Method

Simulation-based inference neural networks require two important inputs: Waveform models and prior constraints on model parameters.

We sample parameters from the prior and utilise the waveform models to create simulated data.

This data is passed into a normalising flow neural network, learning the association between the data and the parameters.

The neural network learns how to do statistical inference, thus we are creating a density estimator.

The density estimator is then used on empirical data to derive the posterior distribution.

Normalising Flows

Normalising flows are probabilistic models, enabling complex transformations of simple probability distributions.

We are then able to transform a base distribution \( x \) into a more complicated one \( z \) using a series of invertible, differentiable functions \( f \).

Multiple spline functions \( j \) are chained together to model the complex distribution and enable density estimation.

\[
x_0 \xrightarrow{f_1(z_0)} x_1 \xrightarrow{f_2(z_1)} \cdots \xrightarrow{f_k(z_k)} z = X_k
\]