

COMPUTER VISION

COMPUTER VISION



IS EVERYWHERE

memegenerator.net

What is it?

- The field of Computer Science that deals with understanding visual elements such as images or videos.
- Seeks to perform tasks humans can accomplish visually

Tasks like ...

- Object classification
- Face recognition
- Motion Capture
- 3D scene reconstruction
- Image Segmentation
- Background/Foreground Detection

Tasks like ...

- **Object classification**
- Face recognition
- Motion Capture
- 3D scene reconstruction
- Image Segmentation
- Background/Foreground Detection



4 → 4	2 → 2	3 → 3
4 → 4	9 → 9	0 → 0
5 → 5	7 → 7	1 → 1
9 → 9	0 → 0	3 → 3
6 → 6	7 → 7	4 → 4



UBER ATG

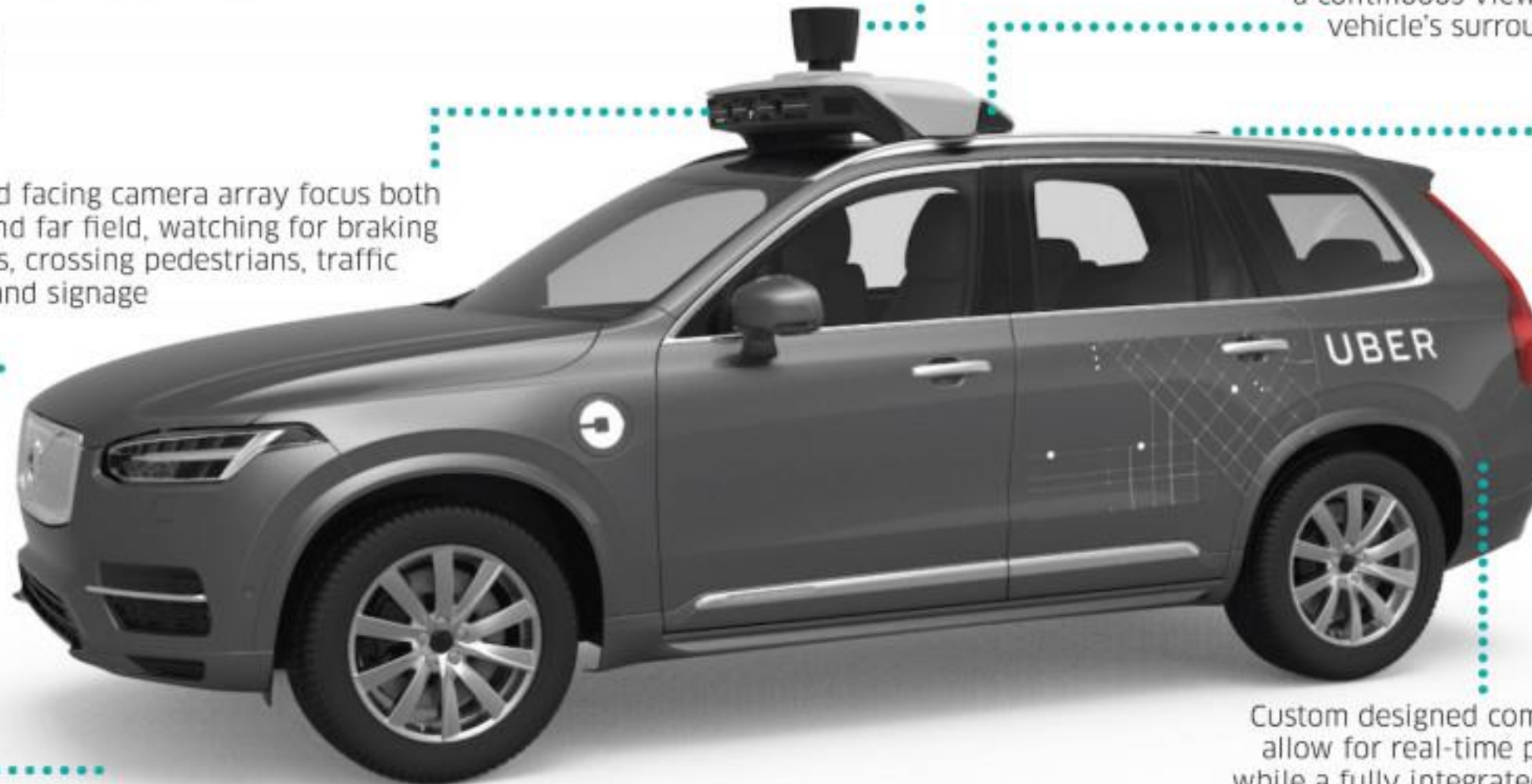
Top mounted lidar units provide a 360° 3-dimensional scan of the environment

Side and rear facing cameras work in collaboration to construct a continuous view of the vehicle's surroundings

Forward facing camera array focus both close and far field, watching for braking vehicles, crossing pedestrians, traffic lights, and signage

Roof mounted antennae provide GPS positioning and wireless data capabilities

360°
radar
coverage



Custom designed compute and storage allow for real-time processing of data while a fully integrated cooling solution keeps components running optimally

Self Driving Uber sensor suite

7 Cameras
1 Laser
Inertial Measurement Units

Custom compute and data storage
360° radar coverage

Advanced
Technologies
Group

UBER

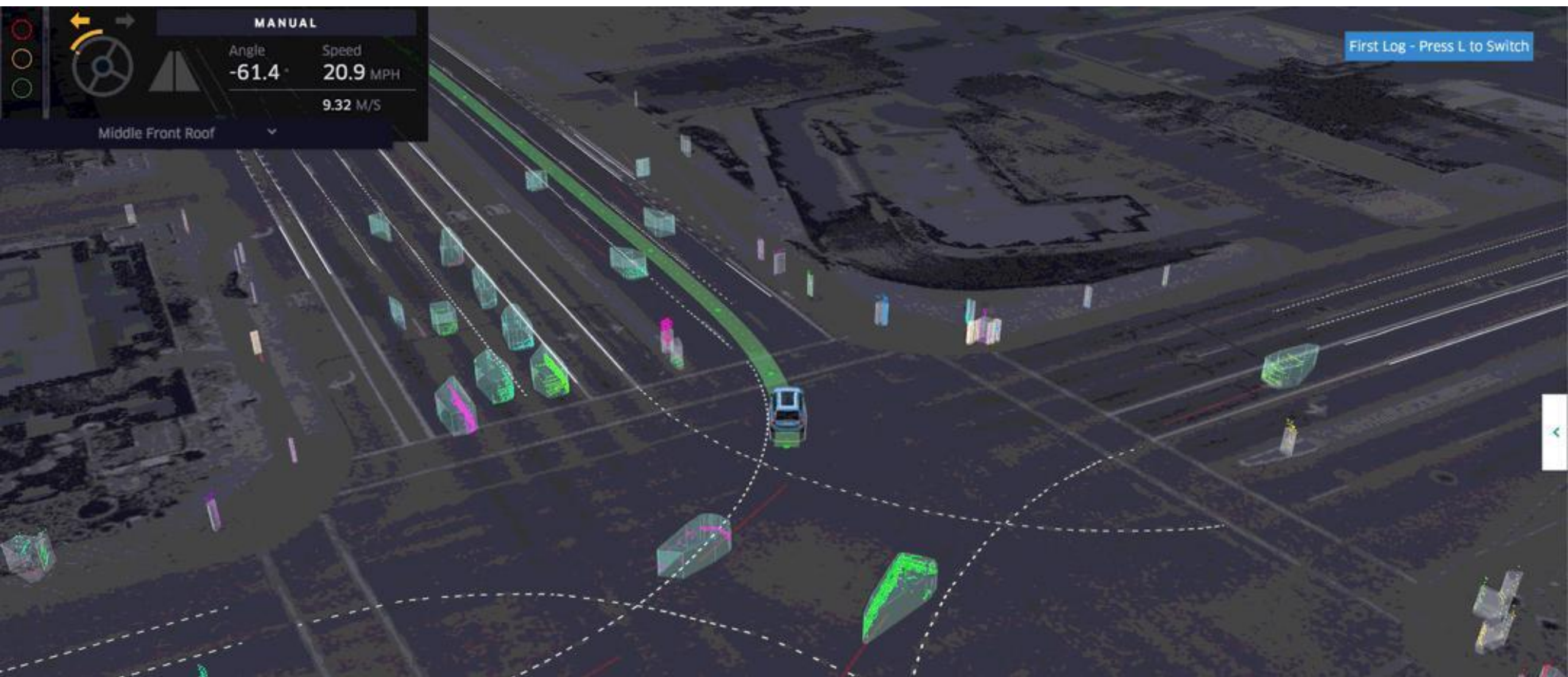
MANUAL

Angle
-61.4°

Speed
20.9 MPH
9.32 M/S

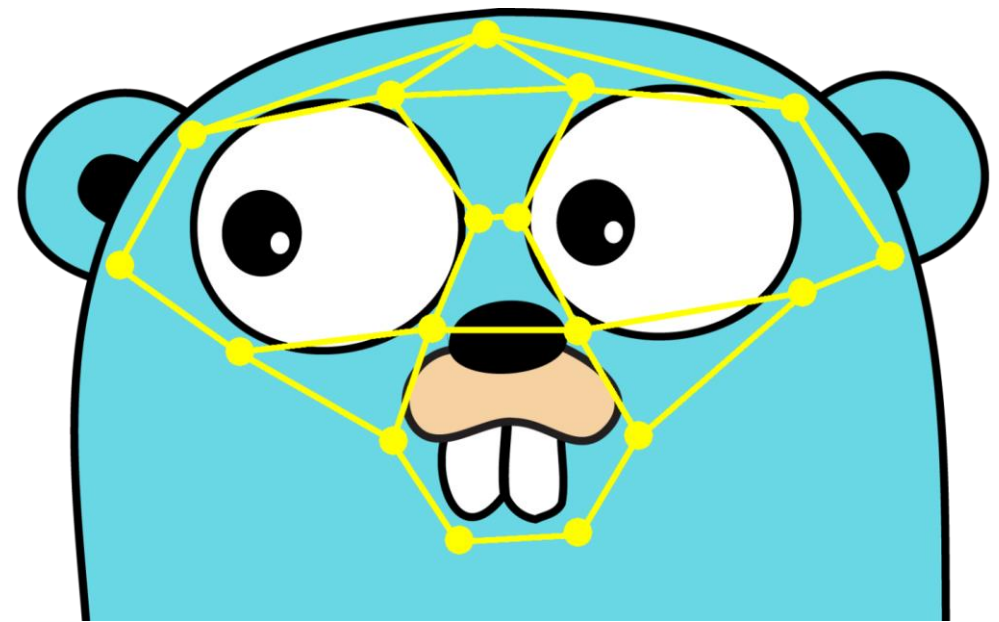
Middle Front Roof

First Log - Press L to Switch



Tasks like ...

- Object classification
- **Face recognition**
- Motion Capture
- 3D scene reconstruction
- Image Segmentation
- Background/Foreground Detection



pred: Colin_Powell
true: Colin_Powell



pred: George_W_Bush
true: George_W_Bush



pred: Colin_Powell
true: Colin_Powell



pred: Tony_Blair
true: Tony_Blair



pred: George_W_Bush
true: George_W_Bush



pred: Colin_Powell
true: Colin_Powell



pred: Colin_Powell
true: George_W_Bush



pred: George_W_Bush
true: George_W_Bush



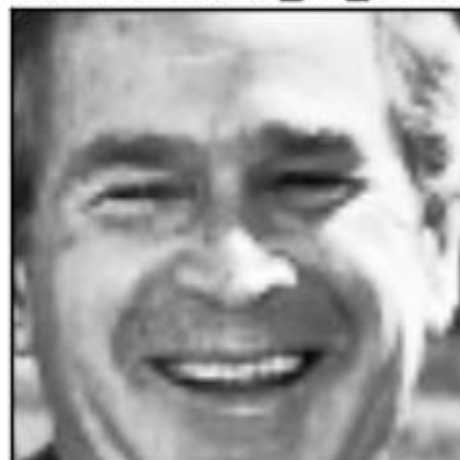
pred: Tony_Blair
true: Tony_Blair



pred: Colin_Powell
true: Colin_Powell

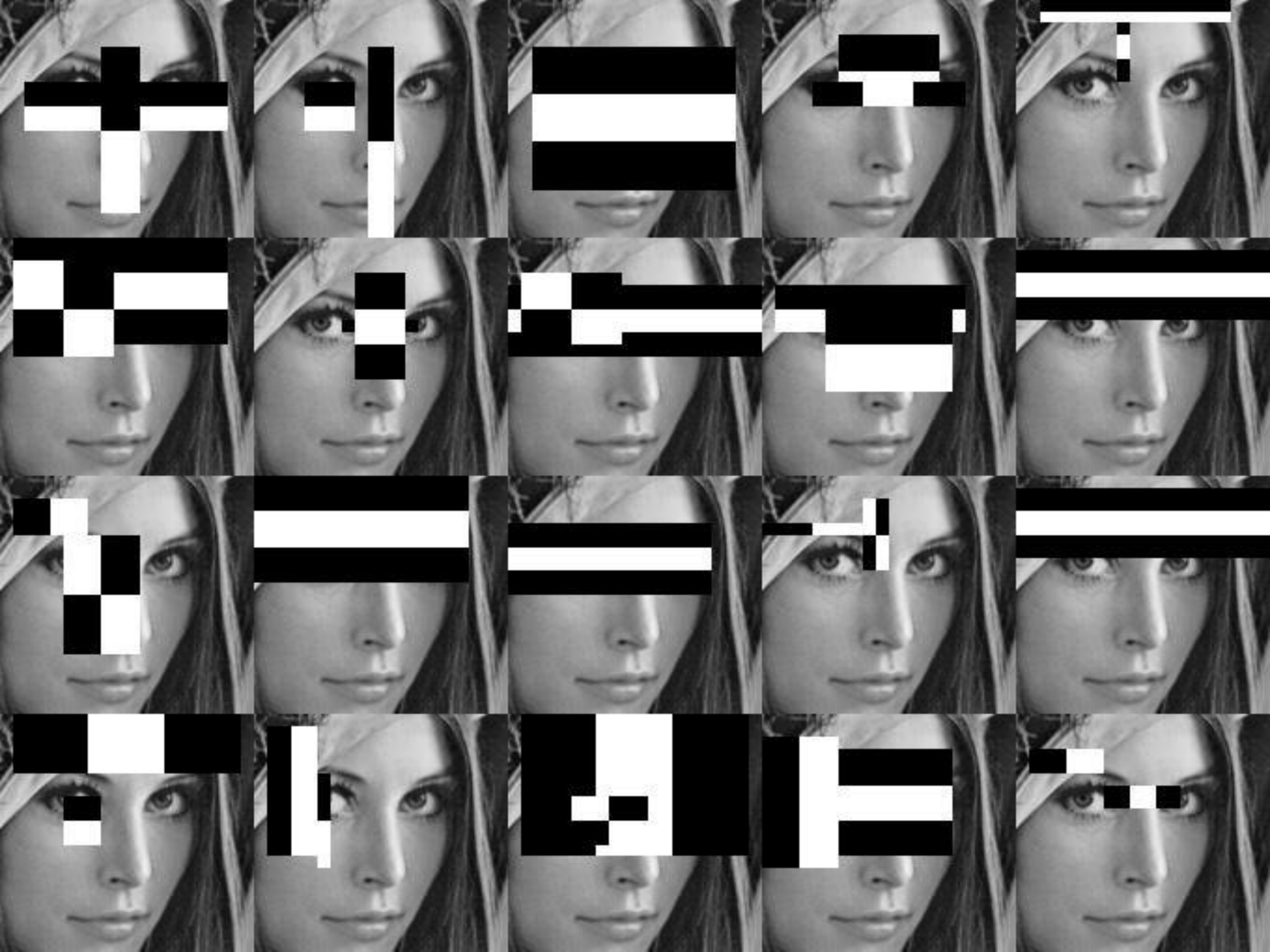


pred: George_W_Bush
true: George_W_Bush



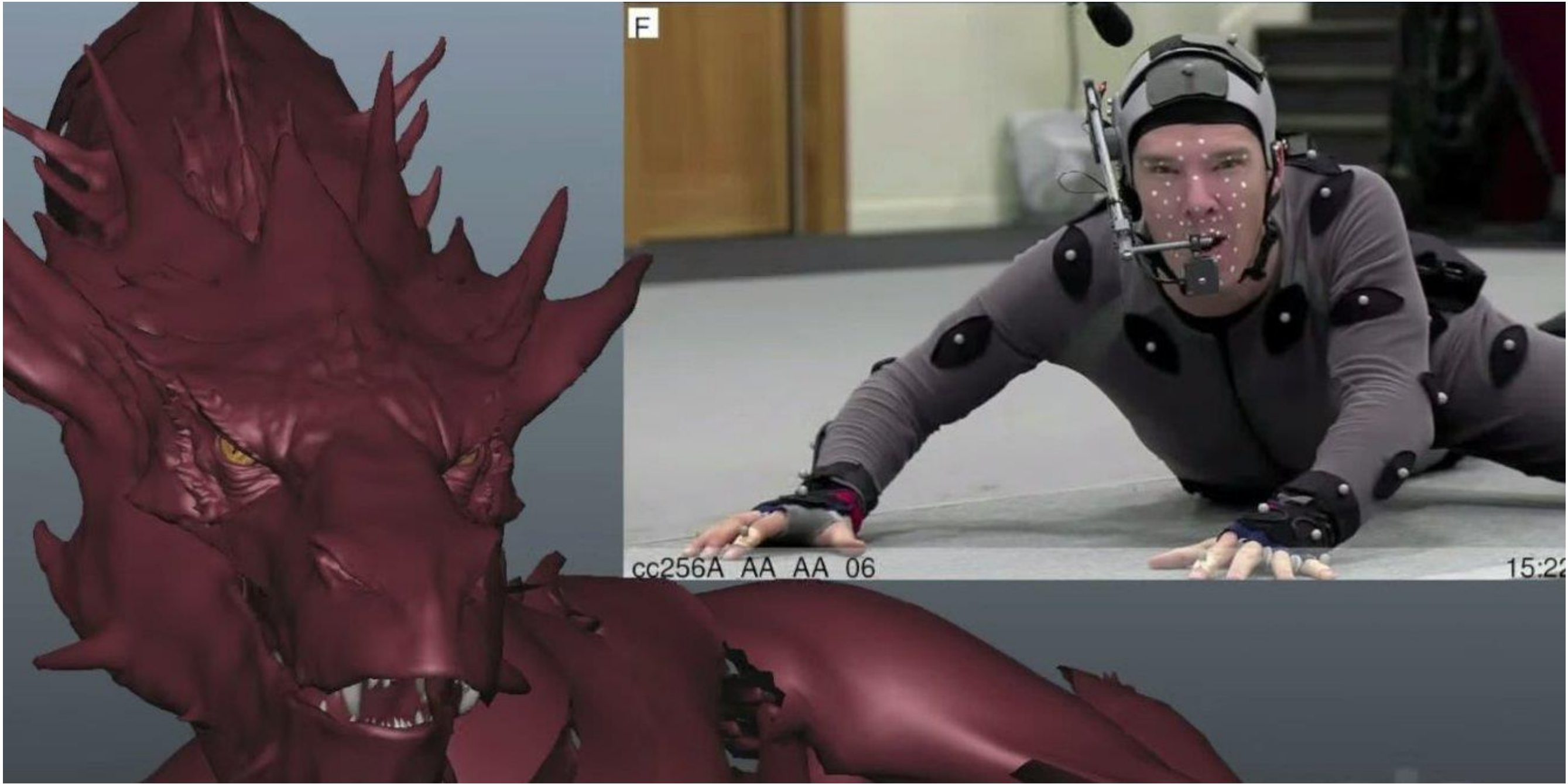
pred: Donald_Rumsfeld
true: Donald_Rumsfeld

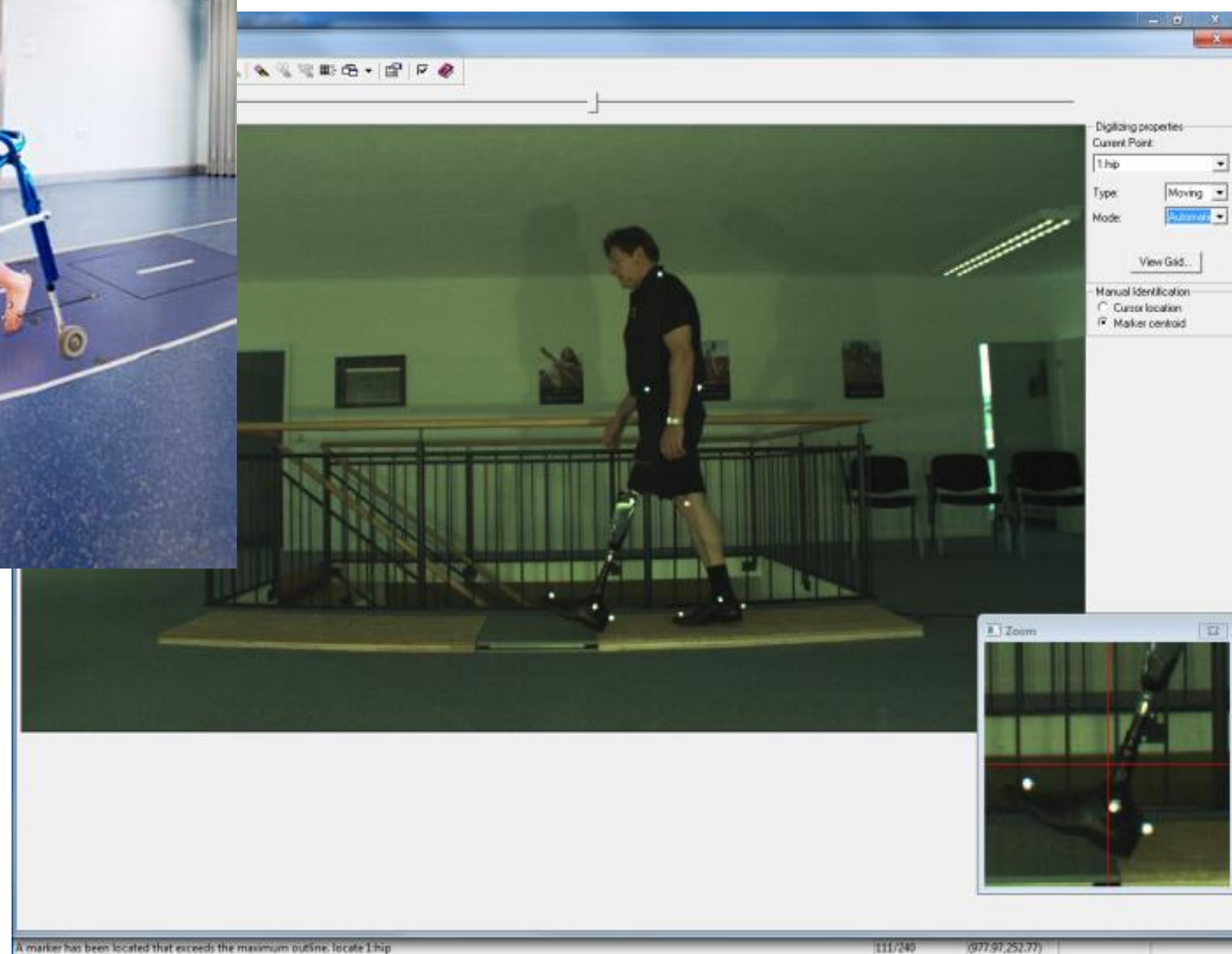
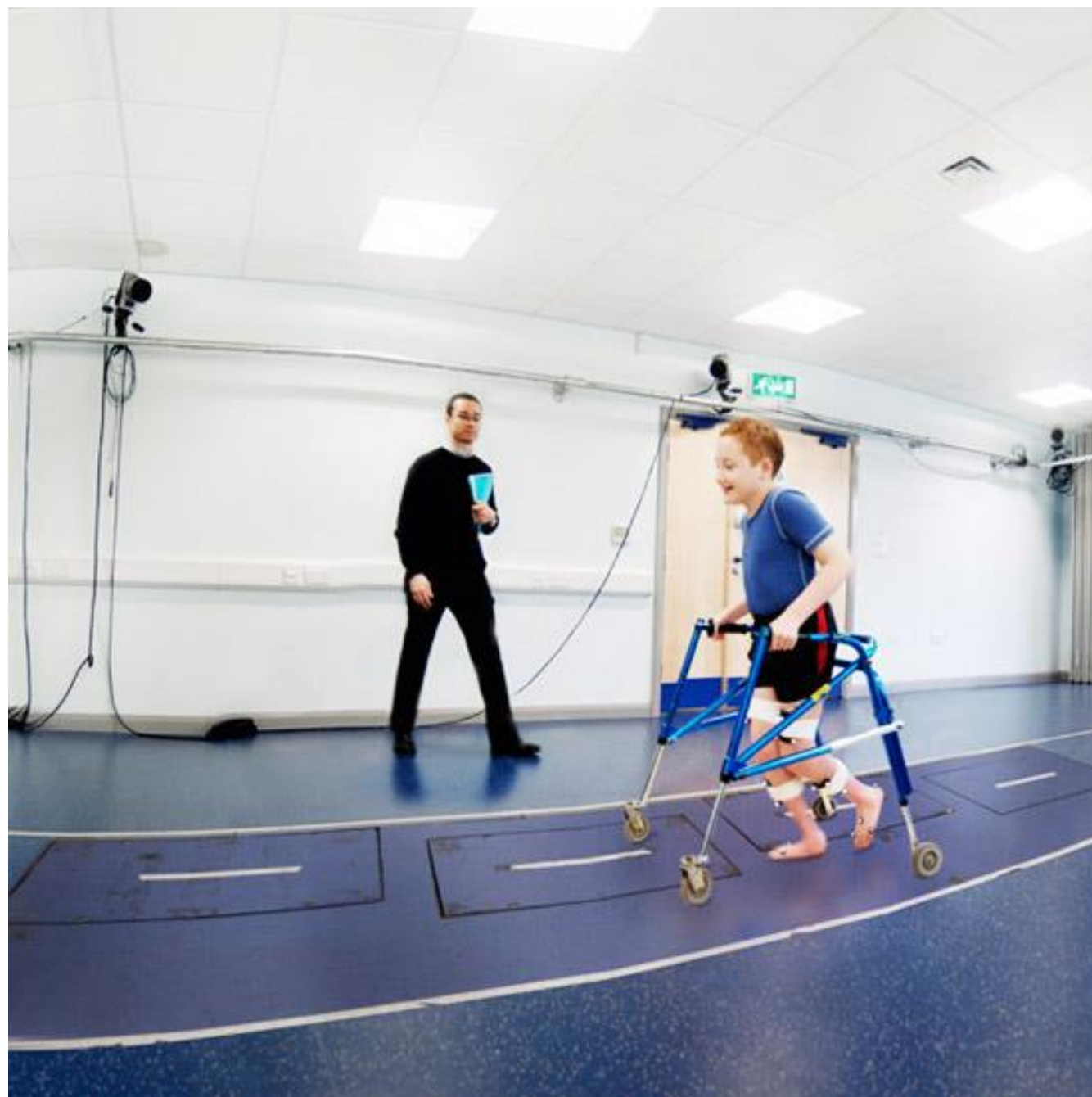




Tasks like ...

- Object classification
- Face recognition
- **Motion Capture**
- 3D scene reconstruction
- Image Segmentation
- Background/Foreground Detection







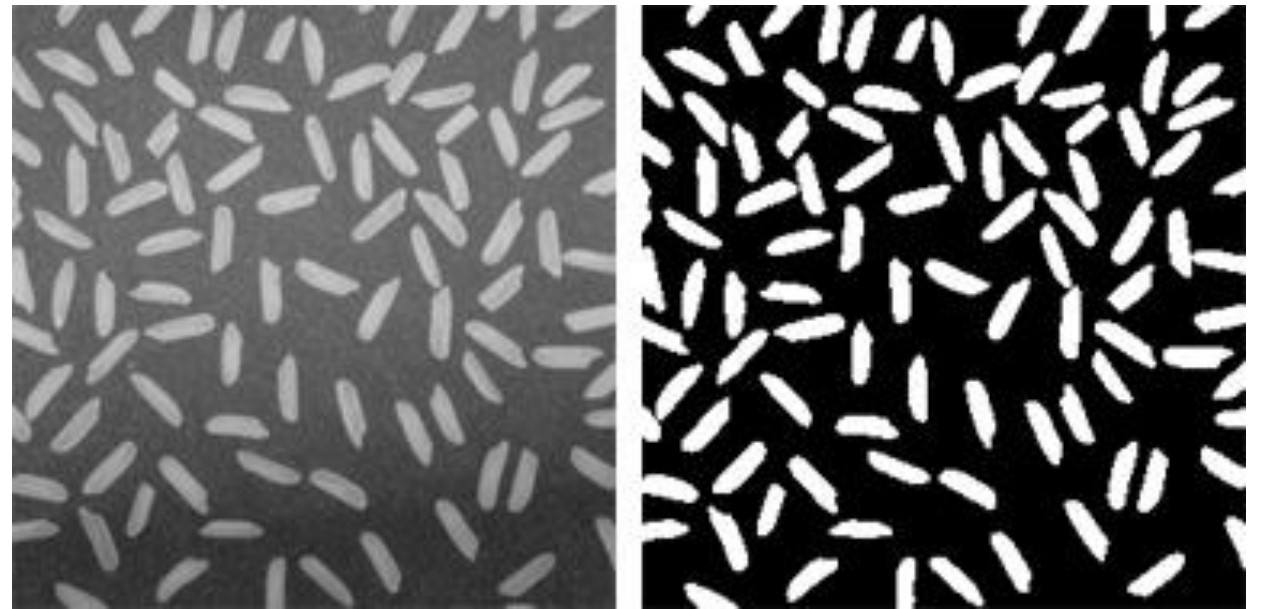
Tasks like ...

- Object classification
- Face recognition
- Motion Capture
- **3D scene reconstruction**
- Image Segmentation
- Background/Foreground Detection



Tasks like ...

- Object classification
- Face recognition
- Motion Capture
- 3D scene reconstruction
- **Image Segmentation**
- Background/Foreground Detection



Tasks like ...

- Object classification
- Face recognition
- Motion Capture
- 3D scene reconstruction
- Image Segmentation
- **Background/Foreground Detection**



Background Image

Foreground Image

Background Weight

Shadow Weight

Foreground Result

Graphcut (non-black)
Blob finding (white)

Background/Foreground Detection



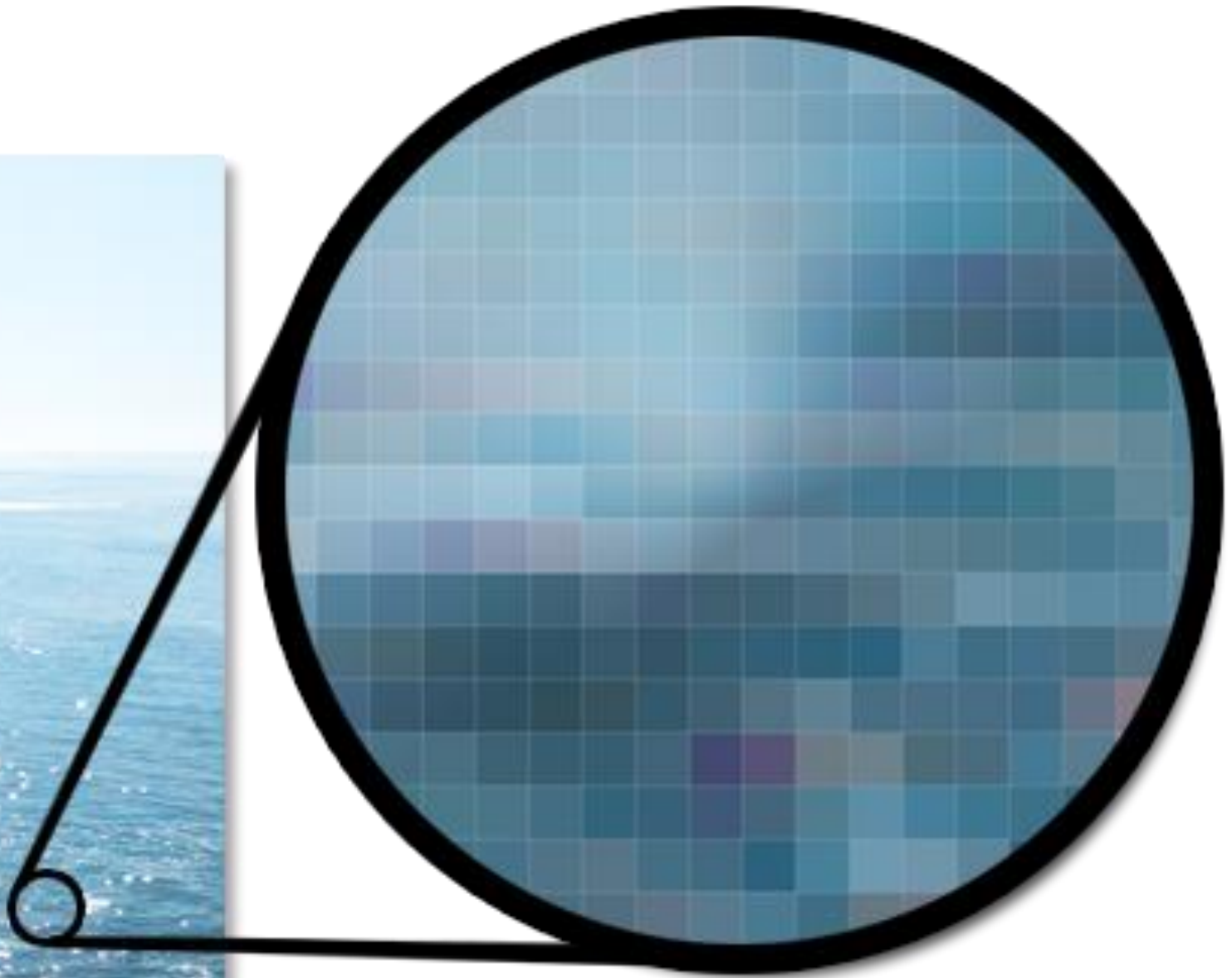


But wait!

- How are these videos and images even represented in computers?
- Well, ever heard someone or yourself say “gosh this pic is so pixelated”!
- Yep, it’s done using **pixels**

PIXEL





All those 2D list free response
questions,

we teach them for a reason!

Back to background/foreground stuff

- Any ideas?

(inefficient) Code

```
def getBackground(imgList, rows, cols):  
    bg = [[0]*cols for i in range(rows)]  
    for row in range(rows):  
        for col in range(cols):  
            for img in imgList:  
                bg[row][col] += img[row][col]  
    return bg
```

```
#divide by number of imgs
```

RGB vs. Grayscale

- RGB: Red, Blue, Green components in range (0-255)
- (0, 0, 0) -> Black
- (255, 255, 255) -> White
- Grayscale: Just gray level
- 0 to 255 (Black -> White)



(show basic openCV
image
reading/conversion)

Image Segmentation

- Literally, just partitioning an image into multiple segments based on your needs



Hough Circles

Any questions, yo?

