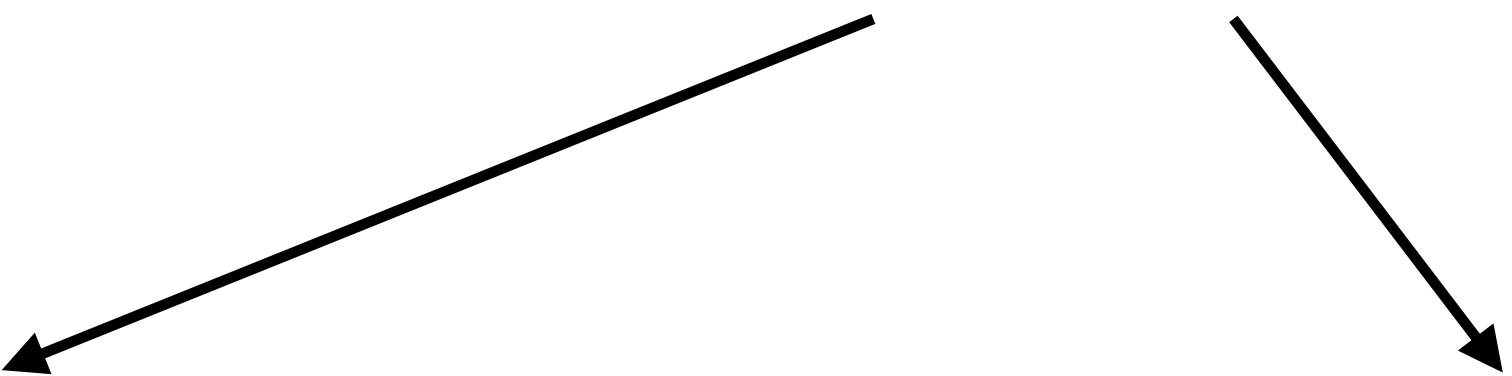


# Reparameterization Trick

Reparameterization expresses the new GP mean with the included  $x^{n+1}$  data point  $\mu_y^{n+1}(x)$  using the old GP mean  $\mu_y^n(x)$

$$\mu_y^{n+1}(x) = \mu_y^n(x) + \tilde{\sigma}_y^n(x, x^{n+1}) Z_y, \quad Z_y \sim \mathcal{N}(0,1),$$
Two arrows originate from the equation above. One arrow points from the term  $\mu_y^n(x)$  down to the text 'Reparameterized covariance coefficient of x, x^{n+1}'. The other arrow points from the term  $Z_y$  down to the text 'Introduces randomness to GP posterior sampling'.

Reparameterized covariance coefficient of  $x, x^{n+1}$

$$\tilde{\sigma}_y^n(x, x^{n+1}) = \frac{k_y^n(x, x^{n+1})}{\sqrt{k_y^n(x^{n+1}, x^{n+1}) + \sigma_\epsilon^2}}$$

Introduces randomness to GP posterior sampling

**Notice the new posterior mean is a linear function of  $Z_y$**

# Discretization and Linear-Envelope - 1

Scott et al 2011

The domain  $X$  is discretized into a finite set  $X_j \{x_1, x_2, \dots, x_J\}$

