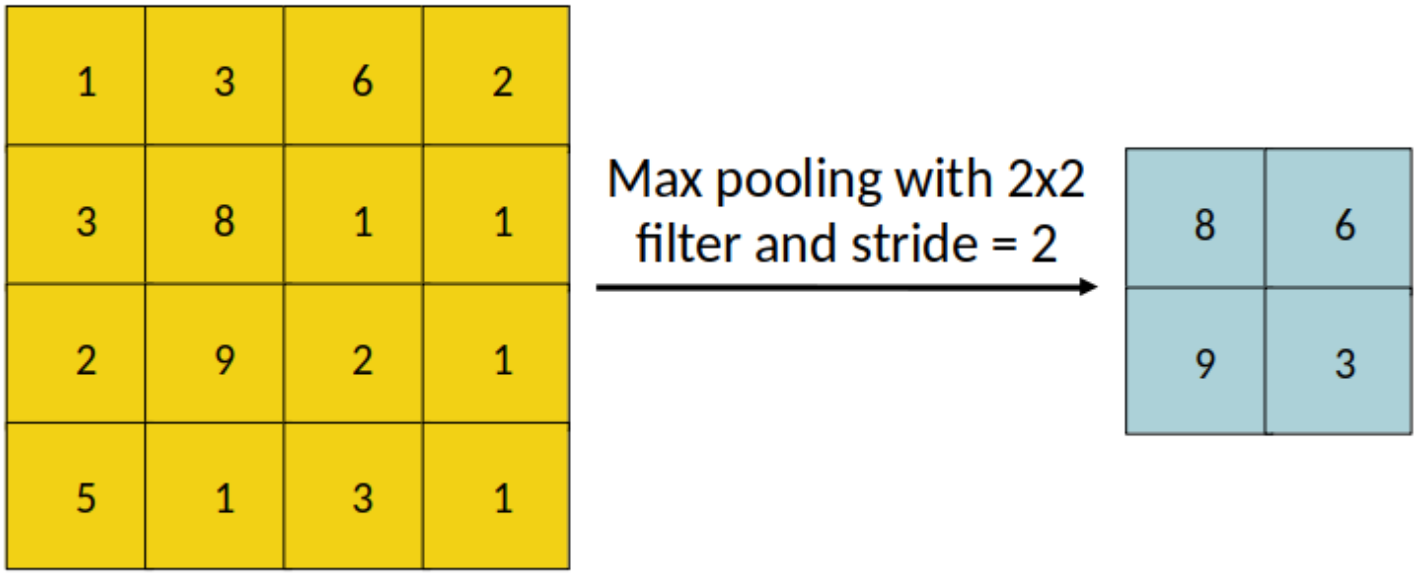
CNN: Pooling

Introduction to Deep Learning

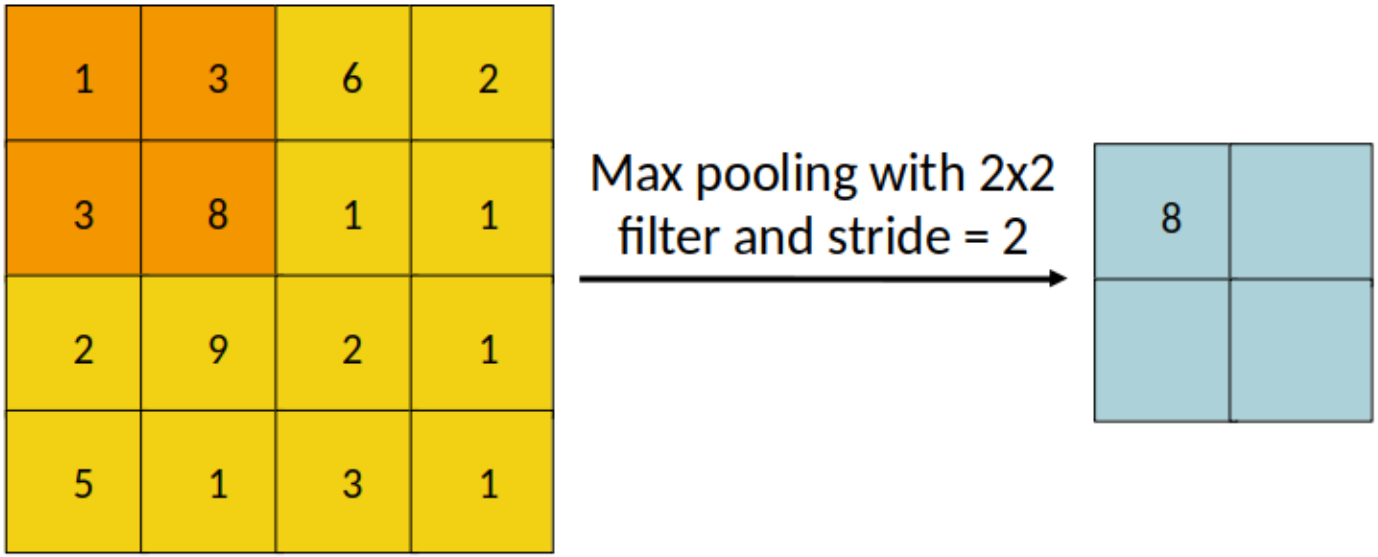
4

MAX POOLING



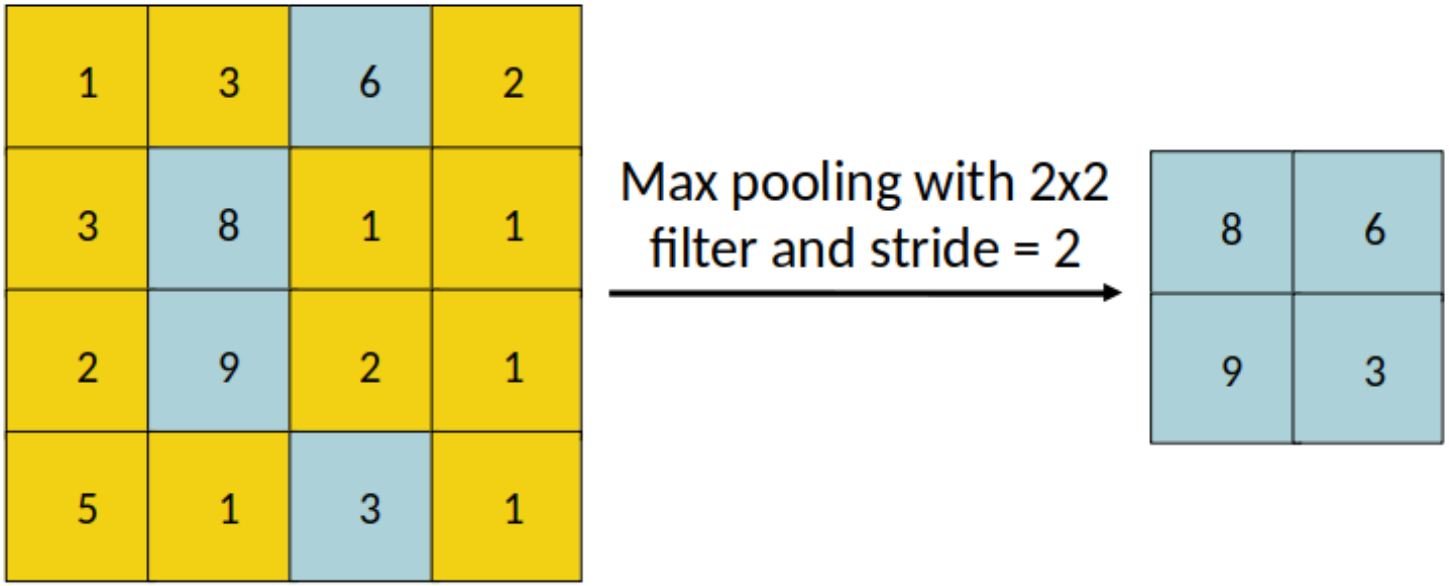
- We've seen how convolutions work, but there is one other operation we need to understand.
- We want to downsample the feature map but optimally lose no information.

MAX POOLING



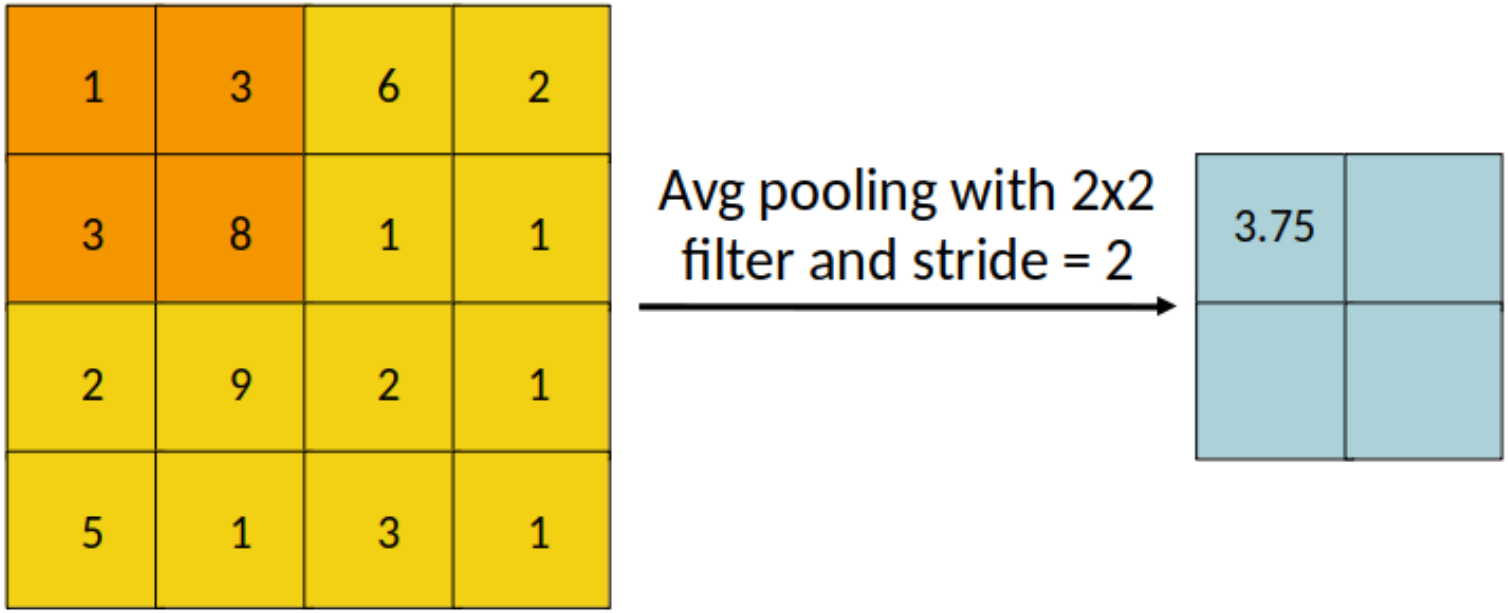
- Applying the max pooling operation, we simply look for the maximum value at each spatial location.
- That is 8 for the first location.
- Due to the filter of size 2 we have the dimensions of the original feature map and obtain downsampling.

MAX POOLING



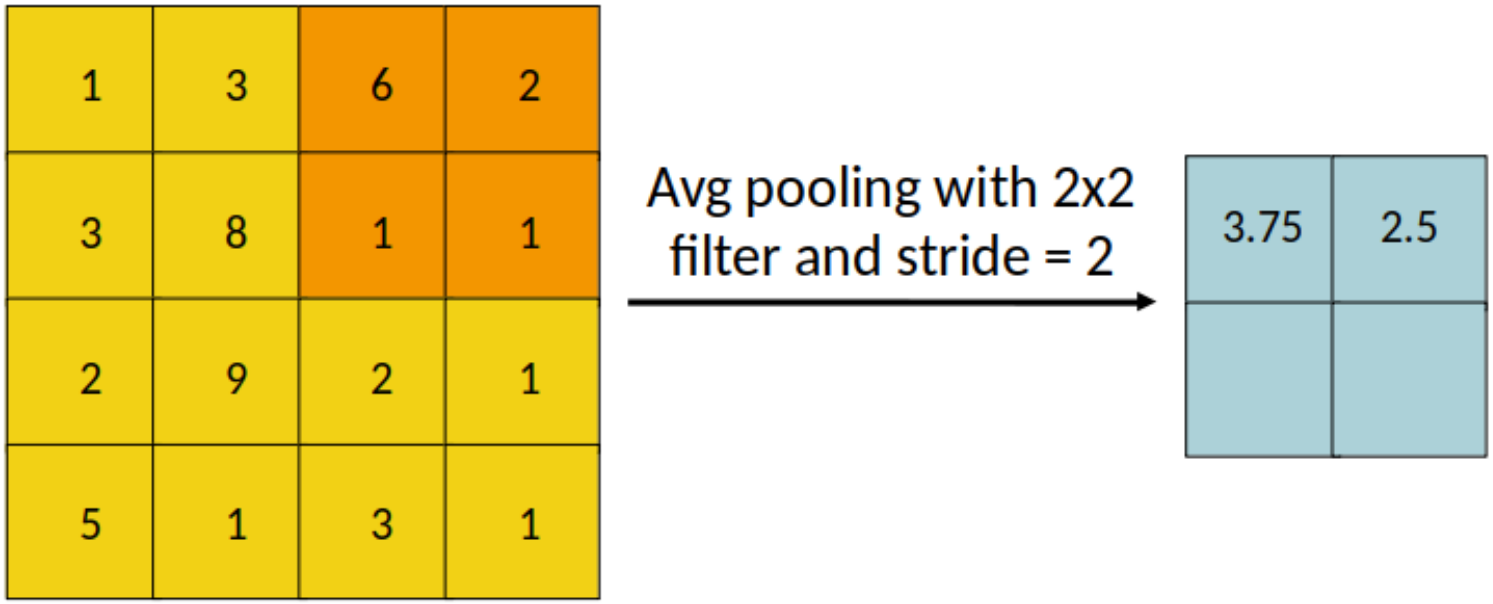
- The final pooled feature map has entries 8, 6, 9 and 3.
- Max pooling brings us 2 properties: 1) dimention reduction and 2) spatial invariance.
- Popular pooling functions: max and (weighted) average.

AVERAGE POOLING



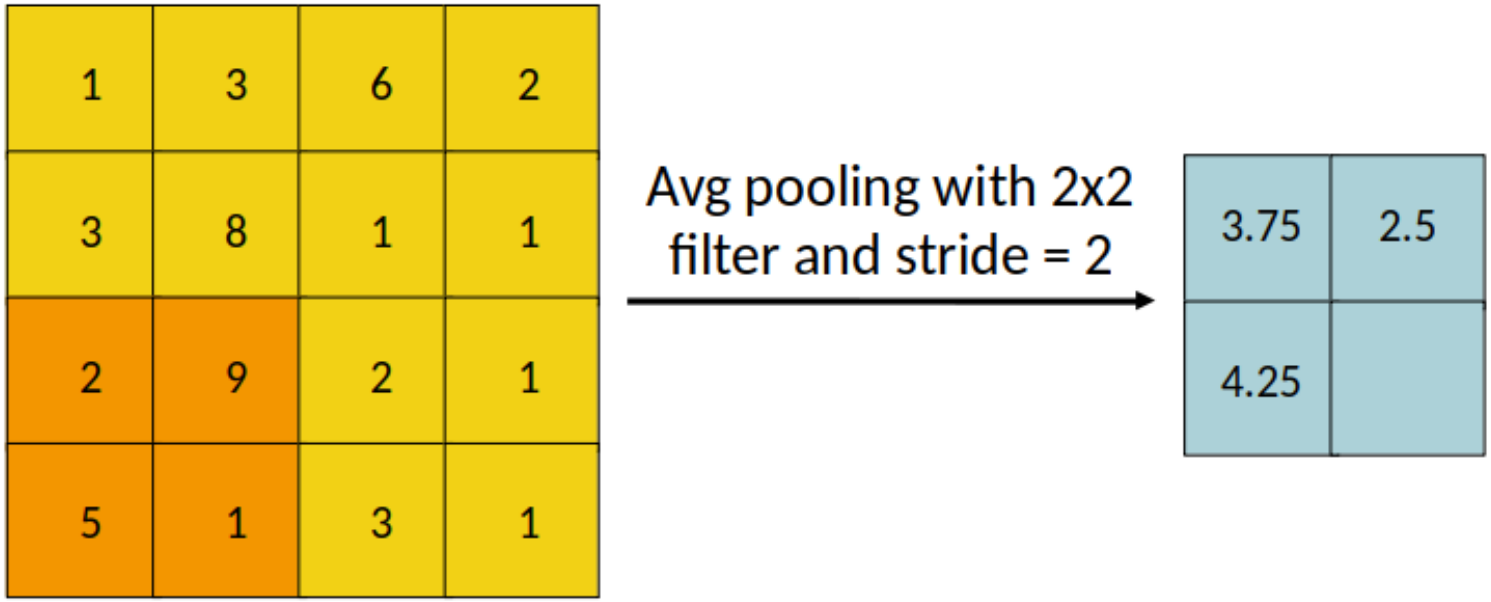
- We've seen how max pooling worked, there are exists other pooling operation such as Avg Pooling, Fractional Pooling, LP Pooling, Wavelet Pooling, Softmax Pooling, Stochastic Pooling, Blur Pooling, Orderable Pooling, Global Average Pooling, and etc.
- Similar to max pooling, we downsample the feature map but optimally lose no information.

AVERAGE POOLING



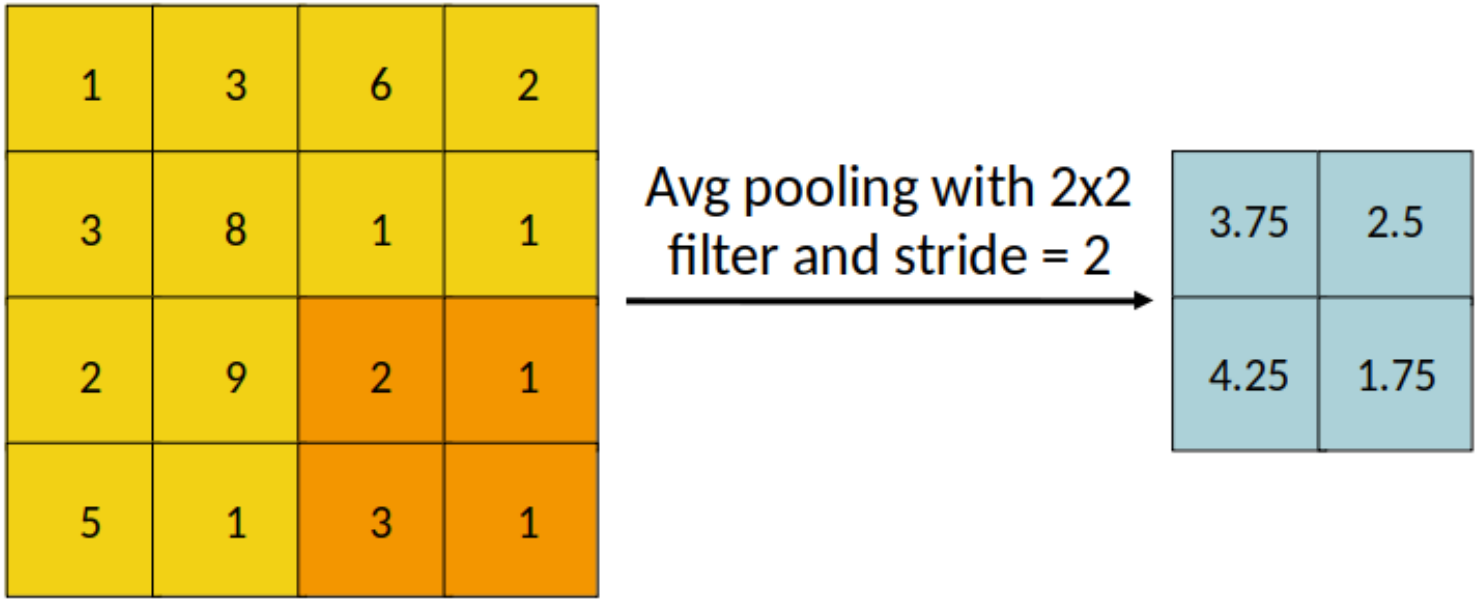
- Applying the average pooling operation, we simply look for the mean/average value at each spatial location.

AVERAGE POOLING



- We use all information by Sum and backpropagated to all responses.
- It is not robust to noise.

AVERAGE POOLING



- The final pooled feature map has entries 3.75, 2.5, 4.25 and 1.75.

COMPARISION OF MAX AND AVERAGE POOLING

- Avg pooling use all information by sum but Max pooling use only highest value.
- In Max-pooling operation details are removed therefore it is suitable for sparse information (Image Classification) and Avg pooling is suitable for dense information (NLP)

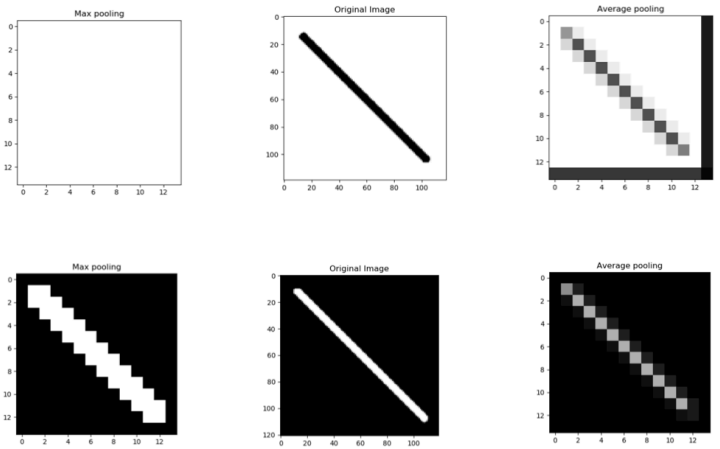


Figure: Shortcomings of Max and Average Pooling using Toy Image (photo source: https://iq.opengenus.org/maxpool-vs-avgpool/)