

CNN Fundamentals Assignment

1. Explain the basic components of a digital image and how it is represented in a computer. State the differences between grayscale and color images.

A digital image consists of pixels, each containing color information or intensity. In a grayscale image, each pixel represents varying intensities of light (black to white), while in a color image, each pixel typically has three values (RGB: Red, Green, Blue) to represent color.

2. Define Convolutional Neural Networks (CNNs) and discuss their role in image processing. Describe the key advantages of using CNNs over traditional neural networks for image-related tasks.

CNNs are specialized deep learning models for image processing. They use convolutional layers to automatically extract features from images. Unlike traditional neural networks, CNNs reduce the need for manual feature extraction and are more efficient in handling spatial hierarchies in images.

3. Define convolutional layers and their purpose in a CNN. Discuss the concept of filters and how they are applied during the convolution operation. Explain the use of padding and strides in convolutional layers and their impact on the output size.

Convolutional layers apply filters (kernels) to input data to detect patterns like edges or textures. Filters slide over the image to produce feature maps. Padding adds extra pixels around the input to preserve its dimensions, while strides control the step size of the filter, affecting the output size.

4. Describe the purpose of pooling layers in CNNs. Compare max pooling and average pooling operations.

Pooling layers reduce the spatial size of feature maps, making the model more computationally efficient and less prone to overfitting. Max pooling selects the maximum value from a region, while average pooling takes the average of values in the region. Max pooling is commonly used to retain more distinct features.