**Step 1:** Define the prior distribution over the hyperparameter space

**Step 2:** Randomly sample hyperparameter configurations from .

**Step 3:** For each configuration evaluate the objective function ) (e.g., cross-validated loss).

**Step 4:** Split the observed data into two groups:

- : Configurations with loss values below a certain threshold.

- : Configurations with loss values above the threshold.

**Step 5:** Fit kernel density estimators to model:

- for

- for

**Step 6:** Calculate the expected improvement (EI) or any other acquisition metric:

where and are the estimated densities for good and bad configurations, respectively.

**Step 7:** Optimize the acquisition function to find the next hyperparameter configuration .

**Step 8:** Evaluate the objective function at and update the dataset .

**Step 9:** Repeat steps 4 to 8 until a stopping criterion is met (e.g., a fixed number of evaluations )

**Step 10**: Return the hyperparameter configuration that yields the lowest observed loss.