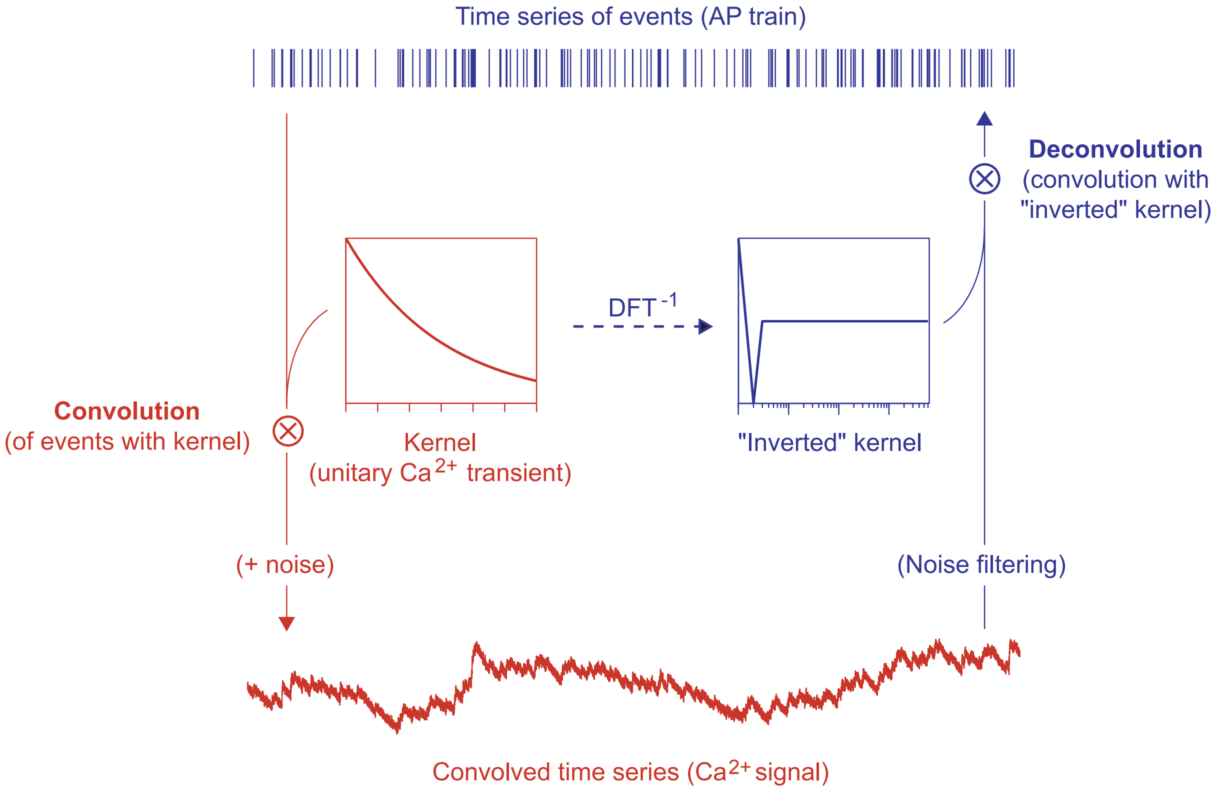

Supplementary Figure 1 | Principle underlying the reconstruction of AP firing from Ca^{2+} signals by temporally deconvolved Ca^{2+} imaging (TDCa imaging). Under the assumption that each AP evokes a unitary, usually exponentially decaying, Ca^{2+} transient, the time-varying neuronal Ca^{2+} signal can be approximated by a convolution of a time series of instantaneous events (APs) with a kernel describing the Ca^{2+} transient plus noise (red). The AP train may thus be reconstructed from the measured Ca^{2+} signal using the inverse operation called deconvolution or inverse filtering (blue). Deconvolution is the convolution with a kernel obtained by inverting the discrete Fourier transform (DFT) of the original kernel. In commercially available software packages, deconvolution may be implemented using slightly different, but practically equivalent, procedures. To deconvolve realistic Ca^{2+} signals, it is likely that high-frequency noise, particularly shot noise, has to be attenuated by filtering. Such filtering may be performed before the deconvolution (as in this study), or it may be achieved by modifications of the deconvolution kernel.