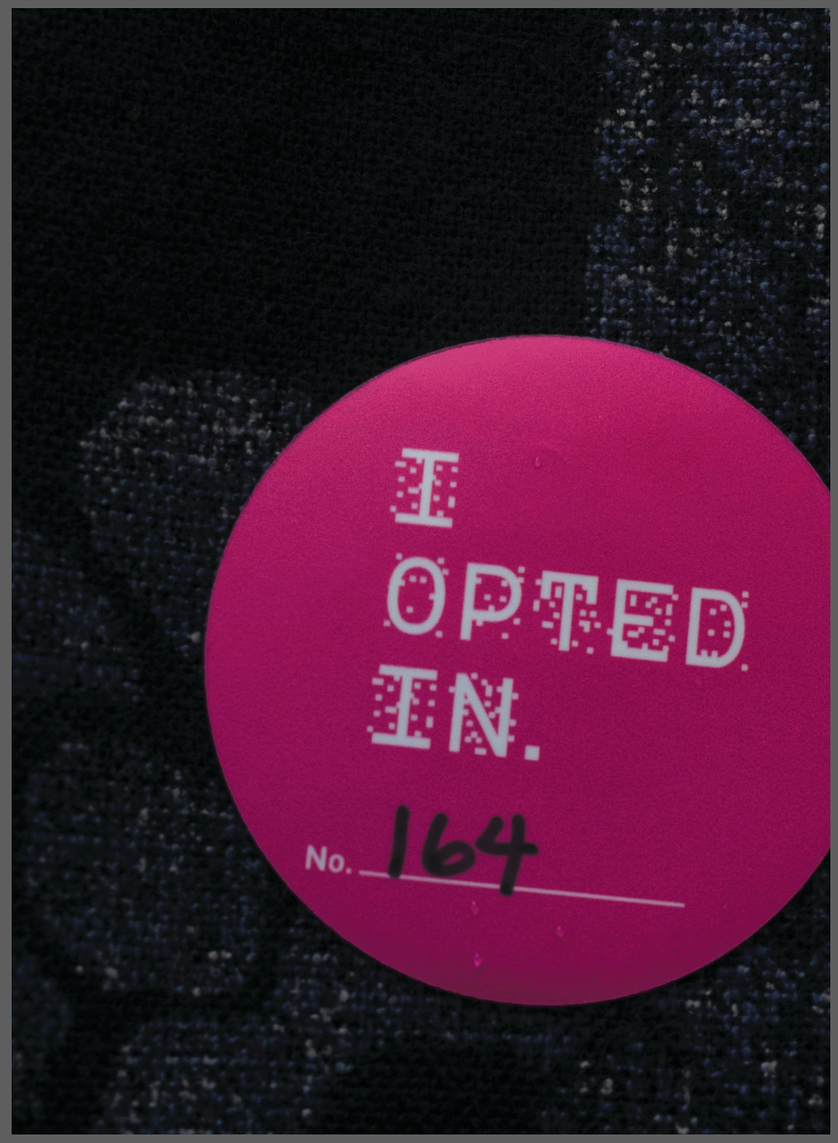
# My Profile Tour

1. Opt-in?
2. If yes, then selfie



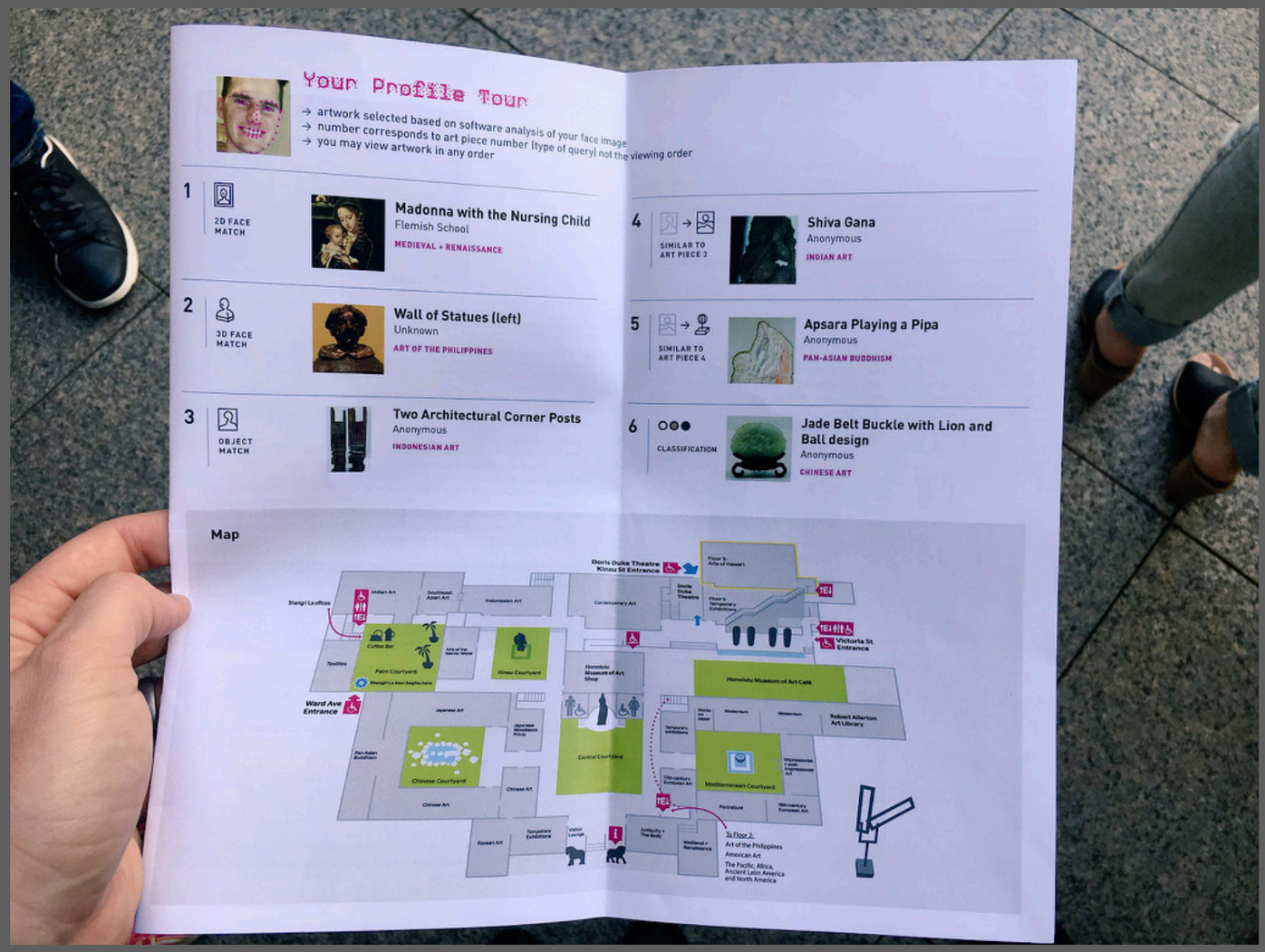
# My Profile Tour

1. Opt-in?
2. Selfie
3. **Labeling**



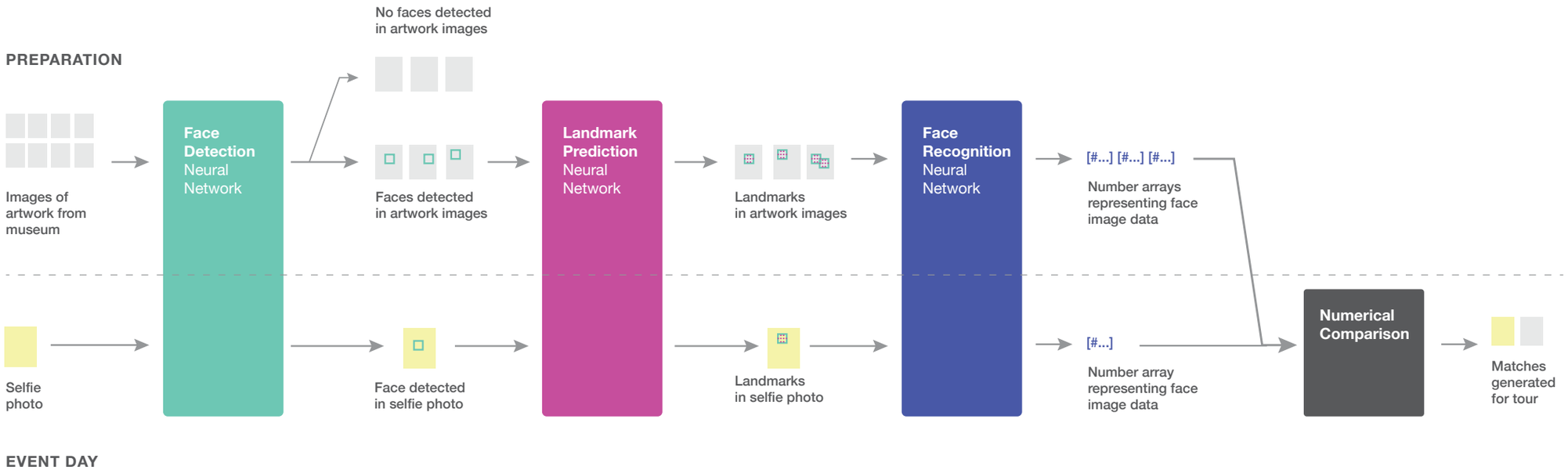
# My Profile Tour

1. Opt-in?
2. Selfie
3. Labeling
4. **Custom Tour**



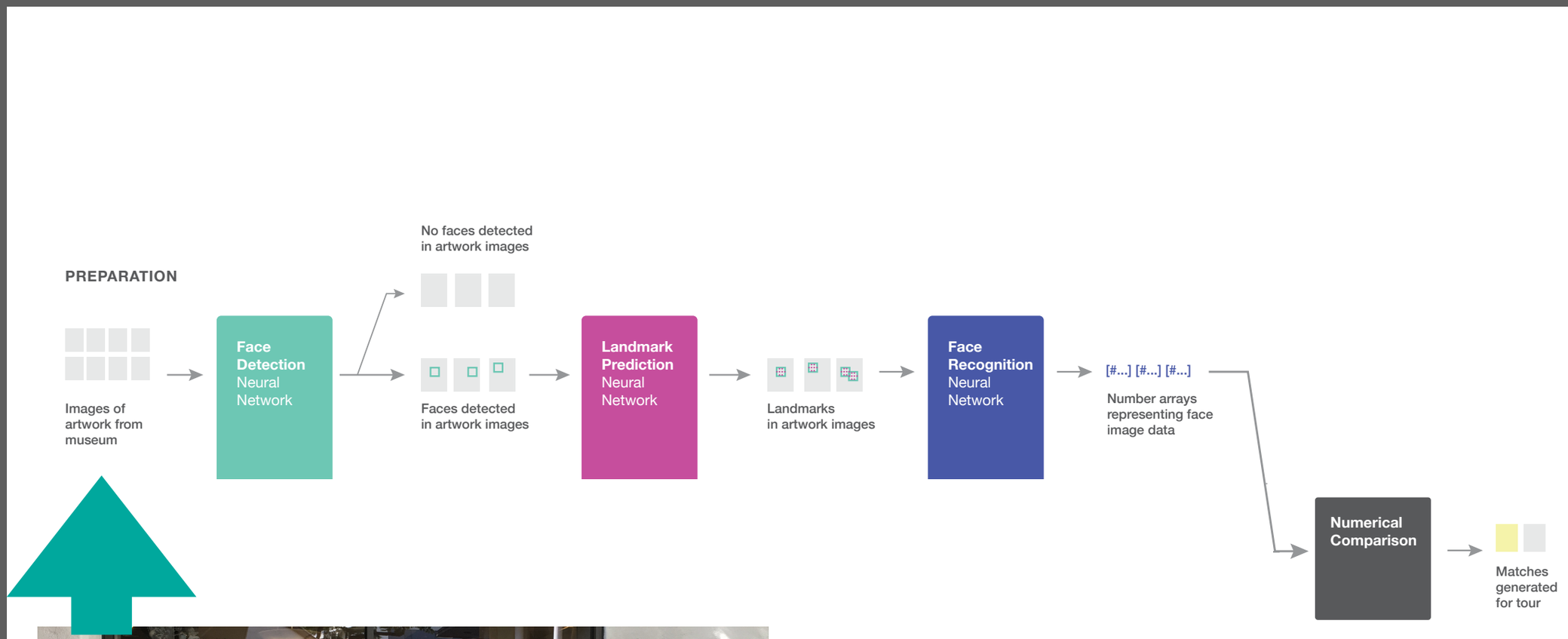
# My Profile Tour

# Process



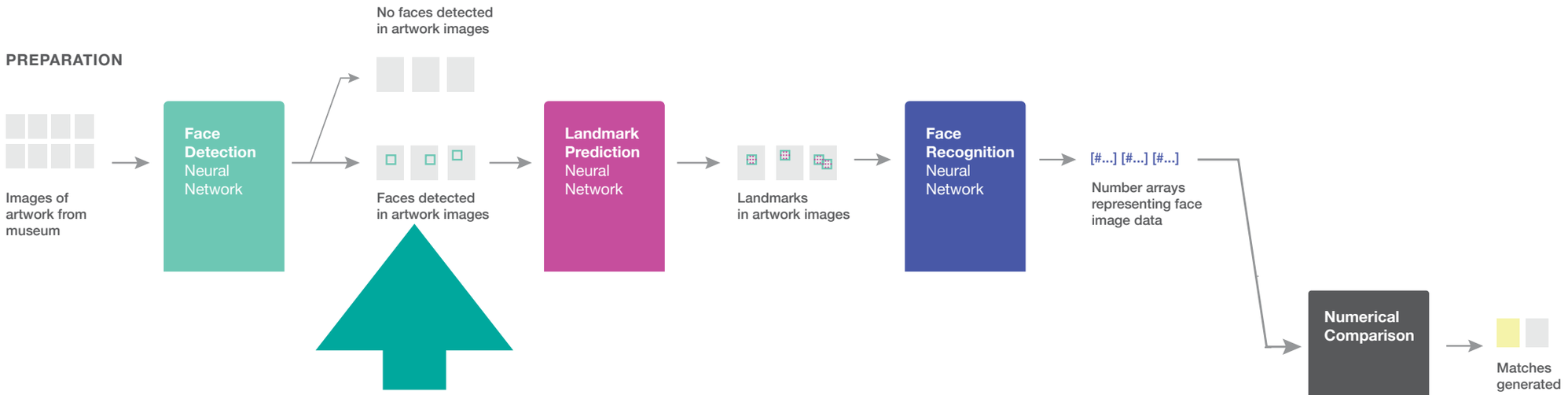
# My Profile Tour

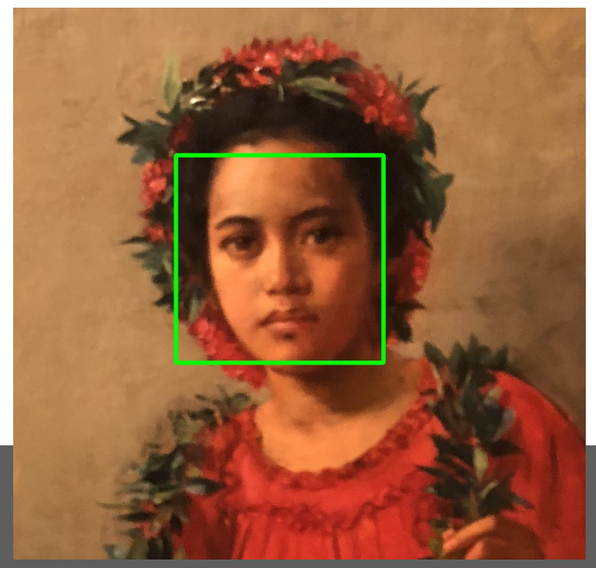
# Process




# My Profile Tour

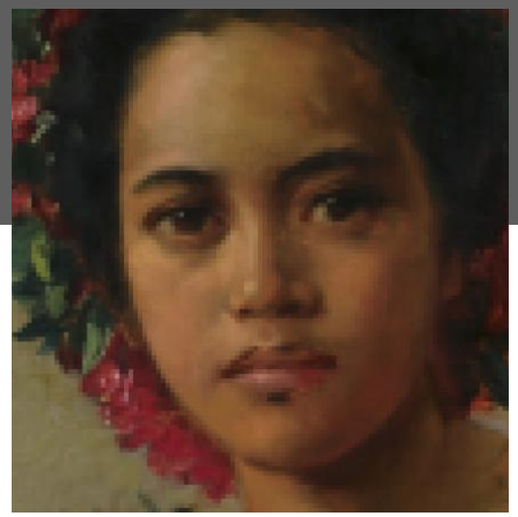
# Process

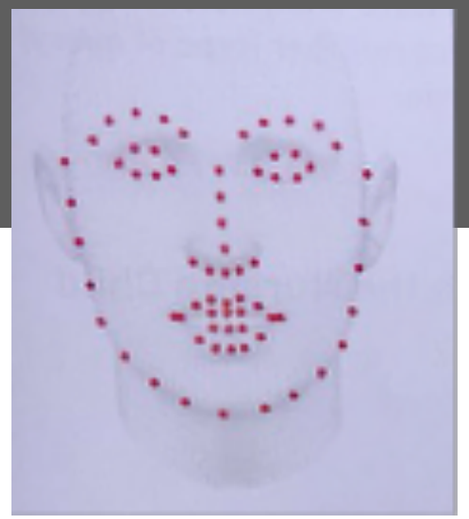


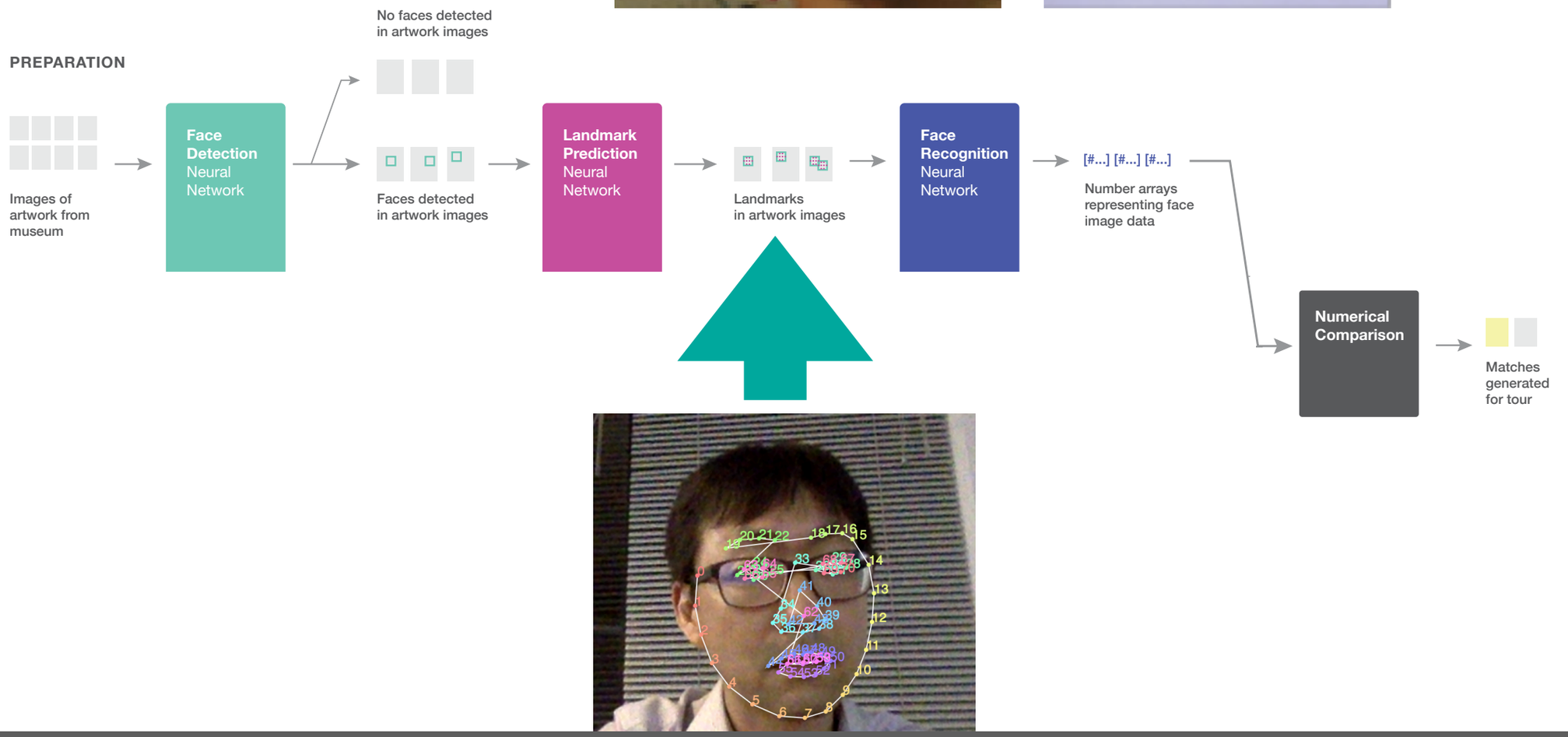



# My Profile Tour

# Process



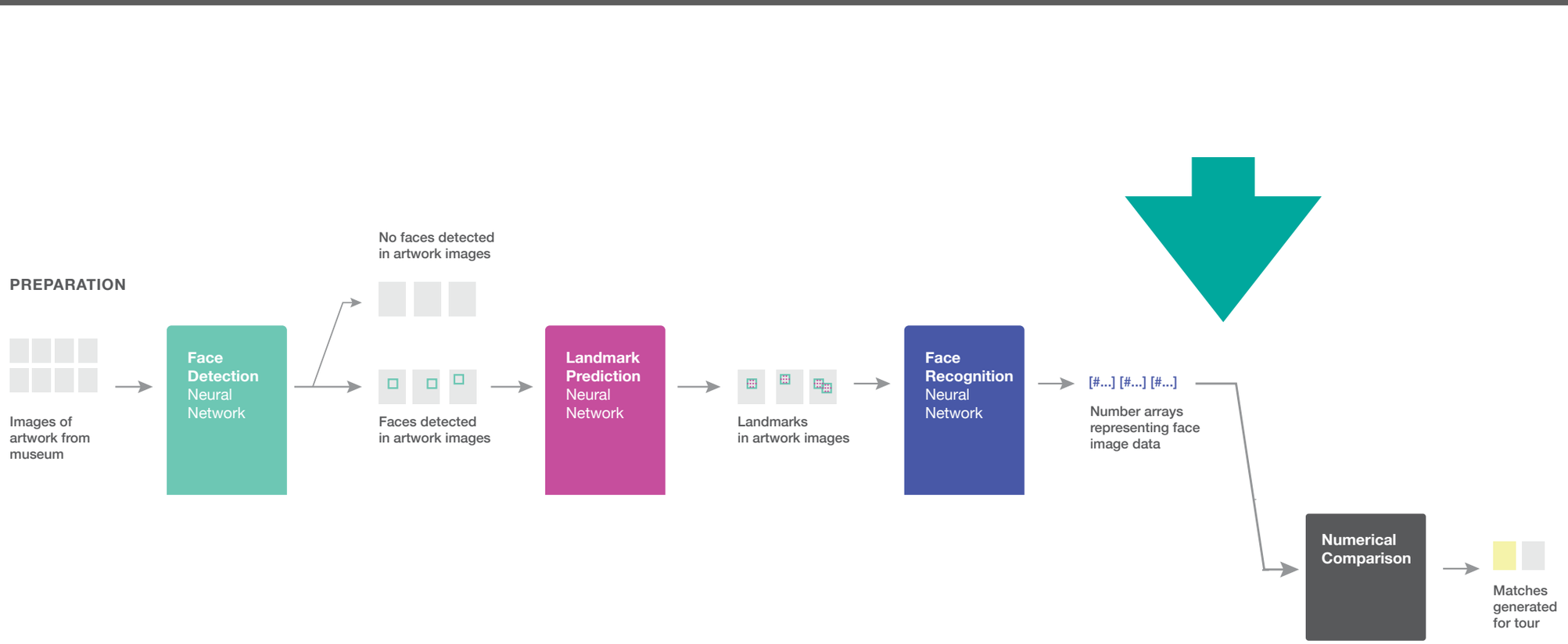





kylemcdonald.github.io/cv-examples/FaceTracking

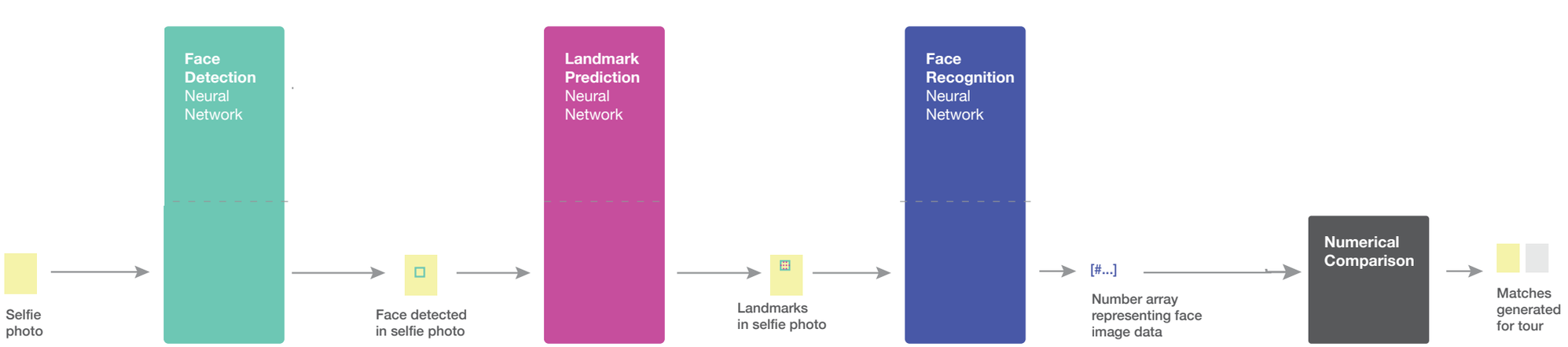
# My Profile Tour

# Process



# My Profile Tour

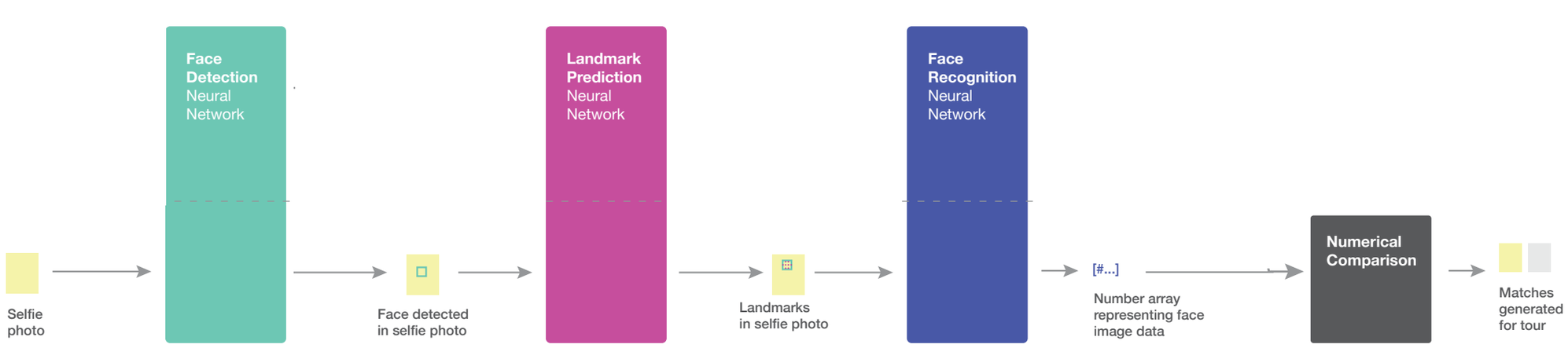
## Process



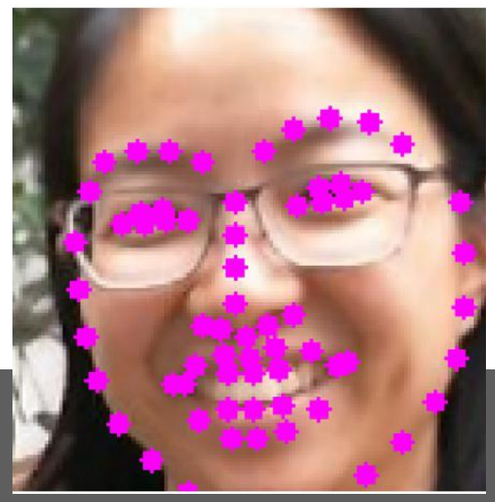

**EVENT DAY**

# My Profile Tour

## Process

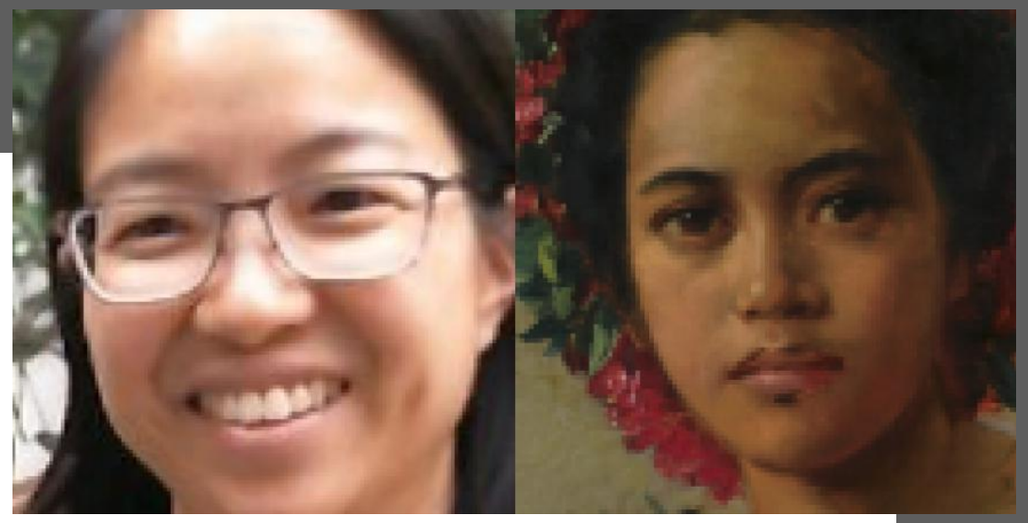


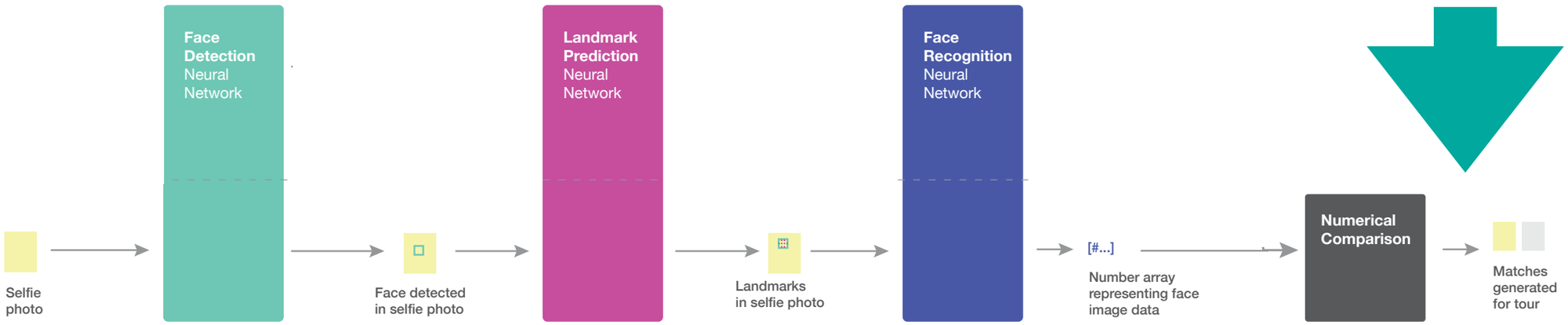

**EVENT DAY**



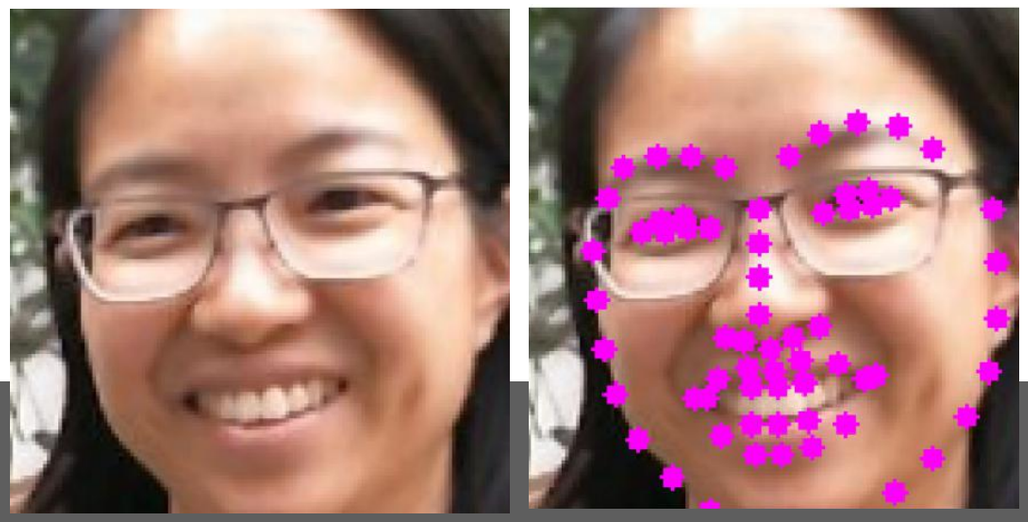
# My Profile Tour

## Process



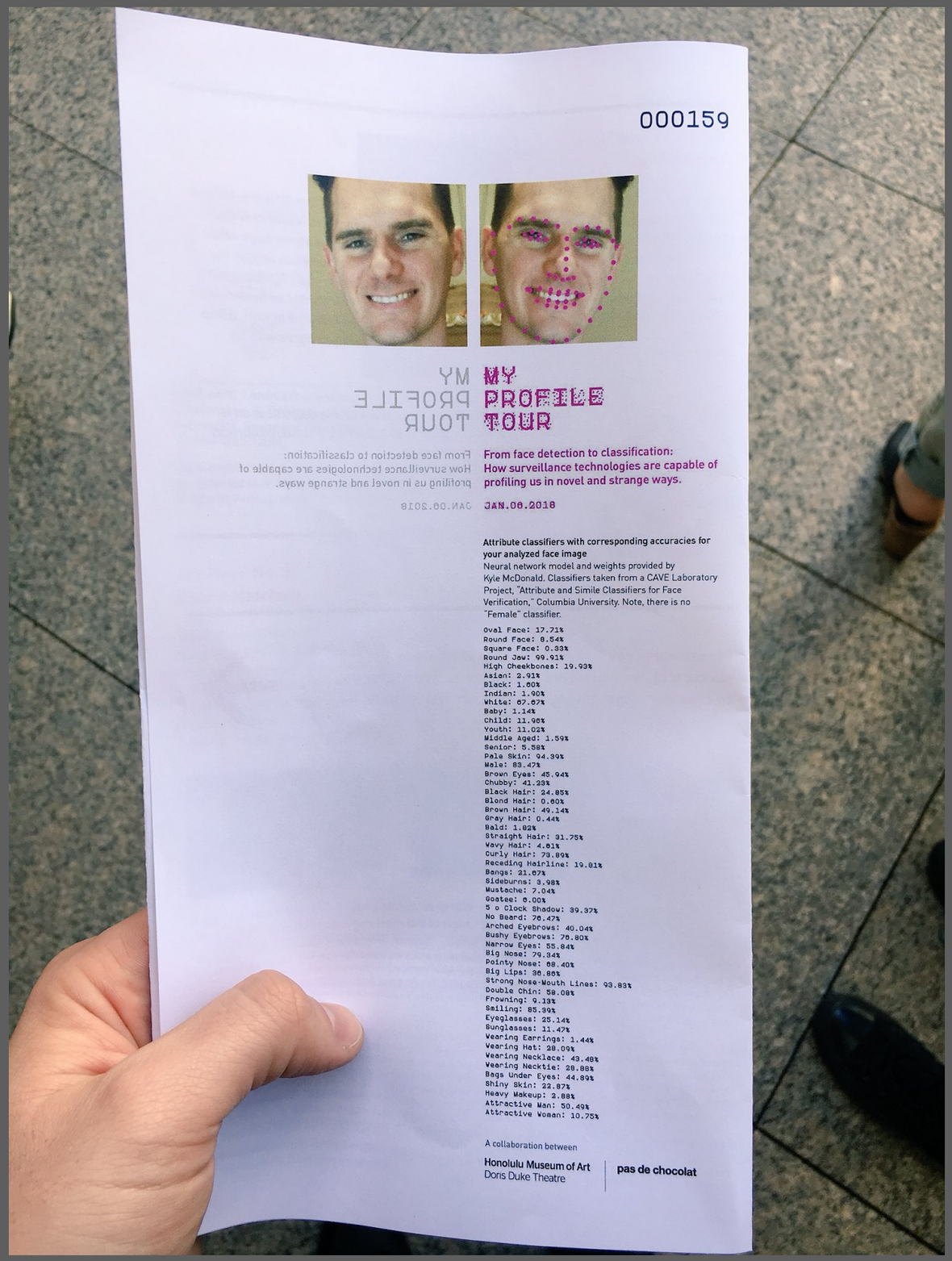



**EVENT DAY**




BEST MATCH: #000260
Have a nice day. Press any key to continue.
000260
000234
000120
000210
000259

# My Profile Tour



CLASSIFICATIONS: guest_000009.jpg
Round Jaw: 99.82
Eyes Open: 97.93
Pale Skin: 97.29
No Beard: 95.61
Straight Hair: 91.72
Frowning: 91.61
Teeth Not Visible: 90.61
Pointy Nose: 88.17
Color Photo: 86.50
Mouth Closed: 81.72
Bangs: 71.47
Attractive Man: 70.13
Child: 66.89
Arched Eyebrows: 64.99
Obstructed Forehead: 57.74
No Eyewear: 56.36
Youth: 54.95
Big Lips: 53.12
Attractive Woman: 50.01
Wearing Lipstick: 45.87
Brown Hair: 43.89
Brown Eyes: 42.71
Male: 41.46
Soft Lighting: 40.97
Asian: 39.45
Black Hair: 37.09
Narrow Eyes: 35.04
Bushy Eyebrows: 34.34
Round Face: 34.29
White: 32.16
Sideburns: 29.46
Flash: 25.84
Curly Hair: 23.51
Blurry: 22.10
Wearing Necklace: 22.00
Oval Face: 21.33
Wearing Hat: 19.62
Wearing Earrings: 18.58
Outdoor: 18.52
Partially Visible Forehead: 17.74
Harsh Lighting: 16.09
Eyeglasses: 15.60
Heavy Makeup: 14.06
Mouth Slightly Open: 12.76
Chubby: 8.96
5 o Clock Shadow: 8.75
Wavy Hair: 7.71
Big Nose: 6.95
Smiling: 6.80
Fully Visible Forehead: 5.82
Sunglasses: 5.58
Goatee: 5.12
Wearing Necktie: 4.96
Shiny Skin: 4.17
Bags Under Eyes: 4.06
Posed Photo: 4.03
Baby: 3.67
High Cheekbones: 2.40
Indian: 1.86
Double Chin: 1.64
Middle Aged: 0.95
Receding Hairline: 0.83
Mouth Wide Open: 0.78
Rosy Cheeks: 0.75
Mustache: 0.69
Strong Nose-Mouth Lines: 0.57
Bald: 0.41
Black: 0.39
Flushed Face: 0.35
Blond Hair: 0.26
Square Face: 0.12
Senior: 0.09
Gray Hair: 0.07

# Your Profile Tour

→ artwork selected based on software analysis of your face image
→ number corresponds to art piece number (type of query) not the viewing order
→ you may view artwork in any order

**1** 2D FACE MATCH

**Madonna with the Nursing Child**
Flemish School
MEDIEVAL + RENAISSANCE

**2** 3D FACE MATCH

**Wall of Statues (left)**
Unknown
ART OF THE PHILIPPINES

**3** OBJECT MATCH

**Two Architectural Corner Posts**
Anonymous
INDONESIAN ART

**4** SIMILAR TO ART PIECE 3

**Shiva Gana**
Anonymous
INDIAN ART

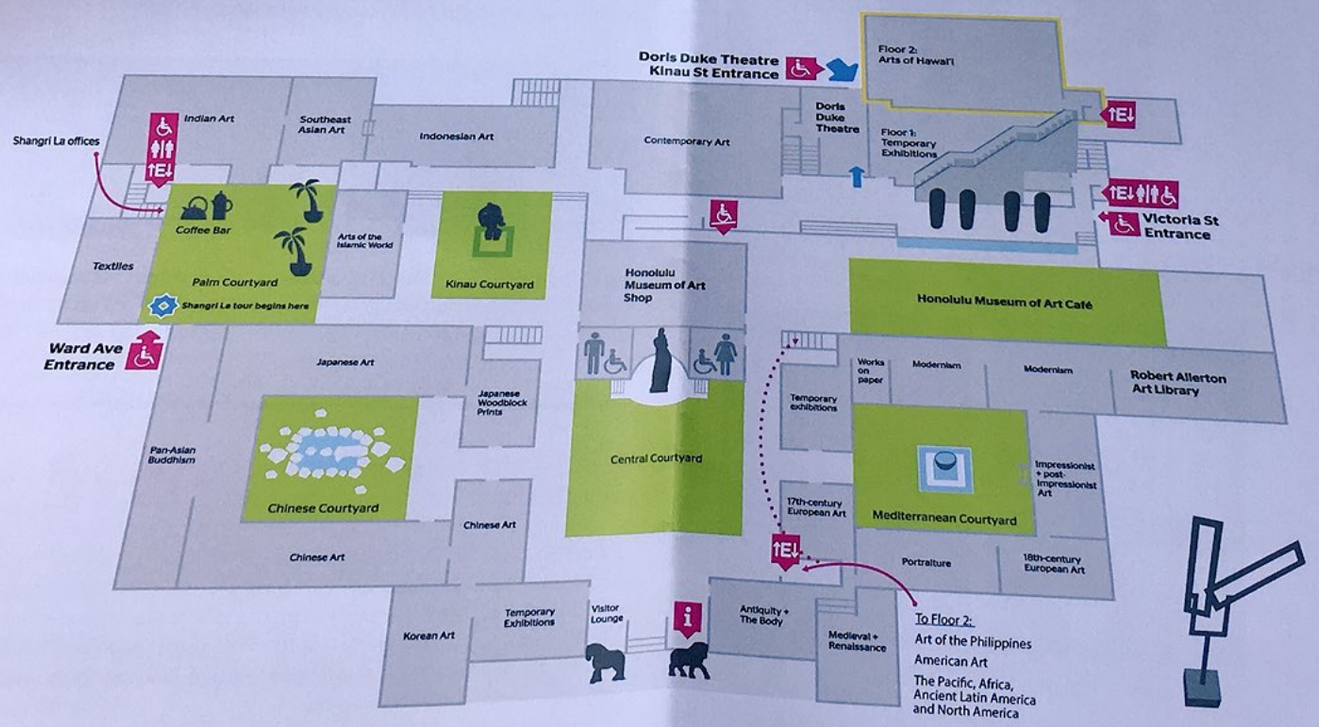
**5** SIMILAR TO ART PIECE 4

**Apsara Playing a Pipa**
Anonymous
PAN-ASIAN BUDDHISM

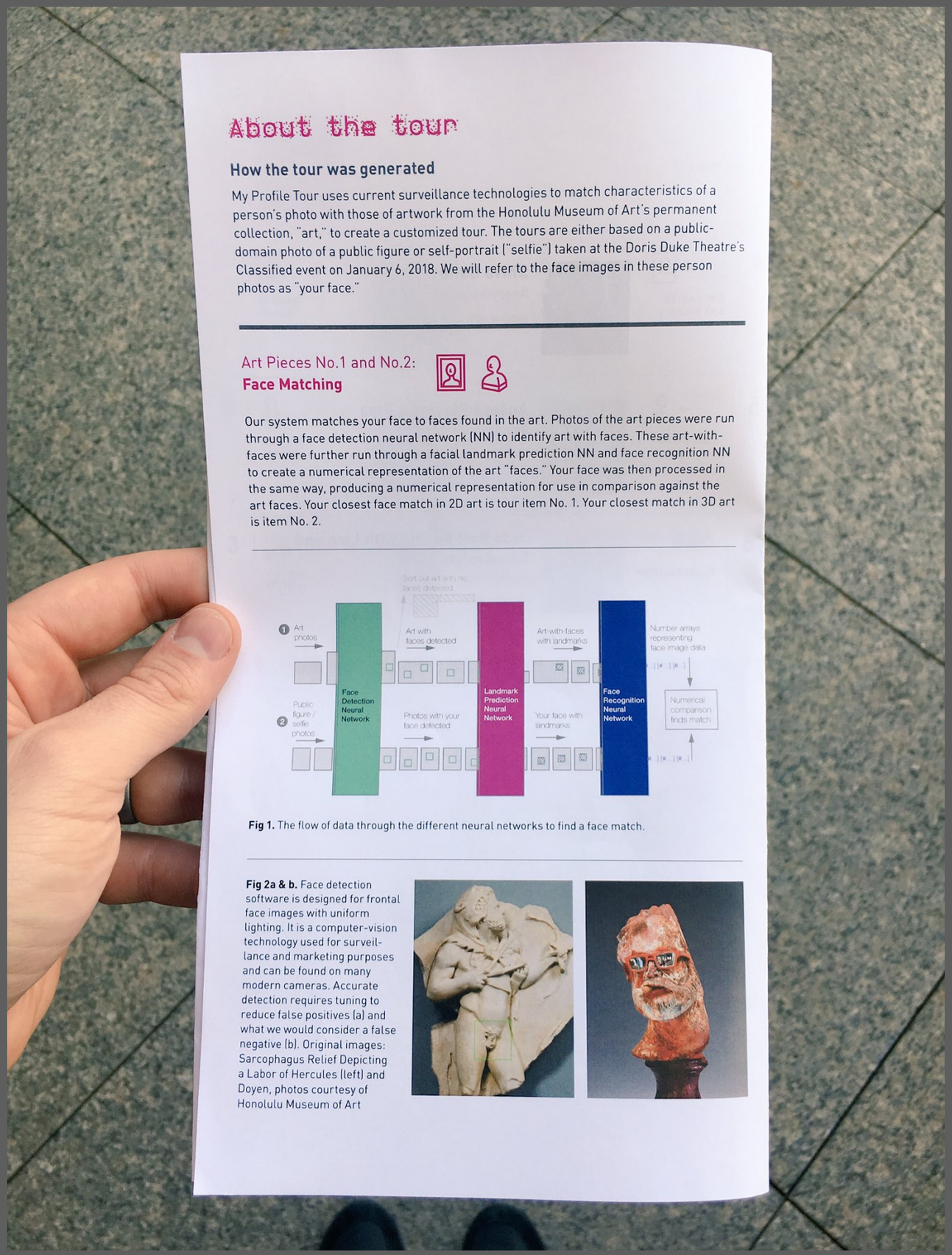
**6** CLASSIFICATION

**Jade Belt Buckle with Lion and Ball design**
Anonymous
CHINESE ART

## Map



# My Profile Tour



## About the tour

### How the tour was generated

My Profile Tour uses current surveillance technologies to match characteristics of a person's photo with those of artwork from the Honolulu Museum of Art's permanent collection, "art," to create a customized tour. The tours are either based on a public-domain photo of a public figure or self-portrait ("selfie") taken at the Doris Duke Theatre's Classified event on January 6, 2018. We will refer to the face images in these person photos as "your face."

Art Pieces No.1 and No.2:
**Face Matching**

Our system matches your face to faces found in the art. Photos of the art pieces were run through a face detection neural network (NN) to identify art with faces. These art-with-faces were further run through a facial landmark prediction NN and face recognition NN to create a numerical representation of the art "faces." Your face was then processed in the same way, producing a numerical representation for use in comparison against the art faces. Your closest face match in 2D art is tour item No. 1. Your closest match in 3D art is item No. 2.



**Fig 1.** The flow of data through the different neural networks to find a face match.

**Fig 2a & b.** Face detection software is designed for frontal face images with uniform lighting. It is a computer-vision technology used for surveillance and marketing purposes and can be found on many modern cameras. Accurate detection requires tuning to reduce false positives (a) and what we would consider a false negative (b). Original images: Sarcophagus Relief Depicting a Labor of Hercules (left) and Doyen, photos courtesy of Honolulu Museum of Art

**Fig. 3.** (left) Landmark prediction used for this tour, MultiPIE/IBUG. Image credit: C. Sagonas, E. Antonakos, G, Tzimiropoulos, S. Zafeiriou, M. Pantic. 300 faces in-the-wild challenge: Database and results. Image and Vision Computing (IMAVIS), Special Issue on Facial Landmark Localisation "In-The-Wild." 2016.

**Fig 4.** (right) Landmark prediction may also have inaccuracies. Here, landmarks are misplaced for the detected face. Identifying errors requires human judgement. Original image: Madonna and Child with Angels, photo courtesy of Honolulu Museum of Art.

## Art Piece No. 3:
## **Object Matching**

No. 3 on your tour was chosen using an object detection NN. Rather than focusing only on your face, this NN extracts features from the entire image. As before, the museum's art was pre-processed, this time with a deep convolutional neural network,[1] designed to detect specific types of objects in digital images. However, we short-circuit the detection system to provide a numerical representation of what is found in the image rather than outputting labeled objects. The numerical representation is compared against the art to find your nearest match using principal component analysis (PCA).[2]

***Fig. 5.*** *The same object matching allows us to look across the museum's collection for visually similar objects. Images from left to right, "Bather Putting Up Her Hair," "The Age of Bronze," "Dancing Bacchante with Amour," "Heracles, The Archer," "Walking Woman"*

## *Art Pieces No. 4, and No. 5:*
## ***Shortest Path***

*Pieces No. 4 and No. 5 on the tour were chosen by drawing a connective path based on image similarity through the museum's art from your object match, No. 3, to your classification match, No. 6. To do so, a graph was plotted (like a roadmap of cities), of all the museum's art. This was done by using the results of the object detection NN and PCA that were then fed into graphing software allowing us to plot a "shortest path" between art objects.[3] Other journeys would have been possible.*

## Cover/Art Piece No. 6:
## **Classification**

For the tour cover and the last tour item, No. 6, we processed the faces through a pre-trained face-recognition and object-detection neural network that categorizes features with highly subjective labels. The categories are quantified and assigned a percentage value. We selected some of the more unique (lower but non-zero overall incidence across the test population) and higher-predicted probability categories (greater than 70%) to associate with specific art pieces. Unlike the previous types of analyses which can be verified with relative clarity (face or no face, landmarks fitted to the facial features or not), these subjective classifications are difficult to evaluate for accuracy. Do you agree with its determinations?

**Fig 6.** Artwork we have associated with the classification for "bushy eyebrows" Image: 5609.1, Earring (Mamuli), courtesy of Honolulu Museum of Art

**Please enjoy your customized tour. If we were successful, we will have raised a few questions for you to consider, regarding technology, art and identity.**

1. Convolutional networks are inspired by biological processes in which the connectivity pattern between neurons is based on the organization of the human visual cortex. Individual cortical neurons respond to stimuli only in a restricted region of the visual field known as the receptive field. The receptive fields of different neurons partially overlap such that they cover the entire visual field. (Wikipedia: https://en.wikipedia.org/wiki/Convolutional_neural_network)

2. Principal component analysis (PCA) is a statistical procedure that uses an orthogonal transformation to convert a set of observations of possibly correlated variables into a set of values of linearly uncorrelated variables called principal components. Its operation can be thought of as revealing the internal structure of the data in a way that best explains the variance in the data. If a multivariate dataset is visualised as a set of coordinates in a high-dimensional data space (1 axis per variable), PCA can supply the user with a lower-dimensional picture, a projection of this object when viewed from its most informative viewpoint. (Wikipedia: https://en.wikipedia.org/wiki/Principal_component_analysis)

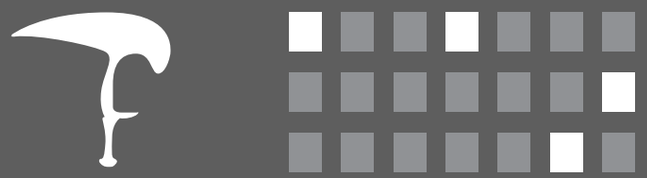
3. Results fed into the Python iGraph software library. Djikstra's algorithm used to determine shortest path.

Typeface used for headers: ZXX Sans and ZXX Noise, designed by Sang Mun, 2013. One of four typefaces designed to be difficult for optical character recognition software.

Graphic design by Jill Misawa / Designer. Designed printed pieces of the My Profile Tour.

Example:

# Find the most similar artwork in collection



# VGG-16
# Deep Convolutional Neural Network

| Layer (type) | Output Shape | Param # |
|---|---|---|
| input_1 (InputLayer) | (None, 224, 224, 3) | 0 |
| block1_conv1 (Conv2D) | (None, 224, 224, 64) | 1792 |
| block1_conv2 (Conv2D) | (None, 224, 224, 64) | 36928 |
| block1_pool (MaxPooling2D) | (None, 112, 112, 64) | 0 |
| block2_conv1 (Conv2D) | (None, 112, 112, 128) | 73856 |
| block2_conv2 (Conv2D) | (None, 112, 112, 128) | 147584 |
| block2_pool (MaxPooling2D) | (None, 56, 56, 128) | 0 |
| block3_conv1 (Conv2D) | (None, 56, 56, 256) | 295168 |
| block3_conv2 (Conv2D) | (None, 56, 56, 256) | 590080 |
| block3_conv3 (Conv2D) | (None, 56, 56, 256) | 590080 |
| block3_pool (MaxPooling2D) | (None, 28, 28, 256) | 0 |
| block4_conv1 (Conv2D) | (None, 28, 28, 512) | 1180160 |
| block4_conv2 (Conv2D) | (None, 28, 28, 512) | 2359808 |
| block4_conv3 (Conv2D) | (None, 28, 28, 512) | 2359808 |
| block4_pool (MaxPooling2D) | (None, 14, 14, 512) | 0 |
| block5_conv1 (Conv2D) | (None, 14, 14, 512) | 2359808 |
| block5_conv2 (Conv2D) | (None, 14, 14, 512) | 2359808 |
| block5_conv3 (Conv2D) | (None, 14, 14, 512) | 2359808 |
| block5_pool (MaxPooling2D) | (None, 7, 7, 512) | 0 |
| flatten (Flatten) | (None, 25088) | |
| fc1 (Dense) | (None, 4096) | 02764544 |
| fc2 (Dense) | (None, 4096) | 16781312 |
| predictions (Dense) | (None, 1000) | 4097000 |

Total params: 138,357,544
Trainable params: 138,357,544
Non-trainable params: 0

remove last layer

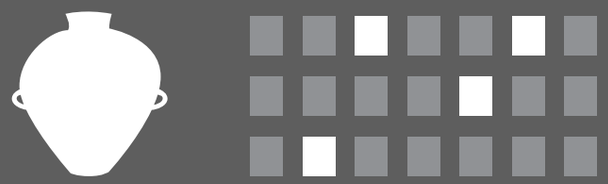
feature extraction vector

Credit:

Learned from Gene Kogan
github.com/ml4a/ml4a-guides

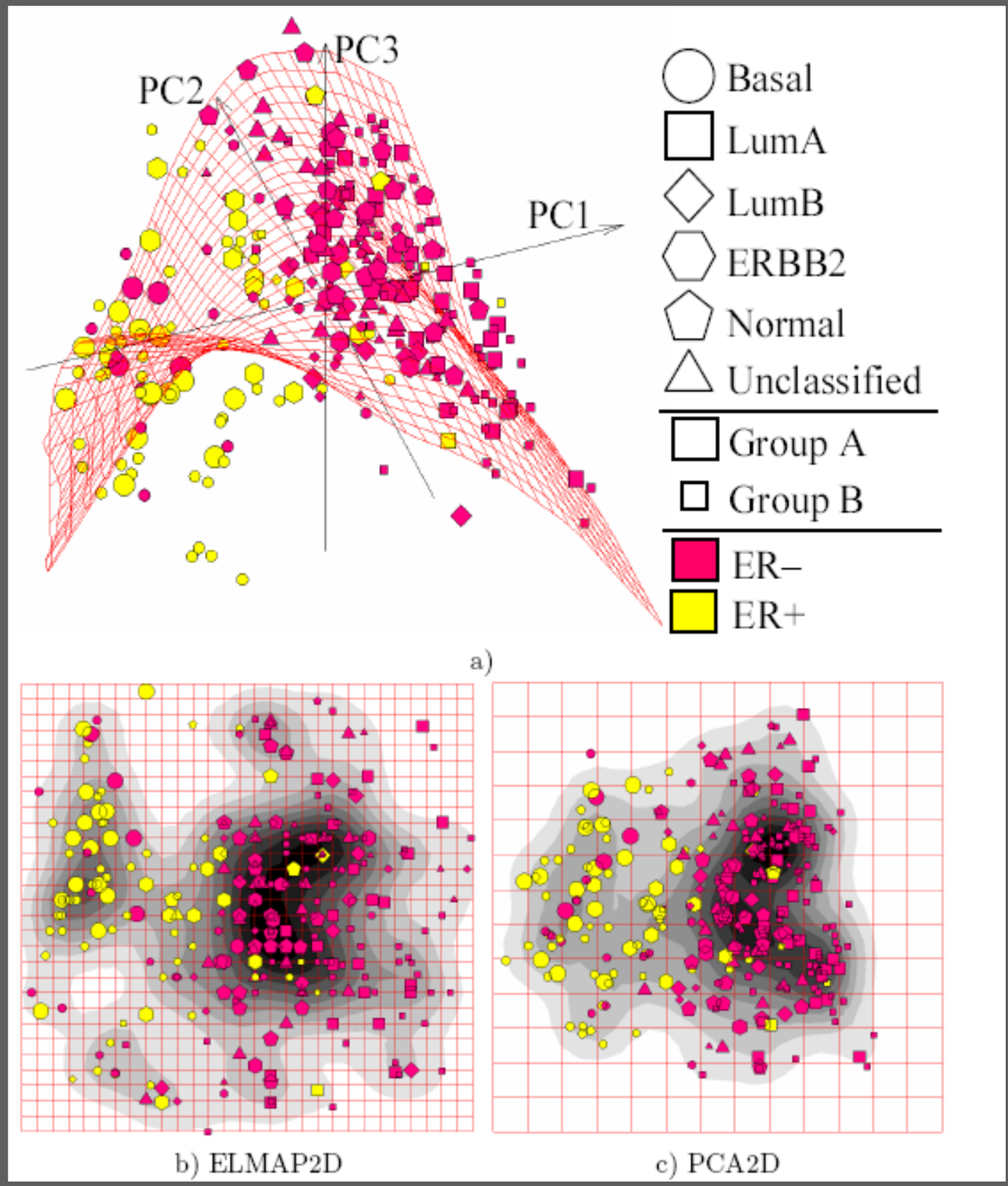
Example:

## Find the most similar artwork in collection



Example:

## Shortest path via feature extraction vectors




https://en.wikipedia.org/wiki/Principal_component_analysis

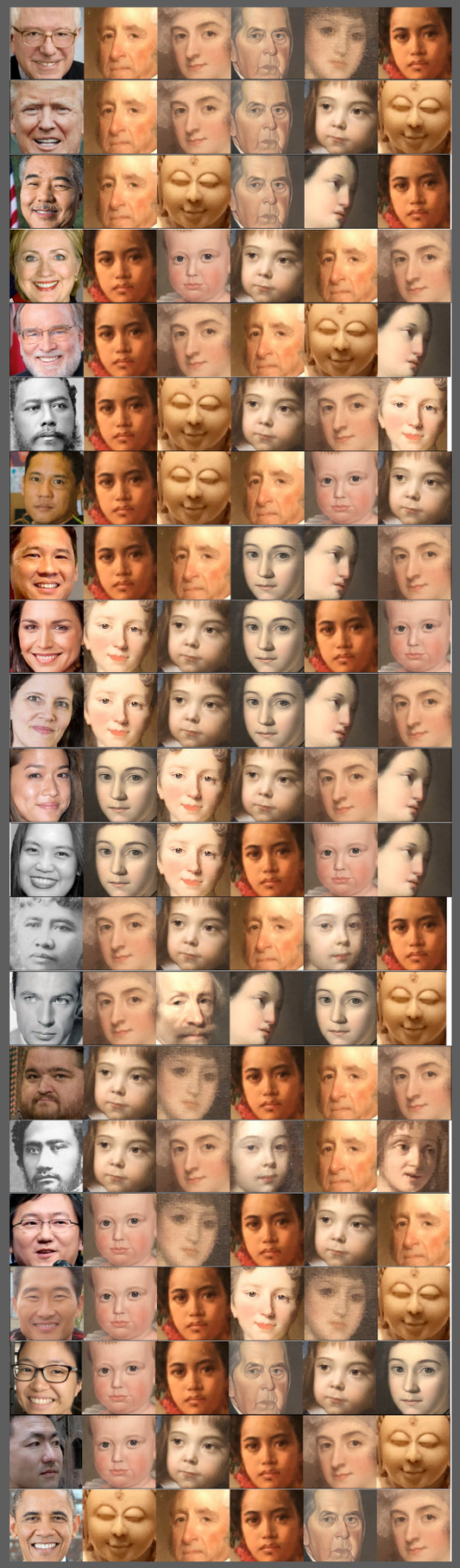
**Example:**

## Shortest path via feature extraction vectors


**Credit:**

## Learned from Gene Kogan github.com/ml4a/ml4a-guides

# Lessons Learned




**Face detection…?**

Step 1

# My Profile Tour Privacy Policy

Effective January 6, 2018

This tour is a collaborative development of the Honolulu Museum of Art and Pas de Chocolat as part of the Doris Duke Theatre's "Classified" program. Your understanding of the implications of information capture and use are an important aspect of the tour experience.

Pas de Chocolat has designed and implemented this experiment and would like you to be aware of the information that is being collected for the tour and the limits of its use. In this Policy, "we" and "our" mean Pas de Chocolat. "You" or "your" means any person who is visiting the museum for the duration of the Classified programming on January 6, 2018.

The tour identifies six works of art from the permanent collection of the Honolulu Museum of Art currently on display at their 900 South Beretania Street premises. Please inquire with the Honolulu Museum of Art if you wish to find out about their privacy policy as pertains to the information it collects on guests on their property. Any information collected by the museum about you as a guest for the Classified program or as a museum member has not been shared with Pas de Chocolat.

## ABOUT THE INFORMATION NOT COLLECTED

We do not collect personal information about you that could be used to identify, track or assist in disambiguating you from others with a high confidence level. Personal information is information such as your name, address, email, phone number, demographic information, social security number, financial information, or your wifi-enabled device's IP or MAC address.

## WHAT WE DO COLLECT

We do collect your face information based on a self-portrait photographic image, or "selfie," that you willingly provide. There may be multiple images captured, although only a single image may be used. See following for details on how to opt-in.

## HOW THE INFORMATION IS USED

The sole purpose of information collection is to provide you with a customized tour experience.

All selfie images are saved to a local file which are used as the basis for various post-processing and analysis. Face detection is used on the selfie to locate your face and allows us to make assumptions about the location of your body in the image. The selfie is also processed with face recognition technology that maps feature landmarks of your face such as eye, nose and mouth locations relative to one another to provide a "face descriptor." The images are normalized (rotated, resized, color edited, cropped) as needed for improved machine processing.

These processed images of you and your face are input into convolutional neural networks trained for face detection, object detection and face recognition. An image of you is compared to museum artwork. Recognition software is used to classify your features for race, age, gender, emotion; detect objects such as face, head, neck and hair accessories; or evaluate features subjectively such as identifying a receding hairline, bushy eyebrows, large nose, or attractiveness as a male or female. Your face image may also be compared with images of other participants to recognize and disambiguate your face from those of other participants to assist in the distribution of the custom tours.

Your face image, matched artwork and classification information are assembled for the custom tour and rendered for printing.

## STORING AND SHARING INFORMATION

Your selfie and related images are transferred and stored locally on the machines used to deliver this tour. They will be used only for the purposes of tour generation, tour distribution or in the explanation of the tour generation process. There is a possibility that the generated tours will be transferred using the museum's guest wifi to encrypted cloud storage to facilitate the print process.

Your selfie and related images will not be shared with any other organization, including the Honolulu Museum of Art, unless for the express purposes listed above. However, should the government request or seize our equipment, we will be required to comply and cannot provide insight into how the information may be used.

The collected and generated data, including generated tours, will be stored until the end of the Classified program for the purposes mentioned above. The selfies, related images and generated tours will be deleted within 30 days after the close of the Classified program.

## LIMITATIONS ON INFORMATION USE

All collected information will only be used for the purpose of providing the custom tour or facilitating the tour experience.

We will not use the selfies or related images to generate any additional tours or use the data for analysis any time after the event date, unless specifically agreed upon and authorized by the individual who has opted in (and whose images would be used).

## TO OPT-IN

To opt-in, you will need to provide your consent by visiting an opt-in station and following instructions to take a selfie. By opting in, you are giving us your consent to use your image as described above. You are also asserting that you are acting on your own behalf.

You will be responsible for picking up your custom printed tour later, as instructed. Due to the one-time processing of the selfie image, there is no option to opt-out once you opt-in. Any tours not picked up by the specified time will be held for the duration of the January 6, 2018, speaker event and be disposed into the municipal waste by the end of the day.

## THE FINE PRINT

If you choose not to opt-in, there is a possibility that your face will be within the image capture range at the time a selfie is taken by another person. This image will be analyzed by face detection and recognition software. While face image information may be created for your face in the processing of the selfie, no tour will be generated. All images captured by the tour generation process will be deleted within 30 days after the close of the Classified program.

# References/Resources


SOFTWARE RESOURCES:

**Kyle McDonald**
http://kylemcdonald.net
classifying neural network

**Dena Kogan**

**YOLO / Darknet**
https://pireddie.com/darknet/yolo/
Object detection

**TensorFlow**
https://www.tensorflow.org/

**Labeled Faces in the Wild (LFW)**
http://vis-www.cs.umass.edu/lfw/index.html

- Gary B. Huang, Manu Ramesh, Tamara Berg, and Erik Learned-Miller.
- Labeled Faces in the Wild: A Database for

TYPEFACE

**ZXX Noise, designed by Sang Mun,** 2013
One of four typefaces designed to be intentionally difficult for optical character recognition software.

/home/koba/work/MY_PROFILE/data/pdc

_of_Barack_Obama.jpg

predict - Mozilla Firefox

Home | transfer.py | run.py | model.py | run

localhost:8888/notebooks/predict.ipynb

jupyter **predict** Last Checkpoint: an hour ago (unsaved changes)

File Edit View Insert Cell Kernel Help

Run Code

```
0.48443475  0.93525583  0.26338226  0.92894095  0.46440455  0.94802666
0.75631773  0.18474649  0.19620655  0.12947559  0.73154426  0.98834151
0.36166373  0.03300952  0.04789246  0.98124141  0.42196575  0.90891832
0.21499245  0.07748241  0.68040782  0.52517968  0.01465013  0.94708729
0.04475405]
```

In [48]:
```
print("there were {n} probabilites".format(n=len(probabilities)))
```
```
there were 73 probabilites
```

In [52]:
```
results = zip(categories, probabilities)
results = list(results)

asian_idx = 1
white_idx = 2
black_idx = 3
indian_idx = 57
race_idxs = [asian_idx, white_idx, black_idx, indian_idx]
race_results = [r for i, r in enumerate(results) if i in race_idxs]
print(race_results)
```
```
[('Asian', 0.061704557), ('White', 0.64642322), ('Black', 0.60918617), ('Indian', 0.1294755
```

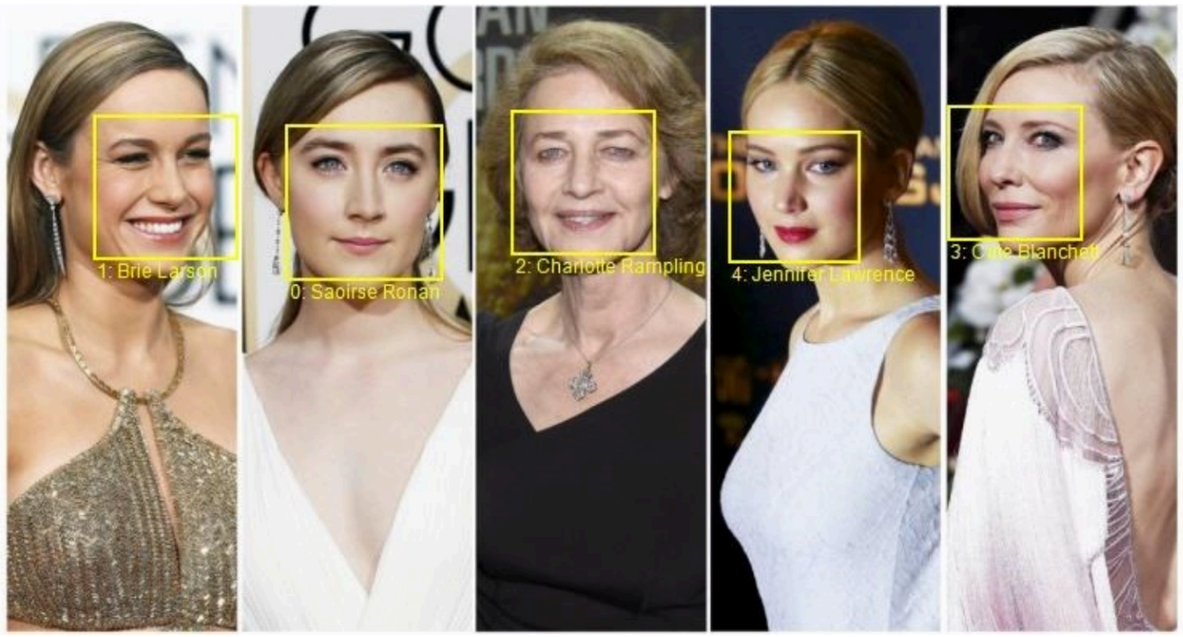
In [58]:
```
#sorted_results = copy.deepcopy(results)
sorted_results = sorted(results, key=lambda tup: tup[1], reverse=True)
sorted_results = filter(lambda r: r[1] > 0.5, sorted_results)
```

In [59]:
```
list(sorted_results)
```

Out[59]:
```
[('Big Nose', 0.98875648),
 ('Bags Under Eyes', 0.98834151),
 ('Pale Skin', 0.98124141),
 ('Male', 0.96592617),
 ('Color Photo', 0.94802666),
 ('Wearing Necktie', 0.94708729),
 ('Harsh Lighting', 0.93958962),
 ('Wearing Hat', 0.93525583),
 ('Narrow Eyes', 0.93415612),
 ('Square Face', 0.92894095),
```

# Taking a wider view

# MSR Image Recognition Challenge (IRC) @ACM Multimedia 2016




## People

**Yuxiao Hu**
Senior Research Software Developer

**Lei Zhang**
Principal Research Manager

**Yandong Guo**
Researcher

**Xiaodong He**
Principal Researcher, Research Manager

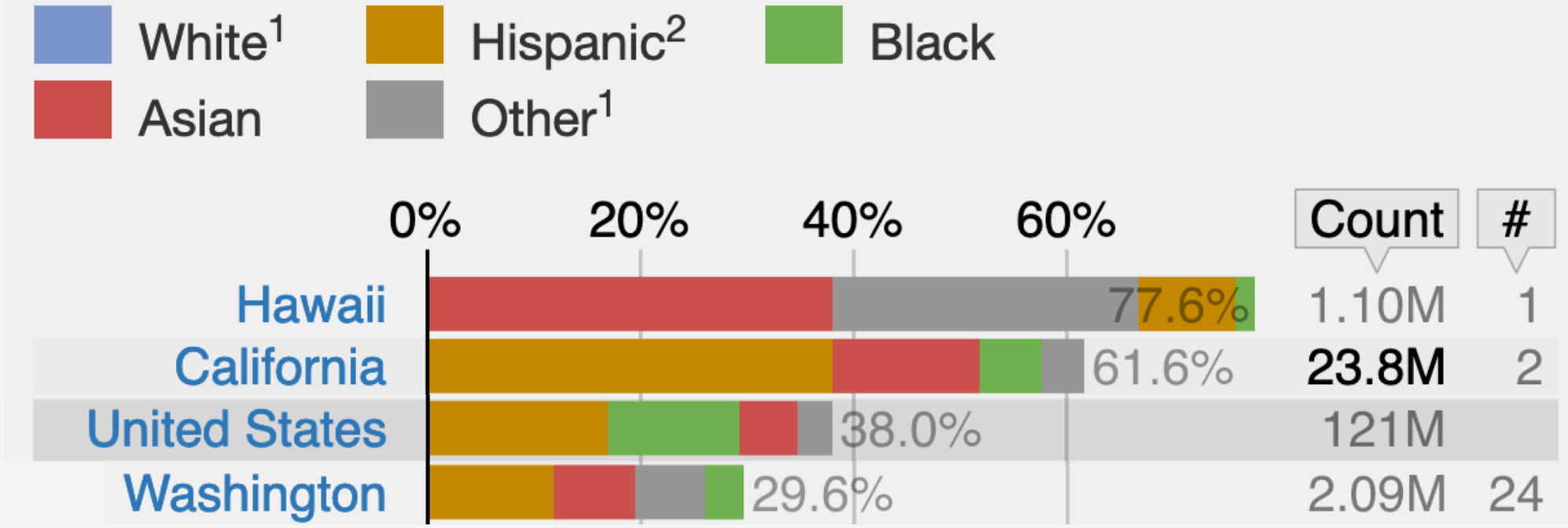
**Jianfeng Gao**
Partner Research Manager

**Jin Li**
Partner Research Manager

# Non-White Population by State

Percentage of the total population.

*Scope: population of the United States and selected states in the United States*




Statistical Atlas, Race and Ethnicity in the United States
https://statisticalatlas.com/United-States/Race-and-Ethnicity 2019/2/5

PRESS RELEASE

# Honolulu Police Department Purchases 1,200 Axon Body Cameras; Now the 45th Major City to Join the Axon Network

Published: July 10, 2018 7:30 a.m. ET

Aa

**Significant orders placed across the U.S. for Axon's body, in-car and in-room camera systems**

SCOTTSDALE, Ariz., July 10, 2018 /PRNewswire/ -- **Axon AAXN, +4.46%** the global leader in connected law enforcement technologies, today announced that Honolulu Police Department, a **Major Cities Chiefs Association** member, will deploy 1,200 Axon Body 2 cameras with unlimited storage on the digital evidence management solution, Evidence.com. This order was received in the second quarter of 2018 and will ship in multiple phases.

The following orders were received from domestic agencies:

- Honolulu Police Department (HI): 1,200 Axon Body 2 cameras on the Unlimited Plan with five years on Evidence.com and 391 Axon Signal Vehicle units
- Chicago Police Department (IL): 400 Axon Body 2 cameras on the Technology

AXON AI

**“A worthwhile exercise would be to delete the word ‘technology’ from our vocabularies in order to see how quickly capitalism's objectives are exposed.”**

**Shoshana Zuboff**
*The Age of Surveillance Capitalism*

# opportunity

# Chinese businesswoman accused of jaywalking after AI camera spots her face on an advert

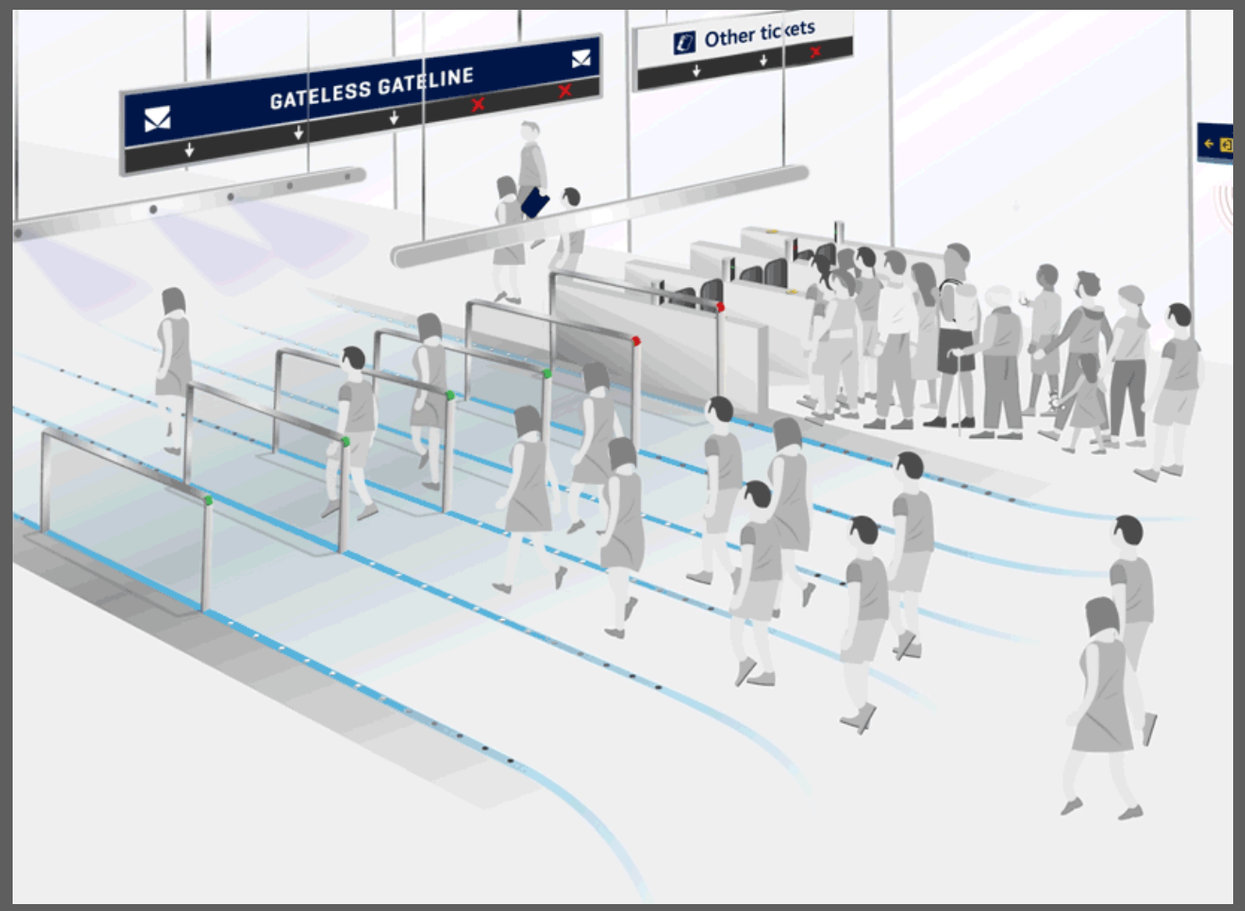



The image of Ms Dong on a public display screen

https://www.telegraph.co.uk/technology/2018/11/25/chinese-businesswoman-accused-jaywalking-ai-camera-spots-face/

**“…inefficiency is precisely what shelters us from the inhumanity of Taylorism and market fundamentalism. When inefficiency is the result of a deliberative commitment by a democratically run community, there is no need to eliminate it, even if the latest technologies can accomplish that in no time.”**

Evgeny Morozov
*To Save Everything, Click Here:*
*The Folly of Technological Solutionism*




designboom, “facial recognition to be your future ticket on the london underground”
https://www.designboom.com/technology/facial-recognition-london-underground-cubic-gateless-gatelines-10-04-2017/

**“…technology is not and never
can be a thing in itself, isolated from economics
and society. This means that technological
inevitability does not exist.”**

**Shoshana Zuboff**
*The Age of Surveillance Capitalism*

# Thank you!

Kyle Oba

@mudphone