

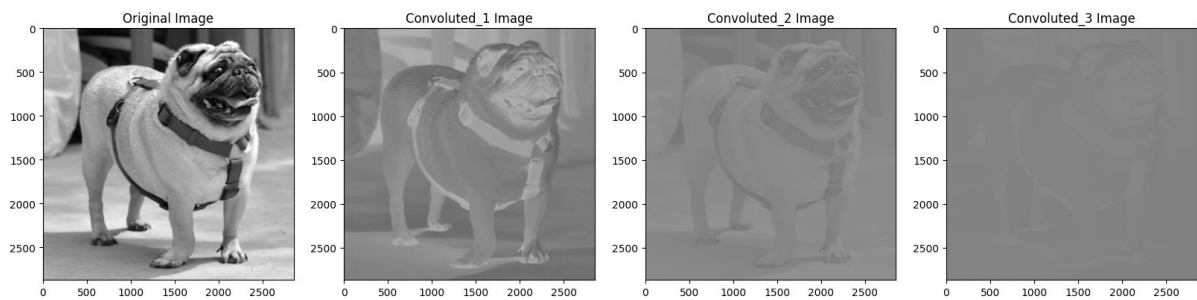
Convolution

The convolution operation in the context of image data involves sliding a filter (or kernel) over the image and computing the dot product between the filter and the image patch it is currently covering.

For image $I \in \mathbb{R}^{H \times W}$ and filter (kernel) $K \in \mathbb{R}^{k_h \times k_w}$: $O(i,j) = \sum_{m=0}^{k_h-1} \sum_{n=0}^{k_w-1} I(i+m, j+n) \cdot K(m,n)$

Components and Parameters:

- **Input Image I :** The 2D matrix of pixel values of the image.
- **Filter (Kernel) K :** The small matrix used to scan the image. Each filter detects different features such as edges, textures, etc.
- **Stride:** The amount by which the filter is moved across the image. A stride of 1 means the filter is moved one pixel at a time.
- **Padding:** Extra pixels added around the border of the image to control the spatial dimensions of the output. $O_h = \frac{I_h - k_h + 2 \cdot p_h}{stride} + 1$, $O_w = \frac{I_w - k_w + 2 \cdot p_w}{stride} + 1$



<https://in.linkedin.com/in/mayankkumar93>