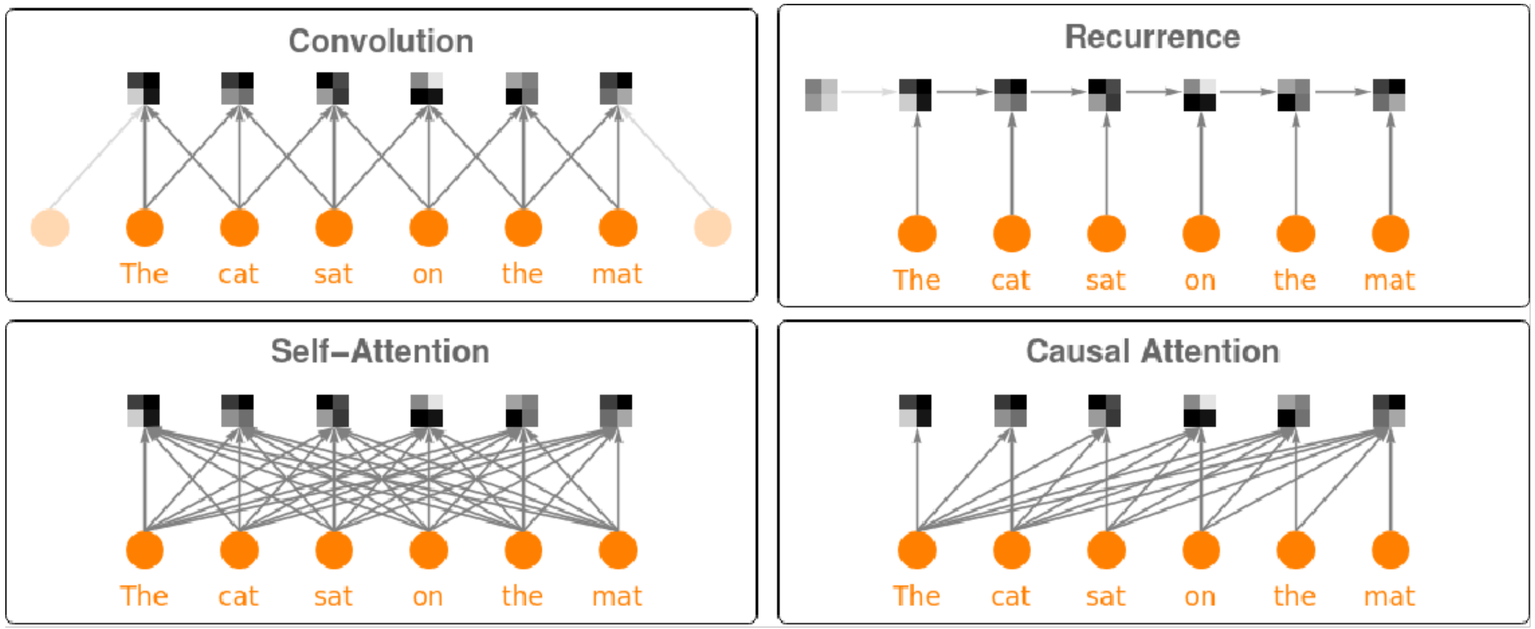
Neural language modeling: capturing context

- The three dominant classes of neural network architecture each differ in how context is captured:
  - Convolutional neural networks (CNNs)
  - Recurrent neural networks (RNNs)
  - Transformer networks (i.e., attention based)



Credit: Wolfram

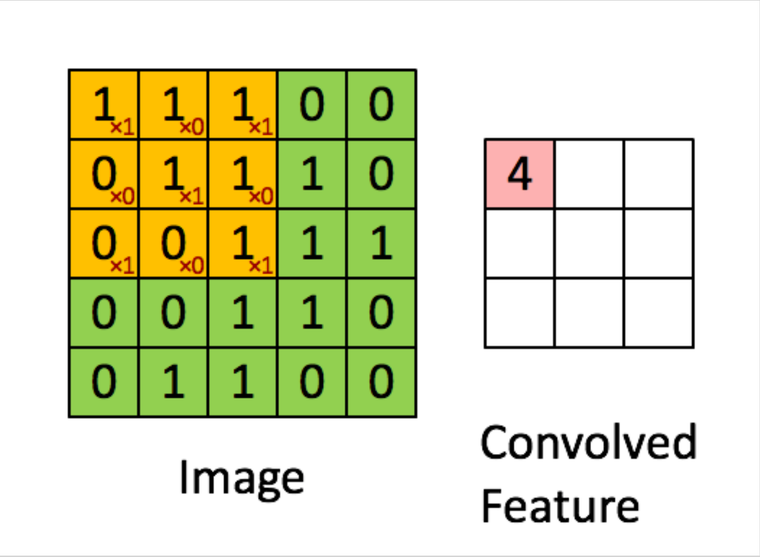
Convolutional filtering

- Convolutional filtering is a general class of techniques used in signal processing for filtering continuous or discrete signals. It's based on the idea of a *finite impulse response filter* (FIR). In deep learning this was first applied to vision, wherein the convolutional filters are 2-dimensional patches (of varying sizes) that mimic the receptive fields in the human visual cortex.

- In NLP, convolutions are performed over the sequence dimension in embedding space, followed by a summation (or similar operation) to collapse the convolved features along the sequence dimension (this is called *pooling)*, yielding a fixed size feature representation.

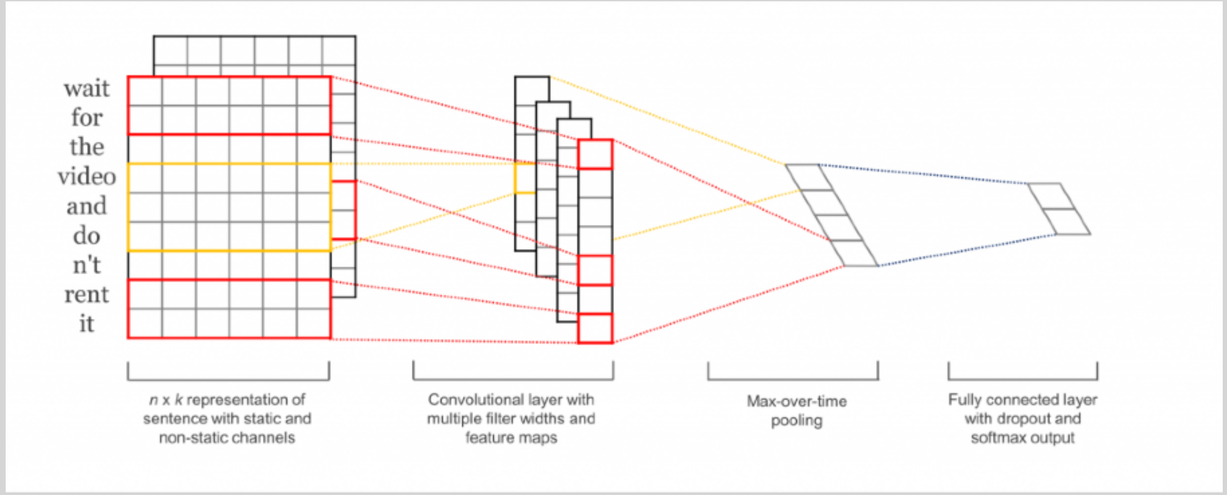
- Because of this pooling operation, convolutional filtering does not capture long range dependences well.

Convolutions applied to images



Illustrations taken from Stanford UFLDL Wiki

Convolutions applied to text



Illustrations taken from Stanford UFLDL Wiki