Introduction to Image Segmentation

What we will be covering in this module?

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- Introduction to Image Segmentation

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- Introduction to Image Segmentation
- How to solve Image Segmentation problems?

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- Introduction to Image Segmentation
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- Approaches for Image Segmentation
  - Use Traditional Methods
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- What's Next?

Recap on problems in Computer Vision

Q. What is the **object** present in the image?

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Recap on problems in Computer Vision

Q. What is the object present in the image?

There is a **dog**!

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Recap on problems in Computer Vision

Q. What is the object present in the image?

There is a dog!

Formulate this as **image classification** problem

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Recap on problems in Computer Vision

Q. What is the **object** present in the image?

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Recap on problems in Computer Vision

Q. What **are the objects** present in the image?

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Recap on problems in Computer Vision

Q. What are the objects present in the image?

There is a **dog** and a **cat**!

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Recap on problems in Computer Vision

Q. What are the objects present in the image?

There is a dog and a cat!

Formulate this as **multi-class image classification** problem

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Recap on problems in Computer Vision

Q. **What** are the objects present in the image? **Where** are they?

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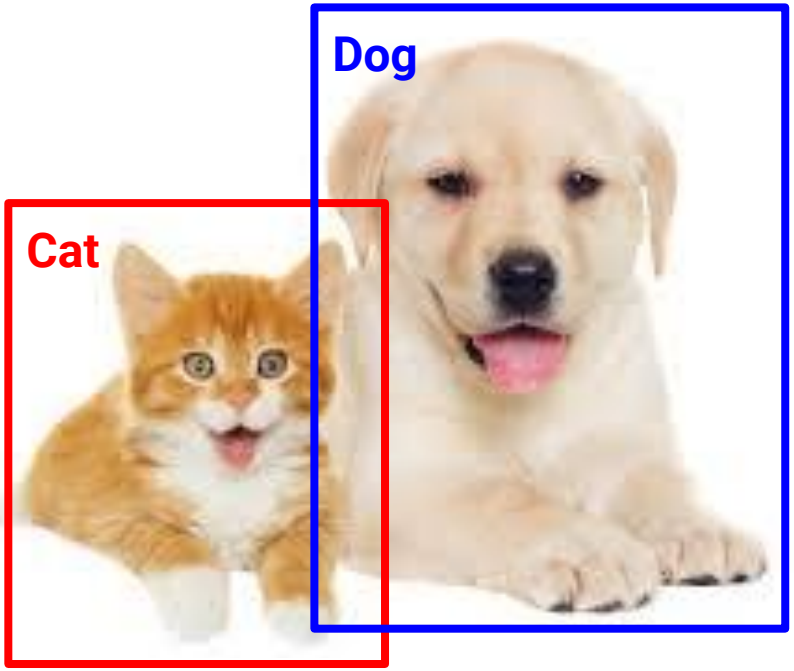
Recap on problems in Computer Vision

Q. What are the objects present in the image? Where are they?

There is a **dog** and a **cat**!

The dog → **blue** box
The cat → **red** box



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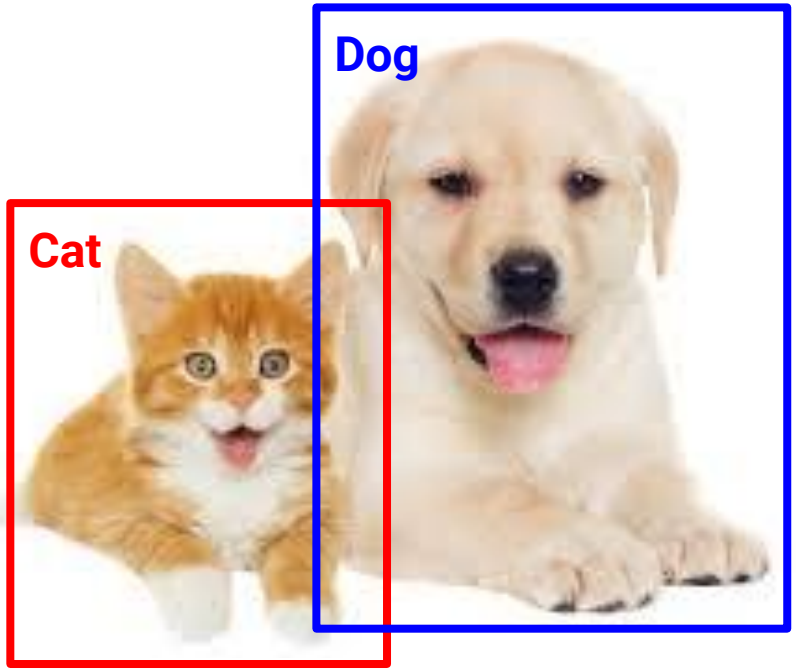
Recap on problems in Computer Vision

Q. What are the objects present in the image? Where are they?

There is a dog and a cat!

The dog → blue box
The cat → red box

Formulate this as **object detection** problem



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What is Image Segmentation?

Q. **What** are the objects present in the image? **Where** are they **exactly**?

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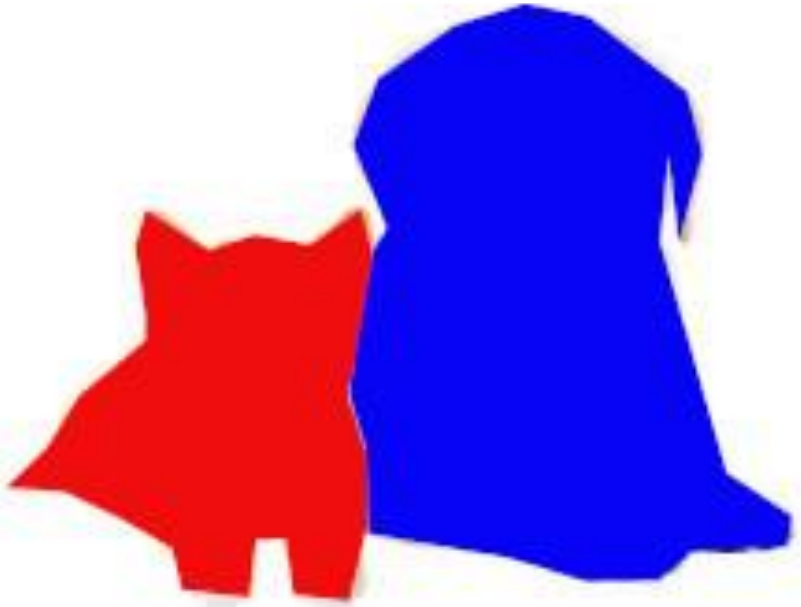
What is Image Segmentation?

Q. What are the objects present in the image? Where are they exactly?

There is a **dog** and a **cat**!

The dog → coloured as **blue**
The cat → coloured as **red**



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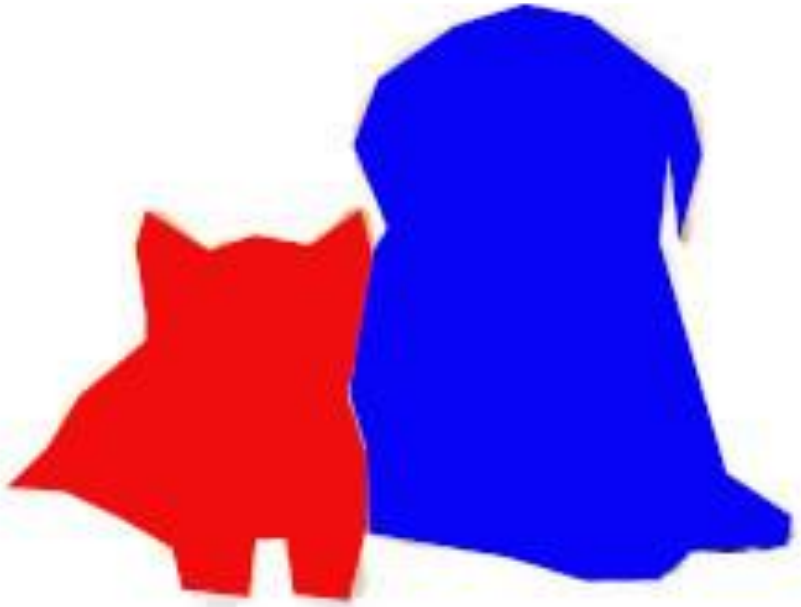
What is Image Segmentation?

Q. What are the objects present in the image? Where are they exactly?

There is a dog and a cat!

The dog → coloured as blue
The cat → coloured as red

Formulate this as **image segmentation** problem



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What is Image Segmentation?

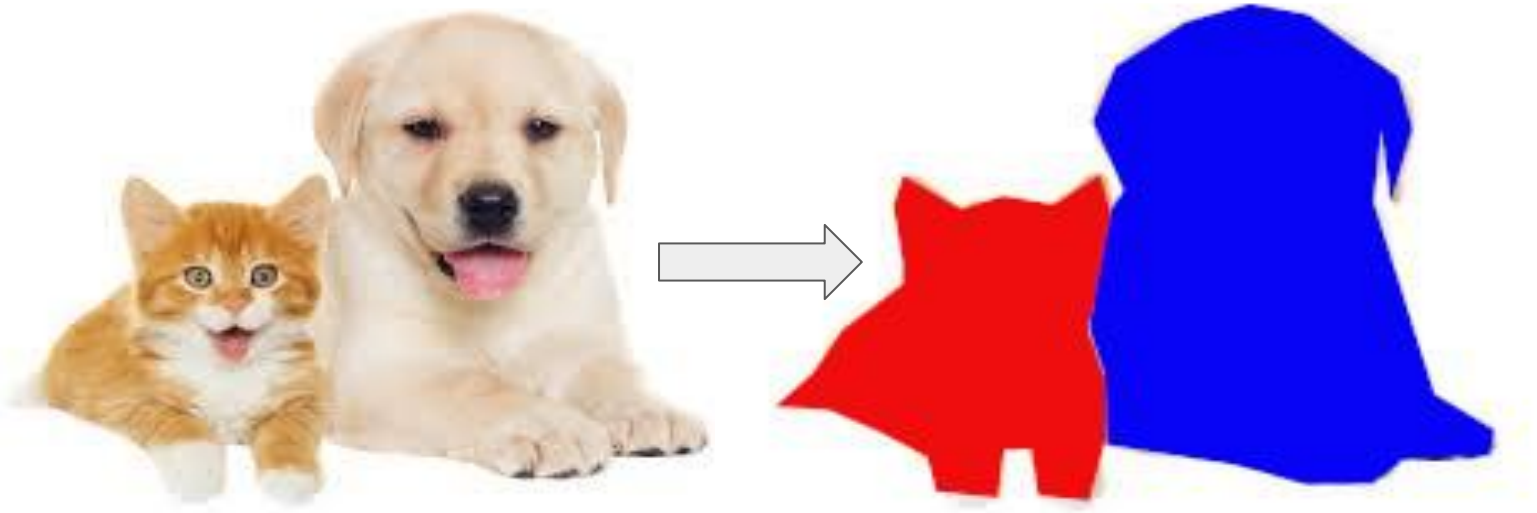

Image Segmentation is the task of partitioning an image into multiple segments

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Applications of Image Segmentation

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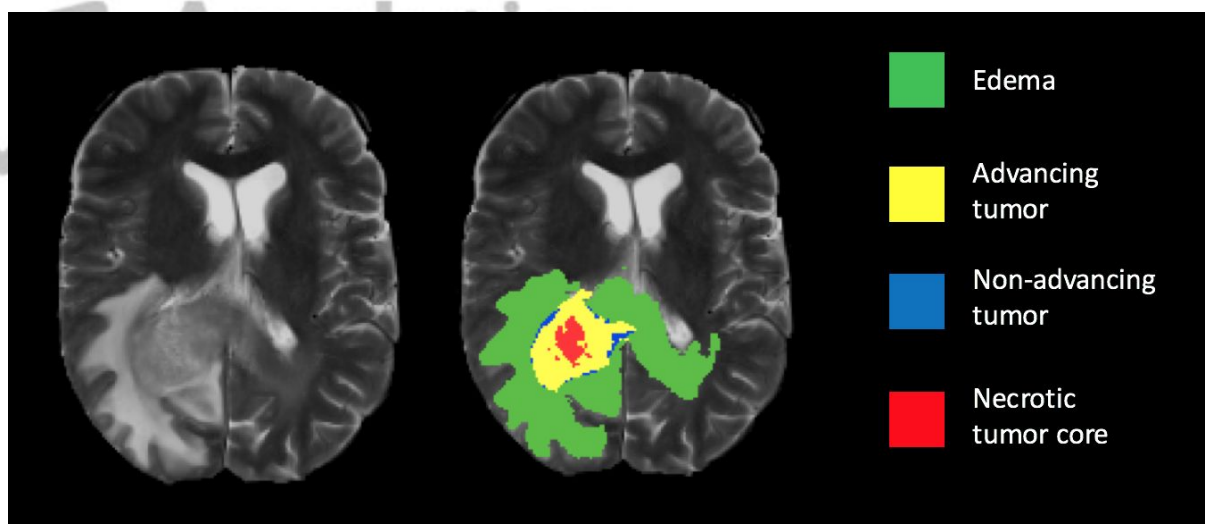
Applications of Image Segmentation

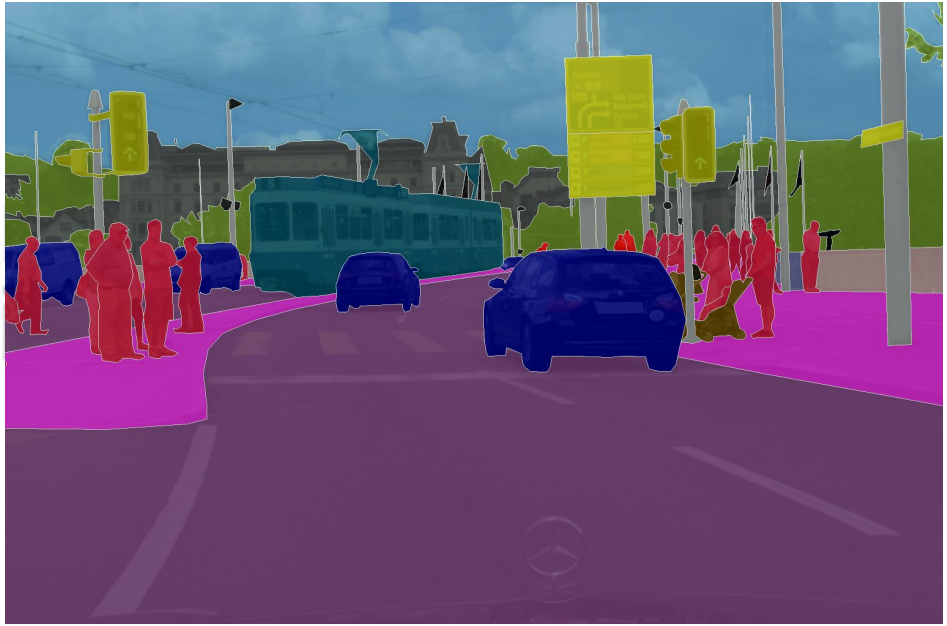
- Medical Imaging
  - Cancer Cell Segmentation
  - Brain Lesion Segmentation



Applications of Image Segmentation

- Medical Imaging
  - Cancer Cell Segmentation
  - Brain Lesion Segmentation

- Self Driving Cars
  - Lane Segmentation
  - Pedestrian Identification



Source: Marius Cordts et al: "The Cityscapes Dataset for Semantic Urban Scene Understanding", 2016

Applications of Image Segmentation

- Medical Imaging
  - Cancer Cell Segmentation
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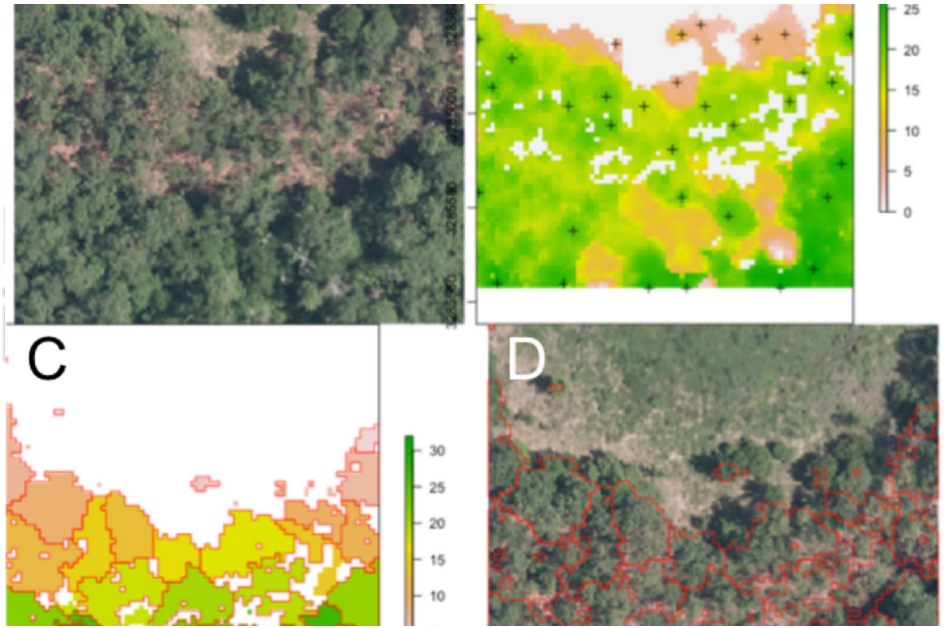
- Self Driving Cars
  - Lane Segmentation
  - Pedestrian Identification
- Satellite imaging / Remote sensing
  - Forest Area Segmentation
  - Locating water bodies (lakes, rivers, oceans)



Source: McMahon CA. 2019. Remote sensing pipeline for tree segmentation and classification in a mixed softwood and hardwood system

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Types of Image Segmentation Problems

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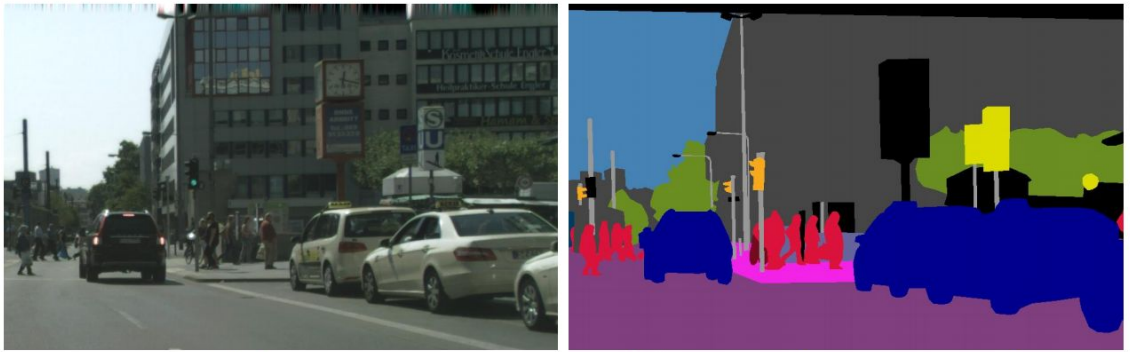
Types of Image Segmentation Problems

- Semantic Segmentation

Types of Image Segmentation Problems



(a) image (b) semantic segmentation

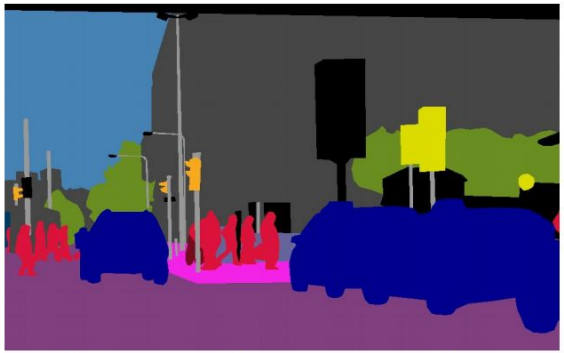
Types of Image Segmentation Problems

- **Semantic Segmentation** -
  - Describes the process of associating each pixel of an image with a class label

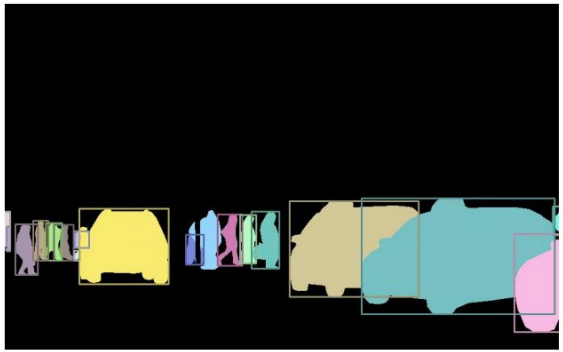
- Instance Segmentation

Types of Image Segmentation Problems

(a) image



(b) semantic segmentation



(c) instance segmentation

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Types of Image Segmentation Problems

- **Semantic Segmentation** -
  - Describes the process of associating each pixel of an image with a class label

- **Instance Segmentation -**
  - Instance segmentation masks each instance of an object contained in an image independently.
  - We only focus on the objects of importance first, and then identify instances of the object

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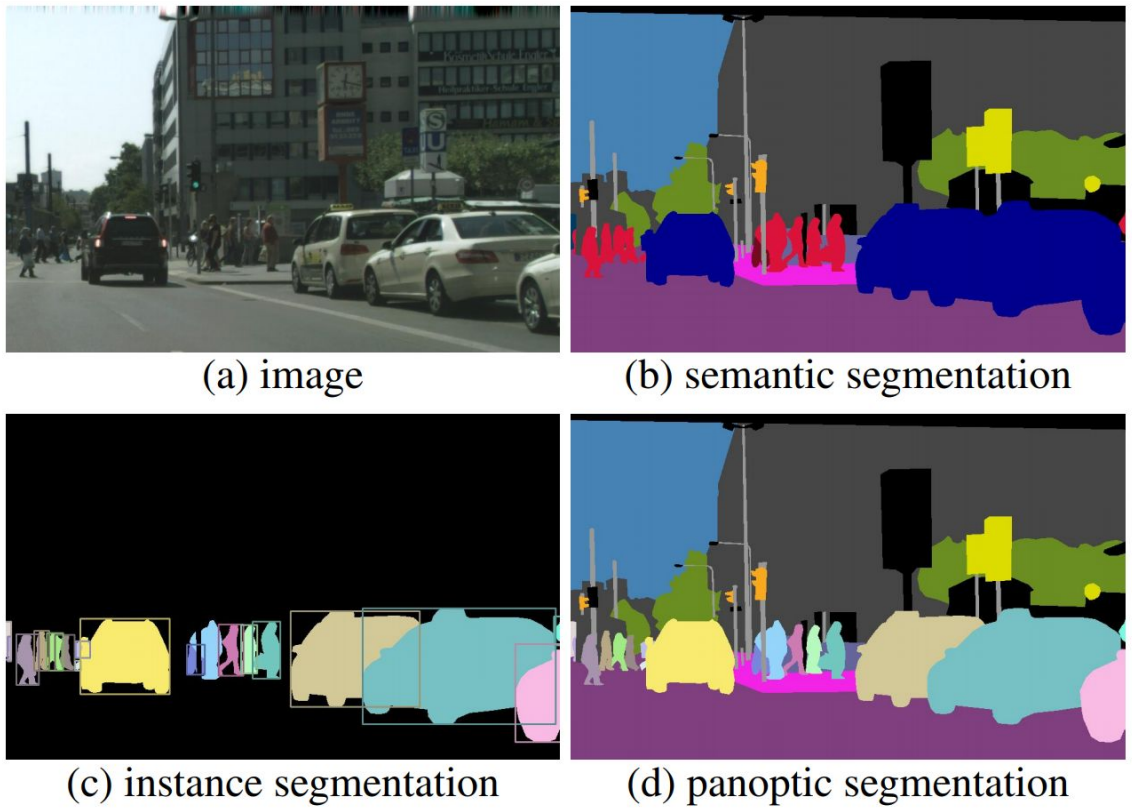
- **Panoptic Segmentation -**

Types of Image Segmentation Problems



(a) image (b) semantic segmentation

(c) instance segmentation (d) panoptic segmentation

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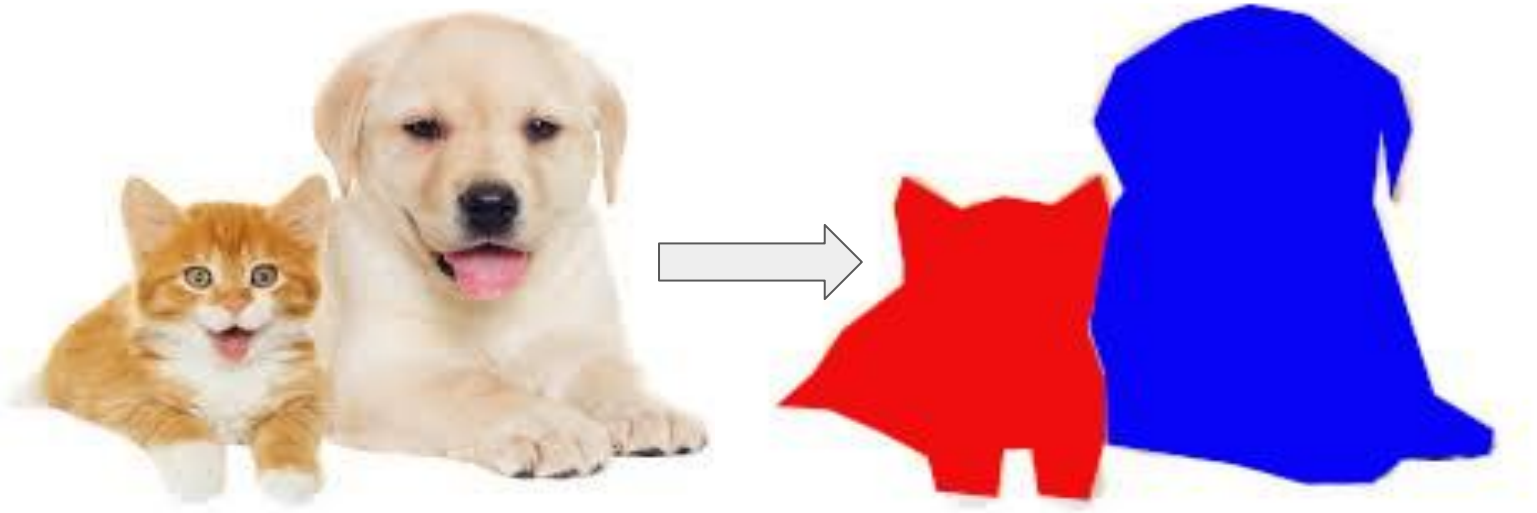

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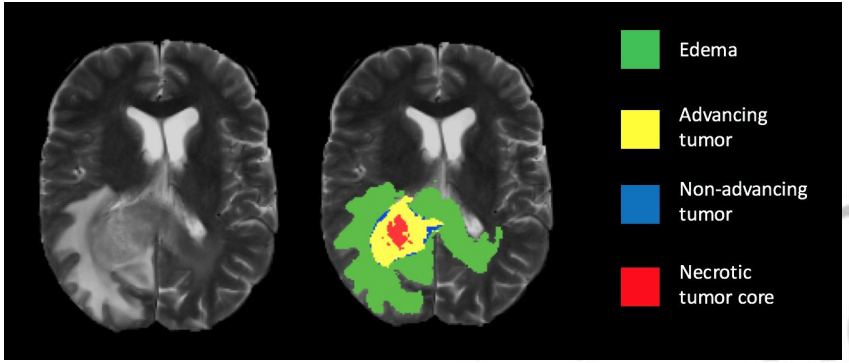
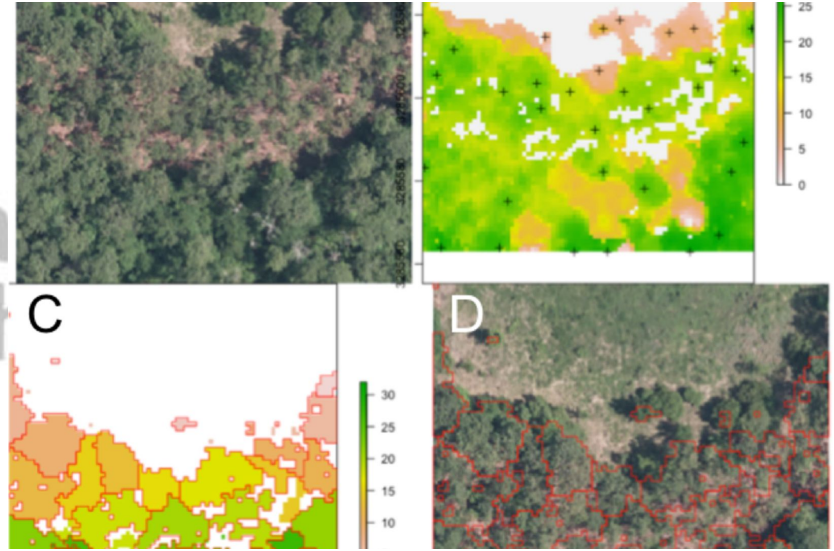
Applications of Image Segmentation





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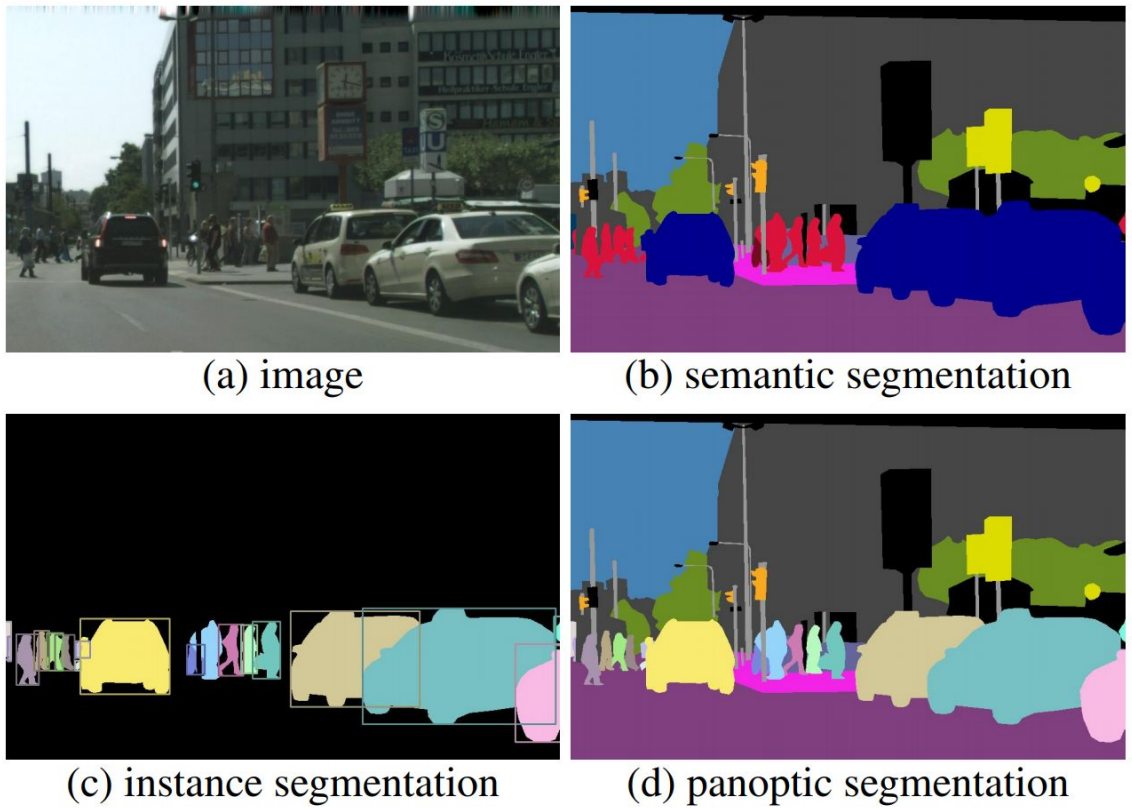

(a) image (b) semantic segmentation

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- **Instance Segmentation -**
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- **Panoptic Segmentation -**
  - Combination of semantic and instance segmentation

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Thank you

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