

Image recognition software

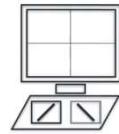
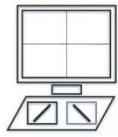
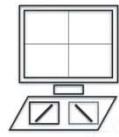
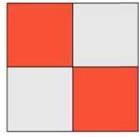
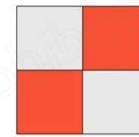


Image recognition software



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$$\begin{array}{c} / \\ \begin{array}{|c|c|} \hline -1 & 1 \\ \hline 1 & -1 \\ \hline \end{array} \end{array} \quad \begin{array}{|c|c|c|c|} \hline -1 & 1 & 1 & -1 \\ \hline \end{array}$$

$$\begin{array}{c} \backslash \\ \begin{array}{|c|c|} \hline 1 & -1 \\ \hline -1 & 1 \\ \hline \end{array} \end{array} \quad \begin{array}{|c|c|c|c|} \hline 1 & -1 & -1 & 1 \\ \hline \end{array} = 0$$

$$\begin{array}{c} / \\ \begin{array}{|c|c|} \hline -1 & 1 \\ \hline 1 & -1 \\ \hline \end{array} \end{array} \quad \begin{array}{|c|c|c|c|} \hline -1 & 1 & 1 & -1 \\ \hline \end{array}$$

$$\begin{array}{c} \backslash \\ \begin{array}{|c|c|} \hline 1 & -1 \\ \hline -1 & 1 \\ \hline \end{array} \end{array} \quad \begin{array}{|c|c|c|c|} \hline 1 & -1 & -1 & 1 \\ \hline \end{array} = 0$$

$$\begin{array}{c} / \\ \begin{array}{|c|c|} \hline -1 & 1 \\ \hline 1 & -1 \\ \hline \end{array} \end{array} \quad \begin{array}{|c|c|c|c|} \hline -1 & 1 & 1 & -1 \\ \hline \end{array} = 0$$

$$\begin{array}{c} \backslash \\ \begin{array}{|c|c|} \hline 1 & -1 \\ \hline -1 & 1 \\ \hline \end{array} \end{array} \quad \begin{array}{|c|c|c|c|} \hline 1 & -1 & -1 & 1 \\ \hline \end{array} = 1$$

$$\begin{array}{c} / \\ \begin{array}{|c|c|} \hline -1 & 1 \\ \hline 1 & -1 \\ \hline \end{array} \end{array} \quad \begin{array}{|c|c|c|c|} \hline -1 & 1 & 1 & -1 \\ \hline \end{array}$$

$$\backslash \begin{array}{|c|c|} \hline 1 & -1 \\ \hline -1 & 1 \\ \hline \end{array} \quad \begin{array}{|c|c|c|c|c|} \hline 1 & \times & -1 & \times & -1 & \times & 1 \\ \hline \end{array} = 1$$

$$/ \begin{array}{|c|c|} \hline -1 & 1 \\ \hline 1 & -1 \\ \hline \end{array} \quad \begin{array}{|c|c|c|c|c|} \hline -1 & \times & 1 & \times & 1 & \times & -1 \\ \hline \end{array} = 1$$

$$\backslash \begin{array}{|c|c|} \hline +1 & -1 \\ \hline -1 & 1 \\ \hline \end{array} \quad \begin{array}{|c|c|c|c|c|} \hline + & - & - & + \\ \hline 1 & -1 & -1 & 1 \\ \hline \end{array}$$

$$/ \begin{array}{|c|c|} \hline +1 & -1 \\ \hline 1 & -1 \\ \hline \end{array} \quad \begin{array}{|c|c|c|c|c|} \hline + & - & - & + \\ \hline -1 & 1 & 1 & -1 \\ \hline \end{array}$$

$$\backslash \begin{array}{|c|c|} \hline +1 & -1 \\ \hline -1 & 1 \\ \hline \end{array} \quad \begin{array}{|c|c|c|c|c|} \hline + & - & - & + \\ \hline 1 & -1 & -1 & 1 \\ \hline +1 & +1 & +1 & +1 \\ \hline \end{array} = 4$$

$$/ \begin{array}{|c|c|} \hline +1 & -1 \\ \hline -1 & 1 \\ \hline \end{array} \quad \begin{array}{|c|c|c|c|c|} \hline + & - & - & + \\ \hline -1 & 1 & 1 & -1 \\ \hline -1 & -1 & -1 & -1 \\ \hline \end{array} = -4$$

Image Recognition Classifier

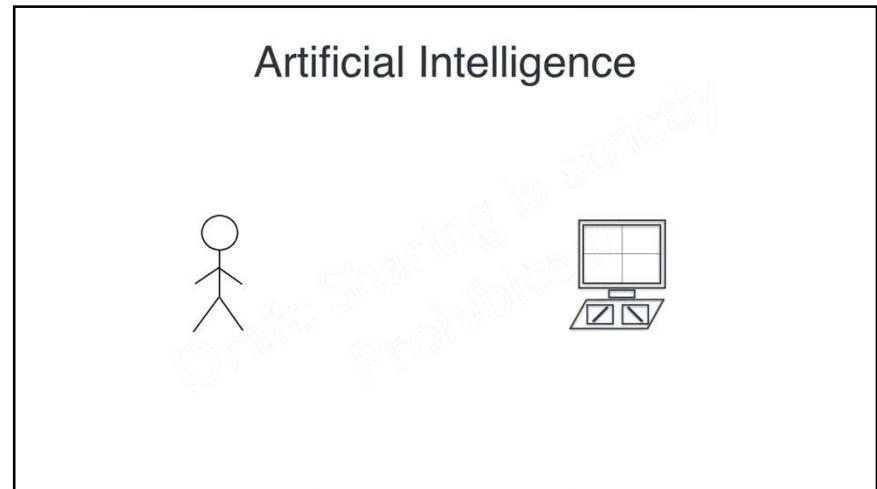
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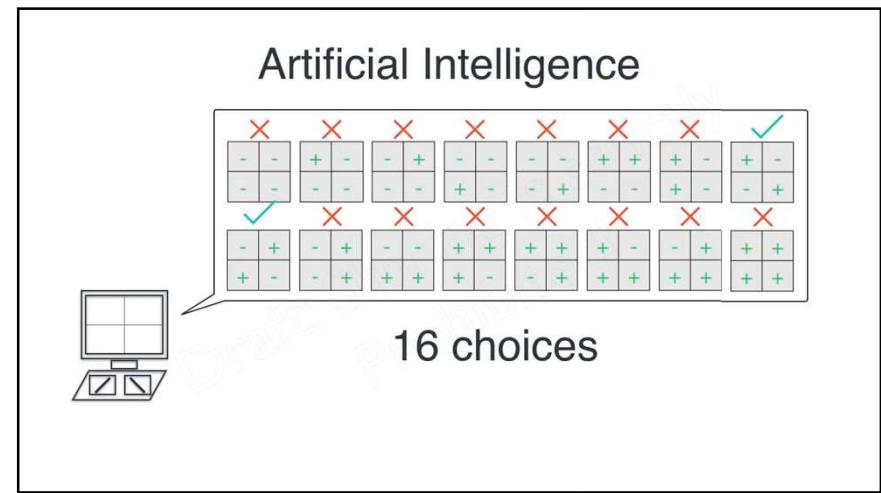
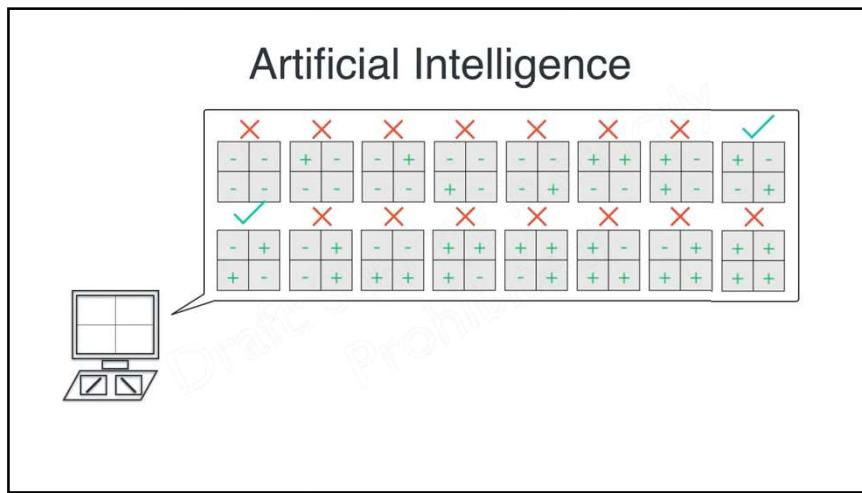
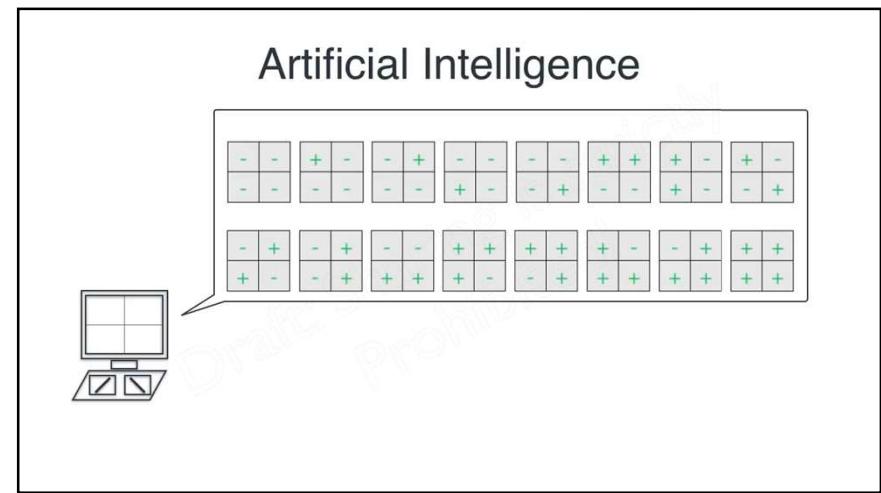
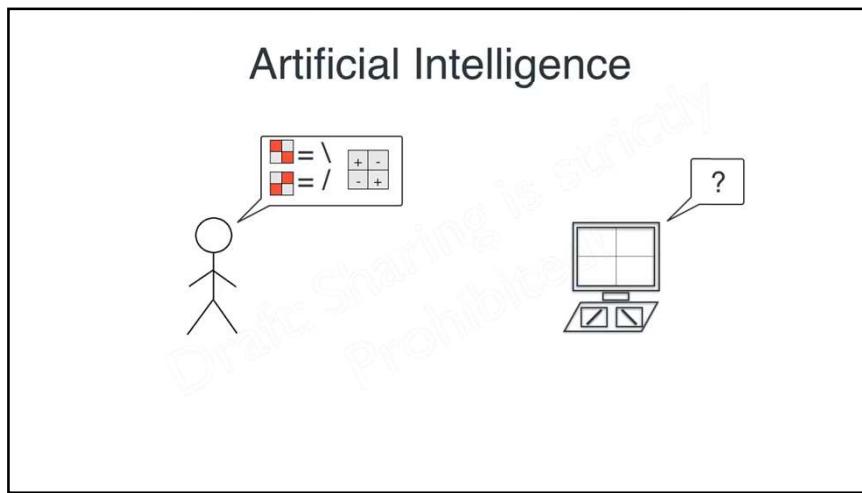
If positive, “\”
If negative, “/”

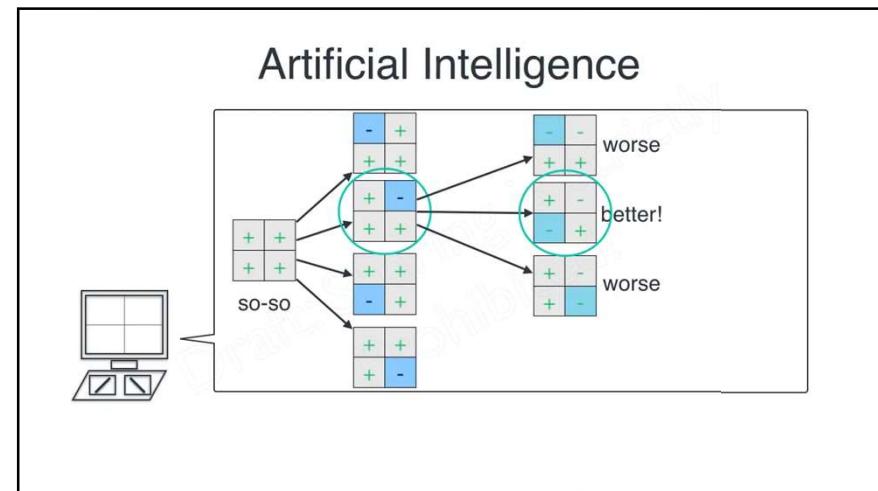
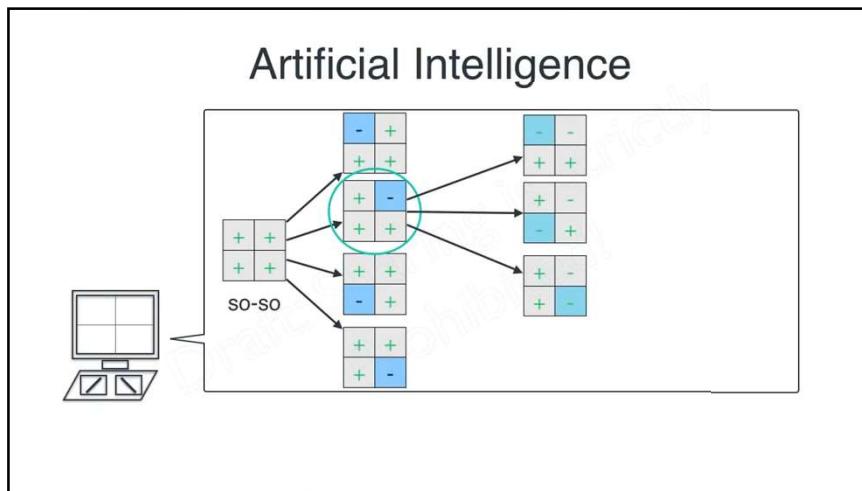
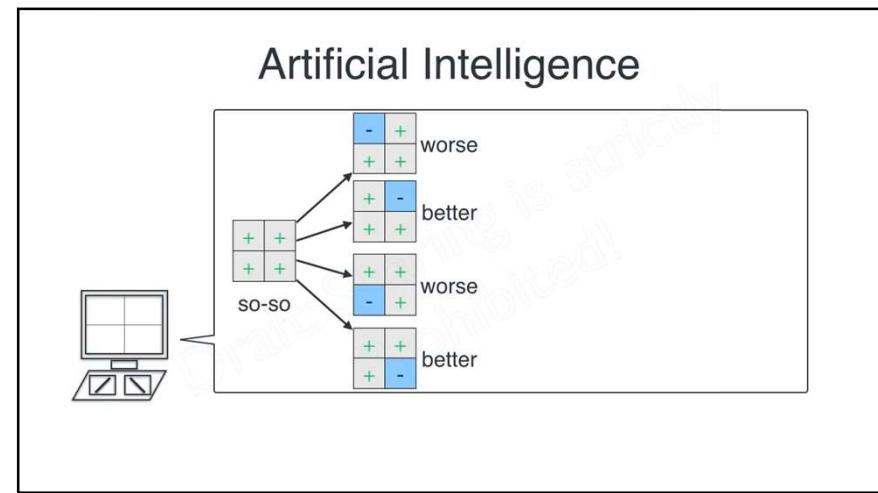
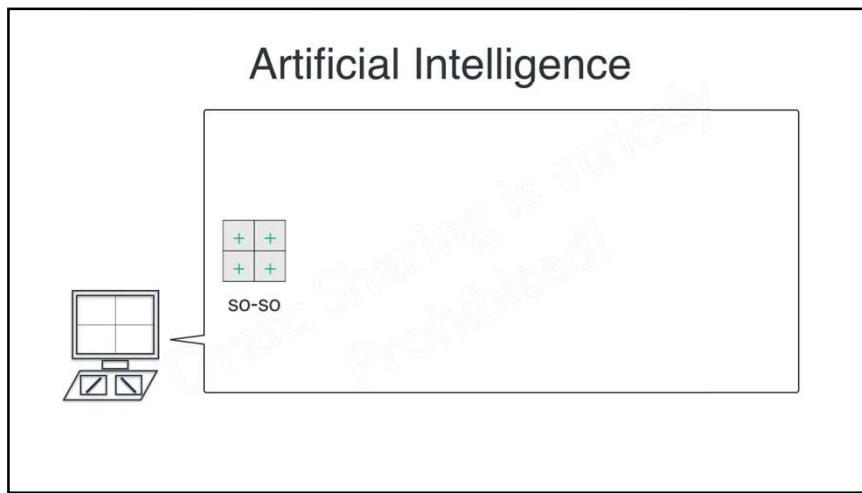
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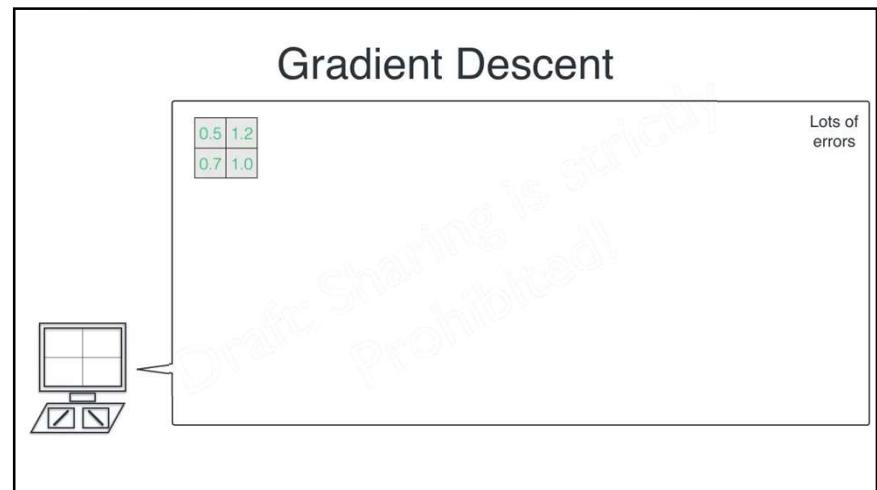
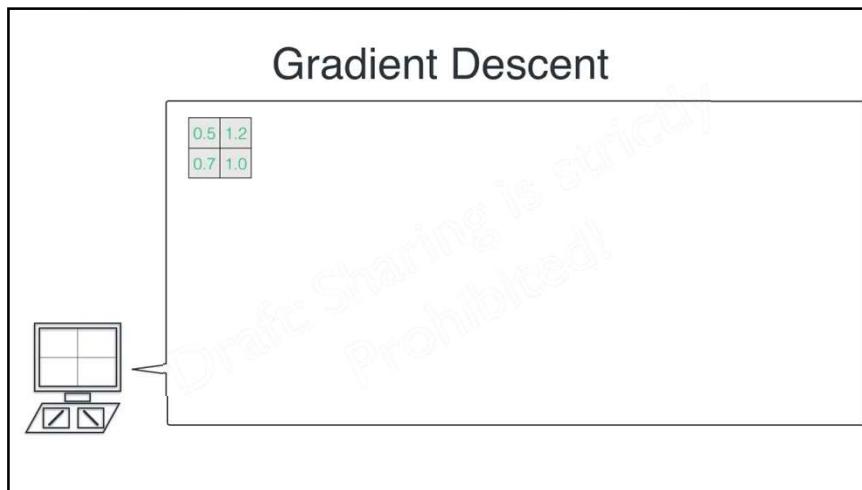
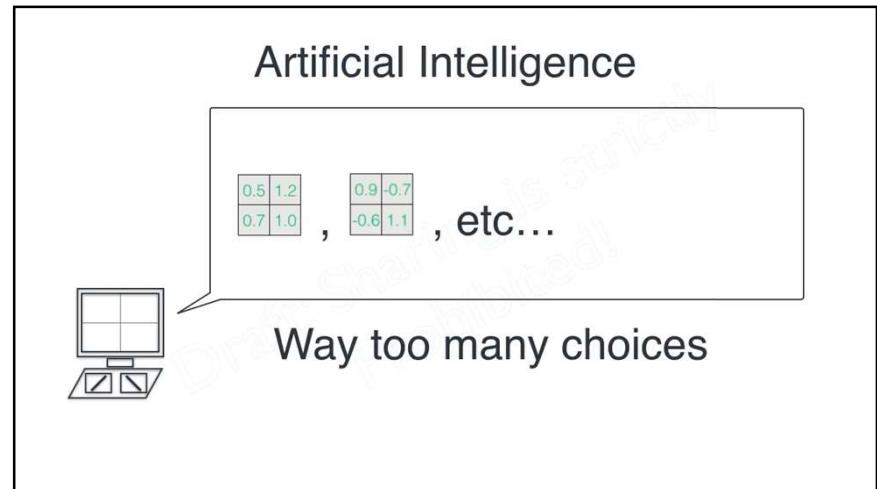
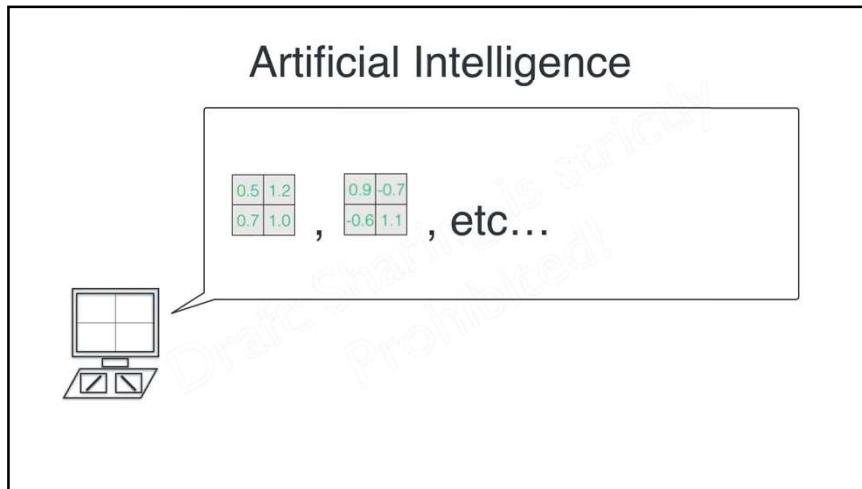
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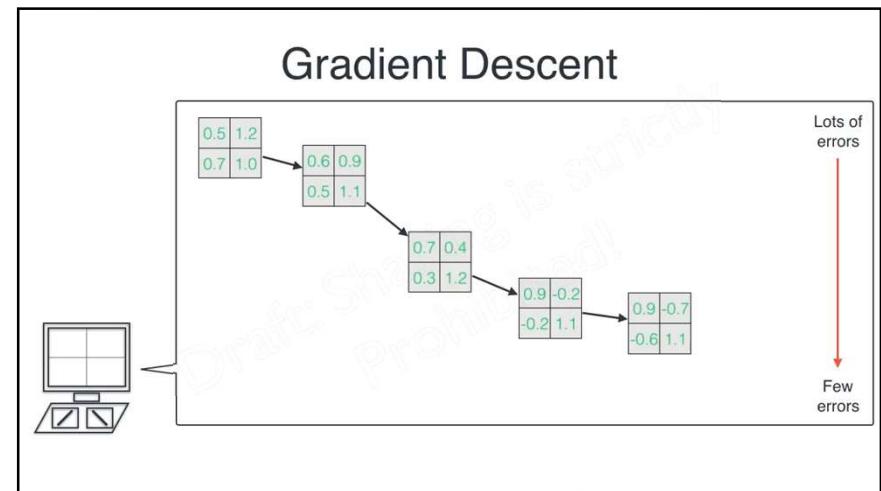
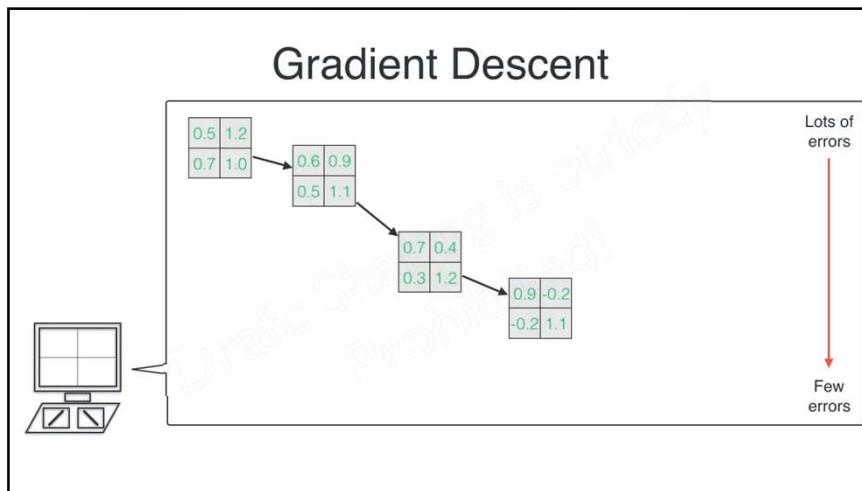
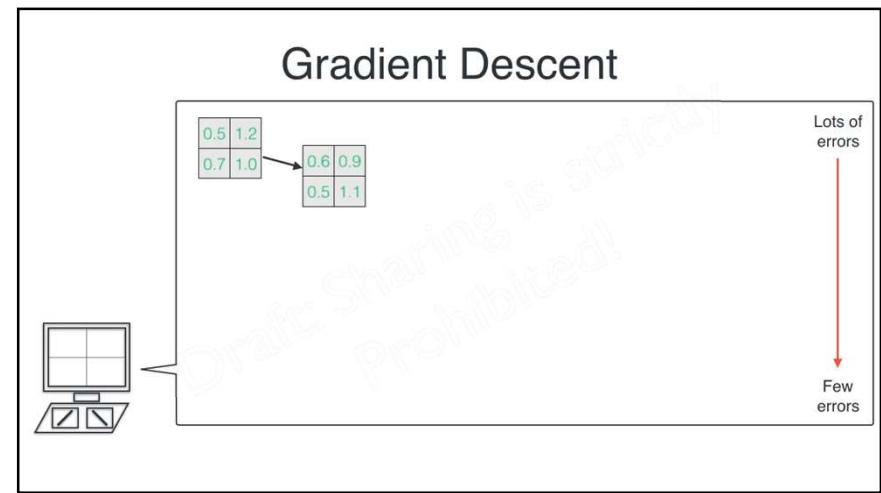
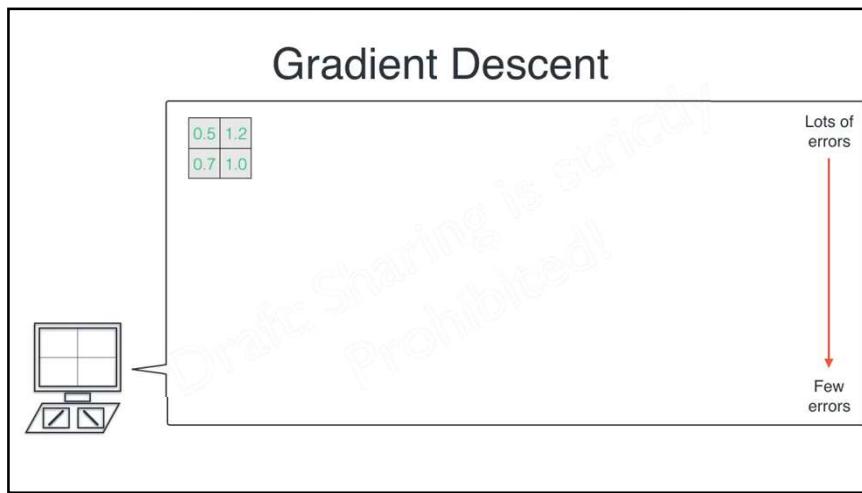
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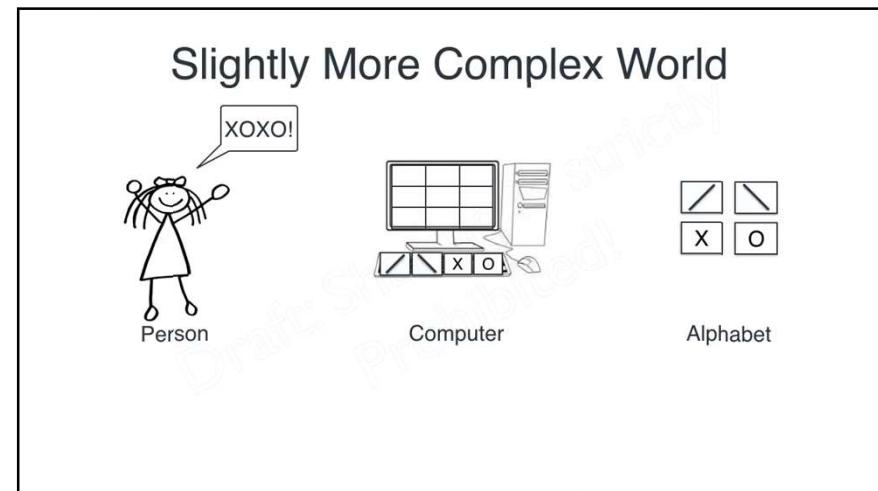
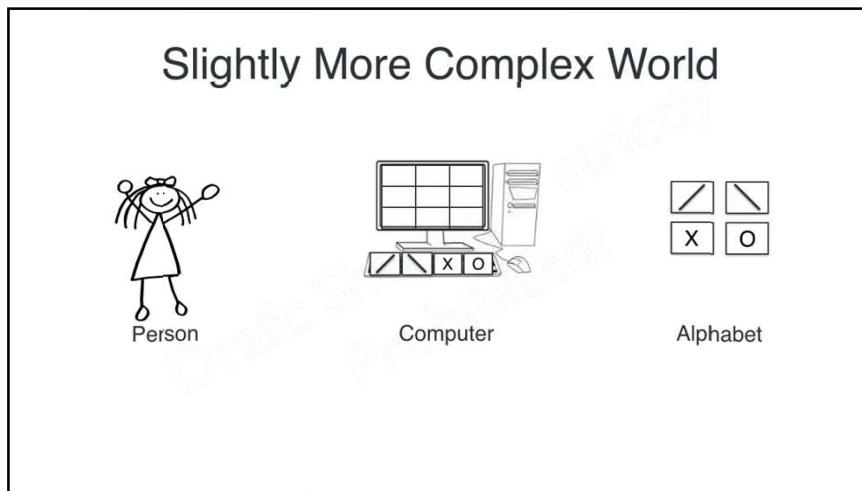
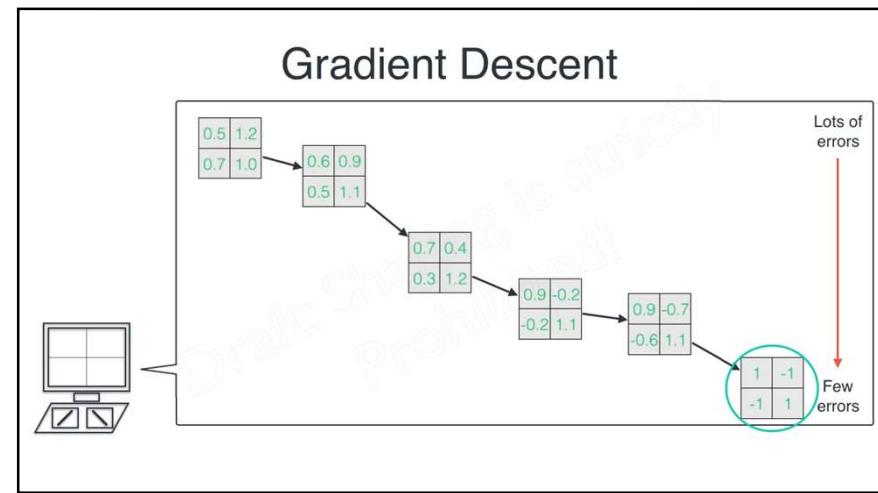
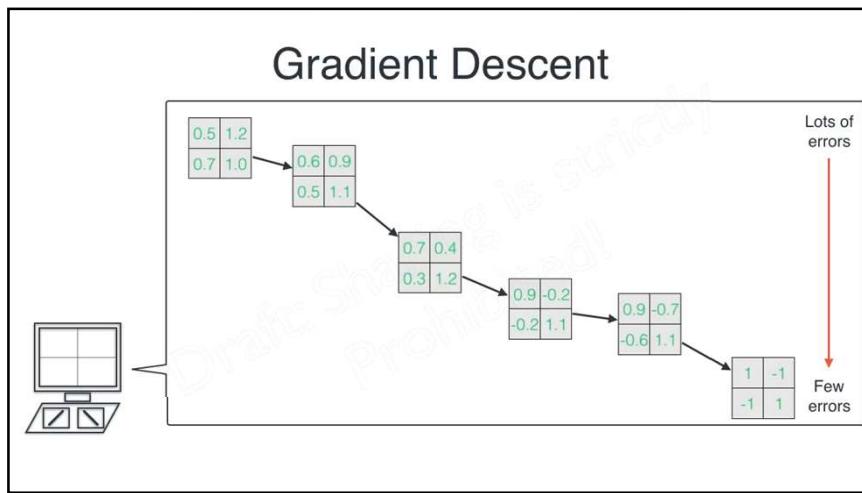












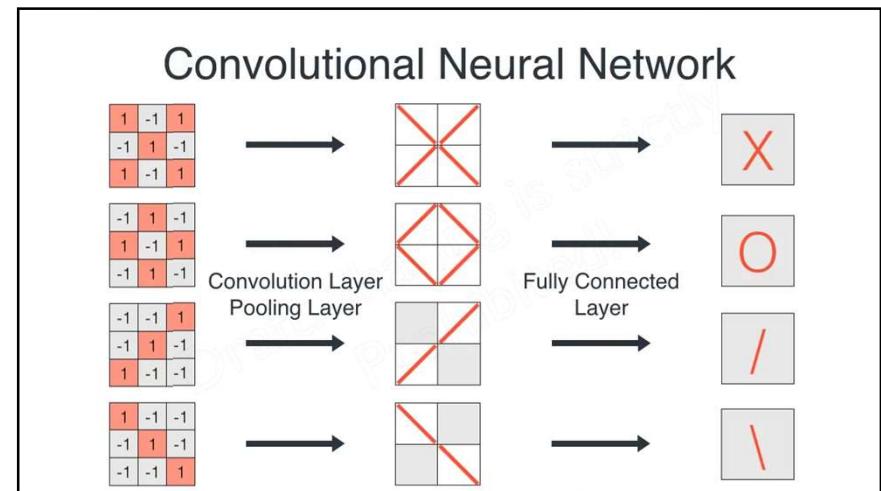
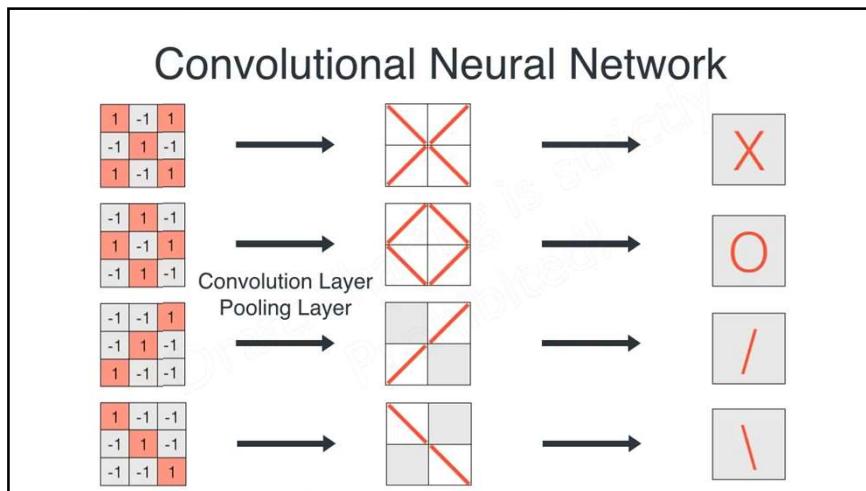
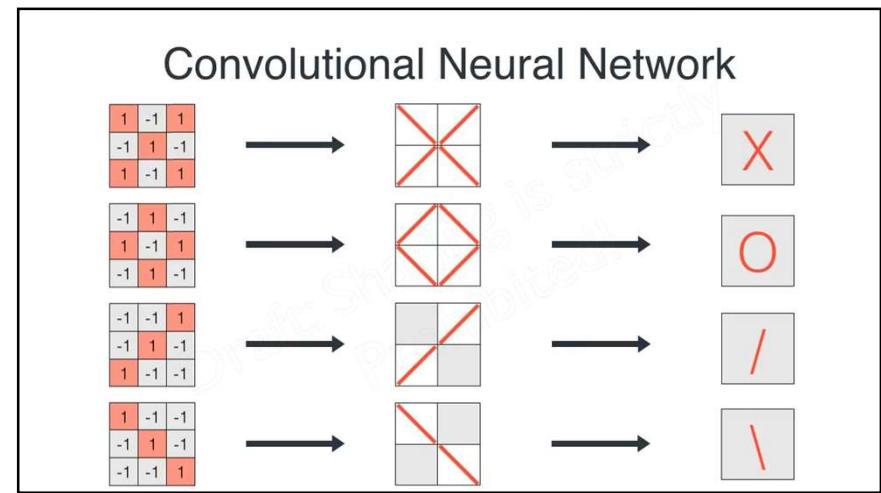
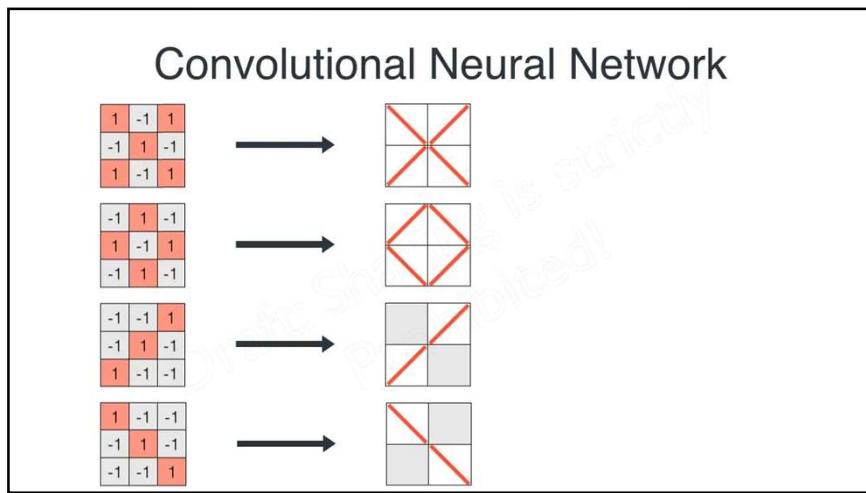
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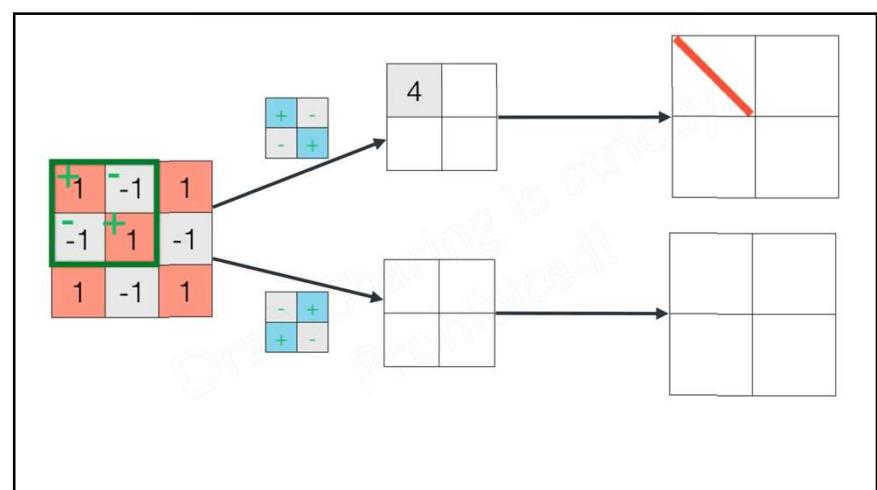
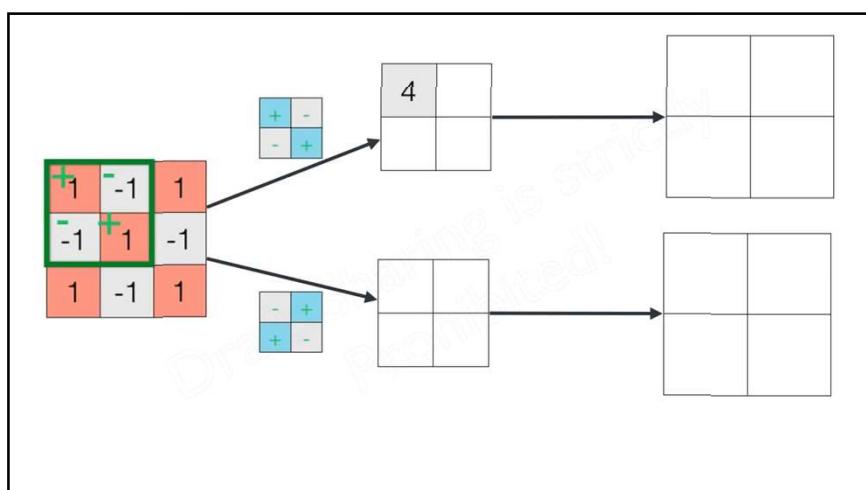
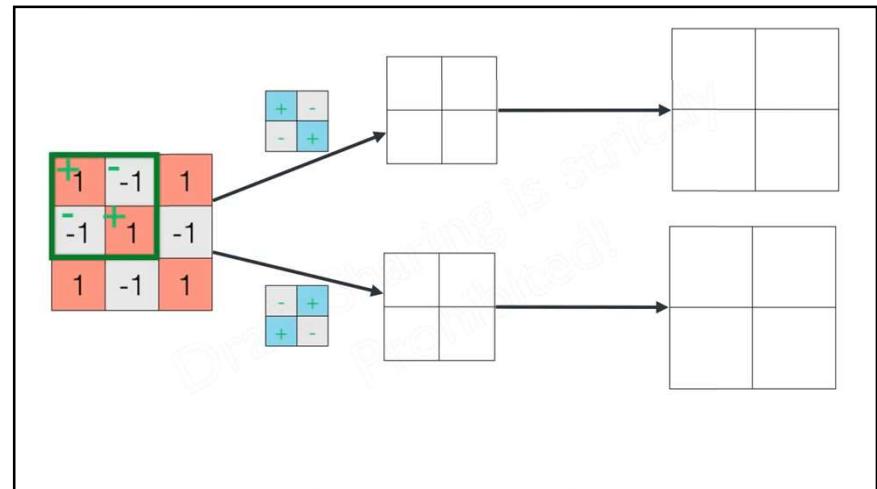
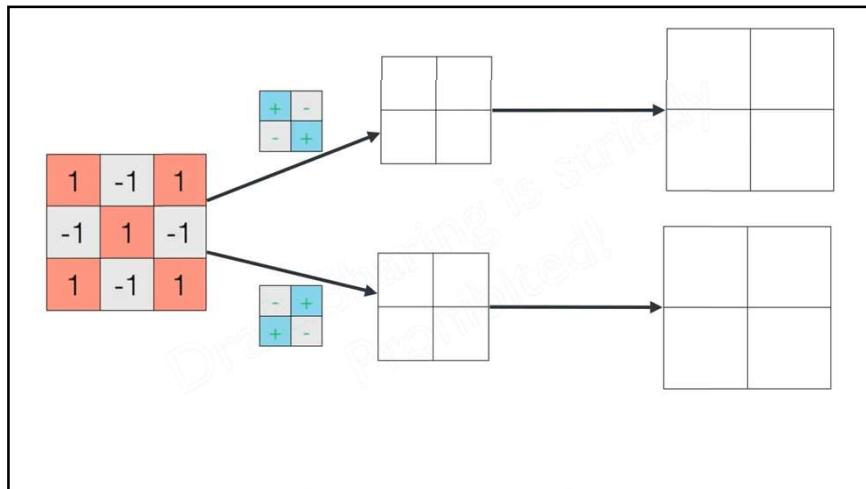
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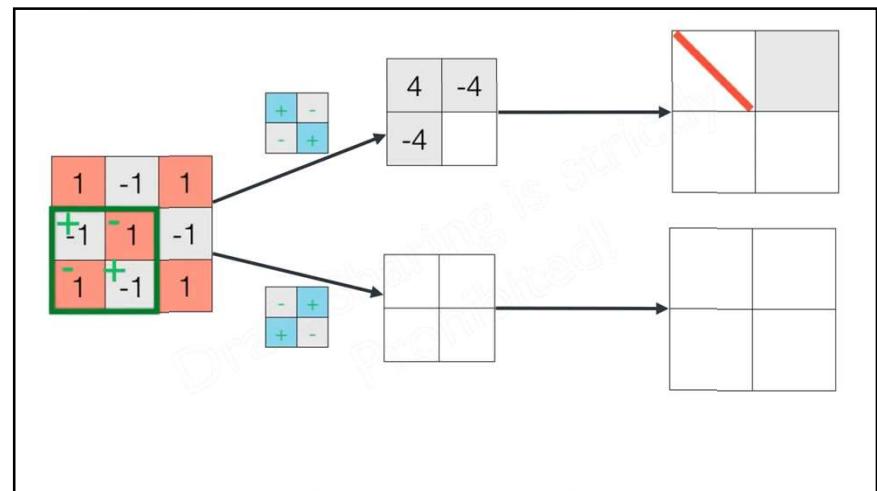
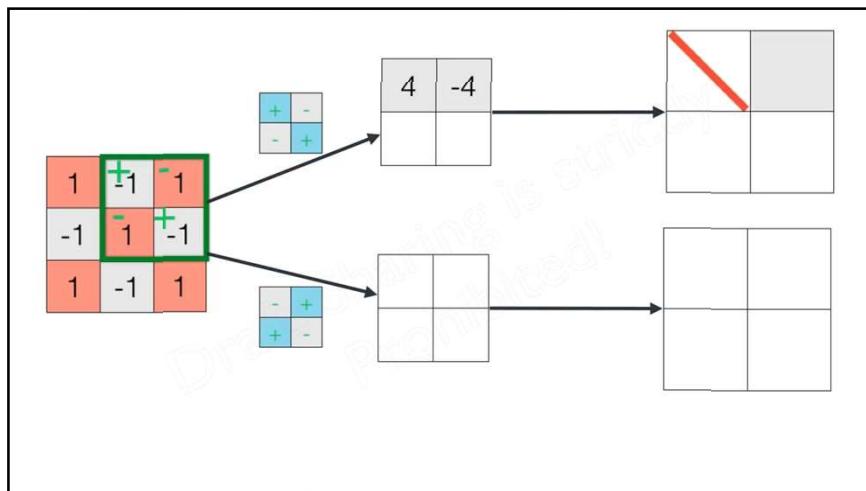
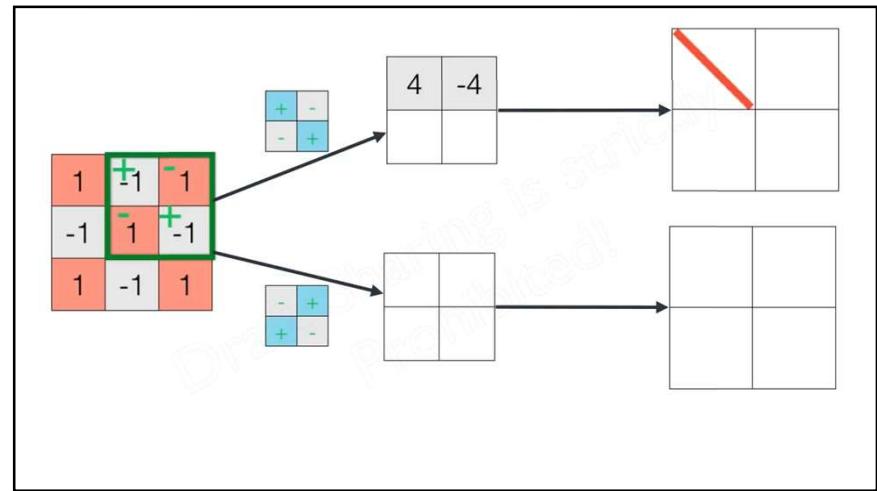
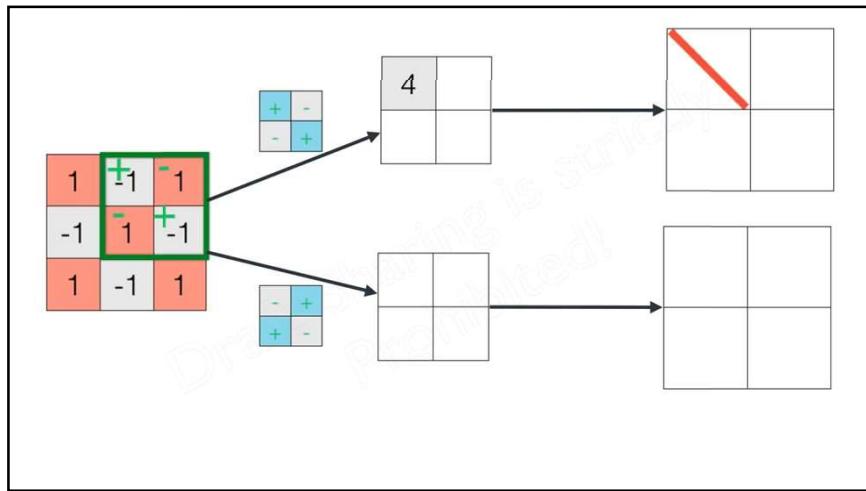
Previous Knowledge

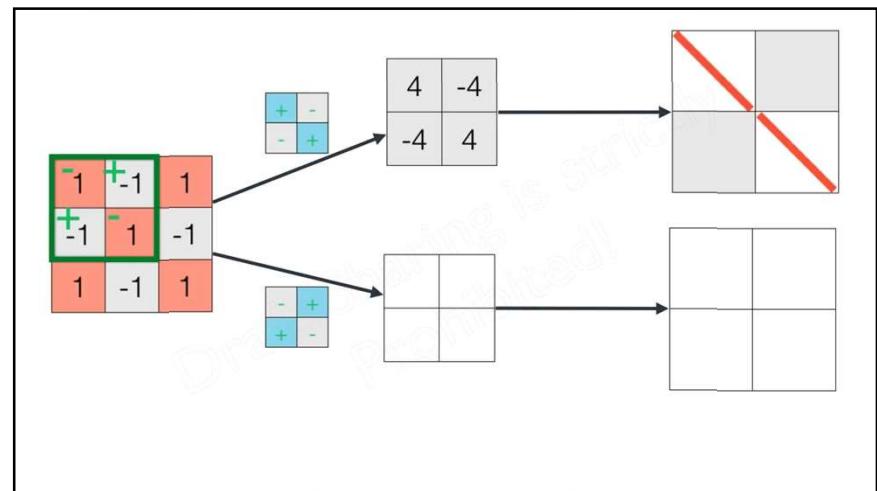
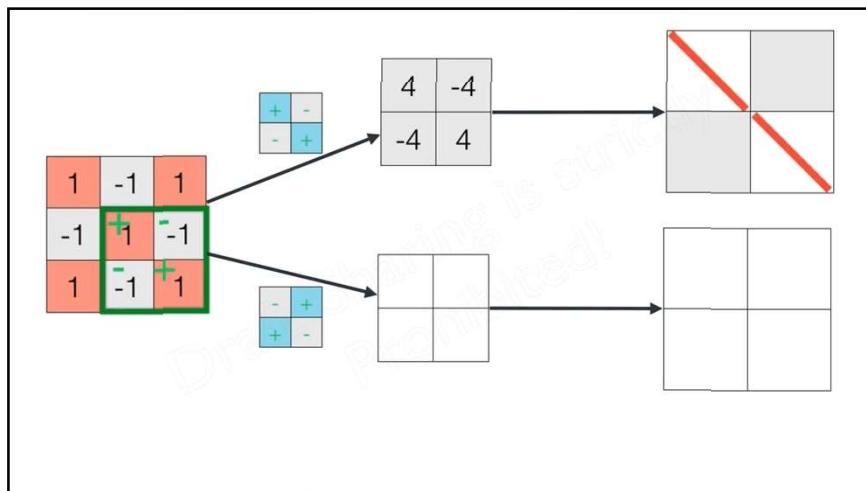
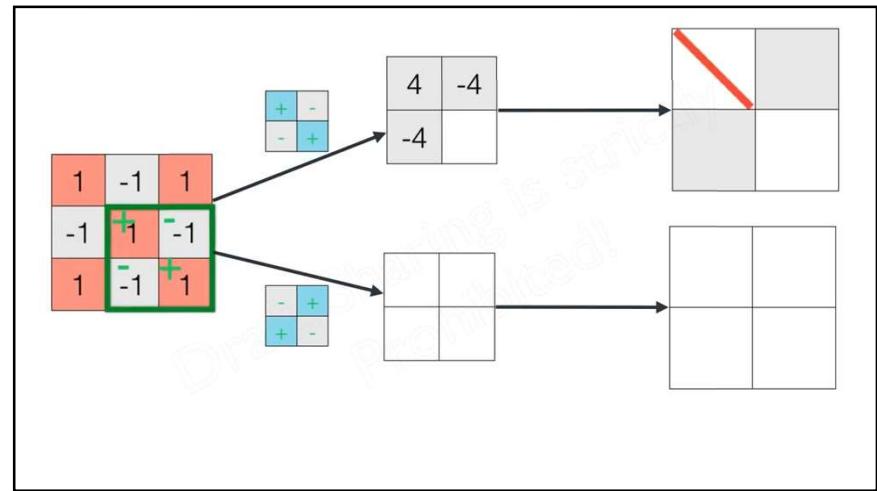
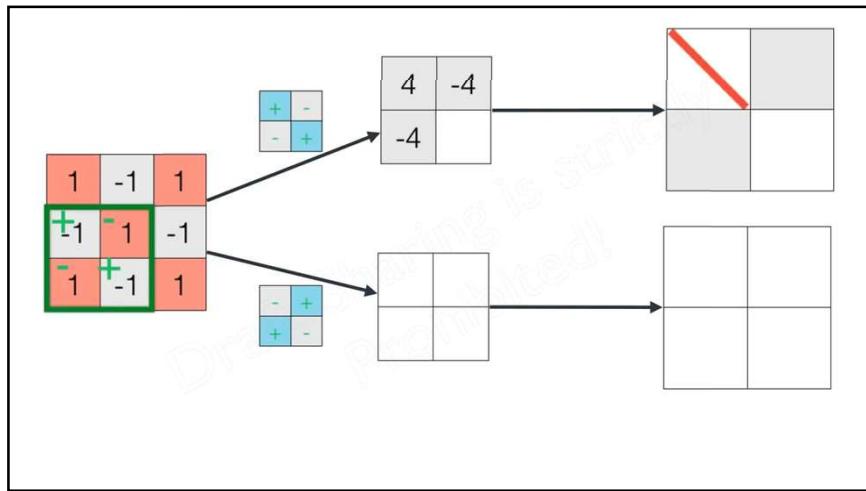
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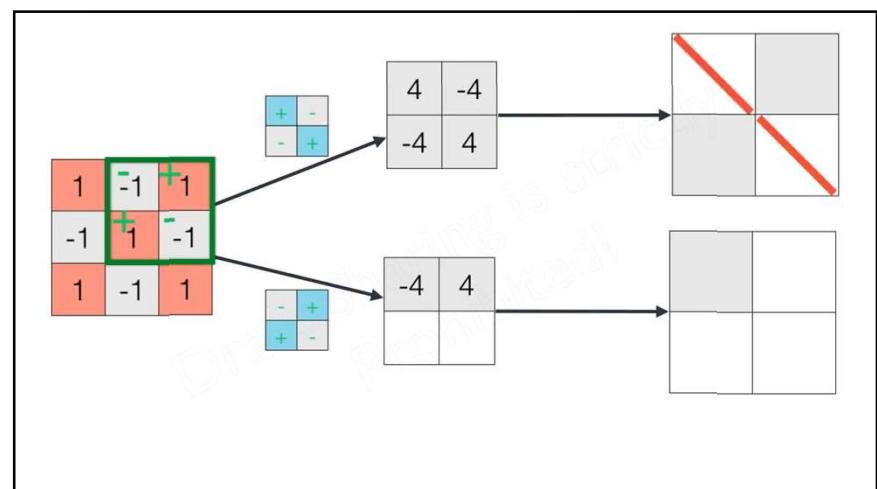
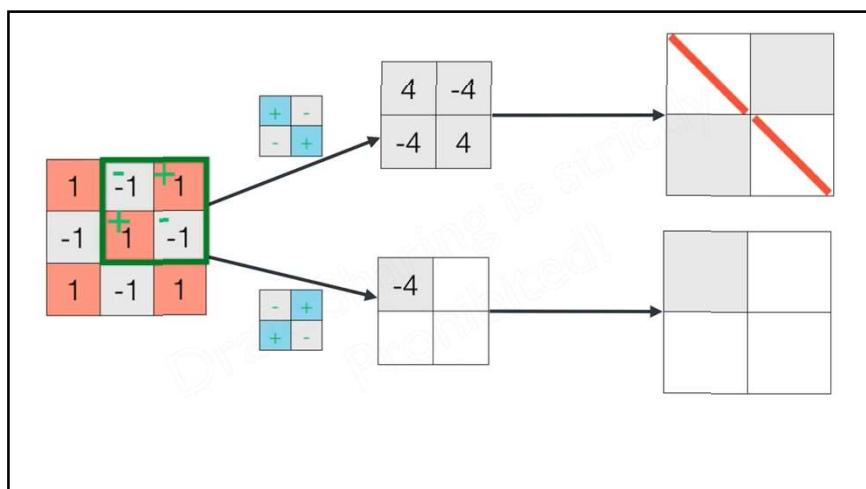
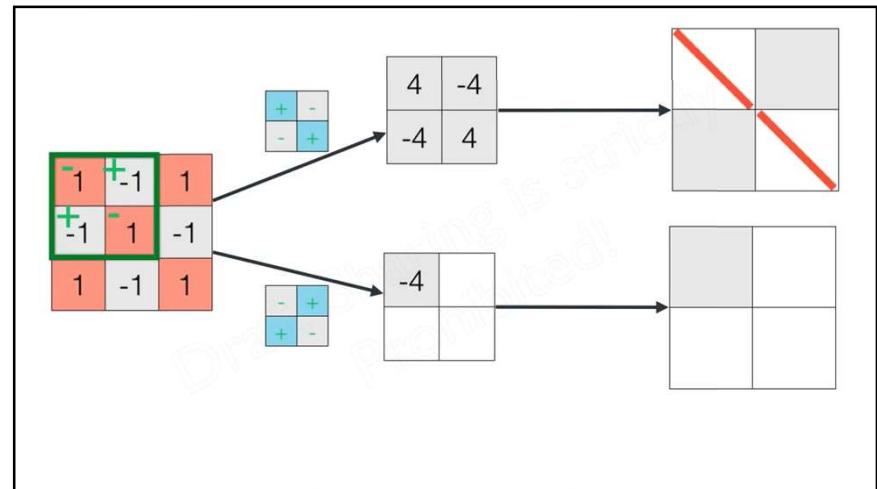
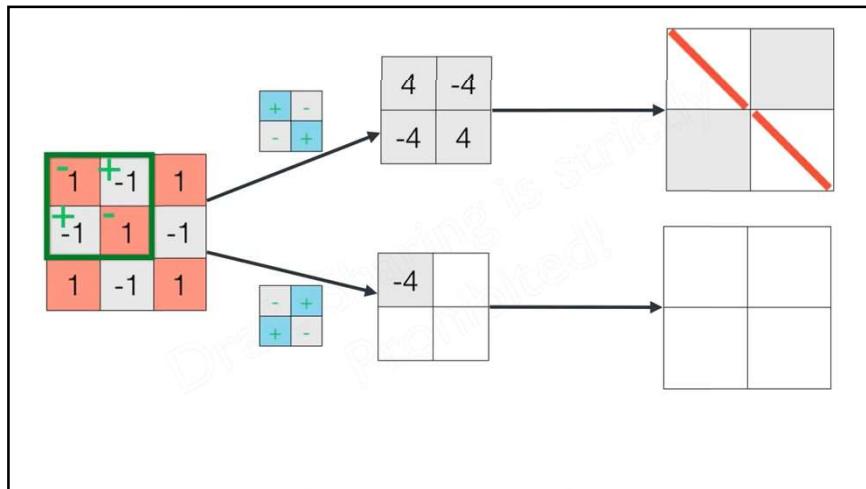
Convolutional Neural Network

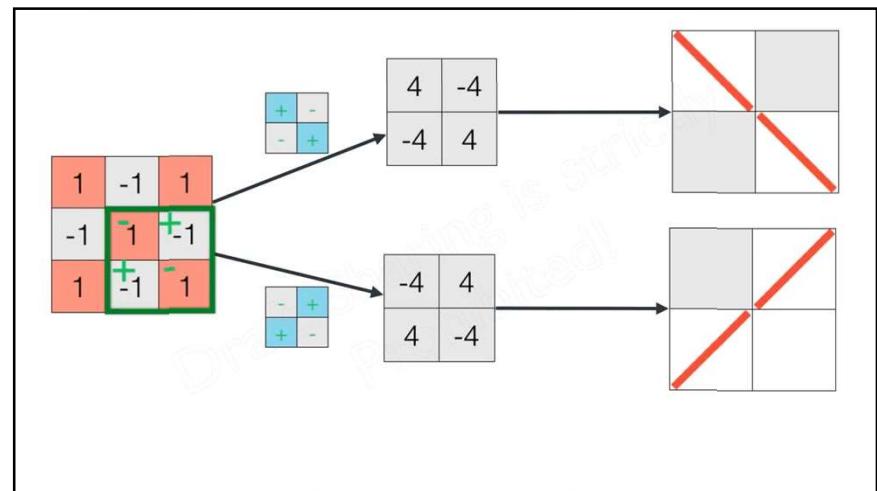
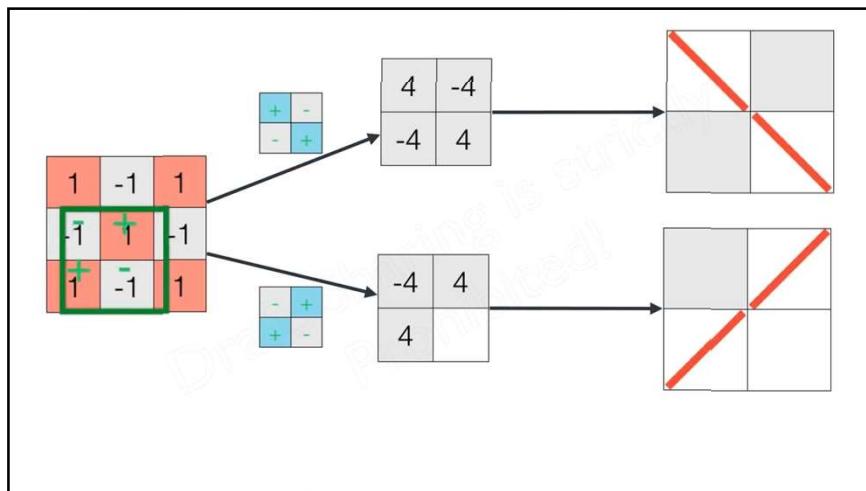
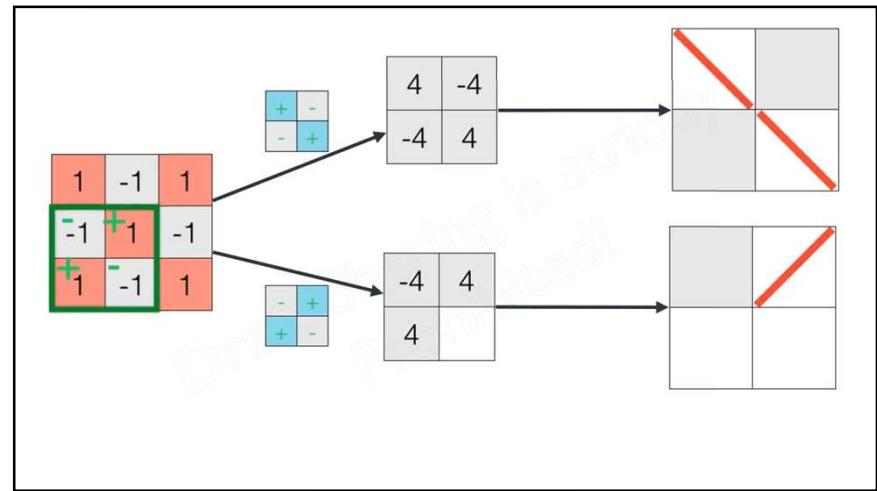
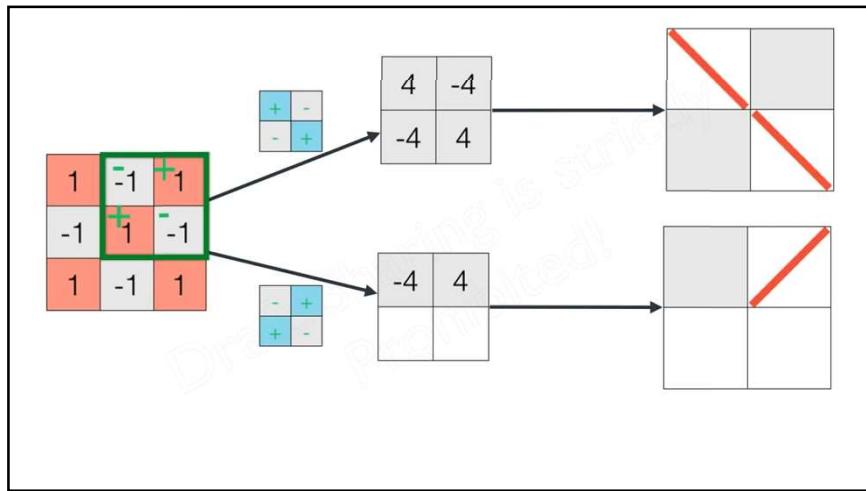


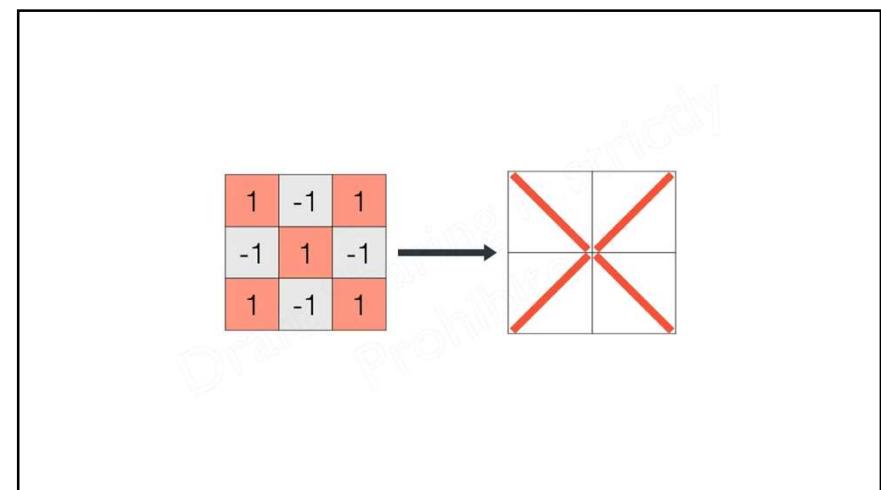
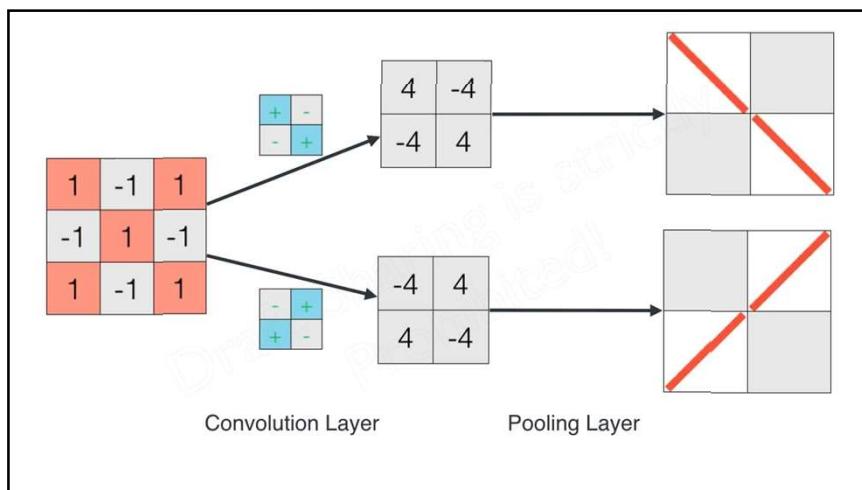
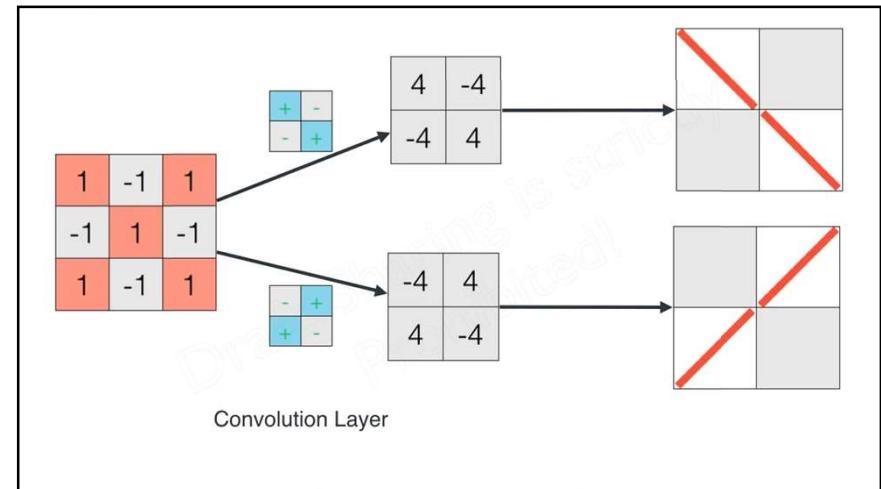
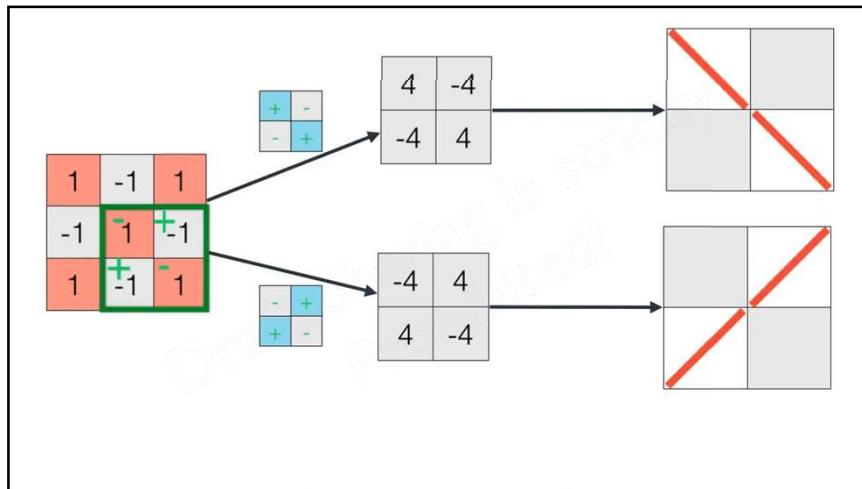


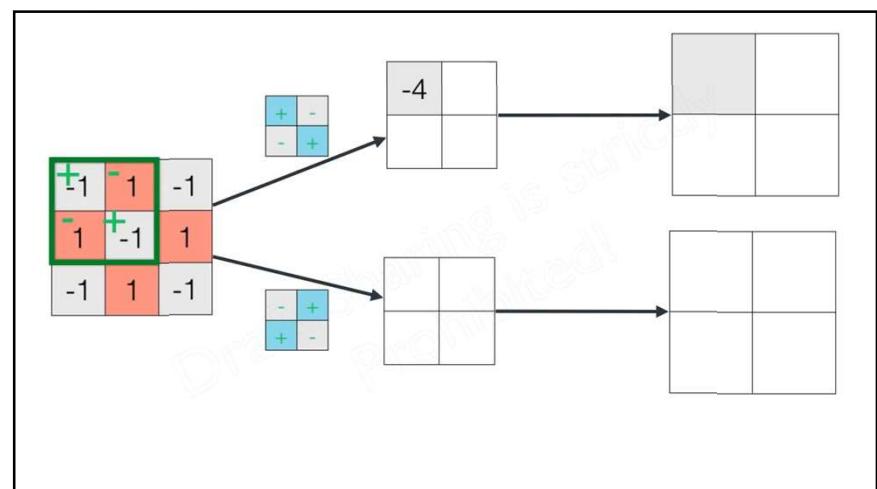
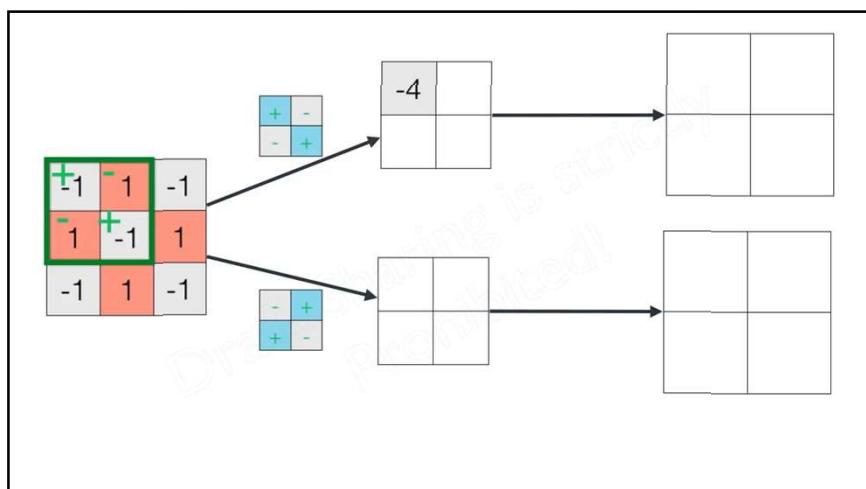
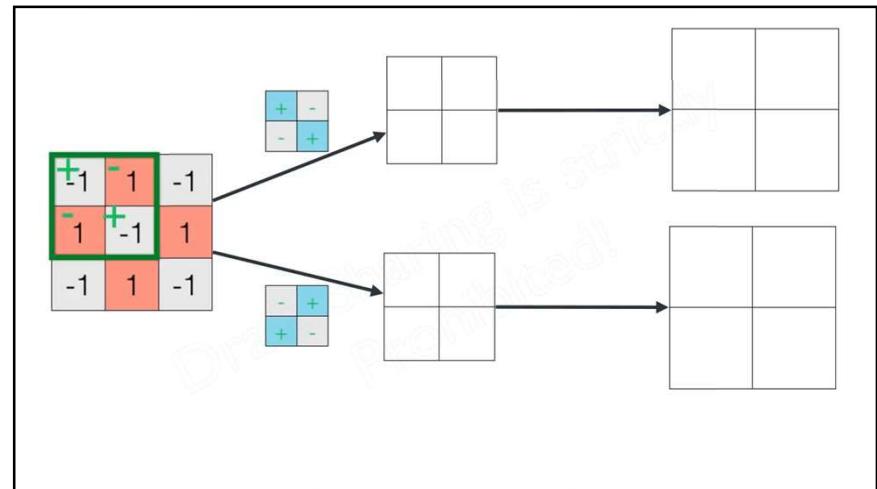
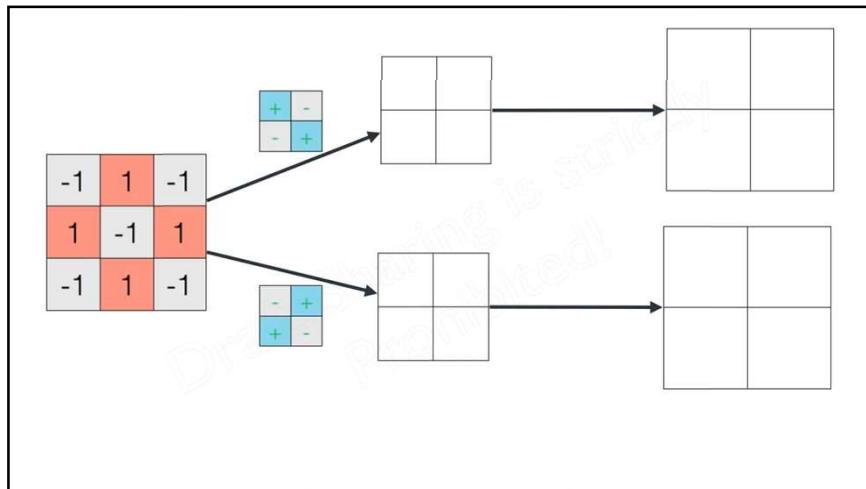


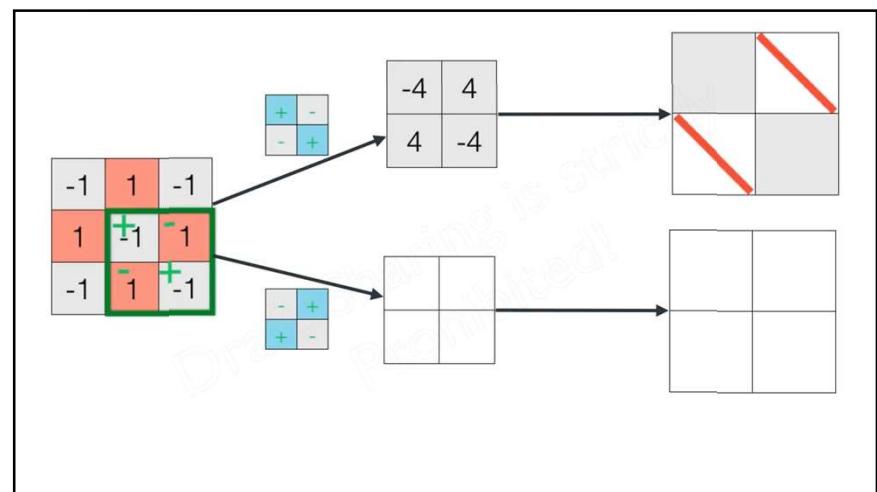
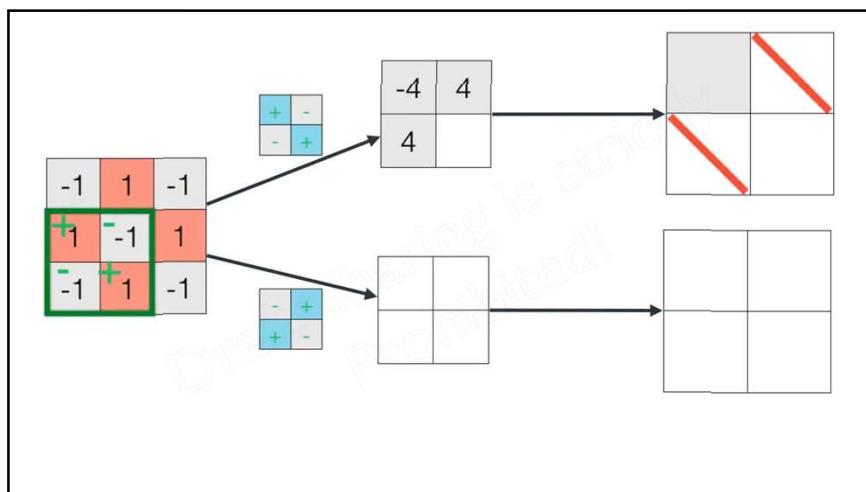
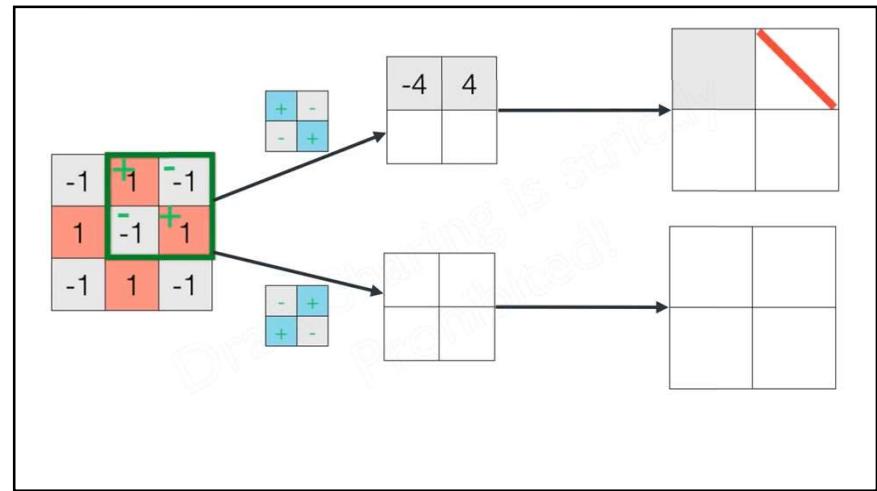
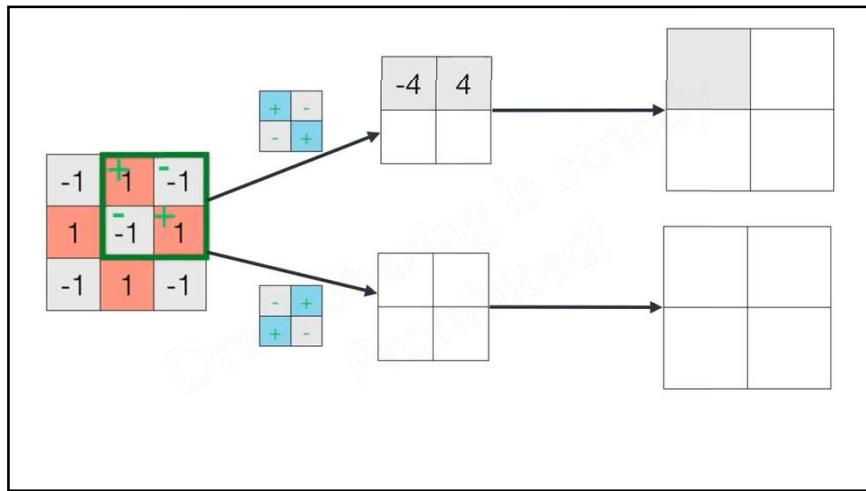


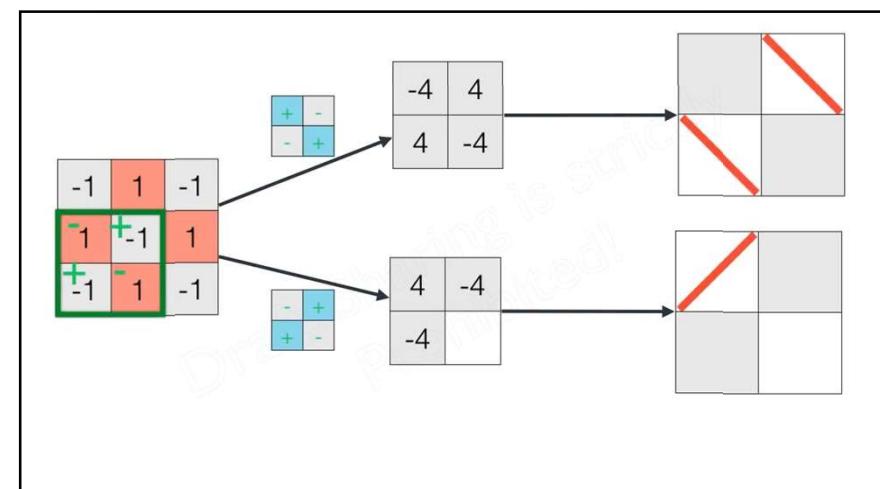
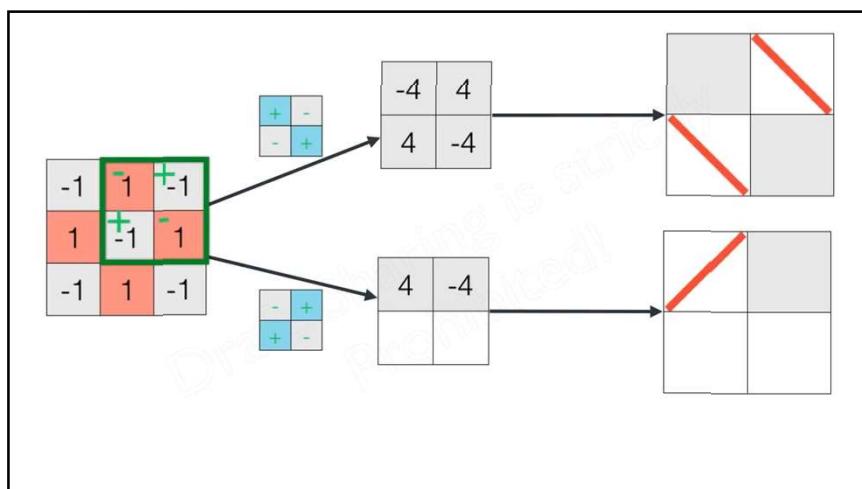
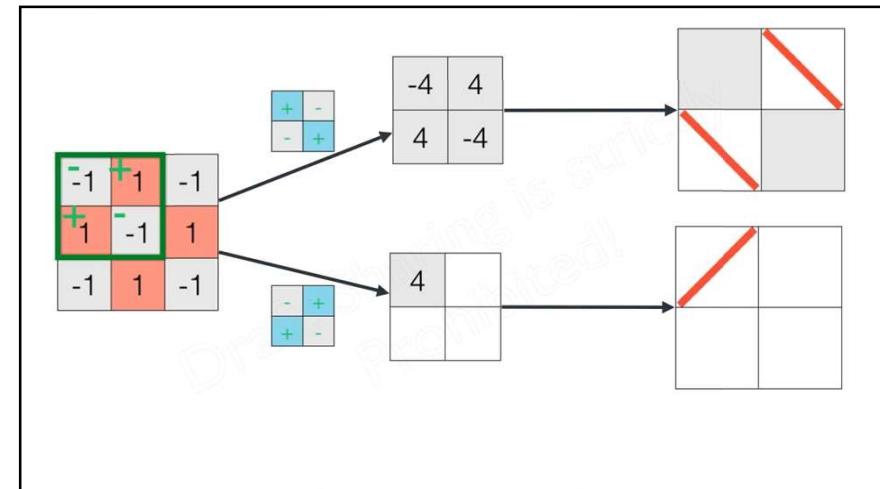
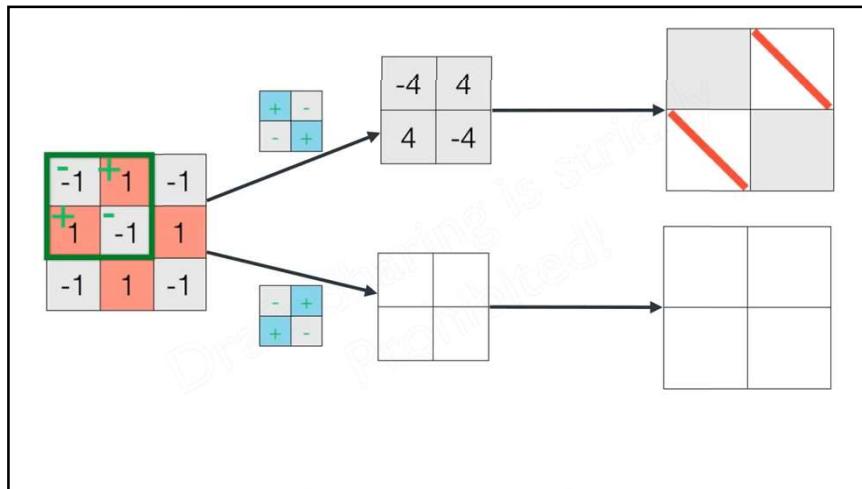


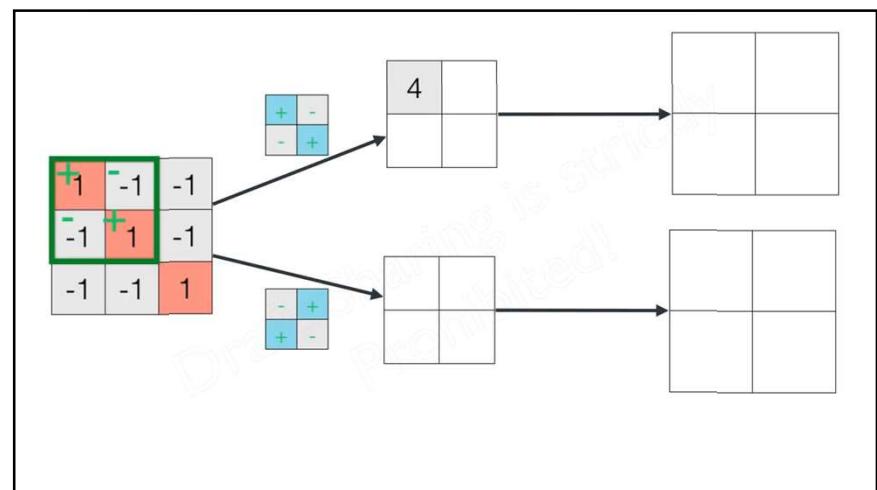
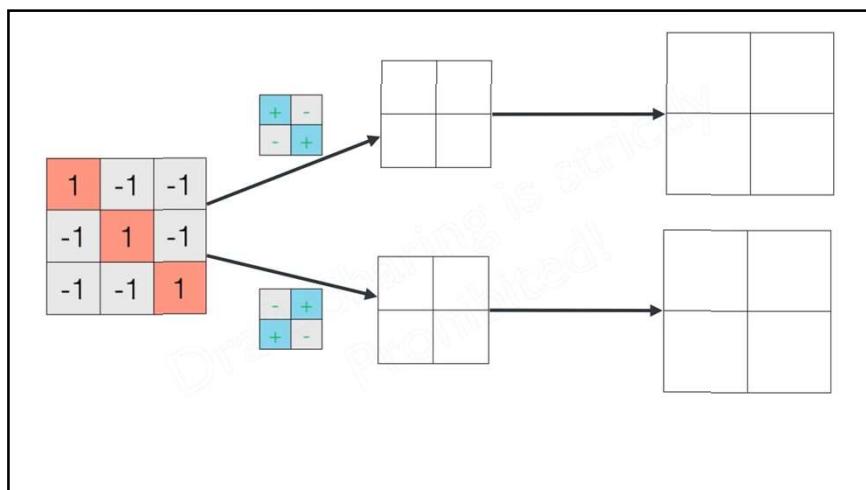
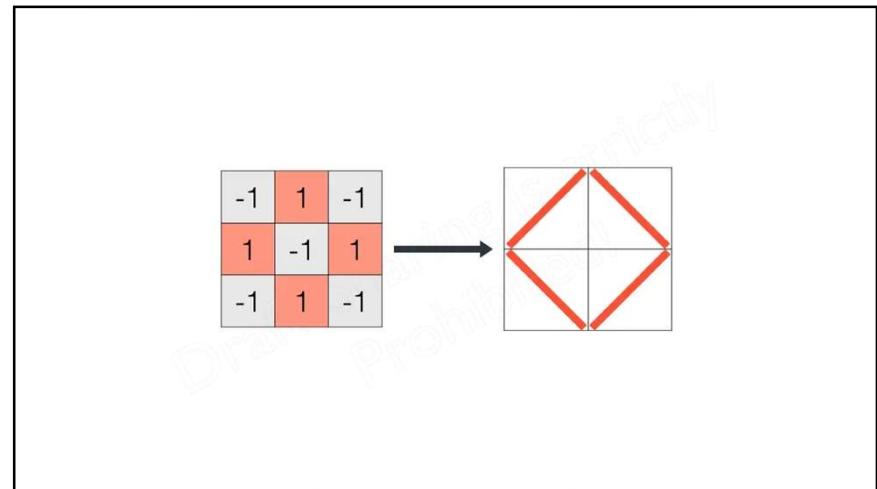
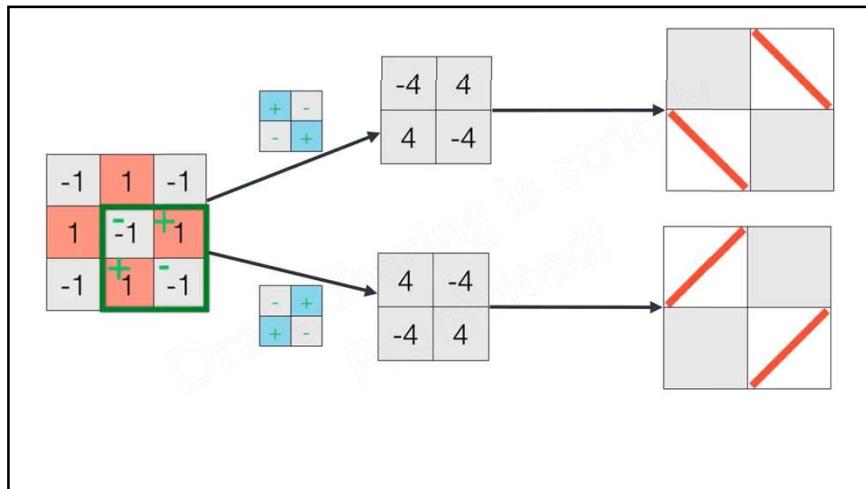


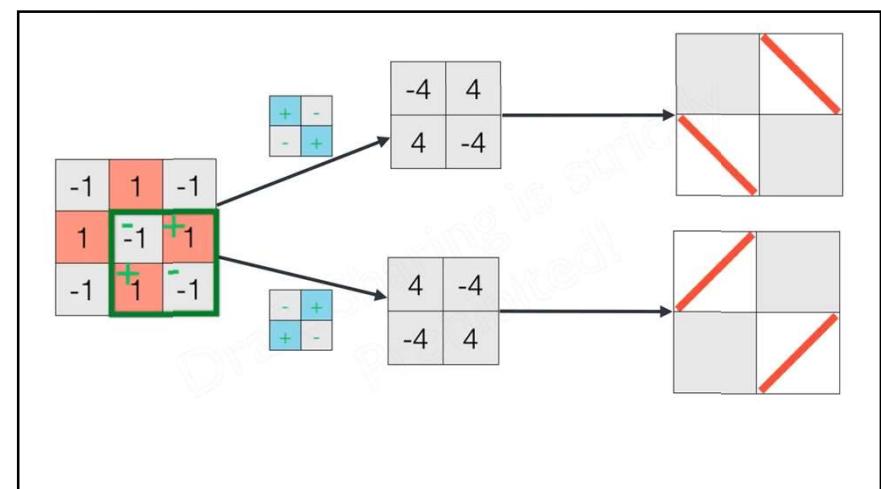
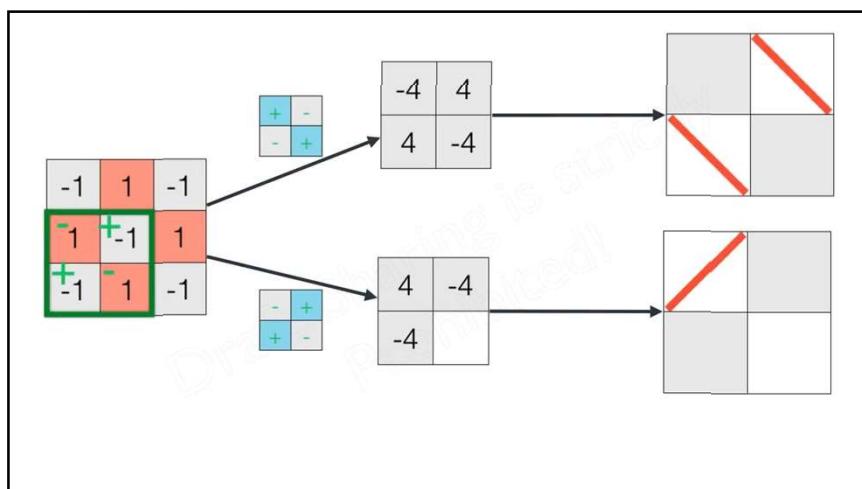
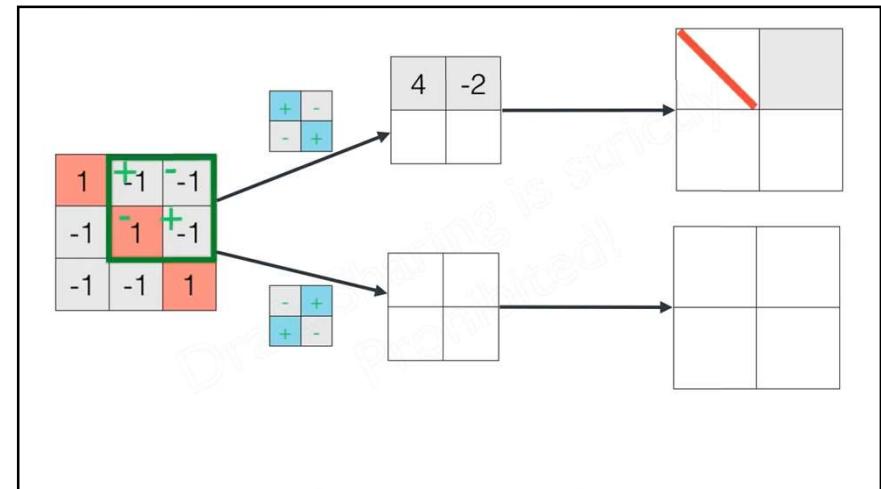
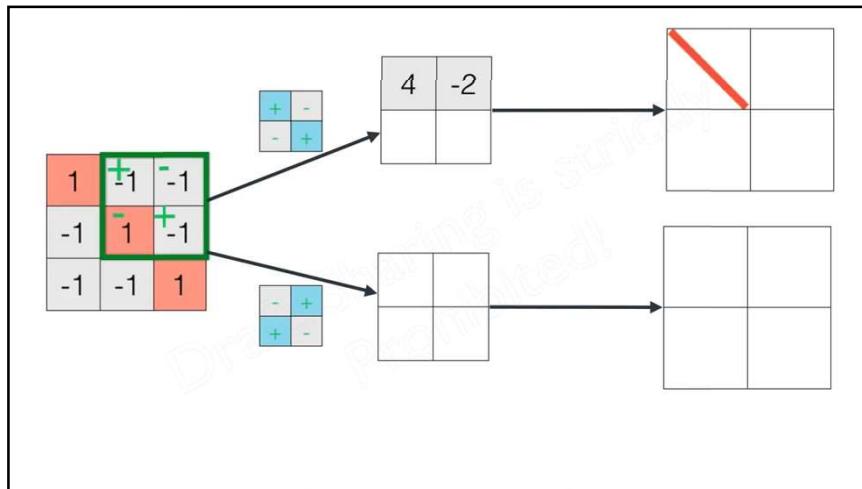


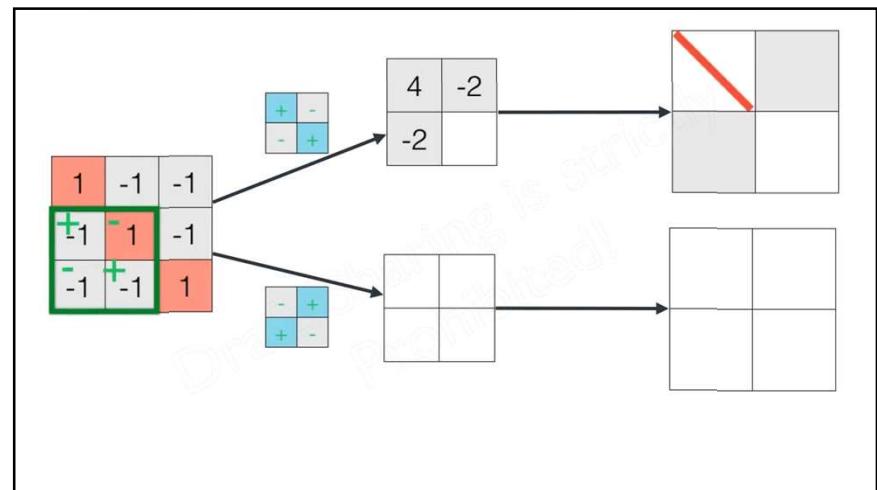
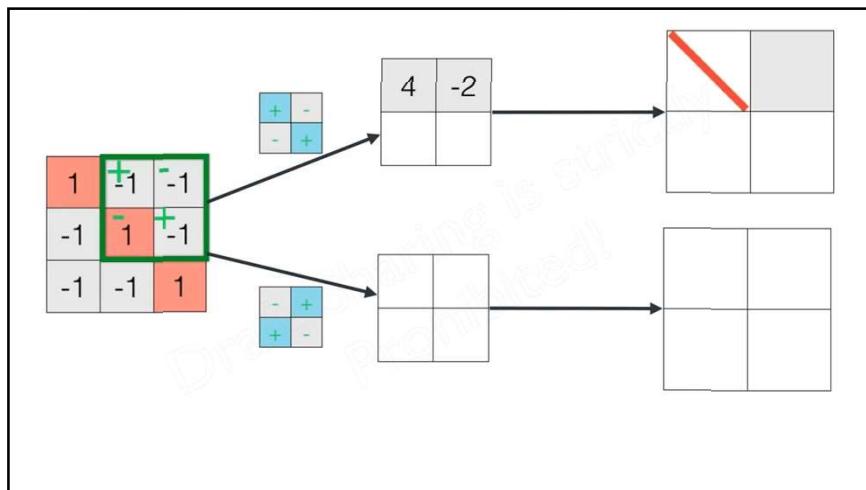
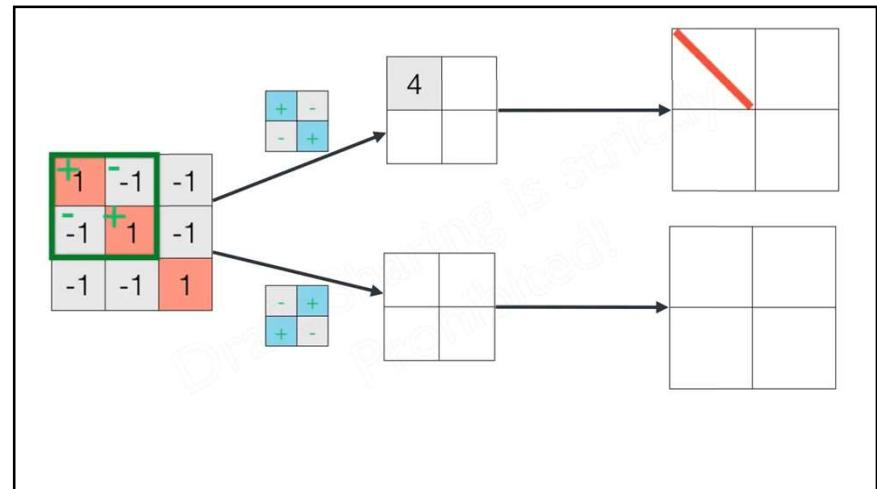
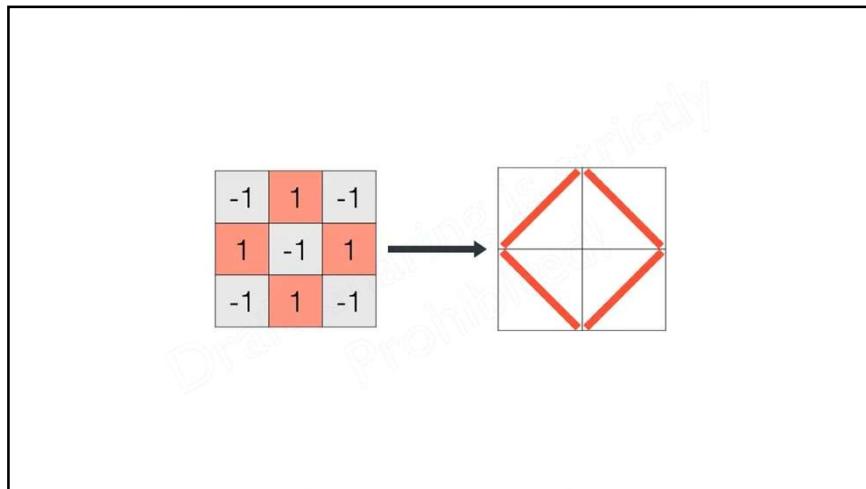


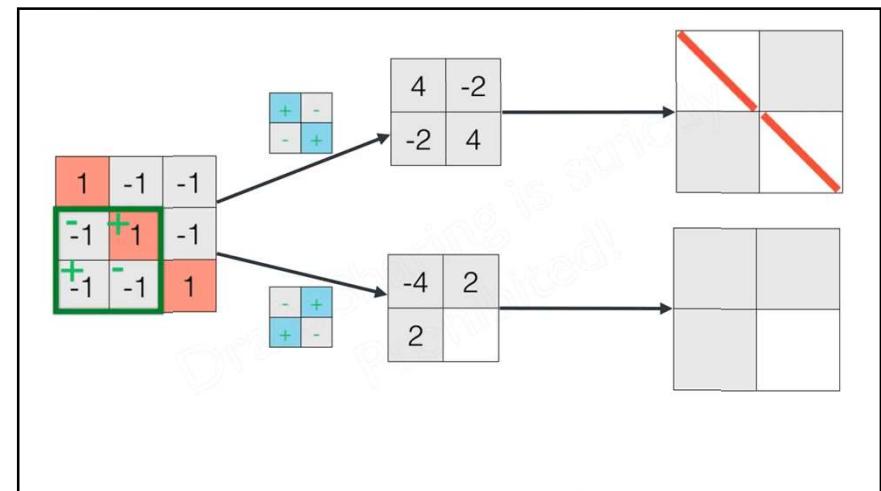
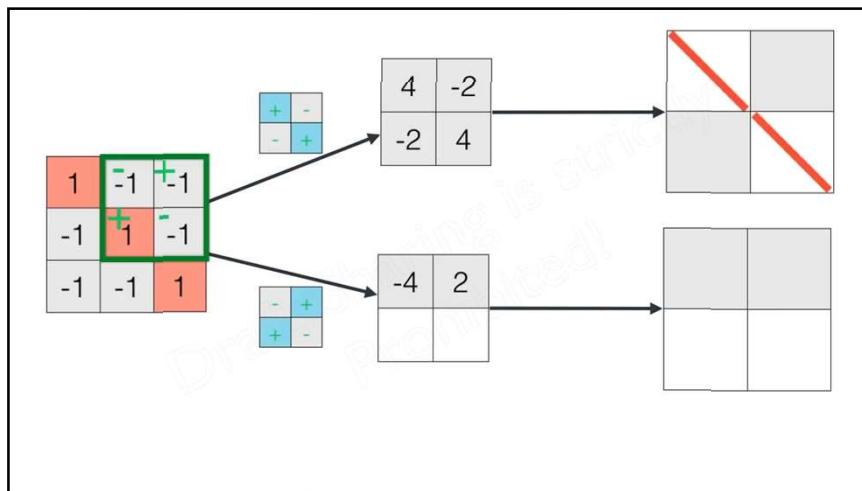
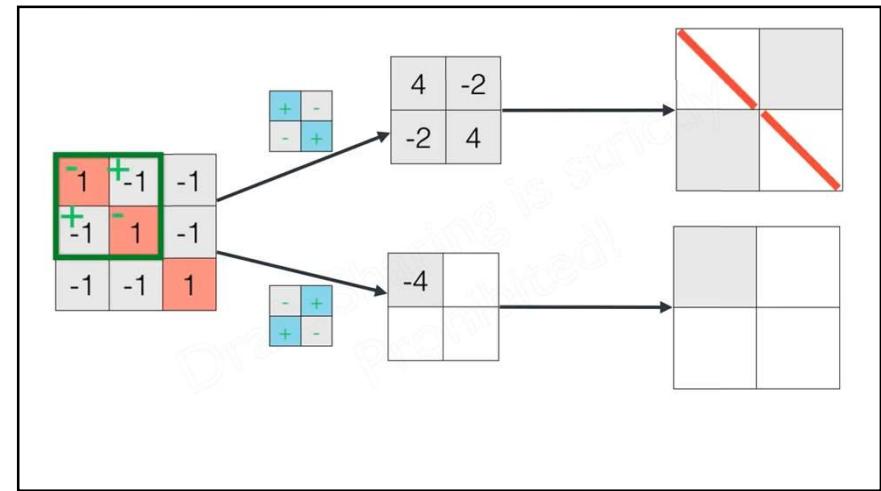
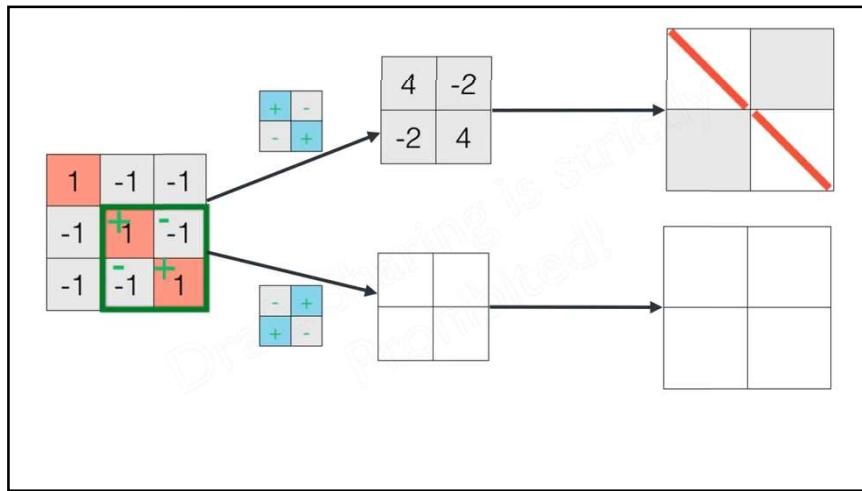


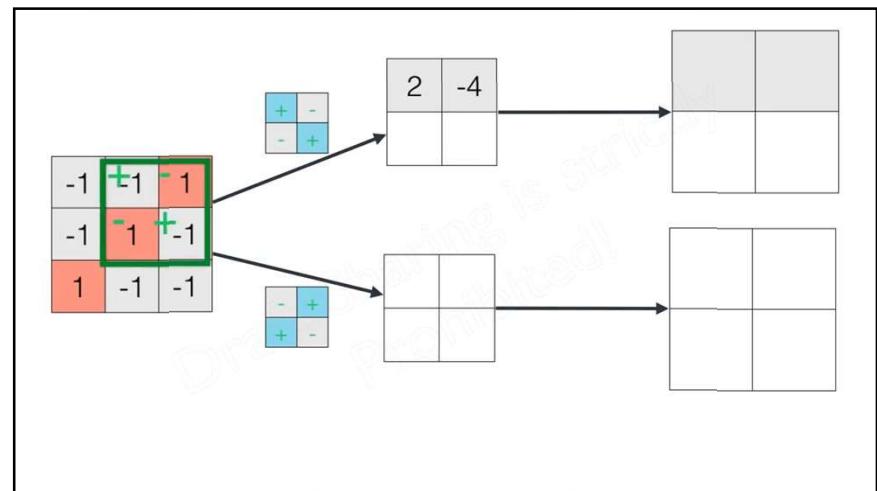
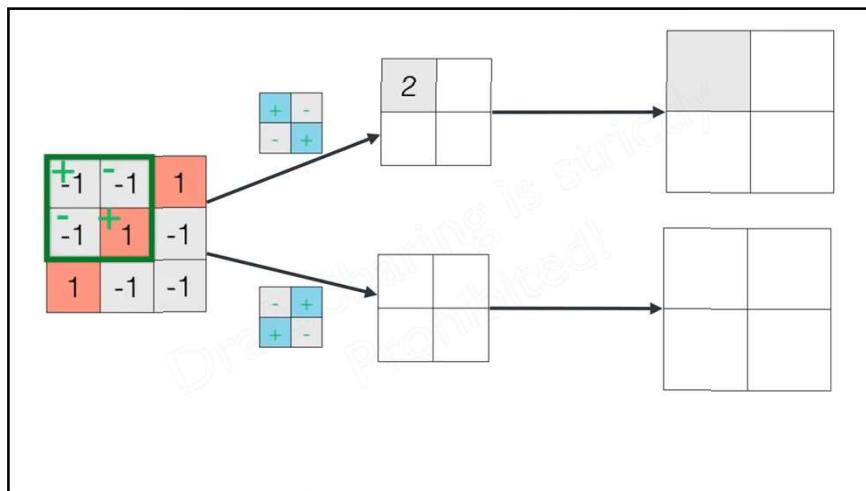
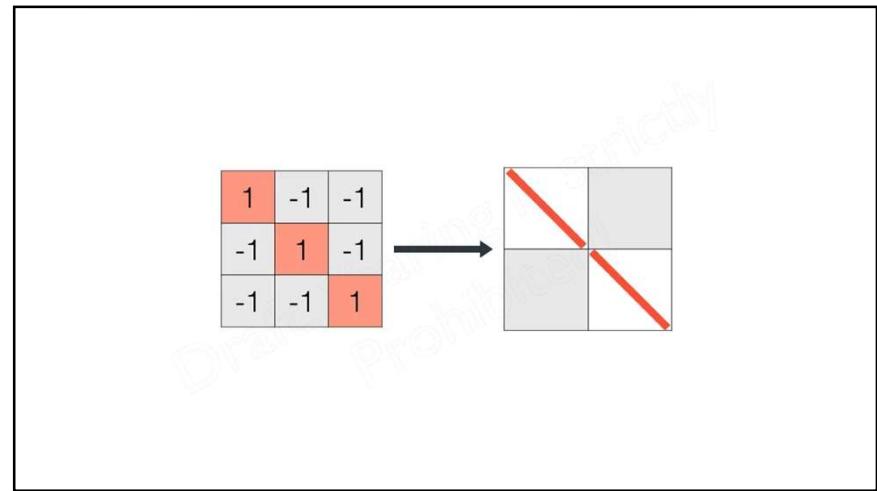
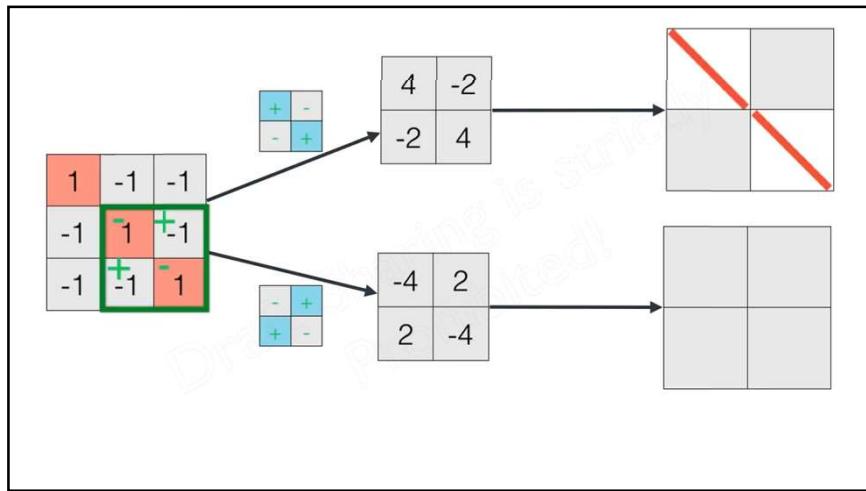


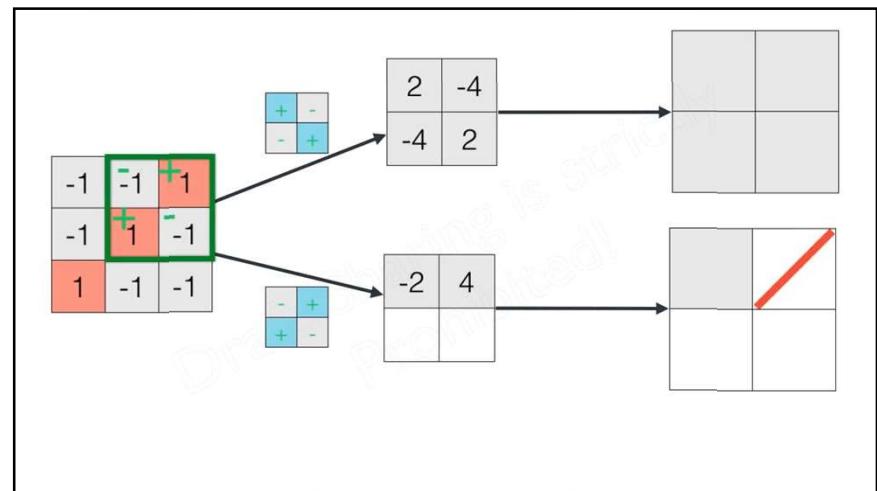
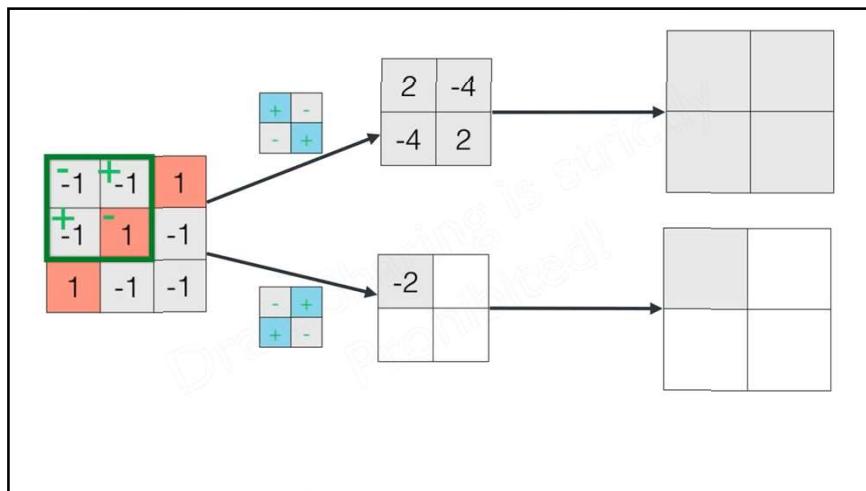
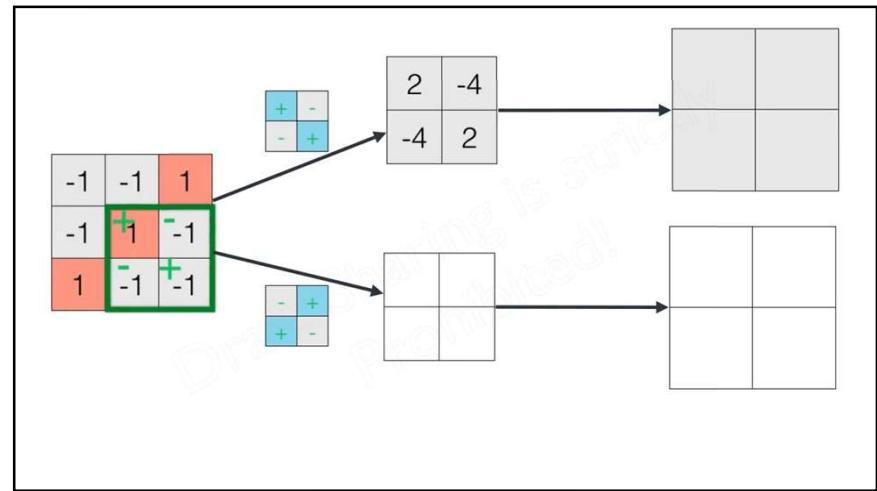
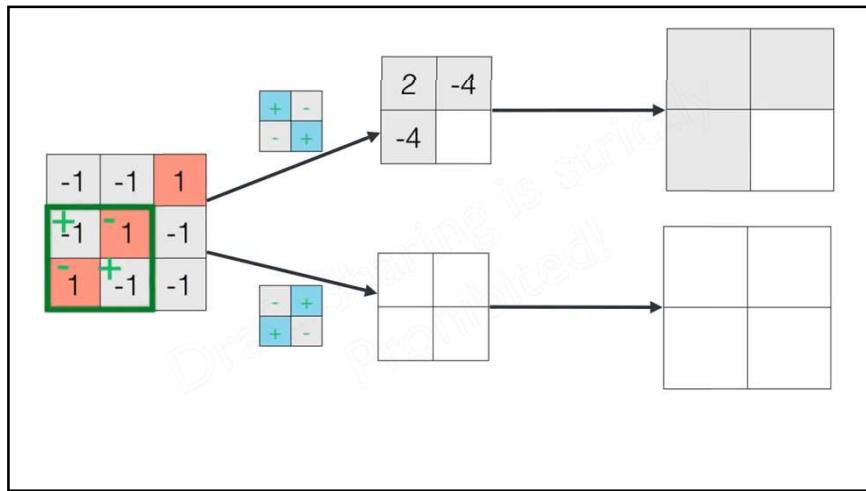


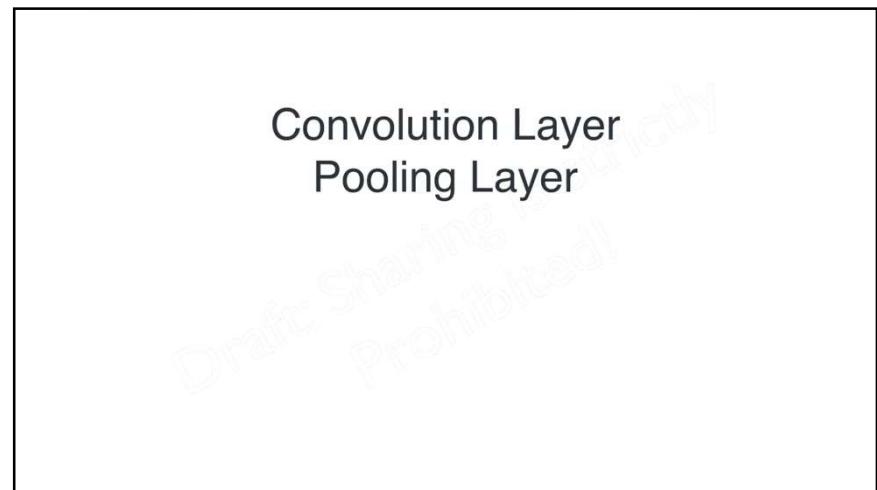
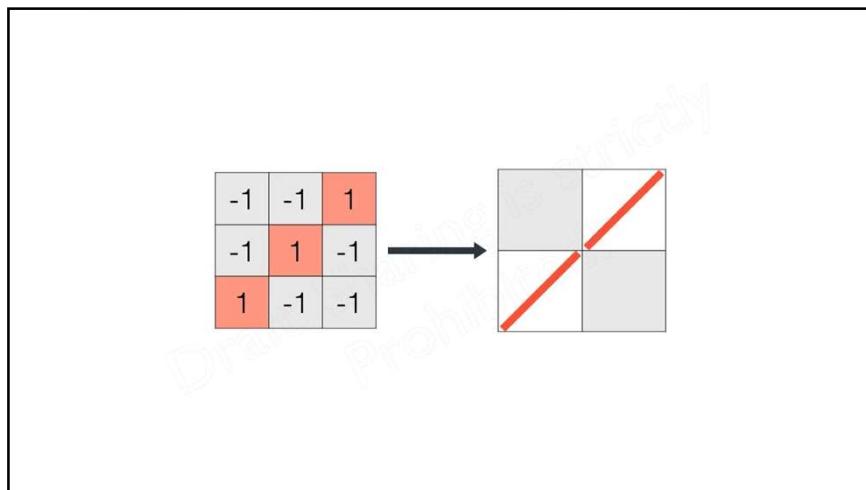
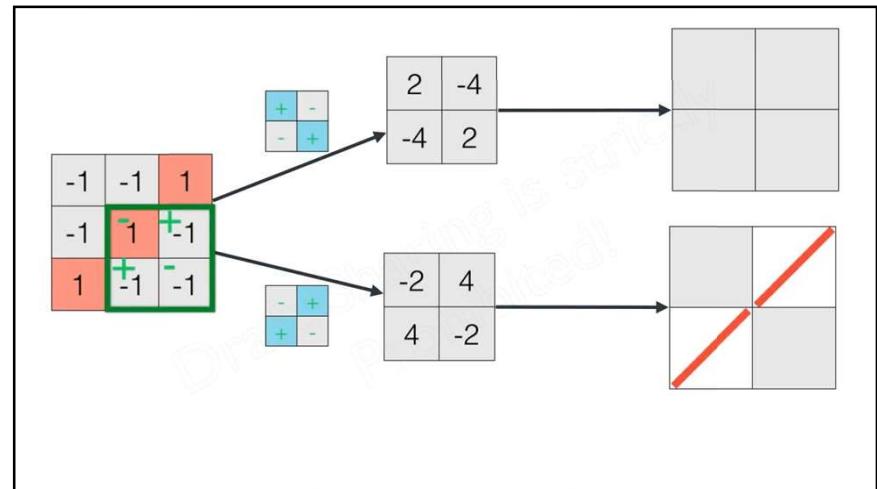
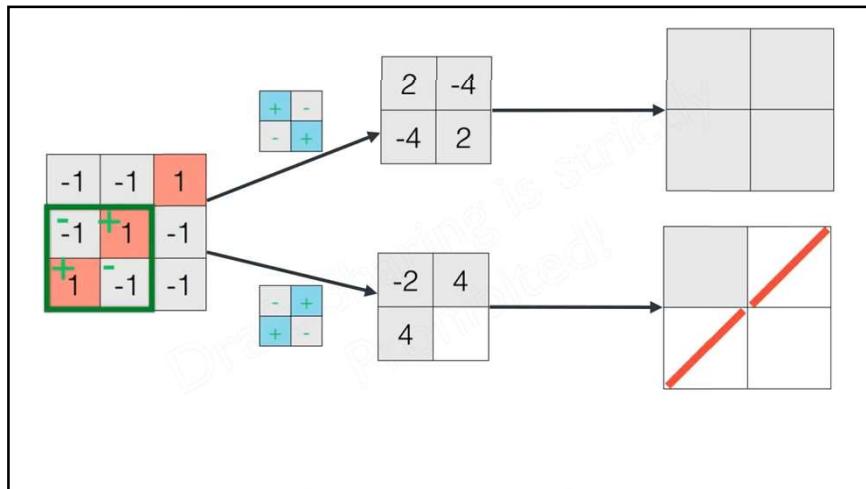












Convolution Layer Pooling layer

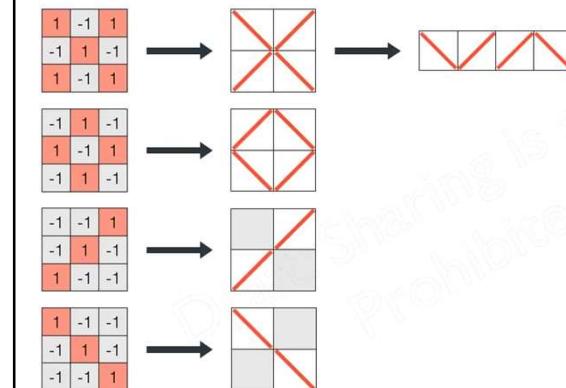
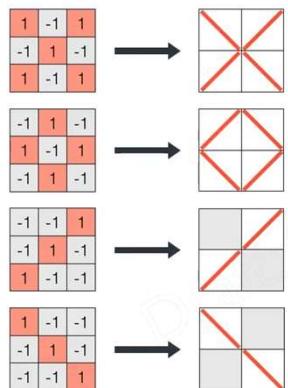
Fully Connected Layer

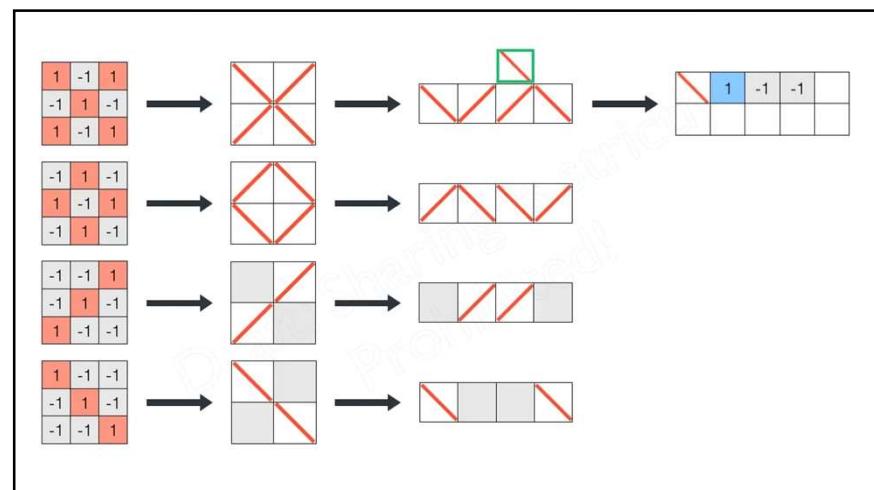
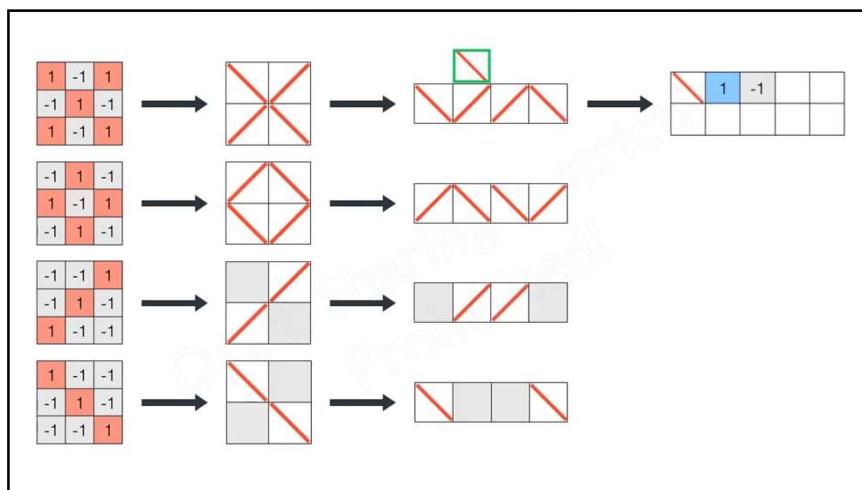
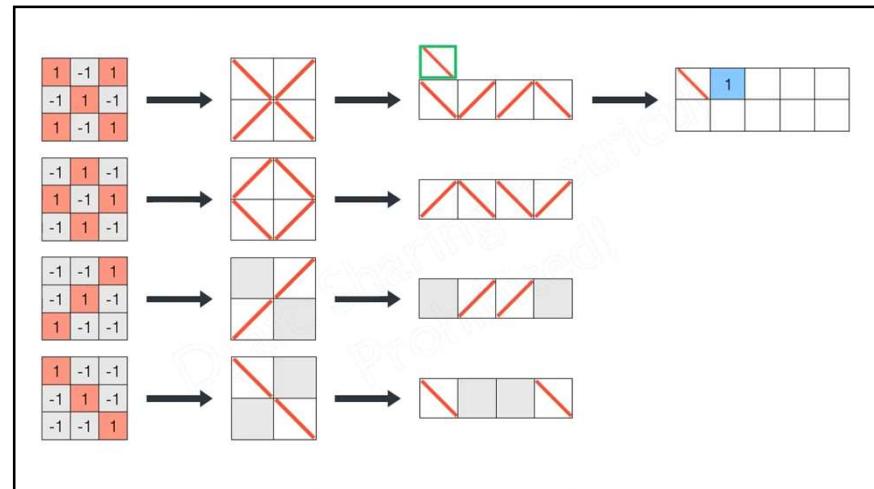
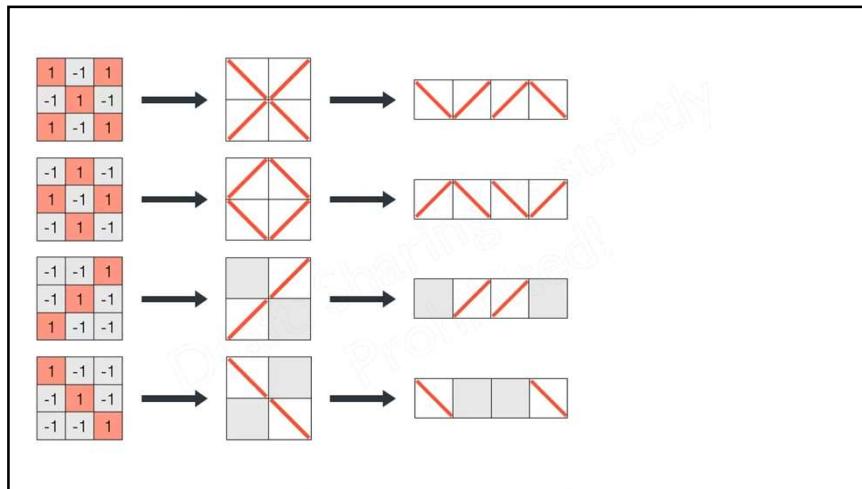
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-1	1	-1
1	-1	1

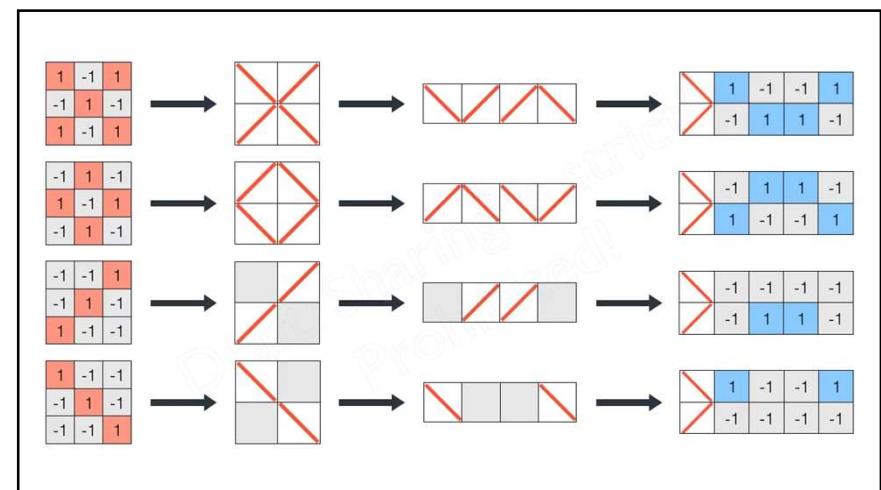
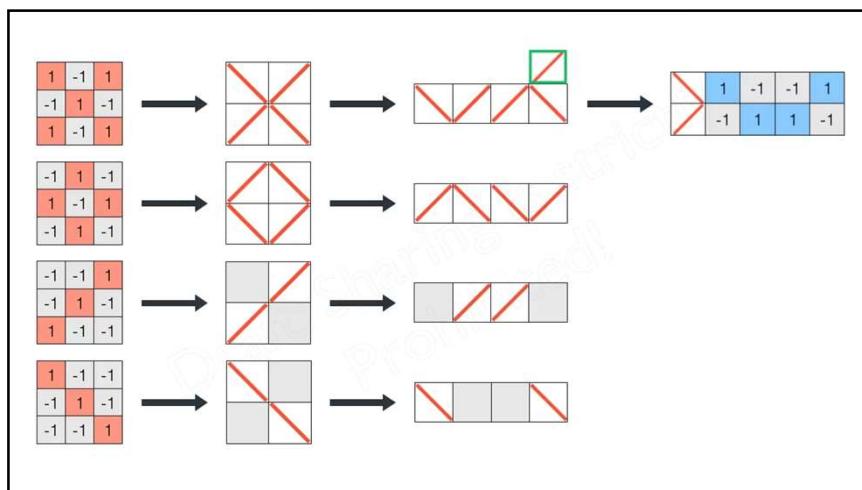
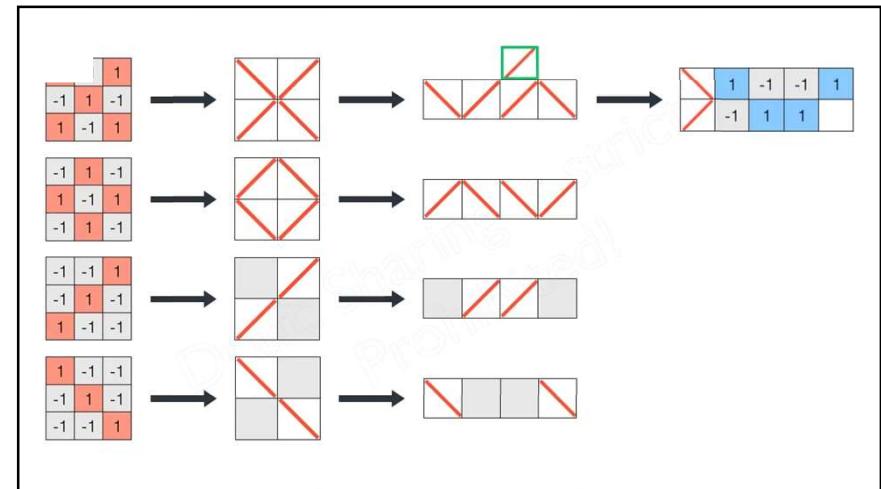
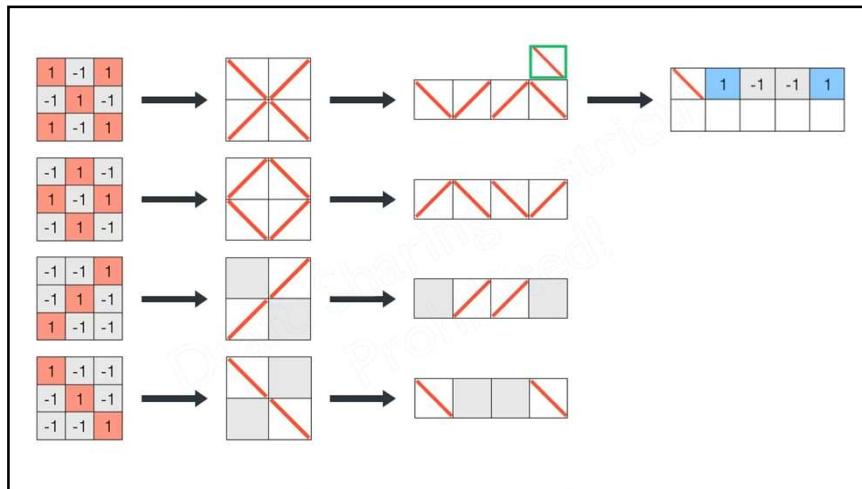
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1	-1	1
-1	1	-1

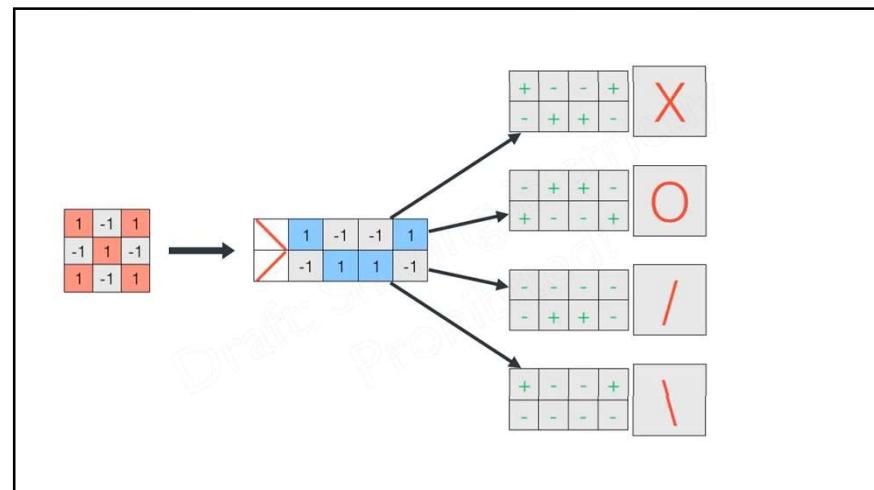
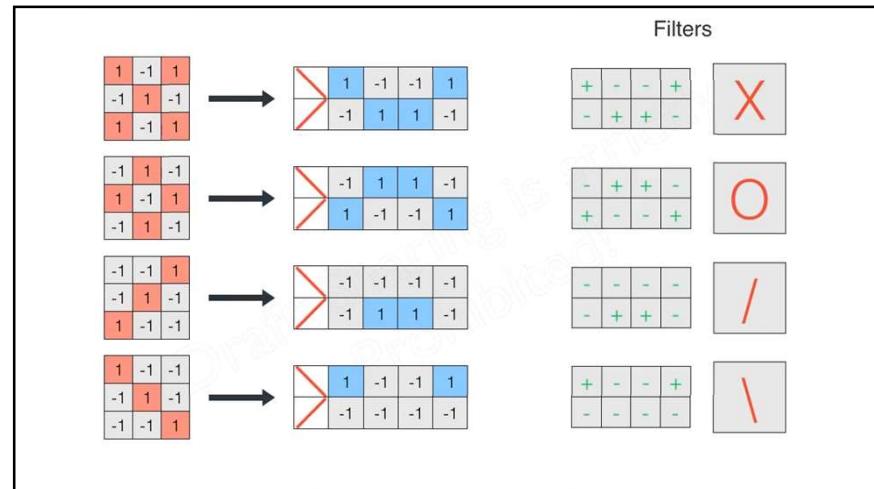
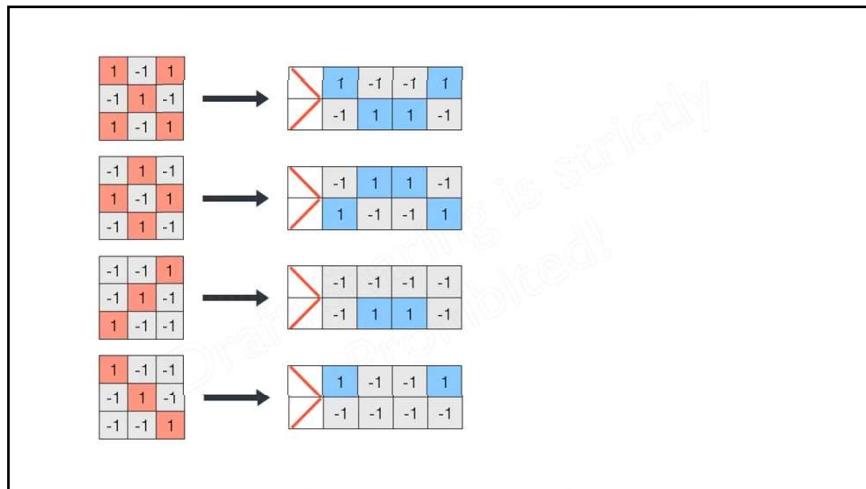
-1	-1	1
-1	1	-1
1	-1	-1

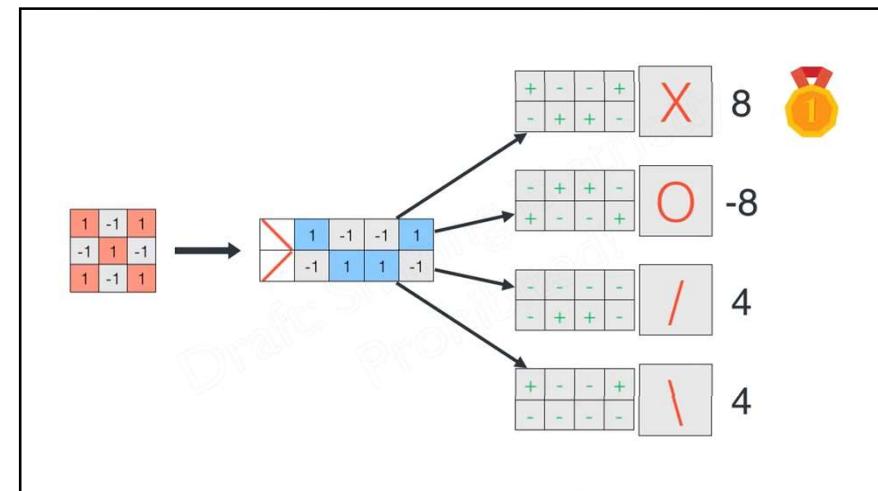
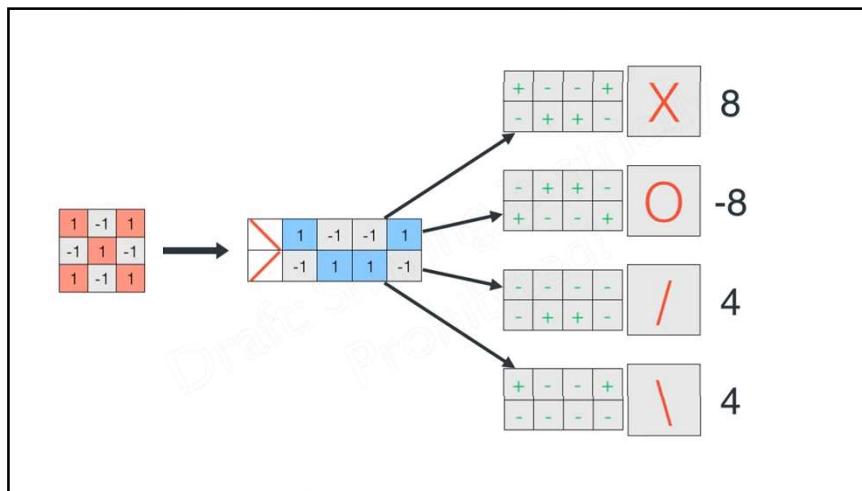
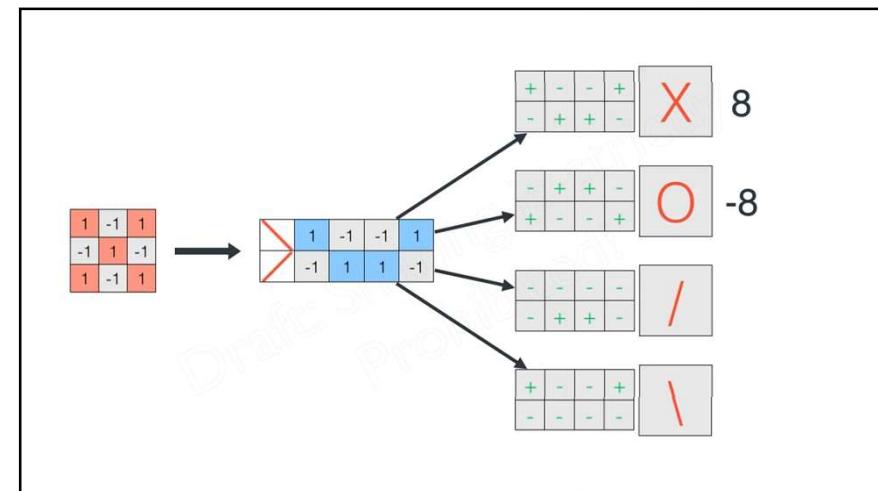
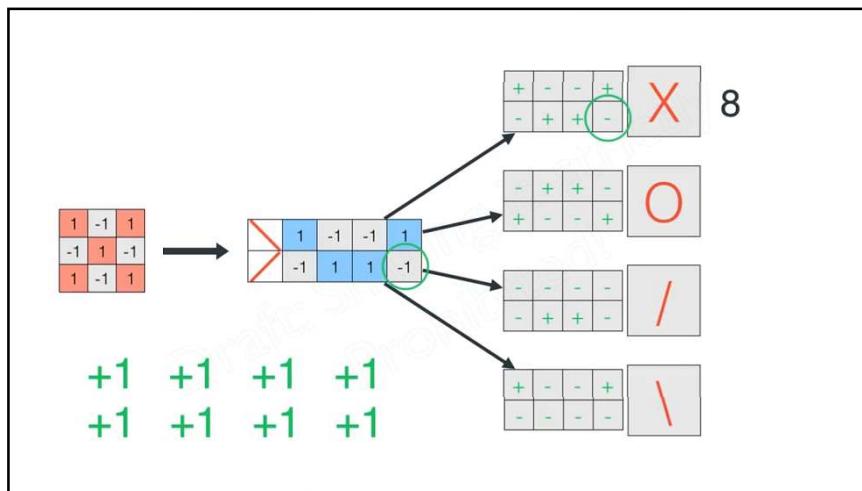
1	-1	-1
-1	1	-1
-1	-1	1

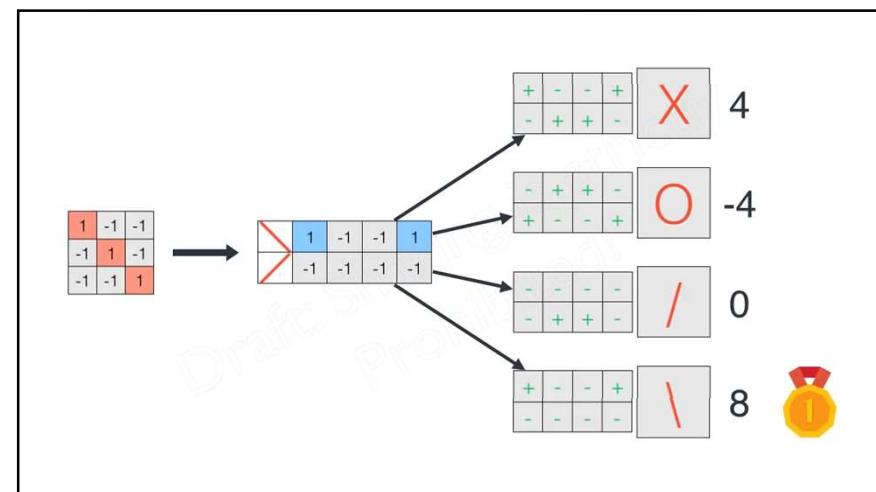
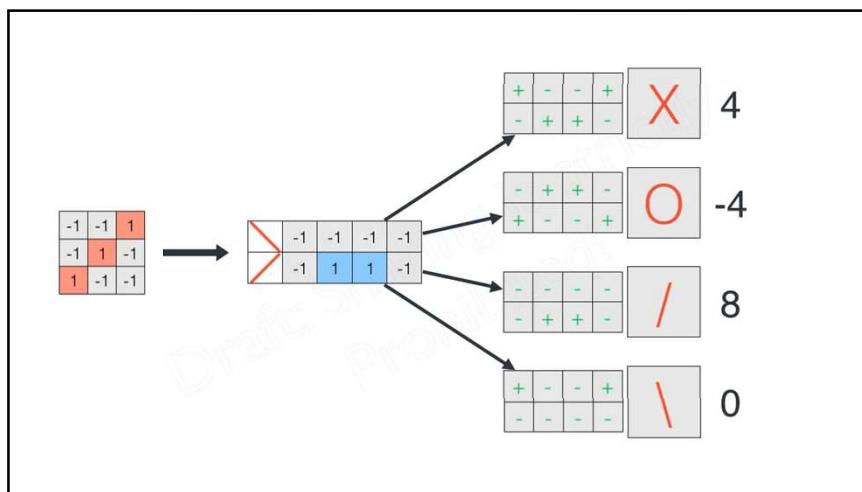
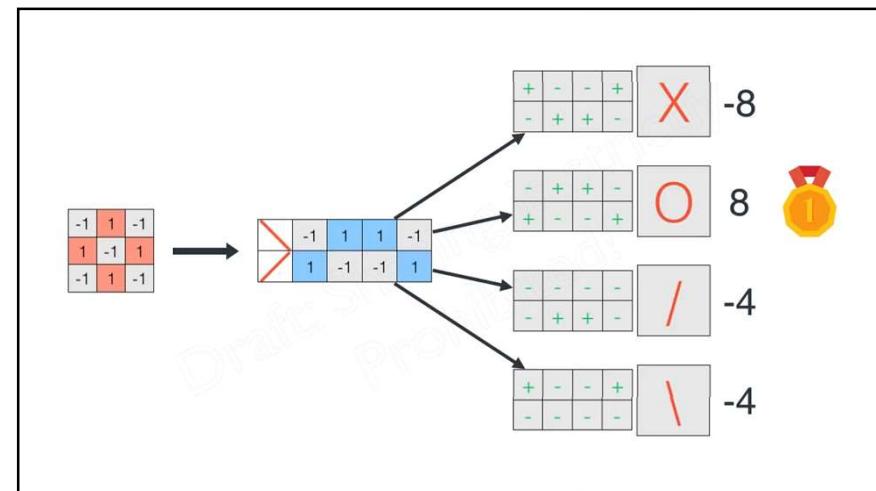
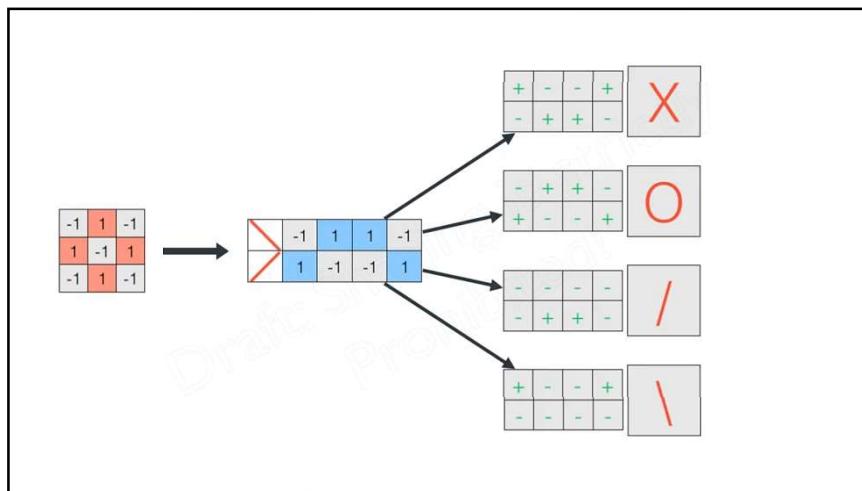












Convolutional Neural Network

$$\begin{bmatrix} 1 & -1 & 1 \\ -1 & 1 & -1 \\ 1 & -1 & 1 \end{bmatrix}$$

$$\begin{bmatrix} -1 & 1 & -1 \\ 1 & -1 & 1 \\ -1 & 1 & -1 \end{bmatrix}$$

$$\begin{bmatrix} -1 & -1 & 1 \\ -1 & 1 & -1 \\ 1 & -1 & -1 \end{bmatrix}$$

$$\begin{bmatrix} 1 & -1 & -1 \\ -1 & 1 & -1 \\ -1 & -1 & 1 \end{bmatrix}$$

Convolutional Neural Network

$$\begin{bmatrix} 1 & -1 & 1 \\ -1 & 1 & -1 \\ 1 & -1 & 1 \end{bmatrix}$$

$$\begin{bmatrix} -1 & 1 & -1 \\ 1 & -1 & 1 \\ -1 & 1 & -1 \end{bmatrix}$$

$$\begin{bmatrix} -1 & -1 & 1 \\ -1 & 1 & -1 \\ 1 & -1 & -1 \end{bmatrix}$$

$$\begin{bmatrix} 1 & -1 & -1 \\ -1 & 1 & -1 \\ -1 & -1 & 1 \end{bmatrix}$$

Convolutional Neural Network

$$\begin{bmatrix} 1 & -1 & 1 \\ -1 & 1 & -1 \\ 1 & -1 & 1 \end{bmatrix}$$

$$\begin{bmatrix} -1 & 1 & -1 \\ 1 & -1 & 1 \\ -1 & 1 & -1 \end{bmatrix}$$

$$\begin{bmatrix} -1 & -1 & 1 \\ -1 & 1 & -1 \\ 1 & -1 & -1 \end{bmatrix}$$

$$\begin{bmatrix} 1 & -1 & -1 \\ -1 & 1 & -1 \\ -1 & -1 & 1 \end{bmatrix}$$

Convolutional Neural Network

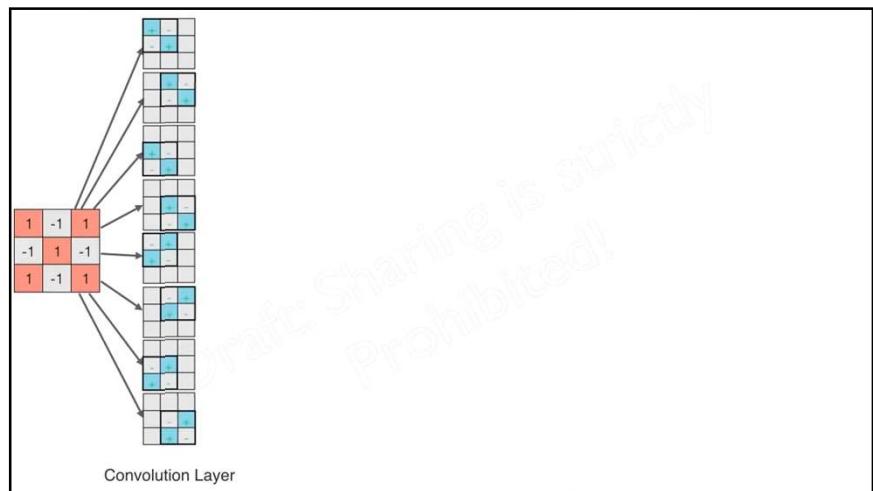
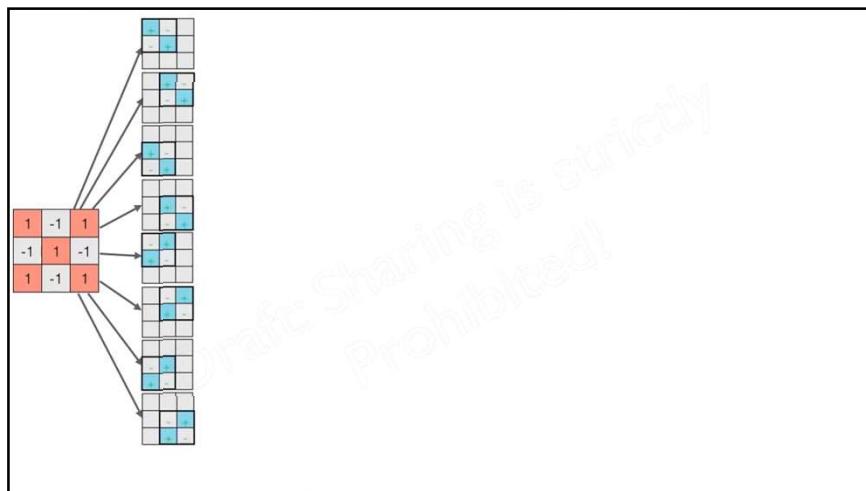
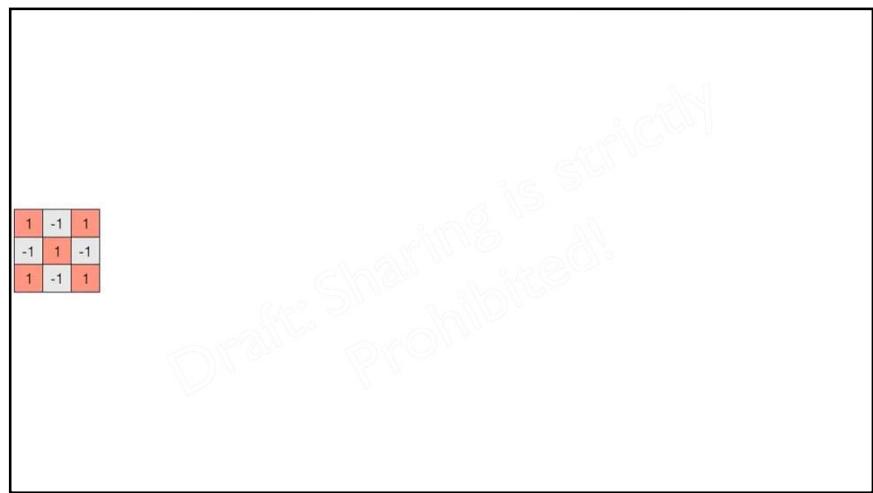
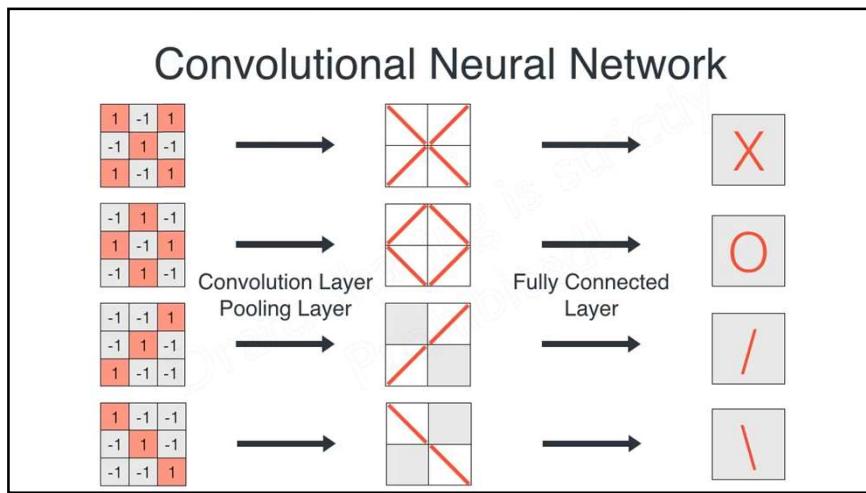
$$\begin{bmatrix} 1 & -1 & 1 \\ -1 & 1 & -1 \\ 1 & -1 & 1 \end{bmatrix}$$

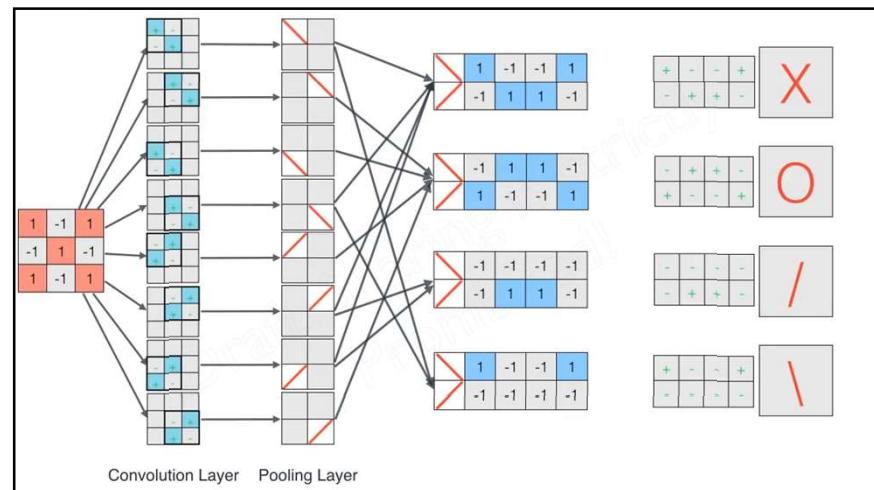
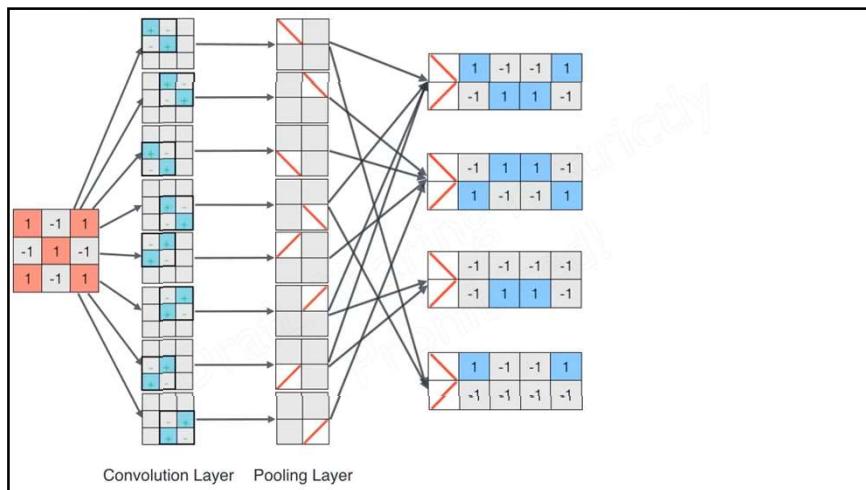
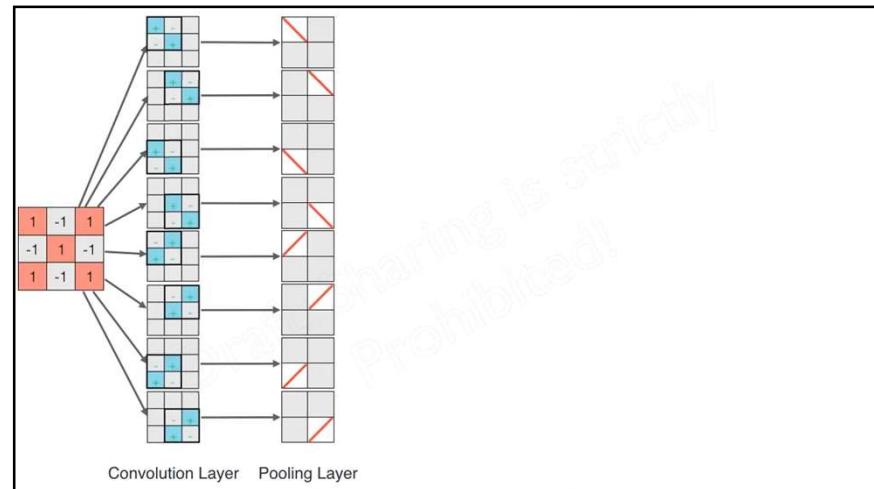
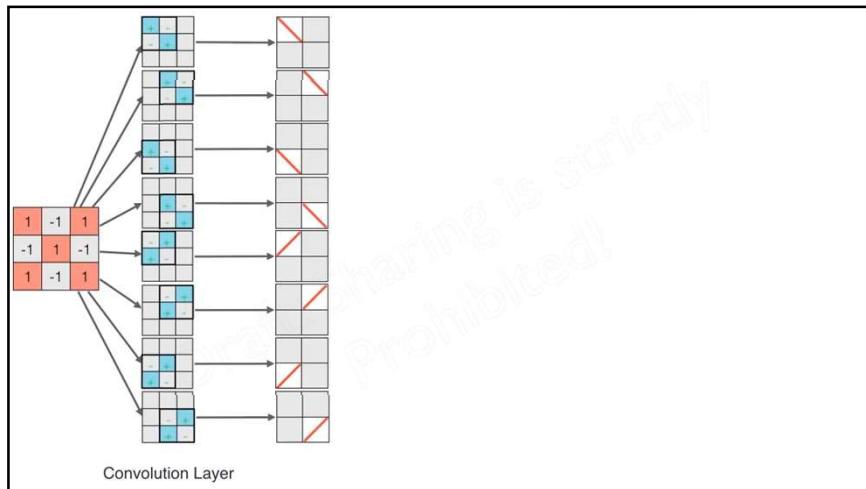
$$\begin{bmatrix} -1 & 1 & -1 \\ 1 & -1 & 1 \\ -1 & 1 & -1 \end{bmatrix}$$

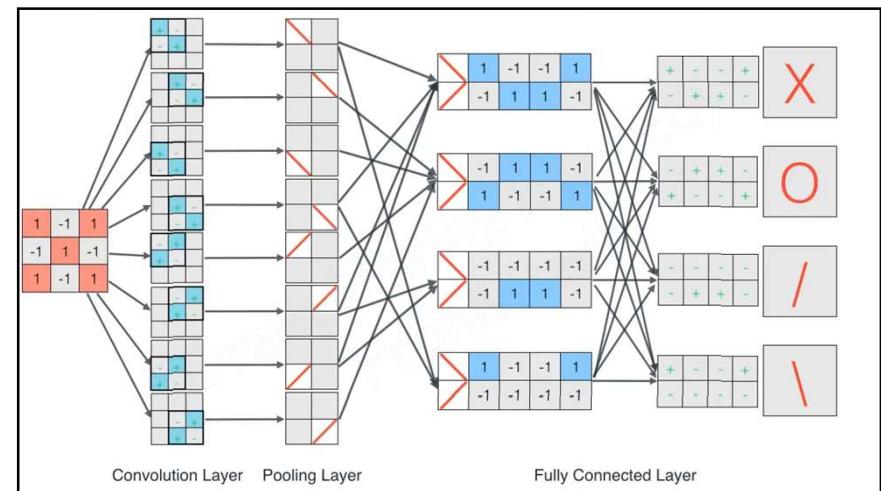
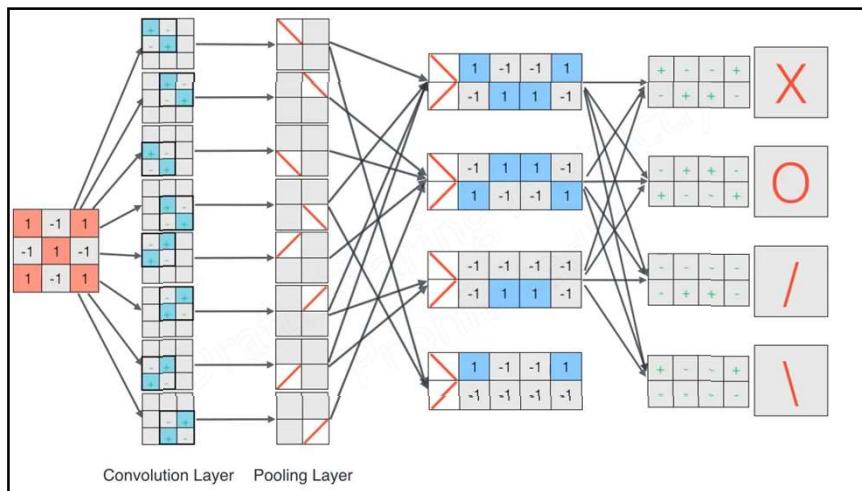
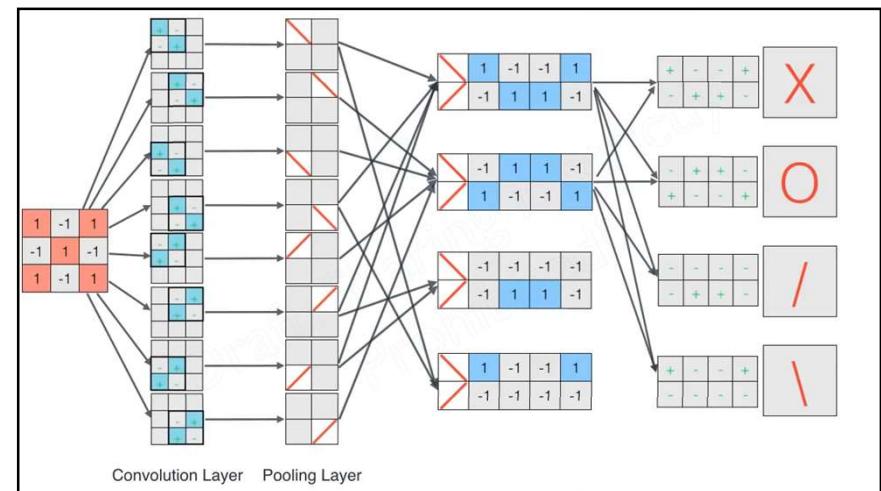
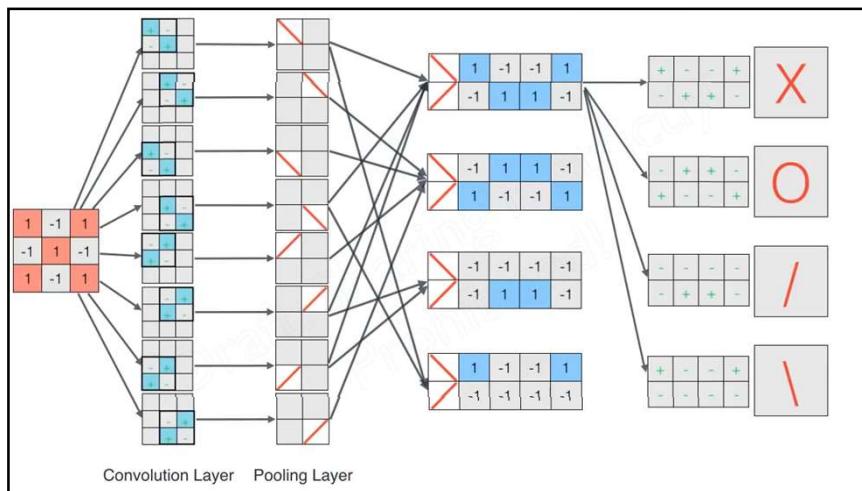
$$\begin{bmatrix} -1 & -1 & 1 \\ -1 & 1 & -1 \\ 1 & -1 & -1 \end{bmatrix}$$

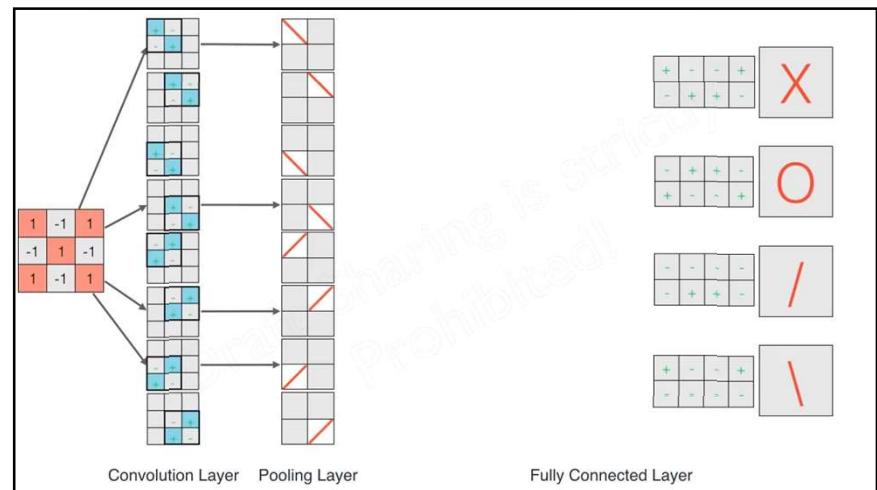
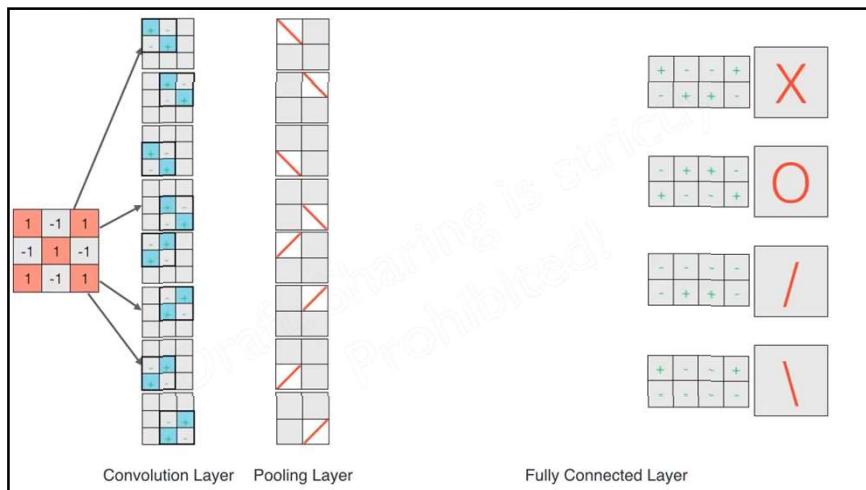
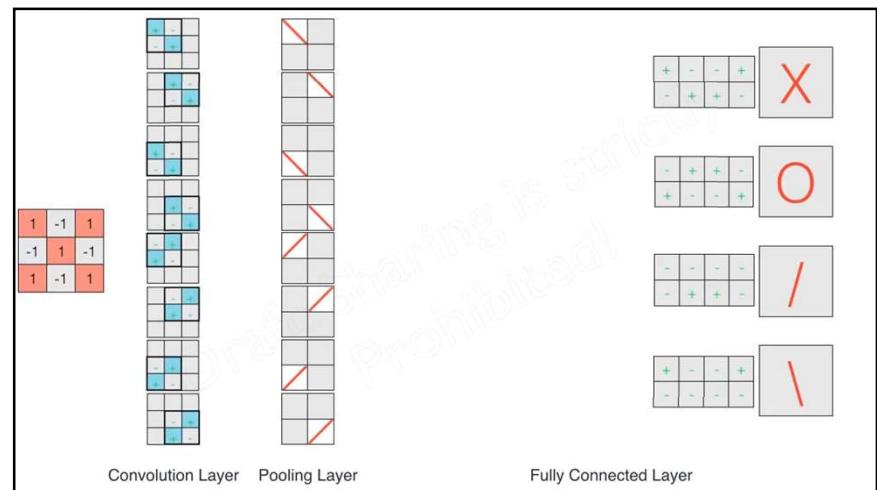
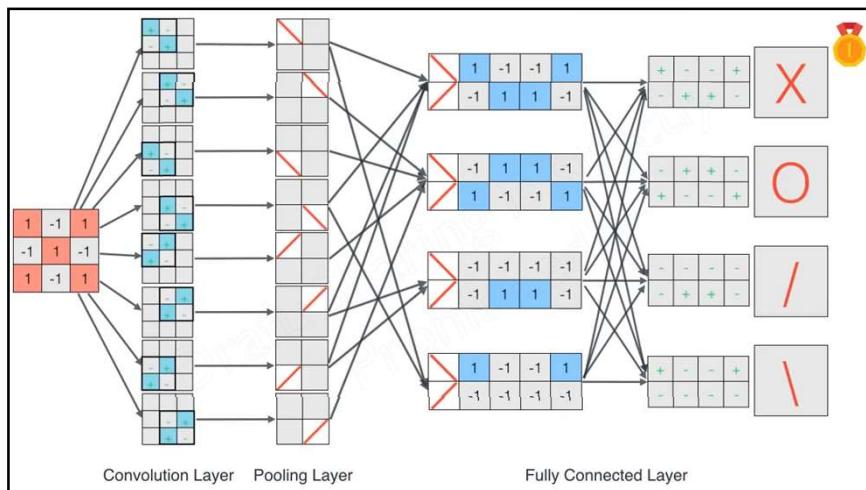
$$\begin{bmatrix} 1 & -1 & -1 \\ -1 & 1 & -1 \\ -1 & -1 & 1 \end{bmatrix}$$

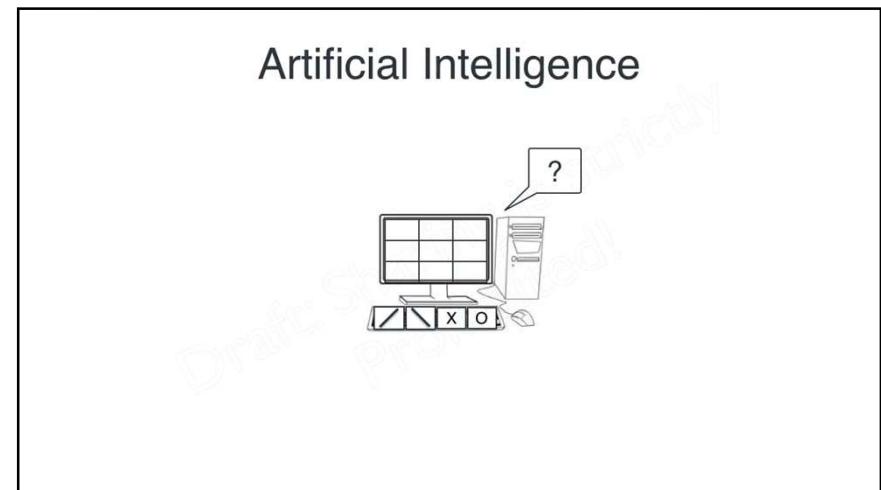
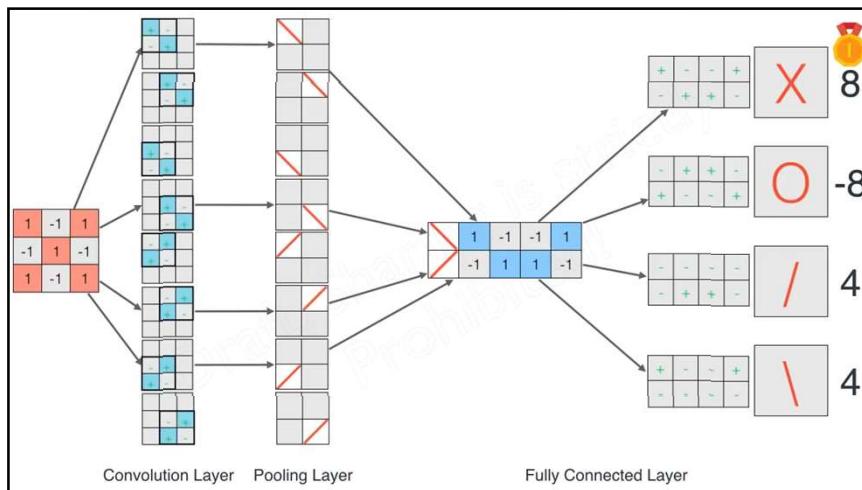
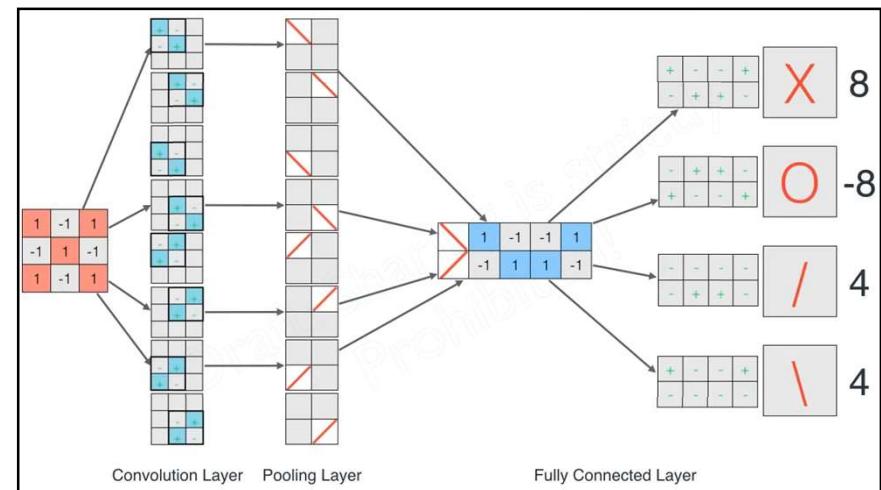
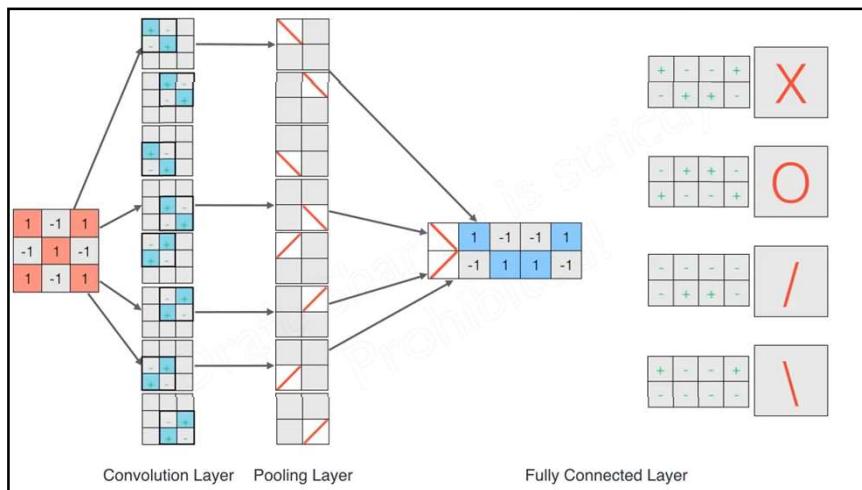
Convolution Layer
Pooling Layer



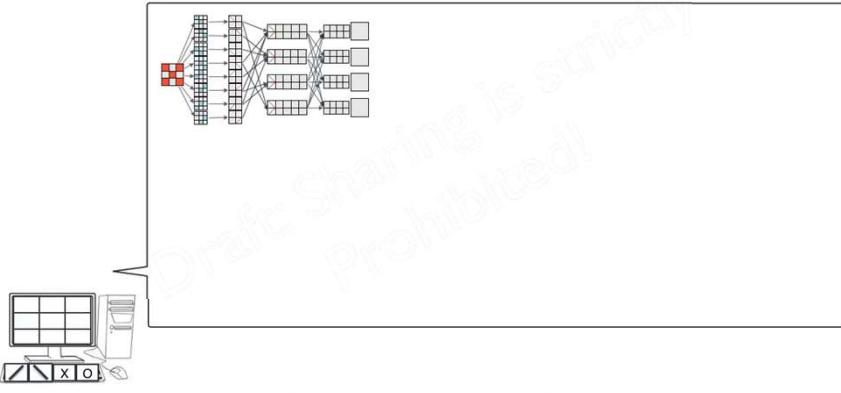




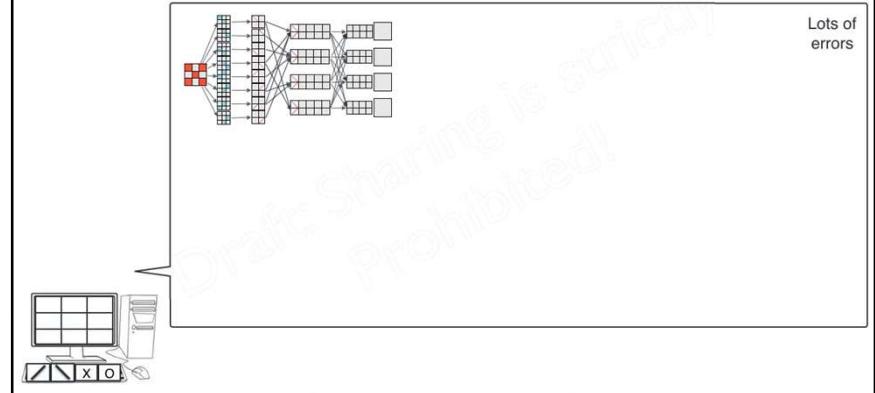




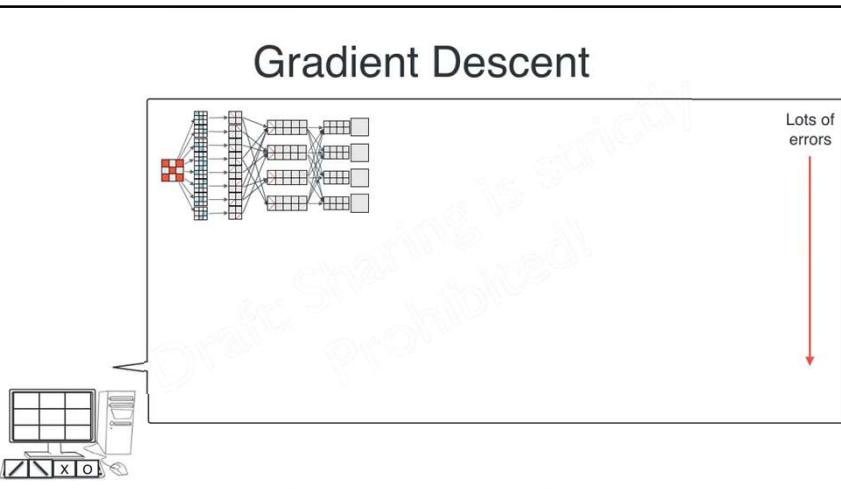
Gradient Descent



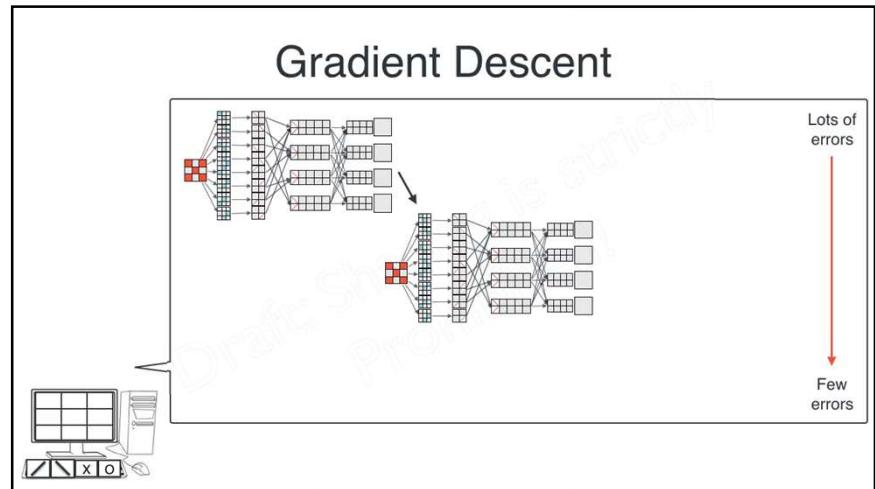
Gradient Descent

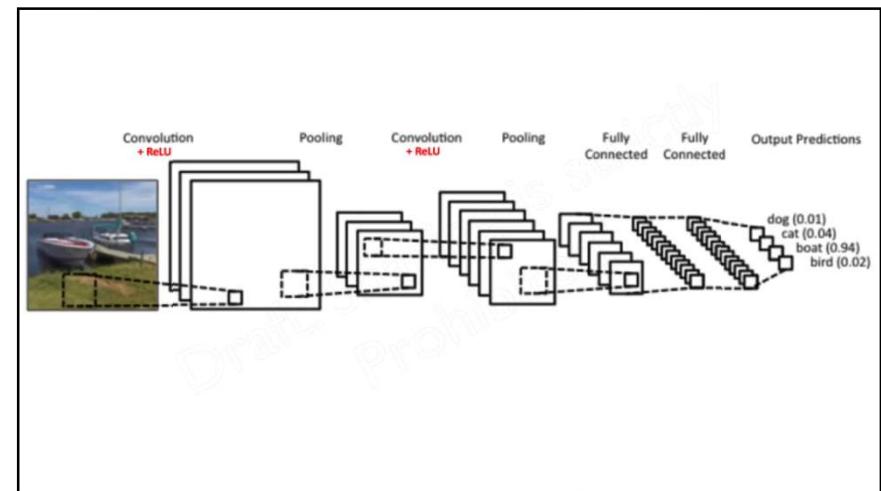
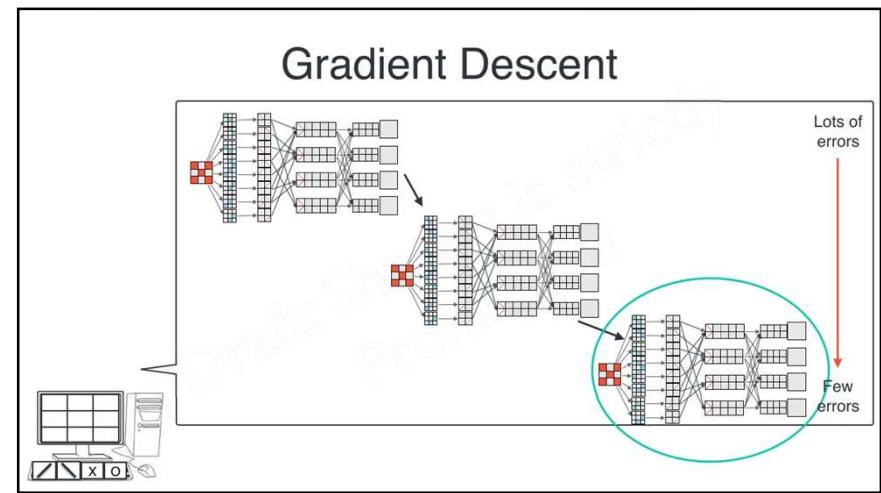
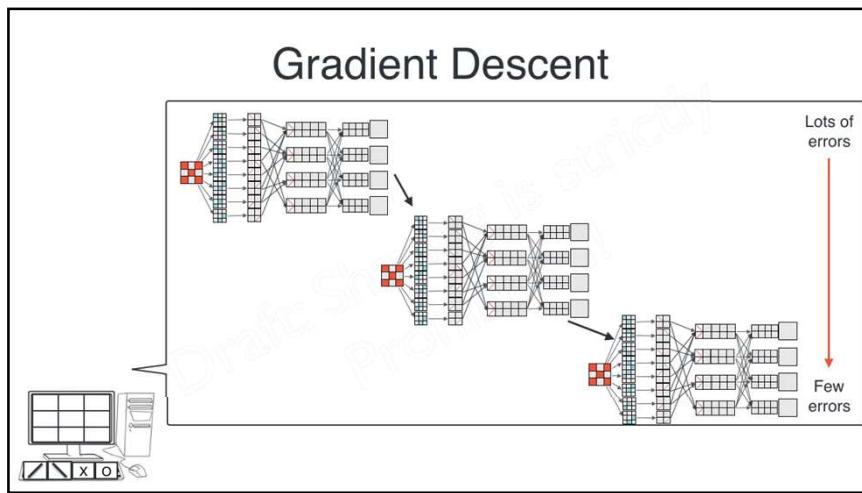


Gradient Descent

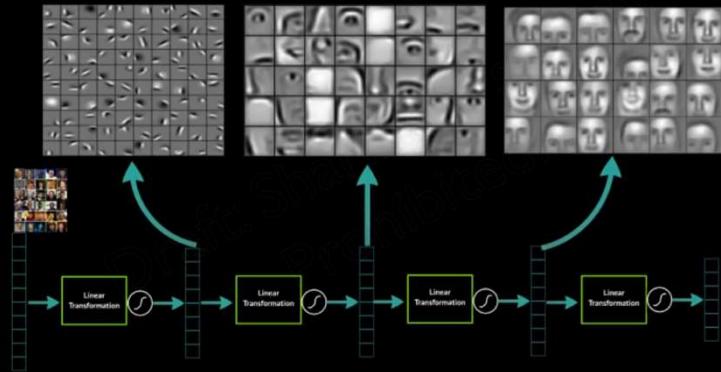


Gradient Descent





Deep Learning learns layers of features



THANK YOU!