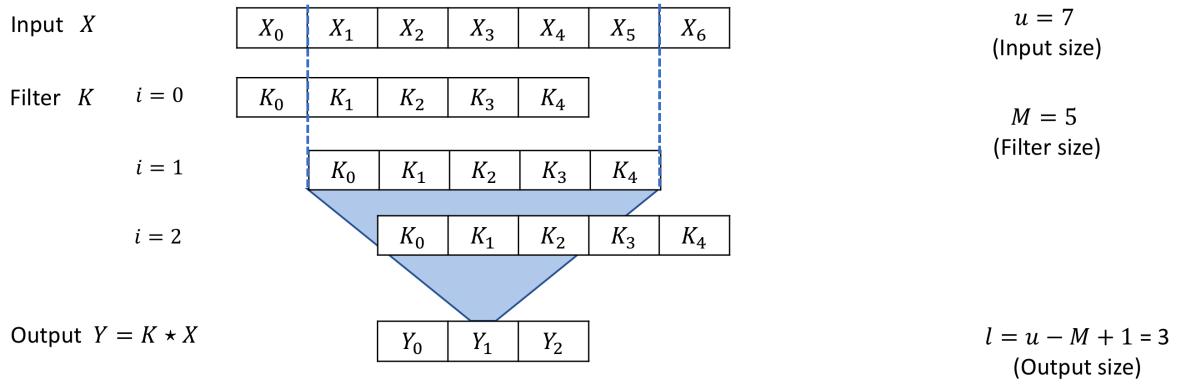


Formulas for Cross-Correlation

Please beware that the cross-correlation (denoted \star) indices are different for the 3 padding modes since the filter starts sliding over the input at different positions of the input, as illustrated below. The formulas for the 2D or 3D cases are analog.

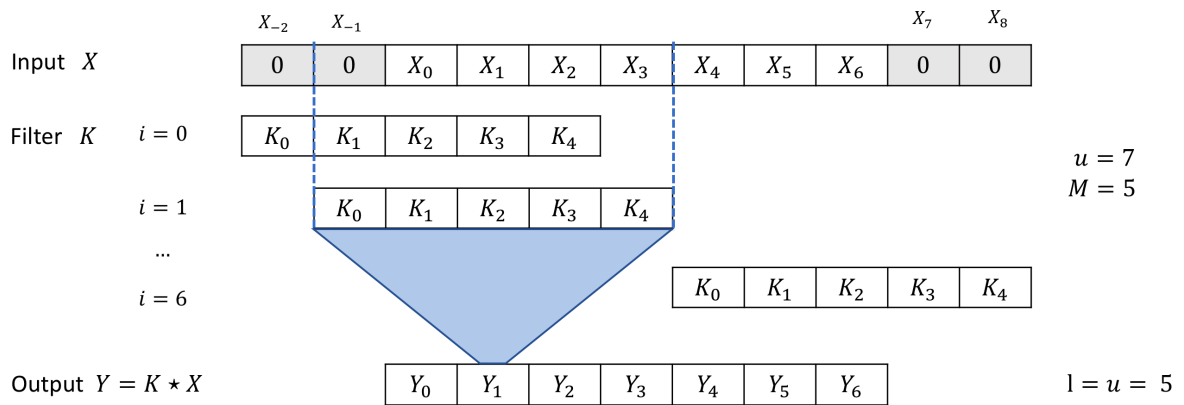
Valid Padding



$$Y_i = \sum_{m=0}^{M-1} K_m X_{i+m}$$

e.g. $Y_1 = K_0 X_1 + K_1 X_2 + K_2 X_3 + K_3 X_4 + K_4 X_5$

Same Padding

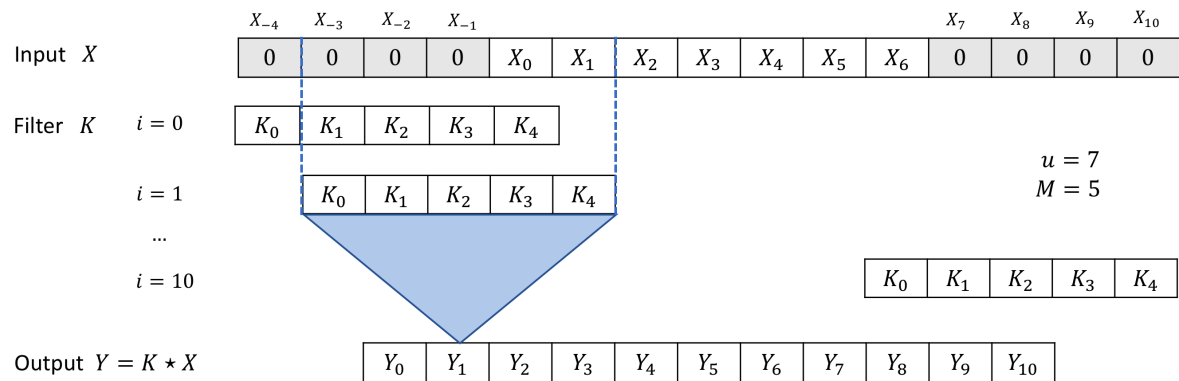


$$Y_i = \sum_{m=0}^{M-1} K_m X_{i+m-\frac{M}{2}}$$

Cut off decimal! $\frac{M}{2} = \frac{5}{2} = 2$

e.g. $Y_1 = K_0 X_{-1} + K_1 X_0 + K_2 X_1 + K_3 X_2 + K_4 X_3$

Full Padding



$$Y_i = \sum_{m=0}^{M-1} K_m X_{i+m-(M-1)}$$

e.g. $Y_1 = K_0 X_{-3} + K_1 X_{-2} + K_2 X_{-1} + K_3 X_0 + K_4 X_1$ $l = M + u - 1 = 11$

For **Convolution** (denoted $*$) the formulas are as follows:

Valid padding

$$Y_i = \sum_{m=0}^{M-1} K_m X_{i-m+(M-1)}$$

Same Padding

$$Y_i = \sum_{m=0}^{M-1} K_m X_{i-m+\frac{M}{2}}$$

Full Padding

$$Y_i = \sum_{m=0}^{M-1} K_m X_{i-m}$$

Note that cross-correlation corresponds to convolution with a flipped filter.