# Gaussian Processes

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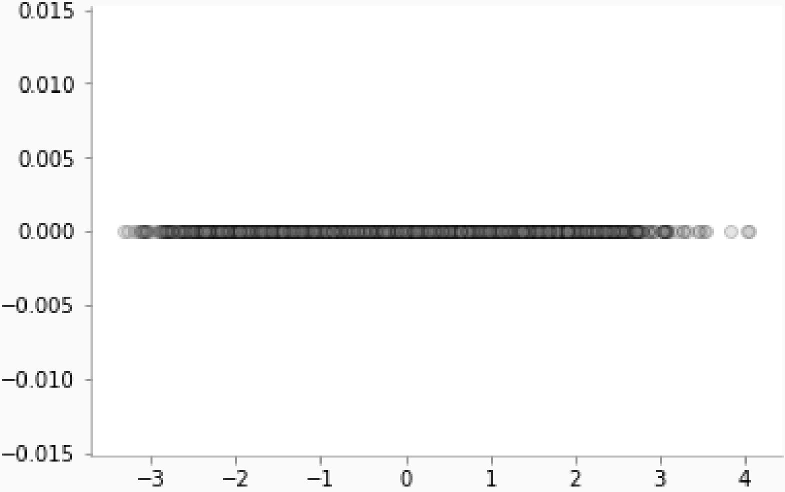
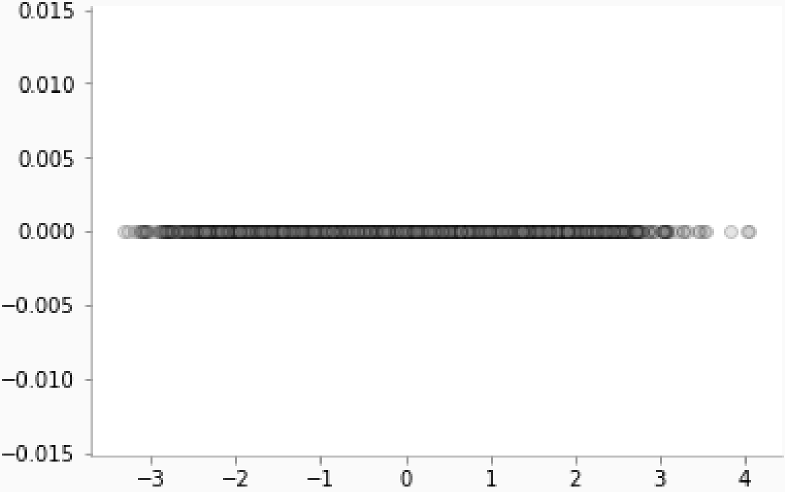
# Gaussian Distribution

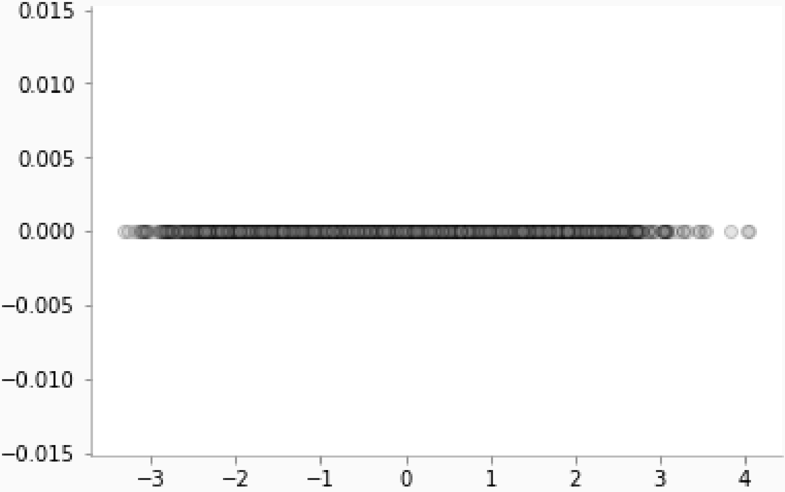
# 1d Gaussian Scatter Plot



# 1d Gaussian Histogram



# Varying 1d Gaussian Variance



# Bi-variate Gaussian

$$\begin{pmatrix} X_1 \\ X_2 \end{pmatrix} \sim \mathcal{N}\left(\begin{pmatrix} \mu_1 \\ \mu_2 \end{pmatrix}, \begin{pmatrix} a & \rho \\ \rho & b \end{pmatrix}\right)$$

# Cholesky Decompostion I

$$\mathsf{A} = \mathsf{L}\mathsf{L}^T$$

where L is a real lower triangular matrix.

We can thus re-write the posterior mean and covariance as:

$$\begin{aligned} p(y_*|X_*, X, y) &\sim \mathcal{N}(\mu', \Sigma') \\ K &= LL^T \end{aligned}$$

# Cholesky Decomposition II

$$\alpha = K^{-1}(x - \mu)$$
$$or, \alpha = {LL^{T}}^{-1}(x - \mu)$$
$$or, \alpha = L^{-T}L^{-1}(x - \mu)$$
$$Let, K^{-1}(x - \mu) = \beta$$
$$Thus, L^{-T}L^{-1}(x - \mu) = \beta$$
$$Let, L^{-1}(x - \mu) = \gamma$$
$$Thus, L\gamma = x - \mu$$
$$Thus, \gamma = L \setminus (x - \mu)$$
$$Thus, \alpha = L^{T} \setminus (L \setminus (x - \mu))$$