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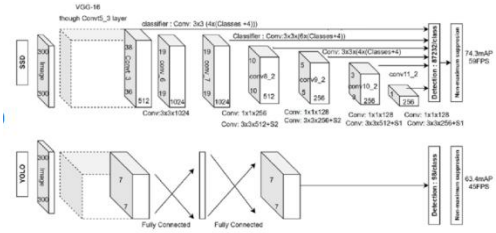
A09

Key Concepts

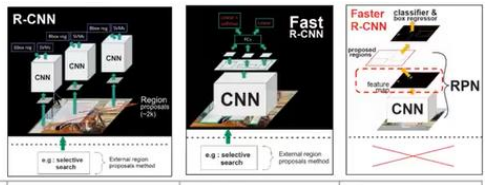
- **Bounding Boxes**: Rectangular boxes around detected objects.
- **Annotations**: Labels assigned to objects in training datasets.
- **Confidence Score**: Likelihood that the detected object is correct.
- **Intersection over Union (IoU)**: Measures the overlap between predicted and ground-truth boxes.

Common Object Detection Algorithms



A comparison between two single-shot detection models: SSD and YOLO [41]

- **SSD (Single Shot MultiBox Detector)**: Detects objects in a single pass, making it faster.
- **YOLO (You Only Look Once)**: Splits the image into grids and detects objects in one go.



	R-CNN	Fast R-CNN	Faster R-CNN
Test time per image	50 seconds	2 seconds	0.2 seconds
Speed-up	1x	25x	250x
mAP (VOC 2007)	66.0%	66.9%	66.9%

- **R-CNN**: Uses region proposals and CNNs for object detection.
- **Fast R-CNN**: Improves R-CNN by using RoI pooling for faster processing.
- **Faster R-CNN**: Introduces a Region Proposal Network (RPN) for speed optimization and computational efficiency.

Object detection tasks workflow

1. **Input**: Input image or video frames
2. **Feature Extraction**: Extract features from the input data, such as edges, shapes, and textures.
3. **Object Localization**: Predict the location of objects by drawing bounding boxes around them.
4. **Object Classification**: Classify object by assigning a label or category
5. **Output**: A list of detected objects, along with their bounding box coordinates and class labels.

Common challenges

Vary shapes and sized objects, occluded objects, & combining localization and classification tasks

Tools & Libraries

Keras OpenCV TensorFlow

Additional Resources

https://learn.nvidia.com/courses/course-detail?course_id=course-v1:DLI+C-FX-01+V2
https://www.ibm.com/think/topics/object-detection