

**From January 2020**

1) Compute the matrix resulting from the convolution between the filter and the image in the figure, with a stride of 1 and no padding.

Image				Filter	
0	1	0	0	0	1
0	1	0	0	0	1
0	1	1	1		
0	1	0	0		

2) Build a Multi-Layer Perceptron able to classify the points:  $\langle 1, 2, 0 \rangle$ ,  $\langle 3, 0, 0 \rangle$ ,  $\langle 1, 0, 1 \rangle$ ,  $\langle 2, 1, 1 \rangle$ , where the first two elements of each vectors are the feature values, and the last element is the class.

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3) Given the following dataset:  $\{ \langle 0, -2, 1 \rangle, \langle 1, 0, 1 \rangle, \langle -1, 3, 1 \rangle, \langle 2, 3, 0 \rangle, \langle -1, 2, 0 \rangle \}$ , where the last element of each vector is its class, construct a multi-layer perceptron that classifies the dataset, and draw its diagram (nodes and edges with corresponding weights).

4) Derive the update rule of the *output* neurons of a multi-layer perceptron according to the algorithm Backpropagation of Errors.