

Perception

Machine Recognition

Yezhou Yang, Ph.D.
Assistant Professor
Zhiyuan Fang, Teaching Assistant
Arizona State University

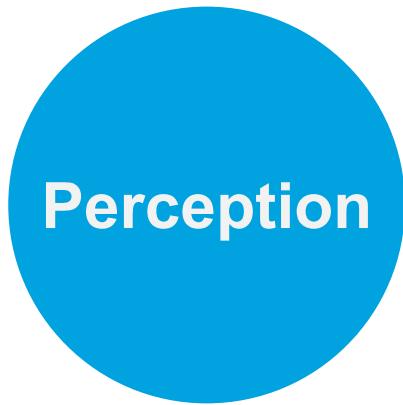
Vision and Perception



| What's the correlation and difference between them?

- It is a ***biological*** process that happens in our eyes. Our eyes work by **detecting** rays of light that are reflected or emitted by objects.

Vision and Perception



| What's the correlation and difference between them?

- It is a *psychological* process during which our brain makes sense of the visual image detected by our eyes.

Object Recognition



OR

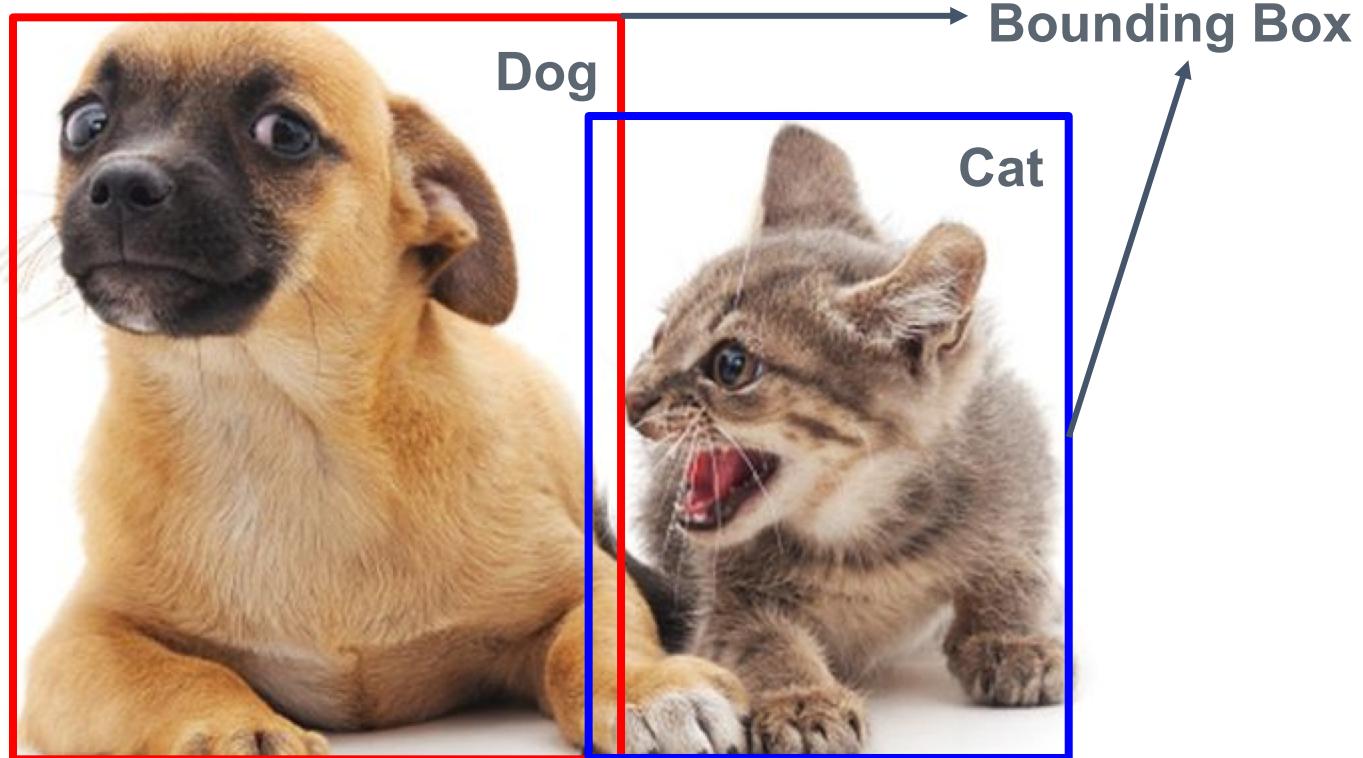


| **Object Recognition (or object classification):**
– Finding and identifying objects in an image

J. Bryner, "USDA Fed Cats and Dogs to Kittens, Alarming Watchdog Report Claims," LiveScience, 19-Mar-2019. [Online]. Available: <https://www.livescience.com/65030-usda-kitten-cannibalism-research.html>. [Accessed: 10-May-2019].

"Social Media Star Boo, 'World's Cutest Dog,' Dies at 12," Fortune. [Online]. Available: <http://fortune.com/2019/01/19/boo-worlds-cutest-dog-dies/>. [Accessed: 10-May-2019].

Object Detection



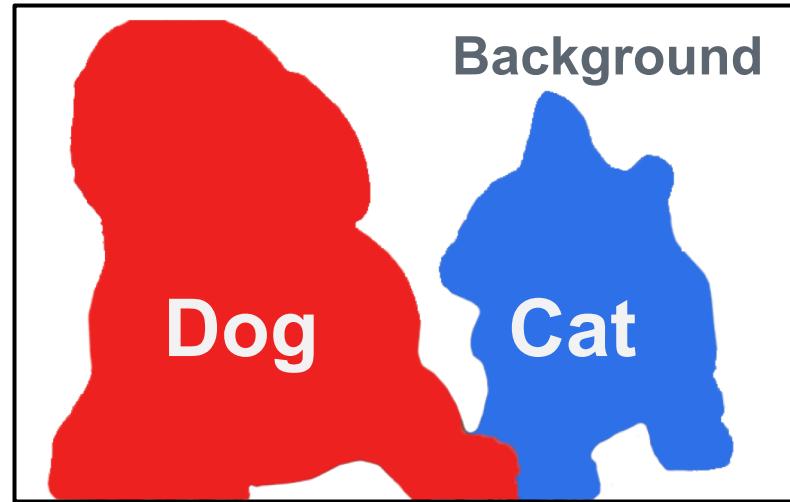
| Object Detection:

- Identifying the locations and categories of objects in an image

Object Segmentation



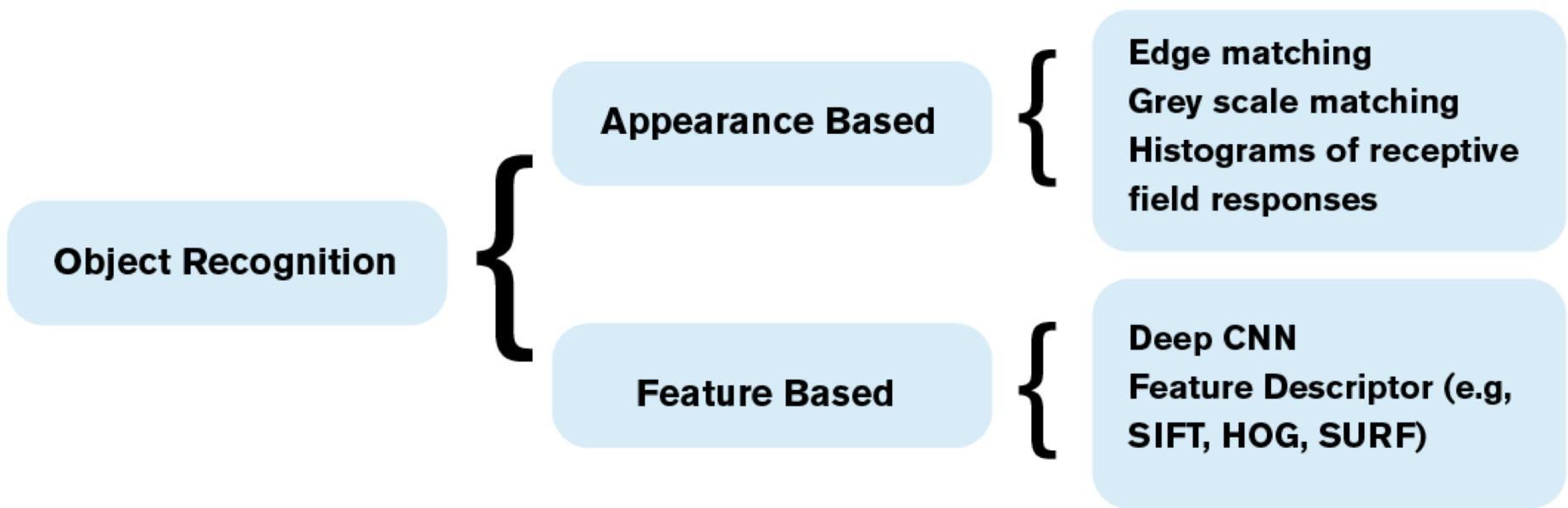
Pixel-Level Mask



| Object Segmentation:

- Process of assigning a label to every pixel in an image such that pixels with the same label share certain characteristics

Object Recognition



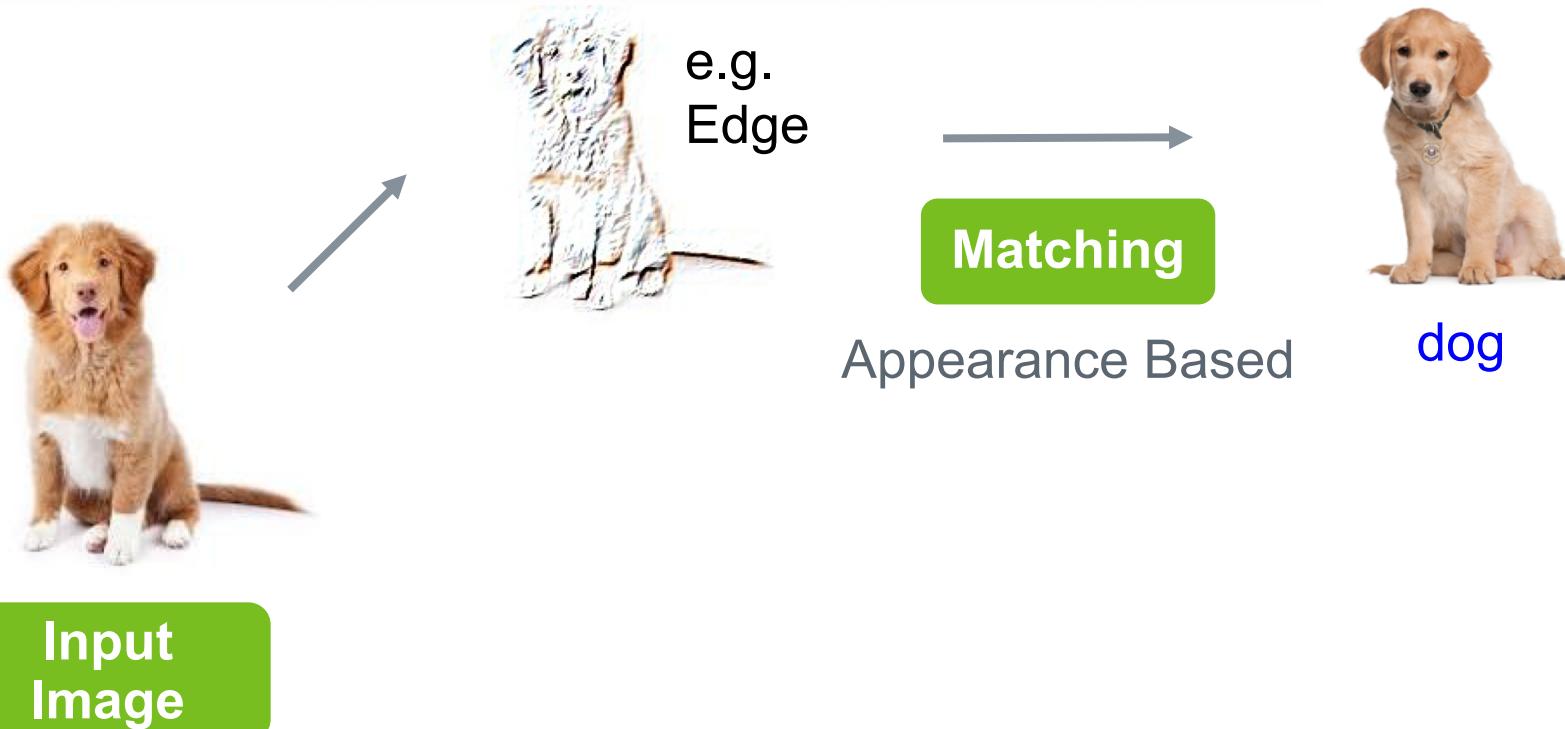
CNN: Convolutional Neural Network

SIFT: Scale-invariant feature transform

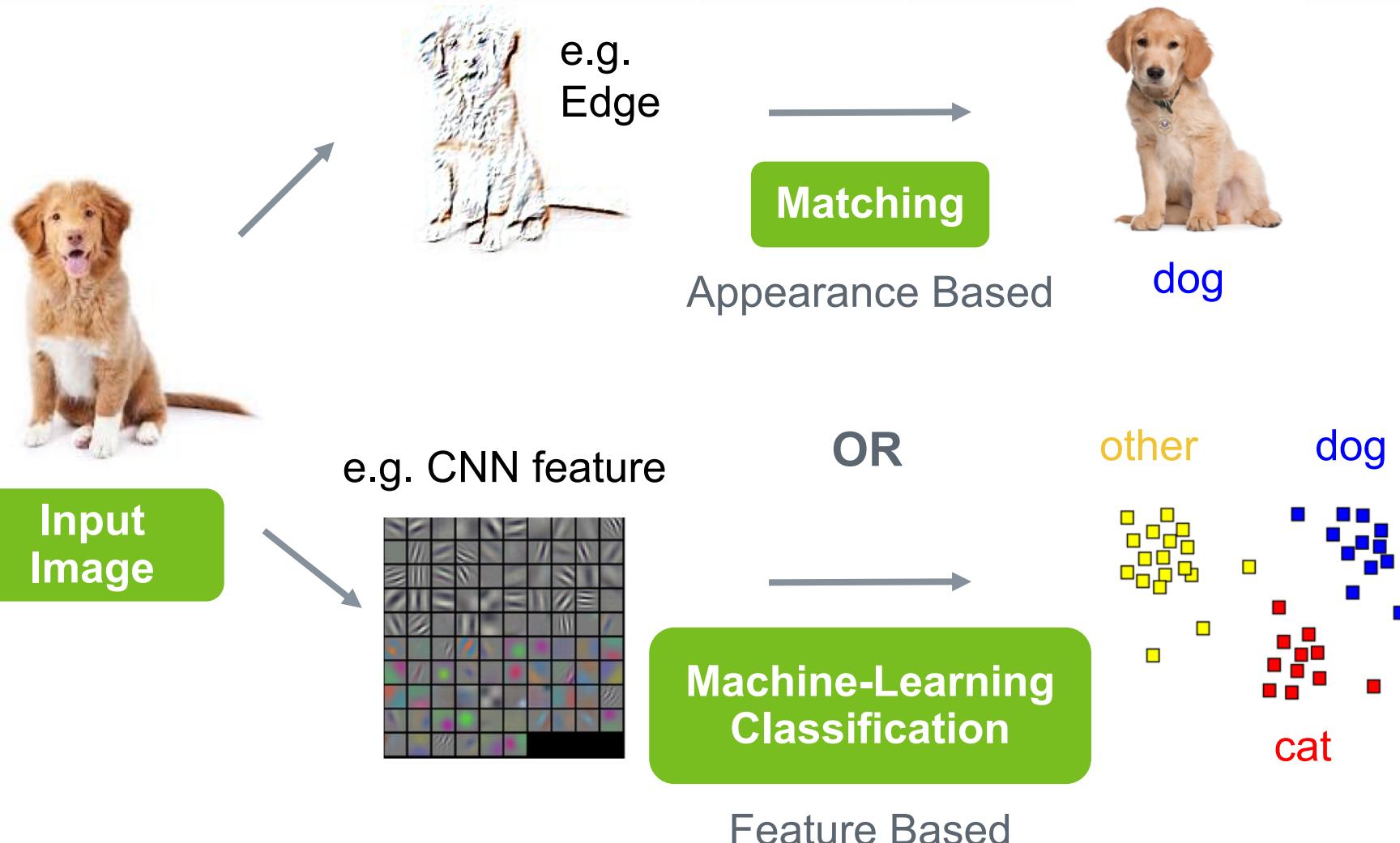
HOG: Histogram of oriented gradients

SURF: Speeded up robust features

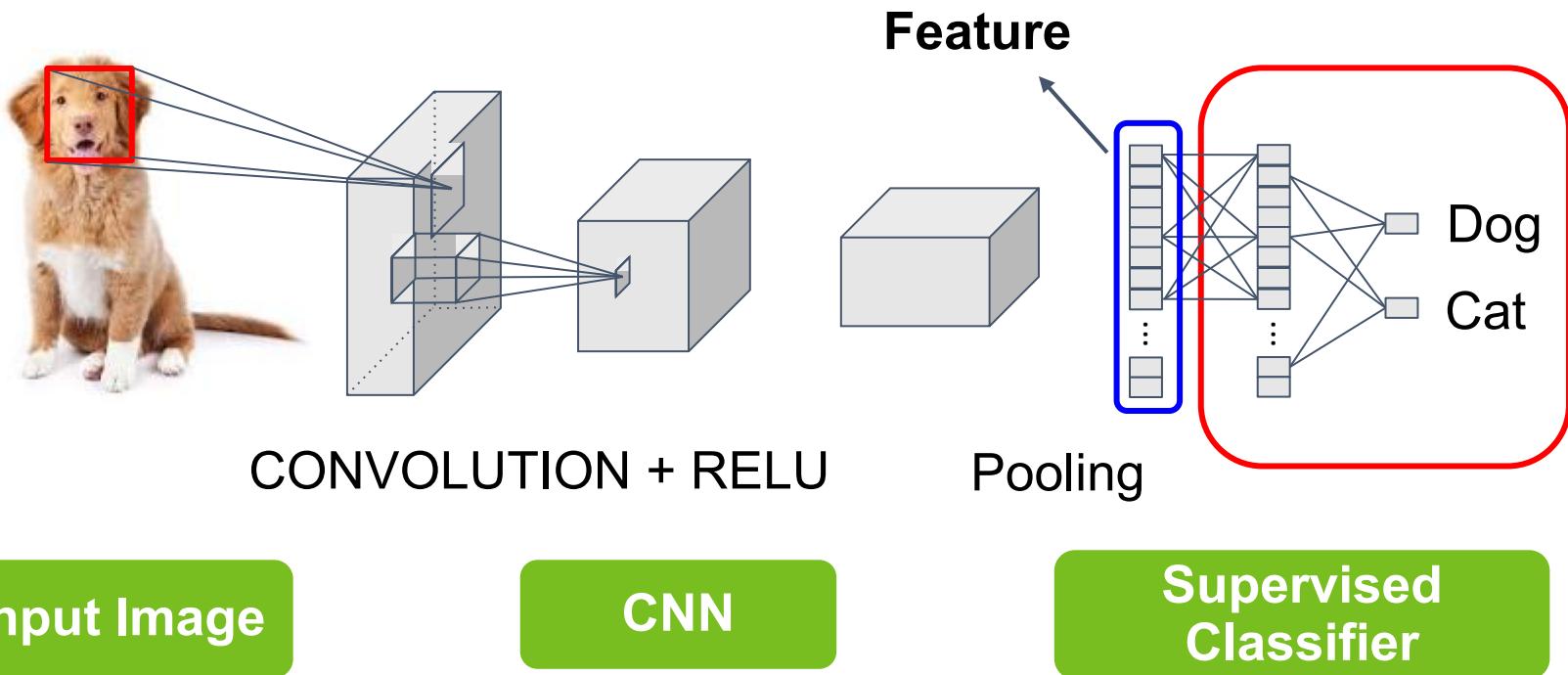
Feature-Based Recognition



Feature-Based Recognition



Convolutional Neural Network

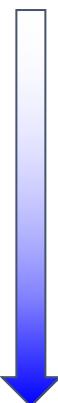


| Convolutional Neural Network (CNN):

- CNN is a hierarchical network consists of multiple hidden layers: convolutional layers, RELU layer, pooling layers, fully connected layers and so forth.

Training Data



Difficulty Level to Annotate	Task	Labels
	Object Classification:	Object-Level Category
	Object Detection:	Object-Level Category Bounding Boxes
Rise 	Object Segmentation:	Pixel-Level Category