3. Hodge-compositional Gaussian processes

GPs on graphs

Modeling node functions

GPs from Euclidean to non-Euclidean

GP in Euclidean settings

Function on a set $f : X \to \mathbb{R}$

$$f \sim \mathrm{GP}(\mu, k)$$

- Predictive distribution $f_{|\mathbf{y}}$
- Matérn GP family, e.g., diffusion

$$k(x, x') = \sigma^2 \exp\left(-\frac{d(x, x')^2}{2\kappa^2} \right)$$

- Distance-based: geometry-aware, but not well-defined for manifolds, graphs …
- Instead, as solutions of SDEs (Whittle (1963); Lindgren et al. (2011))

$$\left(\frac{2\nu}{\kappa^2} - \Delta \right)^{\frac{\nu}{2}+\frac{d}{4}} f = w$$

- Δ: Laplacian, w: white noise
- implicit, generalizable, domain-aware
- explicit for some domains