19.2) Convolutional Networks

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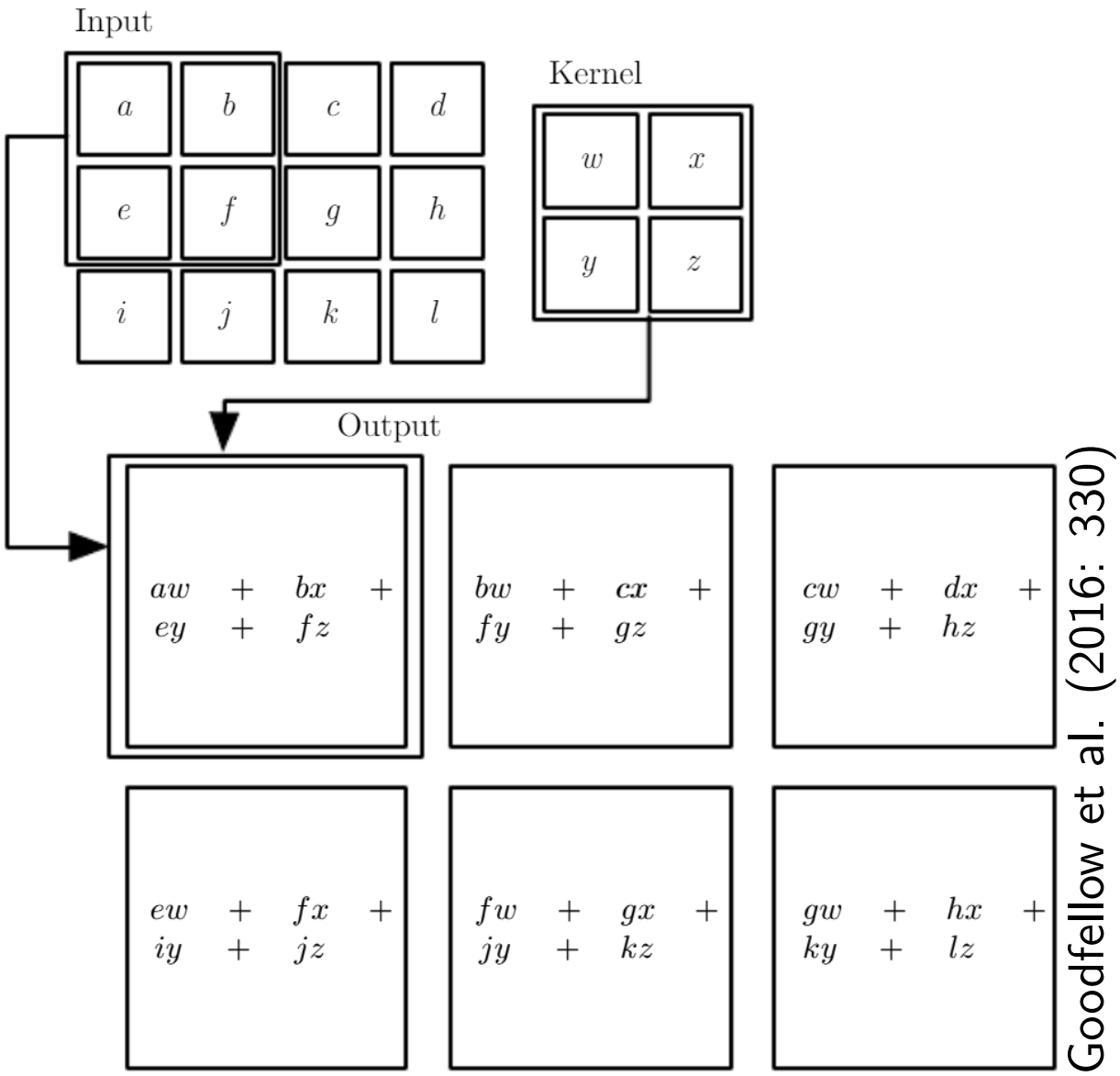
Reference

Goodfellow et al. (2016): Ch 9.

https://www.deeplearningbook.org/

An Example of 2-D Convolution



Goodfellow et al. (2016: 330)

Convolution Operation

Two-dimensional image I as input:

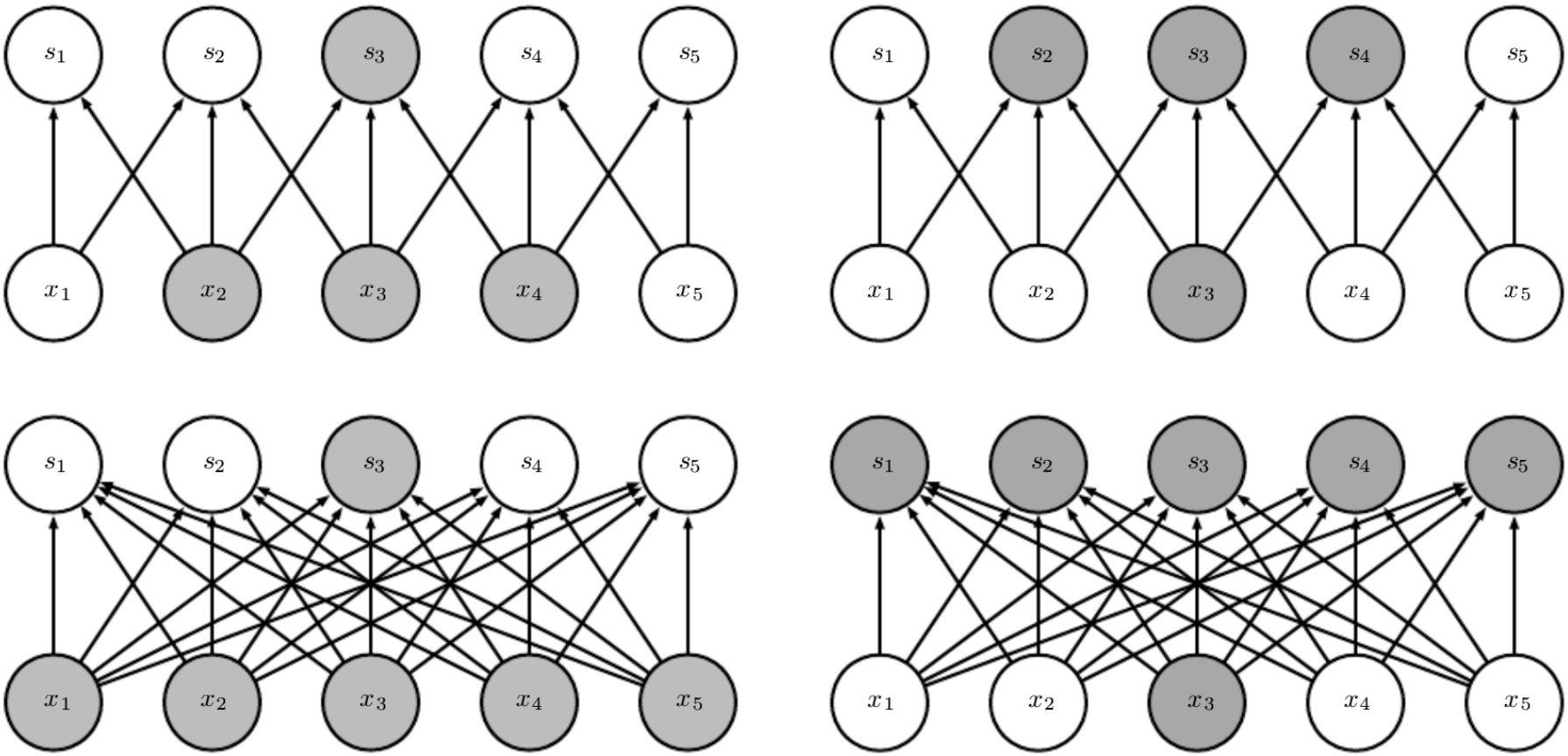
$$S(i,j) = (I * K)(i,j) = \sum_m \sum_n I(m,n) K(i-m, j-n)$$

Kernel smaller than the input

$\therefore$ Sparse interactions, connectivity (weights)

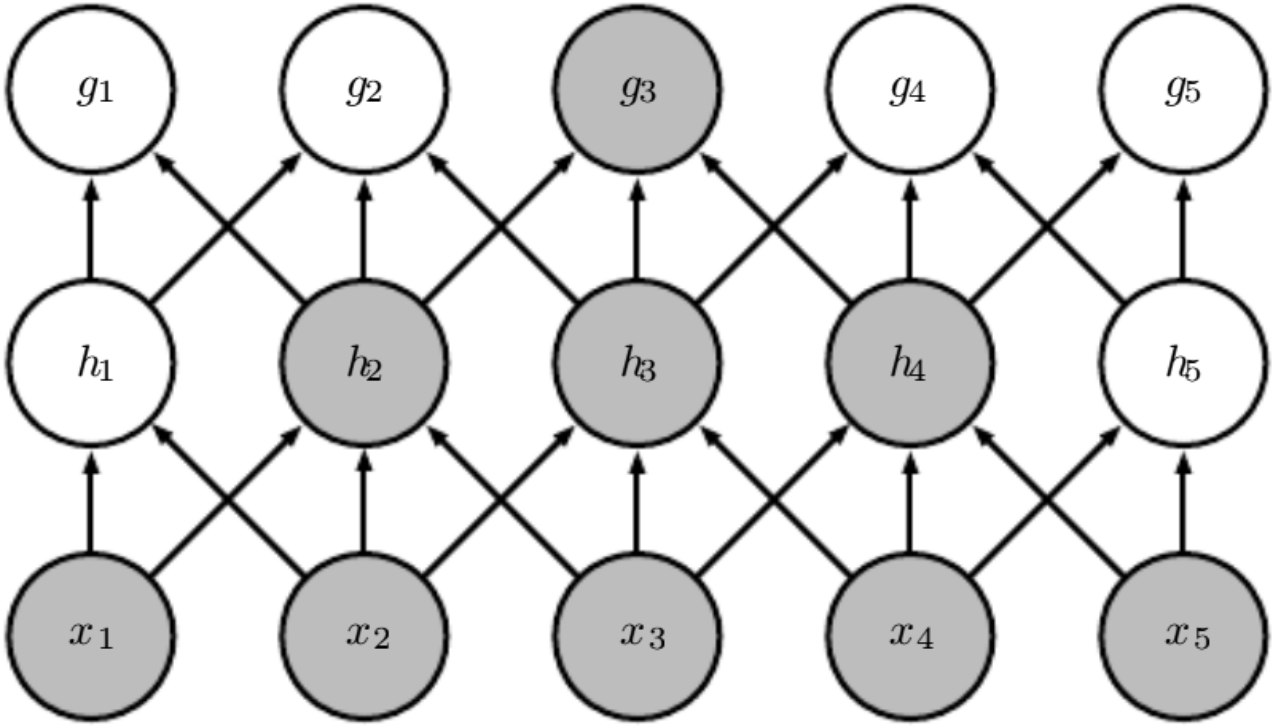
Sparse Matrix: entries are mostly $= 0$

Sparse vs Dense Connectivity



Goodfellow et al. (2016: 331)

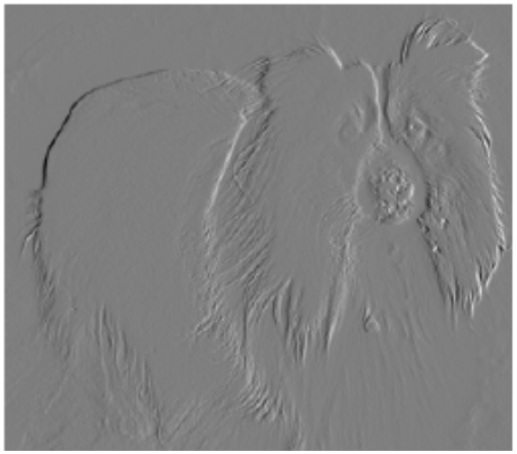
Units in the Deeper Layers can be indirectly connected to all or most of the Input Image



Goodfellow et al. (2016: 332)

Efficiency of Edge Detection

Subtract the value of its neighboring pixel on the left

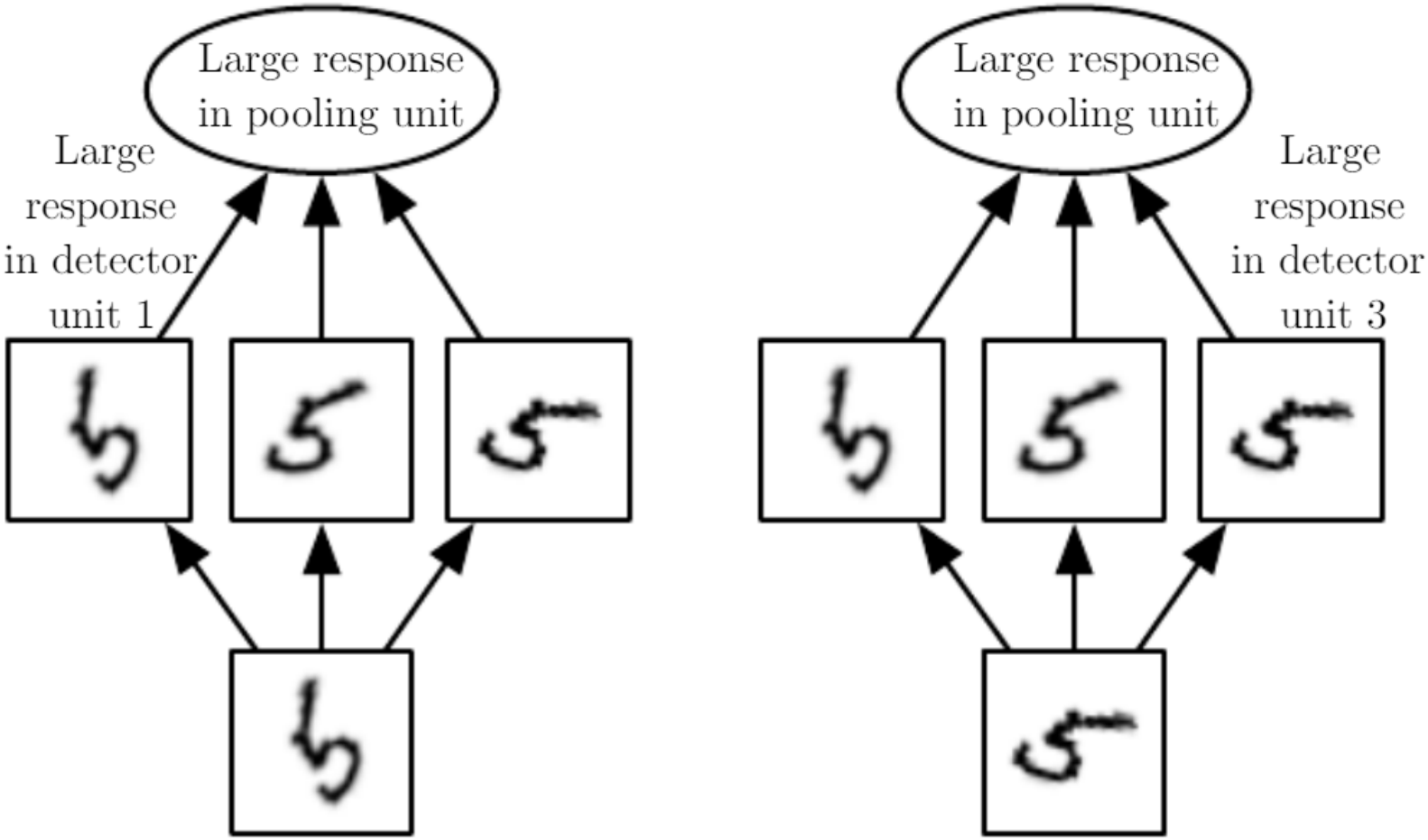


Goodfellow et al. (2016: 334)

320 pixels wide vs 319

Convolution Kernel	**Matrix Multiplication**
319×280×3	320×280×319×280
267,960 floating-point	Over 8 billion

Example of Learned Invariances



Goodfellow et al. (2016: 338)