$$(f * g)(t) = \sum_{\tau=-\infty}^{+\infty} f(t-\tau)\, g(\tau) = \sum_{\tau=0}^{k-1} f(t-\tau)\, g(\tau) + \sum \underset{\text{elsewhere } \tau<0 \text{ or } \tau \geq k}{f(t-\tau)\, g(\tau)}$$

$$= \sum_{\tau=0}^{k-1} f(t-\tau) \quad \Rightarrow \quad g(\tau) = \begin{cases} \frac{1}{k}, & \text{for } \tau = 0, 1, \ldots, k-1 \\ 0, & \text{otherwise} \end{cases}$$

k

g is the kernel/filter