

CNNs Architecture: The Pooling Layer

الشبكات العصبية الالتفافية - عناصر المعمارية



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Today's Outline:

- The Pooling Layer
 - Overview
 - Types
 - Final Thoughts

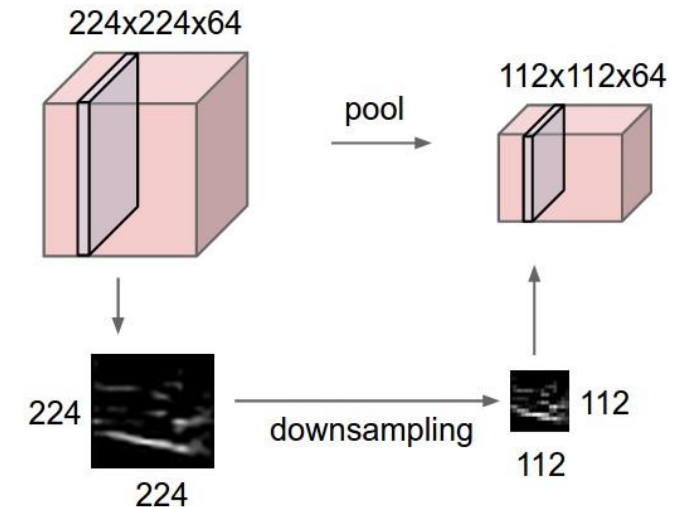
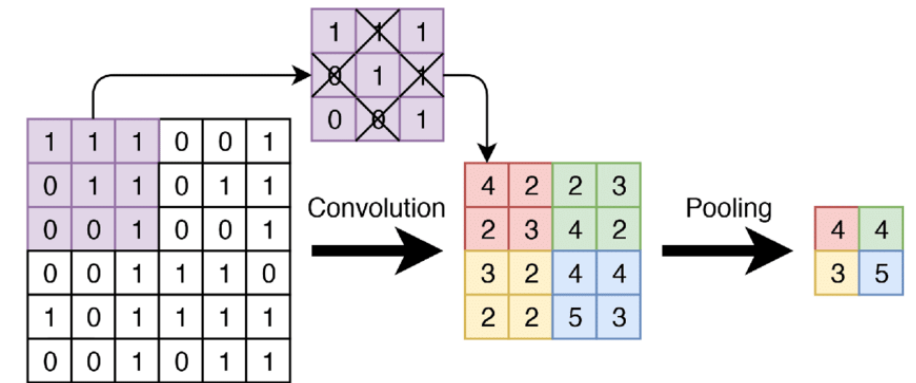


CNNs Architecture: The Pooling Layer

"It's just you and the pool." ~ Unknown

The Pooling Layer (Overview)

- **Pooling layers**, also known as **downsampling**, conducts dimensionality reduction, **reducing** the number of parameters in the input.
- They are commonly inserted **between** successive convolutional layers. We want to follow convolutional layers with pooling layers to progressively reduce the spatial size (width and height) of the data representation.
- The pooling operation sweeps a **filter** across the entire input, this filter does not have any **weights**. Instead, the kernel applies an **aggregation** function to the values within the receptive field, populating the output array.
- The pooling layer helps to reduce **complexity**, improves **efficiency**, and limits risk of **overfitting**.



The Pooling Layer (Types)

- **Max Pooling:**

- It selects the **maximum** element from each of the windows of the feature map. Thus, after the max-pooling layer, the output would be a feature map containing the most **dominant** features of the previous feature map.

- **Average Pooling:**

- It computes the **average** of the elements present in the region of the feature map covered by the filter. It simply averages the features from the feature map.
- Typically, a pooling layer has a **filter size** of **2×2** and a **stride** length of **2**

	Max Pooling		Average Pooling		Sum Pooling	
6	6	6	6	6	6	6
4	5	5	5	5	5	5
2	4	4	4	4	4	4
2	4	4	4	4	4	4



The Pooling Layer

(Final Thoughts)

- The **reason** to use downsampling is to **reduce** the number of feature-map coefficients to process, as well as to **induce** spatial-filter hierarchies by making successive convolution layers look at increasingly large windows.
- Pooling layers do **not** have **parameters** for the layer but do have additional hyperparameters. This layer does not involve parameters, because it computes a fixed function of the input volume.
- It is **not** common to use **zero-padding** for pooling layers.
- **Max Pooling** also performs as a Noise Suppressant. It discards the noisy activations altogether and performs de-noising along with dimensionality reduction.
- On the other hand, **Average Pooling** simply performs dimensionality reduction as a noise suppressing mechanism. Hence, we can say that Max Pooling performs a lot better than Average Pooling.



Further Readings

- Deep Learning Illustrated, Jon Krohn
 - Chapter 10
- Deep Learning with Python, François Chollet
 - Chapter 5
- Deep Learning: A Visual Approach, Andrew Glassner
 - Chapter 16



THANKS

Keep Moving Forward! 😊



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