

## CNN TEST.

Q 1. . How does the architecture of a CNN designed for image classification differ from one used for object detection?

Ans : Image classification uses a Convolutional Neural Network (CNN) architecture, aiming to assign a single label to the entire image, while object detection uses bounding boxes and labels for multiple objects. The output structure is a probability distribution, while object detection uses multiple outputs. Image classification uses convolutional layers, fully connected layers, and softmax for output, while object detection uses anchor boxes.

Q2 What is the role of a Region Proposal Network (RPN) in object detection models like Faster R-CNN, and how does it help in identifying objects in an image?

Ans : The Region Proposal Network (RPN) is a crucial part of object detection models like Faster R-CNN. It generates candidate regions, known as region proposals or anchors, where objects are likely to be located. The RPN adjusts anchor box coordinates and predicts an objectness score for each anchor. It uses non-maximum suppression to reduce redundant or overlapping boxes, focusing on potential object locations in the ROI pooling layer.

Q3 . Explain how transfer learning can be applied to a CNN for both image classification and object detection tasks.

Ans : Transfer learning is a method where a pre-trained CNN model is adapted for tasks like image classification or object detection by reusing its learned features. This approach allows for faster training and better results with limited data. For object detection, a pre-trained CNN is used as the backbone for feature extraction, with new layers added for tasks like bounding boxes and object classification.

Q4. What is the significance of anchor boxes in object detection models, and how do they assist CNNs in predicting object locations?

Ans : Anchor boxes are fixed-size bounding boxes used in object detection models like Fast R-CNN, Yolo, and SSD. They help predict object locations and sizes, classify and localize objects, and provide multiple anchor boxes per location. Anchor boxes enable efficient handling of various object sizes and aspect ratios, ensuring accurate detection of objects of different sizes and shapes in a single image.

Q5 . Compare the loss functions used in CNN-based image classification (e.g., cross-entropy loss) and object detection (e.g., localization loss and classification loss). How are they combined in object detection tasks?

Ans : CNN-based tasks use various loss functions for image classification and object detection. Cross-entropy loss measures the difference between predicted class probabilities and true labels, suitable for multi-class classification tasks. Classification loss evaluates the model's accuracy in classifying objects within bounding boxes, while localization loss measures the difference between predicted and ground-truth boxes. In object detection tasks, the total loss is the sum of classification and localization losses, with lambda balancing the importance of both during training.

Q6 . How does the role of fully connected layers in CNNs for image classification differ from their role(or absence) in object detection networks like YOLO and SSD?

Ans : Fully connected (FC) layers in CNNs aggregate features from convolutional layers for image classification, making final class predictions using softmax. They help learn complex representations for classifying the entire image. In object detection, models like YOLO and SSD use convolutional outputs for faster, more efficient predictions.

Q7. What are the key architectural characteristics of the VGG network, and how does its deep,sequential structure contribute to improved performance in image classification tasks?

Ans : VGG networks, such as VGG16 and VGG19, have a deep architecture with 16 and 19 layers for learning complex features. They use small convolutional filters, max pooling layers, fully connected layers, ReLU activation, and data augmentation techniques. This deep structure enhances pattern recognition, increases model capacity, improves generalization, and enhances robustness to variations. VGG's deep, sequential architecture, small filters, and pooling layers contribute to effective hierarchical feature learning and strong performance in image classification tasks.

Q8 . Explain how Non-Maximum Suppression (NMS) is used in object detection models to eliminate redundant bounding boxes and improve detection accuracy.

Ans : Non-Maximum Suppression (NMS) is a post-processing technique used in object detection to refine predictions by eliminating redundant bounding boxes. It involves sorting boxes by confidence scores, selecting the highest-scoring box, computing the intersection over union (IoU), thresholding if the IoU exceeds a threshold, and repeating until no boxes remain.

Q9 . In a CNN-based object detection model like YOLO, how is the concept of grid cells used to predict multiple bounding boxes in an image, and how does it affect the model's efficiency and accuracy?

Ans: YOLO is a CNN-based object detection model that uses grid cells to predict multiple bounding boxes in an input image. Each grid cell detects objects within its center,

predicting multiple bounding boxes, including coordinates, confidence score, and class probabilities. This efficient and accurate detection process processes the entire image in one pass, allowing for fast, real-time processing and maintaining contextual awareness.