

Image Processing

Objectives

- Understand the fundamental differences between image data and other kinds of data
- Be aware of the tools and pipeline for working with images
- Understand general computer vision techniques for working/transforming images

Image analysis is hard



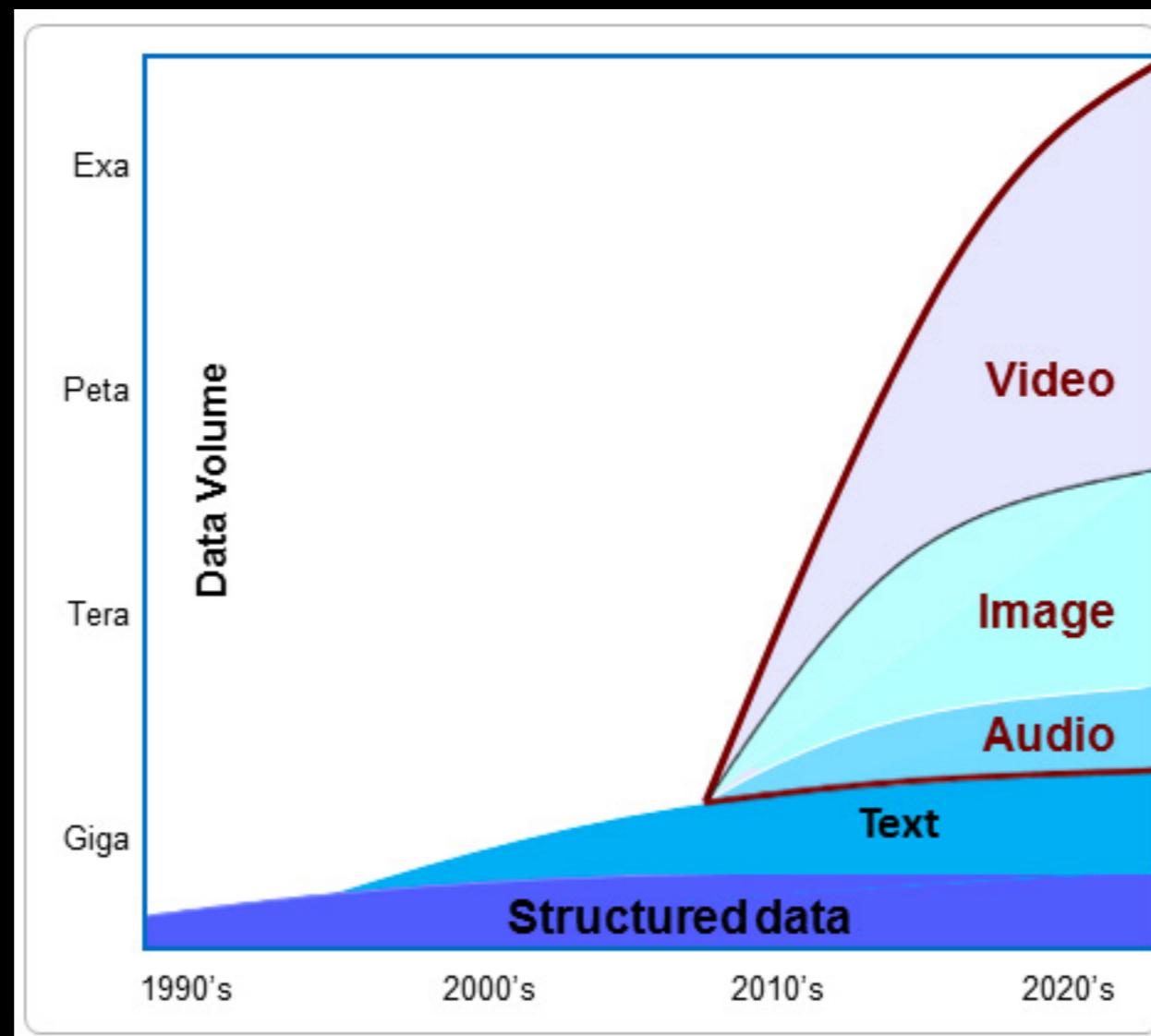
Why?

- Images come in many different sizes
- Viewing conditions are infinite
- Objects are surrounded by other objects

There are so many things about this image that we understand, that computers currently can't ...

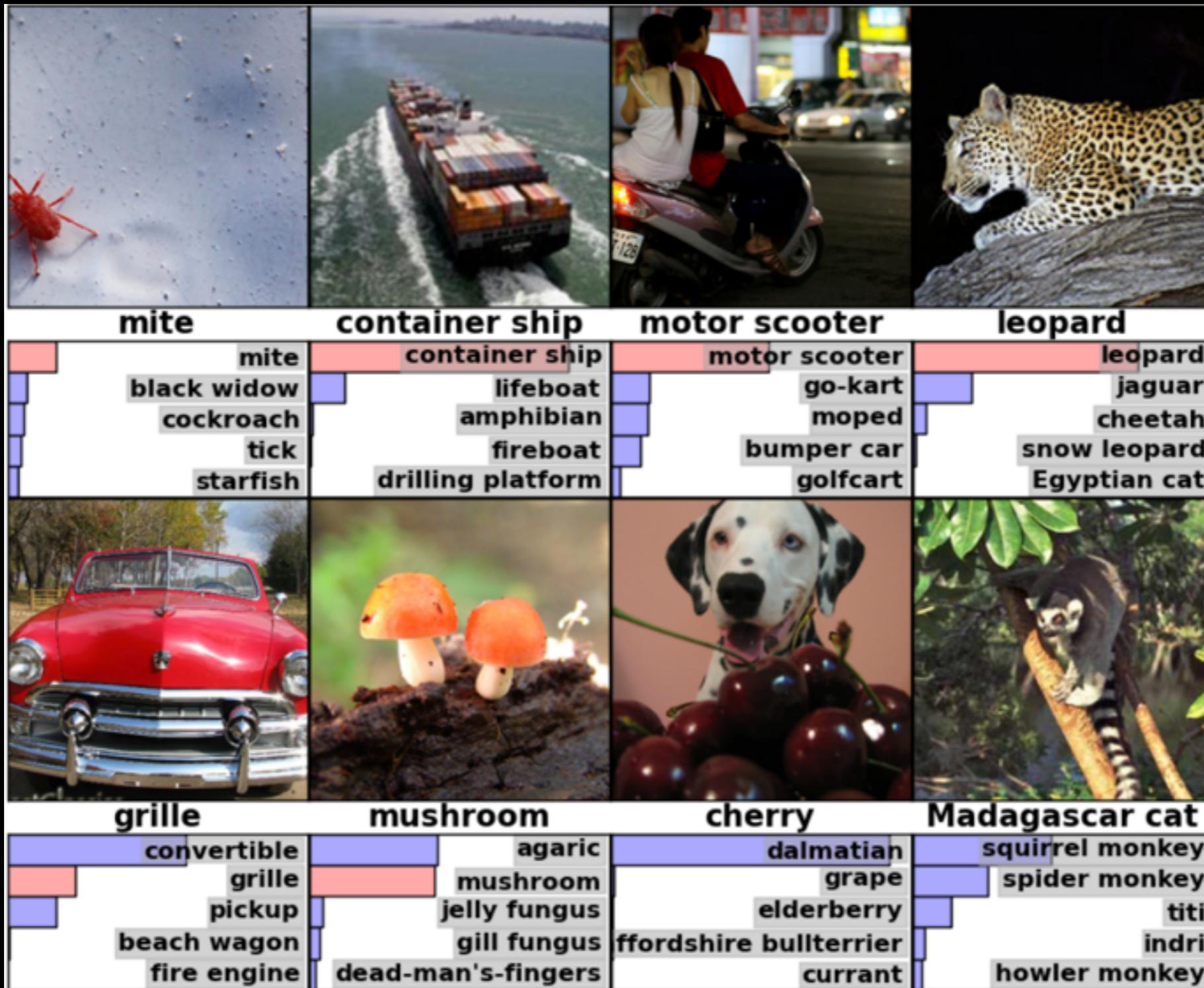


Motivation for Image Analysis



It's clearly the future...

What can we do with it?





Q: How does the woman feel?

DPPnet: happy

Q: What type of hat is she wearing?

DPPnet: cowboy

What do we need?

To perform object recognition, we need:

- To compress the data
- To keep the search simple
- A means of segmenting out potential objects

Python Libraries

- Scikit-image (skimage)
- OpenCV (based on C++)
 - Be careful with package dependencies on this one
- Python Imaging Library
- Pillow (a fork of Python Imaging Library)
- There are probably a couple of others...

Into the Pipeline...

- Read
- Resize
- Transformations

Read

For colored images:

`shape = (width, height, 3)`

For grayscale images:

`shape = (width, height)`

Image Tensor



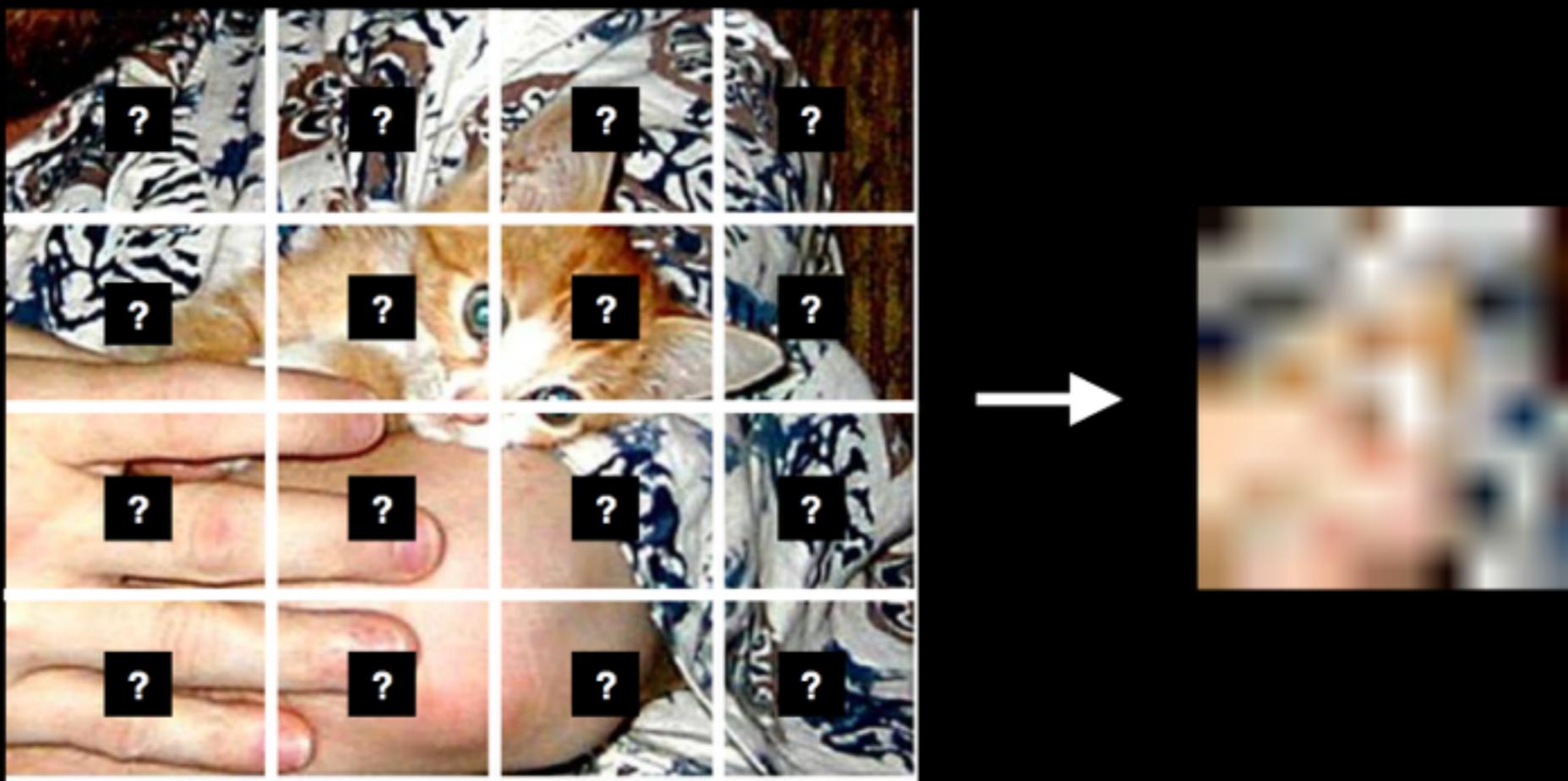
```
array([
    [ [ RGB, RGB ],
      [ [ 108, 50, 13], [111, 55, 18] ],
      [ RGB, RGB ],
      [ [115, 61, 23] , [130, 129, 127] ]
    ] )
```

- What shape is this? = > (2, 2, 3)
- What if it was grayscale? = > (2, 2)

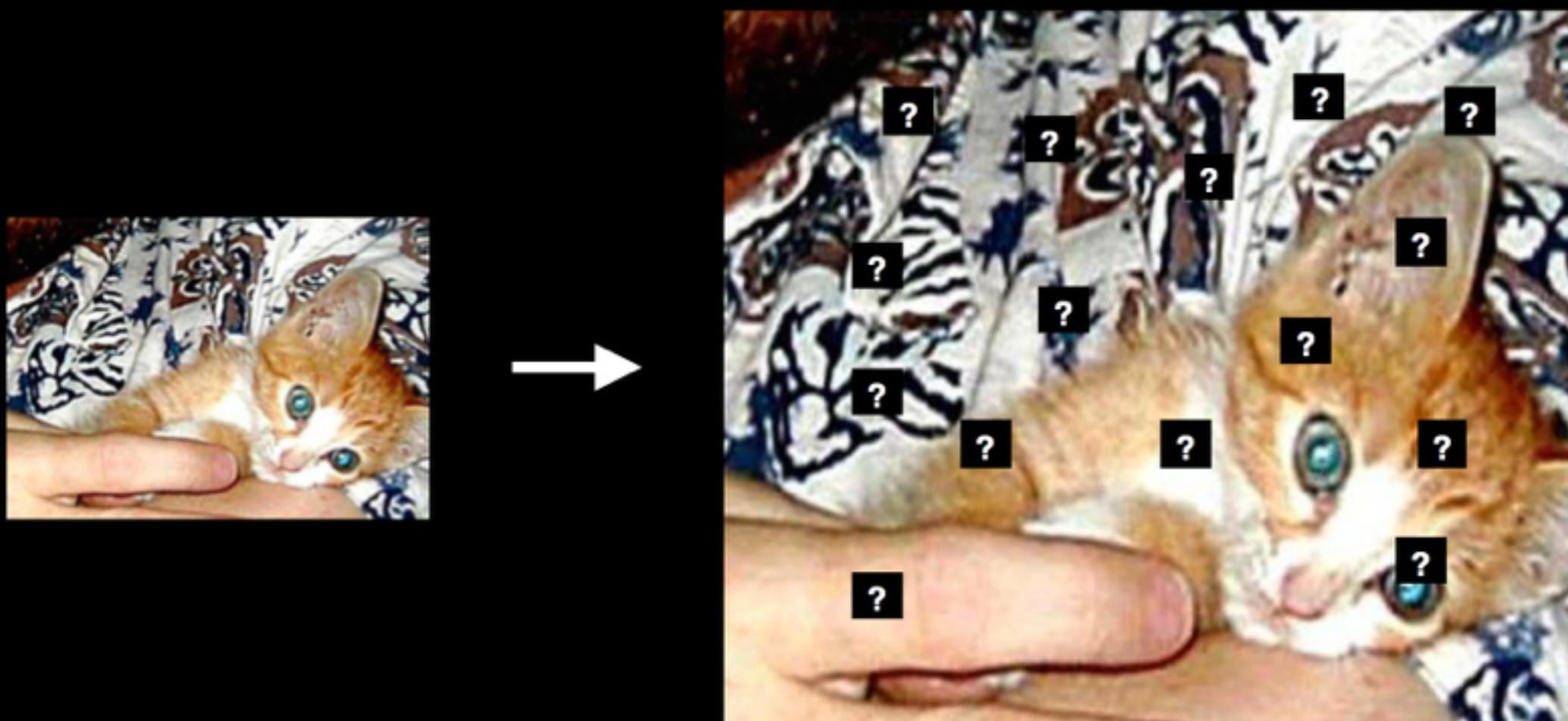
Resize

- Make image a specified shape
- Not cropping

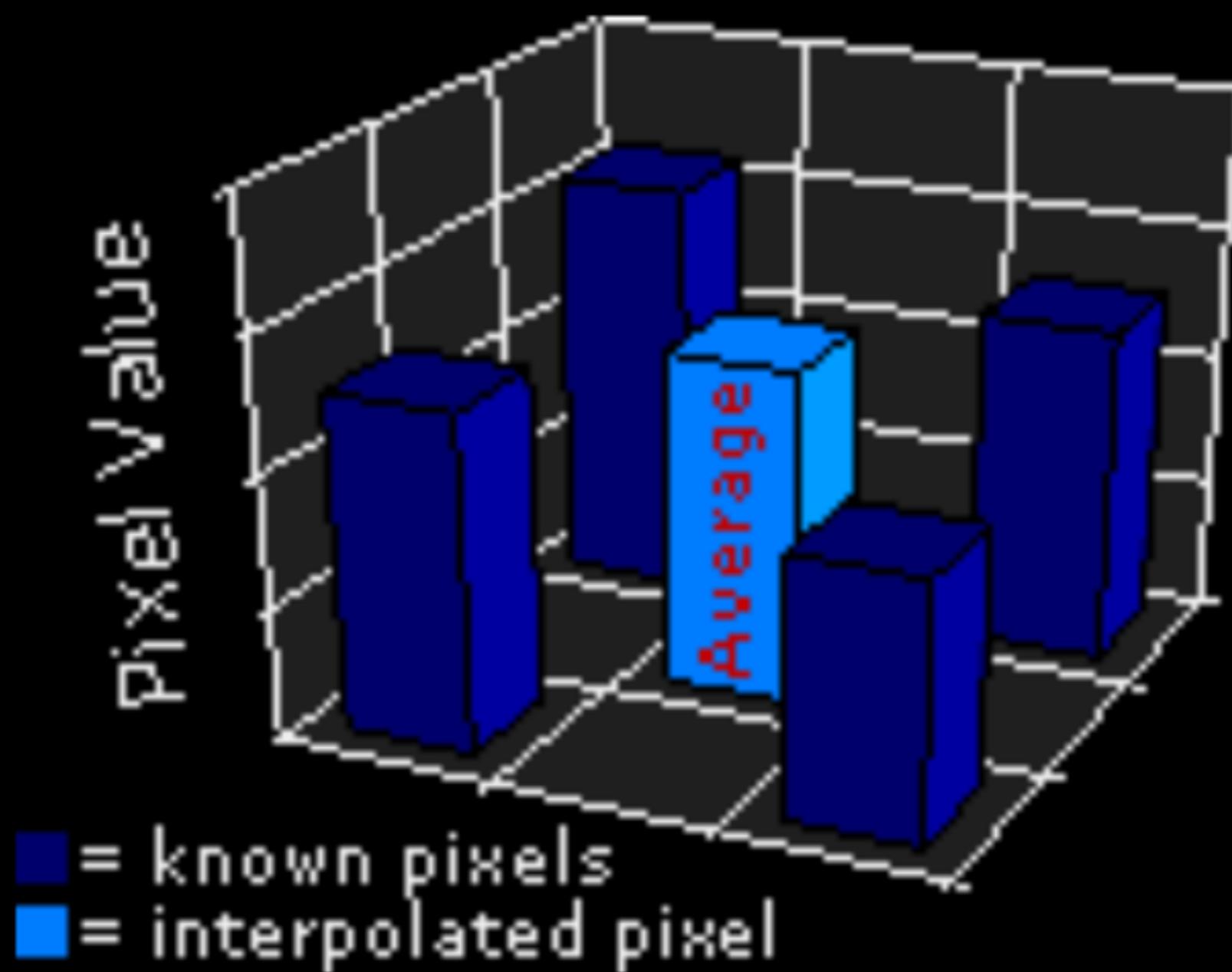
Down-Sampling



Up-Sampling



Interpolation



Transformations

- Convert an image from one domain to another

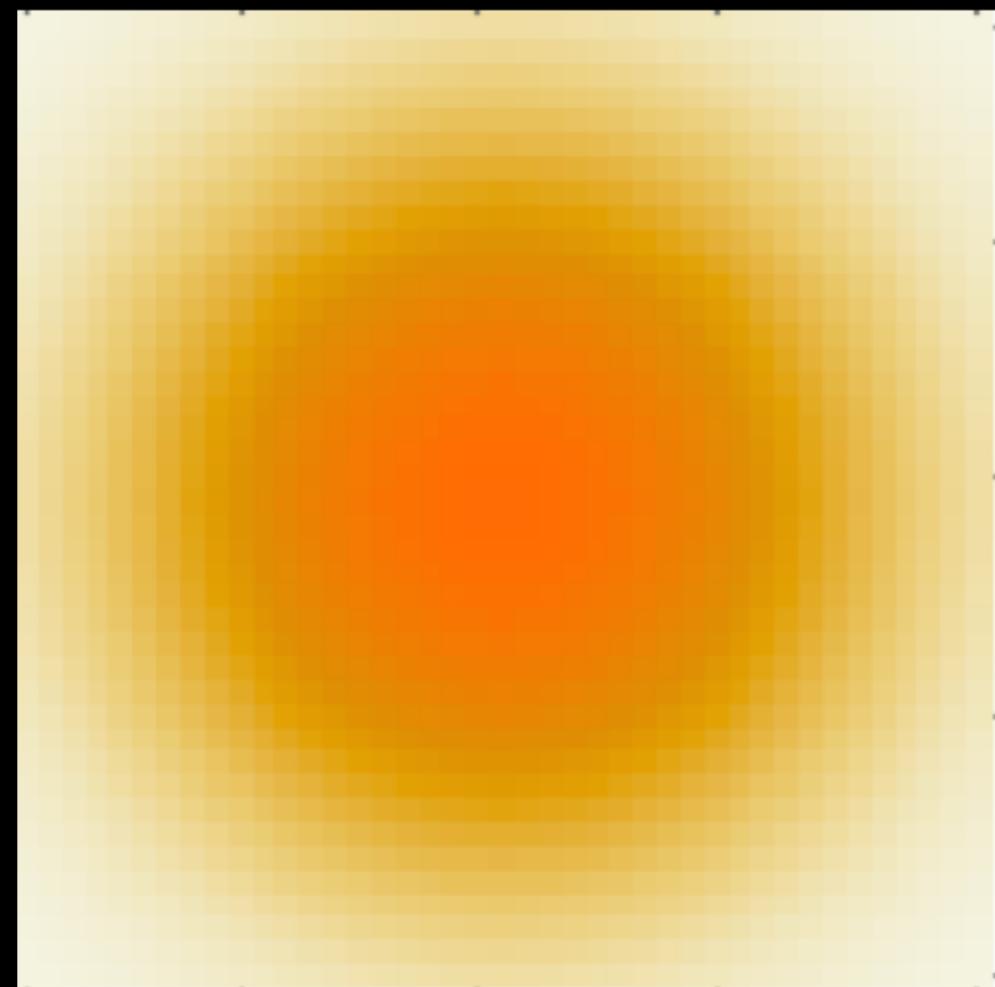
Grayscale



Denoise

- Removing unnecessary details of an image
- Better generalization of the class of image

Gaussian Kernel



What happens if we apply the Gaussian Kernel?

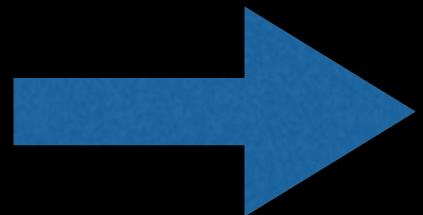
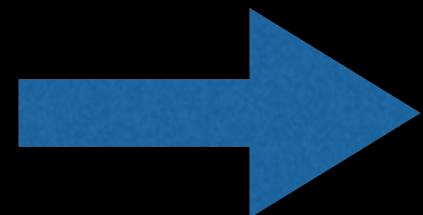
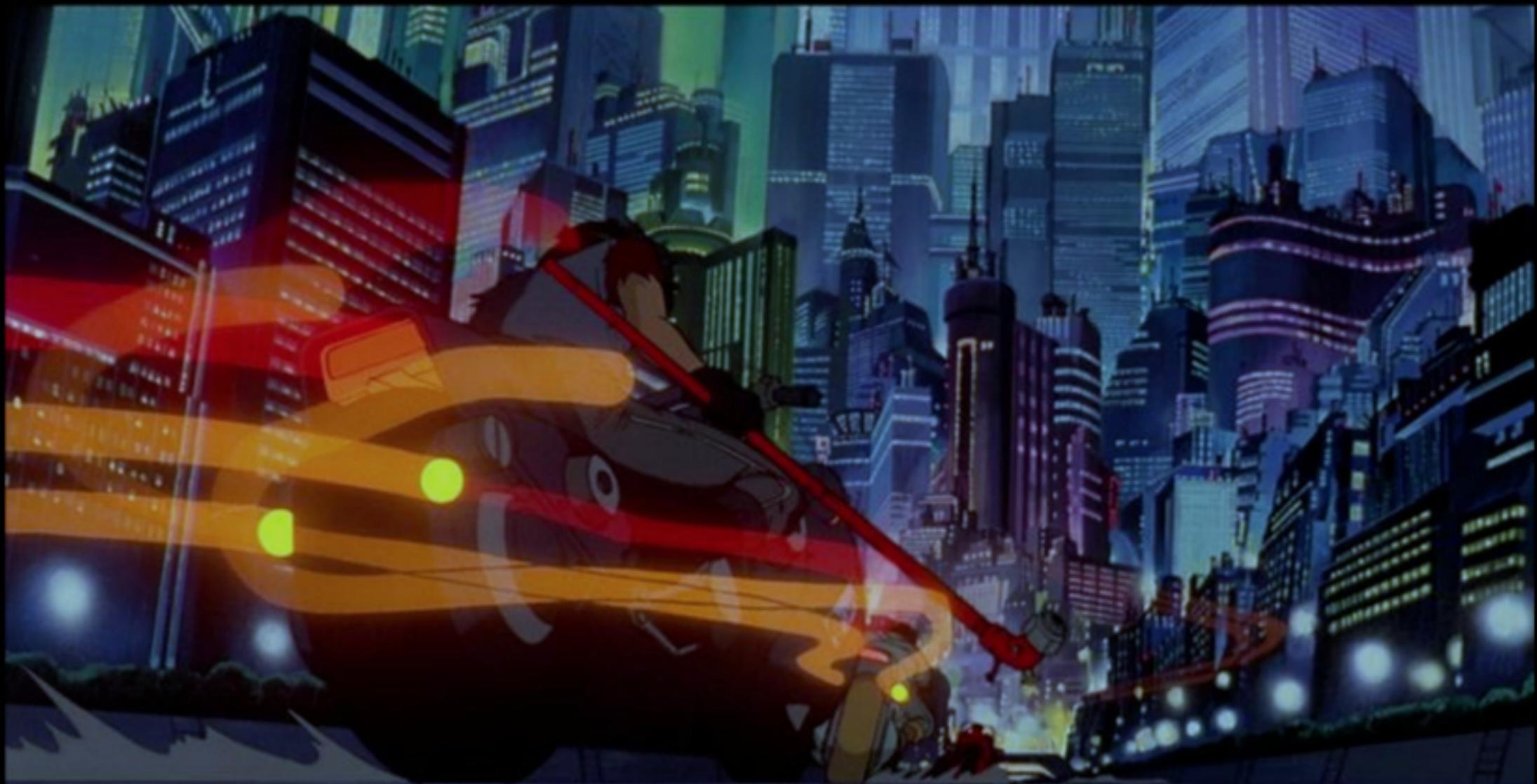


Image Analysis

- Pre convolutional nets, image analysis / object recognition focused on examining pixels / color vectors

K-Means of RGB pixels



Raw Vector Based Methods



Ascertain features in images by looking at intensity gradients