When a convolution operation is applied to an image in a convolutional neural network (CNN), the size of the resulting feature map (output) can change depending on several factors: the size of the filter (kernel), the stride, and the use of padding. Let's break down how each of these factors affects the size of the output:

1. **Filter (Kernel) Size:** The size of the filter determines how much of the image the filter covers during each convolution operation. Common filter sizes are 3x3, 5x5, etc.
2. **Stride:** Stride refers to the number of pixels by which the filter moves across the image. A stride of 1 means the filter moves one pixel at a time, while a stride of 2 means the filter moves two pixels at a time.
3. **Padding:** Padding involves adding extra pixels around the border of the image. This can be done to control the spatial size of the output. Common types of padding are:
   * **Valid Padding (no padding):** The filter is applied only to the valid parts of the image, resulting in a smaller output size.
   * **Same Padding (zero-padding):** Zeros are added around the border of the image to ensure that the output feature map has the same spatial dimensions as the input image.

**Calculating the Output Size**

The size of the output feature map can be calculated using the following formula:

Output Size = floor((Input Size - Filter Size + 2 \* Padding) / Stride) + 1

Where:

* ⌊⋅⌋ denotes the floor operation, which rounds down to the nearest integer.
* Input Size is the height/width of the input image.
* Filter Size is the height/width of the filter.
* Padding is the number of pixels added to the border of the input image.
* Stride is the number of pixels the filter moves at each step.

**Examples**

1. **No Padding, Stride 1:**
   * Input Size: 32x32
   * Filter Size: 3x3
   * Padding: 0
   * Stride: 1

Output Size = floor((32 - 3 + 2 \* 0) / 1) + 1 = 30 means 30\*30 Matrix

1. **Same Padding, Stride 1:**
   * Input Size: 32x32
   * Filter Size: 3x3
   * Padding: 1
   * Stride: 1

Output Size = floor((32 - 3 + 2 \* 1) / 1) + 1 = 32 means 32\*32 Matrix

1. **No Padding, Stride 2:**
   * Input Size: 32x32
   * Filter Size: 3x3
   * Padding: 0
   * Stride: 2

Output Size = floor((32 - 3 + 2 \* 0) / 2) + 1 = 14 means 14\*14 Matrixsssss