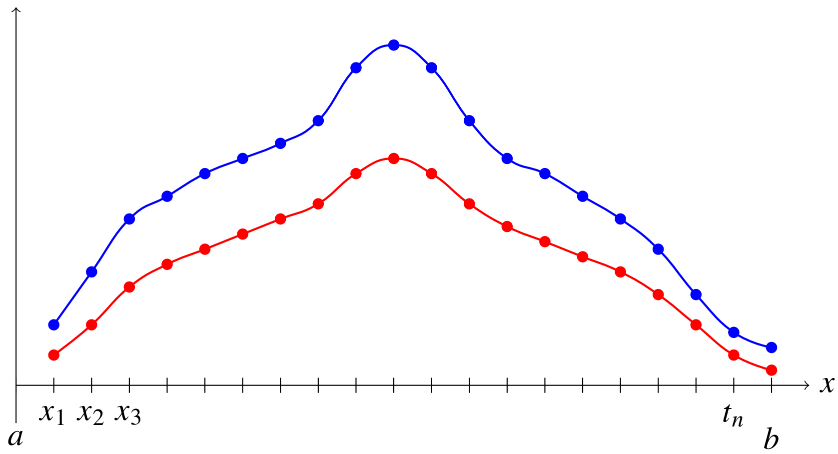
1 A bit of signal analysis

Let $\varphi(t), \phi(t)$ be two continuous signals which are discretely sampled under some sampling frequency f_s. Assume the discrete sampling of these functions produces n points, so that each function is discretely represented by n-dimensional vectors $[\varphi_1, \ldots, \varphi_n]$, $[\phi_1, \ldots, \phi_n]$.



Therefore, the inner product of these signals converges to their convolution:

$$
\begin{aligned}
\lim_{f_s\to\infty} \vec{\varphi} \cdot \vec{\phi} &= \lim_{f_s\to\infty} \sum_{i=1}^{n} \varphi_i \phi_i \\
&= \lim_{f_s\to\infty} \sum_{i=1}^{n} \varphi(t_i)\phi(t_i) \\
&= \int_{t_1}^{t_n} \varphi(t)\phi(t)\; dt
\end{aligned}
$$