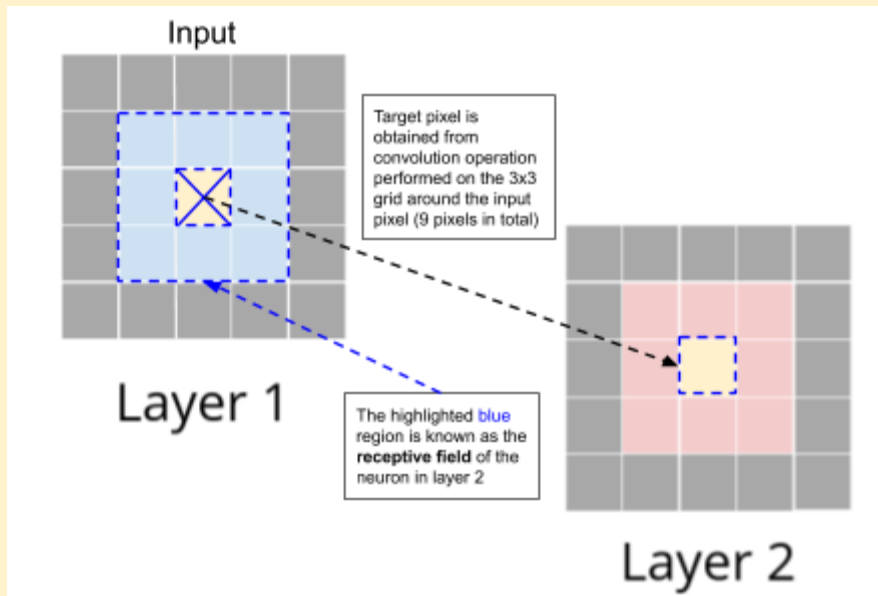


Visualising CNNs

Receptive field of a neuron

How does the receptive field increase across layers?

1. What does a filter learn? What kind of images cause certain neurons to fire? How good are the hidden representations?
2. To answer these questions, we need to talk about the receptive field.
3. Consider a 3 layered CNN, where in each of the layers, we apply a 3x3 filter



4. The **Receptive Field or Region of influence** of the neuron/pixel in a subsequent layer refers to all the neurons/pixels from the previous that were involved in the convolution operation to produce said output neuron/pixel.

One Fourth Labs

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- The diagram illustrates the receptive field of a neuron in a 3-layer convolutional neural network. It consists of three layers: Layer 1 (Input), Layer 2, and Layer 3.
- Layer 1 (Input):** A 5x5 grid of colored dots. A 3x3 region in the center is highlighted with a dashed blue border, representing the receptive field of a neuron in Layer 2.
 - Layer 2:** A 5x5 grid of colored dots. A 3x3 region in the center is highlighted with a dashed green border, representing the receptive field of a neuron in Layer 3.
 - Layer 3:** A 5x5 grid of colored dots. A single dot in the center is highlighted with a dashed yellow border, representing the receptive field of a neuron in Layer 4.
- Arrows indicate the flow of information from Layer 1 to Layer 2, and from Layer 2 to Layer 3. A text box explains that the highlighted green region in Layer 2 is known as the **receptive field** of the neuron in layer 3.
- In turn, each of the coloured dots represent their own 3x3 receptive field from the input layer 1

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- Diagram illustrating a CNN architecture for image classification. The input is a 224x224x3 image. The architecture consists of the following layers:
- Input:** 224x224x3 image.
 - Layer 1:** Convolution (7x7 receptive field) → 96x96x3.
 - Layer 2:** MaxPooling → 48x48x3.
 - Layer 3:** Convolution (5x5 receptive field) → 256x256x3.
 - Layer 4:** MaxPooling → 128x128x3.
 - Layer 5:** Convolution (3x3 receptive field) → 384x384x3.
 - Layer 6:** MaxPooling → 192x192x3.
 - Layer 7:** Convolution → 256x256x3.
 - Layer 8:** MaxPooling → 128x128x3.
 - Layer 9:** Convolution → 64x64x3.
 - Layer 10:** MaxPooling → 32x32x3.
 - Layer 11:** dense → 4096.
 - Layer 12:** dense → 4096.
 - Layer 13:** dense → 1000.
- *Assuming we use a 3x3 filter in each of the layers

10. The increase in receptive field size through the layers increases with a larger filter size.