

Shift-invariant Kernels
$$k(\mathbf{x}-\mathbf{x}') = \langle \phi(\mathbf{x}), \phi(\mathbf{x}') \rangle_{\mathcal{H}} \approx \mathbf{z}(\mathbf{x}')^{\top} \mathbf{z}(\mathbf{x}')$$

Q-samples $oldsymbol{\omega} \sim p(oldsymbol{\omega})$ $b \sim \mathrm{U}(0,2\pi)$ $k(\mathbf{x} - \mathbf{x}') = \int_{\mathbb{R}_{ ilde{O}}} p(oldsymbol{\omega}) \exp(ioldsymbol{\omega}^ op(\mathbf{x} - \mathbf{x}')) doldsymbol{\omega} = \mathbb{E}_{oldsymbol{\omega}}ig\{ \exp(ioldsymbol{\omega}^ op \mathbf{x}) \exp(-ioldsymbol{\omega}^ op \mathbf{x})ig\}$

Localities and translation

equivariance

$$\mathbf{F}_l = z(\mathbf{F}_{l-1}) = \cos\left(rac{\mathbf{W}_l}{\Delta_l}\otimes\mathbf{F}_{l-1} + \mathbf{b}_l
ight)$$

 $z(\mathbf{x}) = \sqrt{rac{2}{Q}ig[\cos(oldsymbol{\omega}_1^ op \mathbf{x} + b_1), \ldots, \cos(oldsymbol{\omega}_Q^ op \mathbf{x} + b_Q)ig]^ op}$