Object Detection in Machine Learning

Object Detection is a computer vision technique that allows machines to identify and locate multiple objects within an image or video. It not only tells what objects are present but also where they are located using bounding boxes.

Unlike simple image classification, which only identifies the category of an image, object detection provides spatial information by drawing boxes around each detected object. This makes it useful for real-world applications like autonomous vehicles, surveillance, and medical imaging.

Object detection models usually work in two steps: first, they extract important features from the image, and then they classify and localize objects. Modern deep learning models use convolutional neural networks (CNNs) to perform both steps efficiently.

Popular object detection architectures include: • R-CNN and Fast R-CNN – Use region proposals followed by CNN-based classification. • YOLO (You Only Look Once) – Performs detection in a single pass, making it very fast. • SSD (Single Shot MultiBox Detector) – Balances speed and accuracy using multiple feature maps. • Faster R-CNN – Combines region proposal and detection into one network for higher efficiency.

Applications of object detection include: • Self-driving cars (detecting pedestrians, traffic signs, vehicles) • Security systems (face and motion detection) • Healthcare (detecting tumors or medical anomalies) • Retail (inventory monitoring and shelf analysis) • Robotics (object localization and manipulation)

In summary, Object Detection combines the power of image classification and localization, enabling machines to visually understand and interact with their environment. It is a cornerstone technology in computer vision and continues to evolve with more efficient and accurate models.