Kriging with Iterative Spatial Prediction of Uncertainty
KRISP-U

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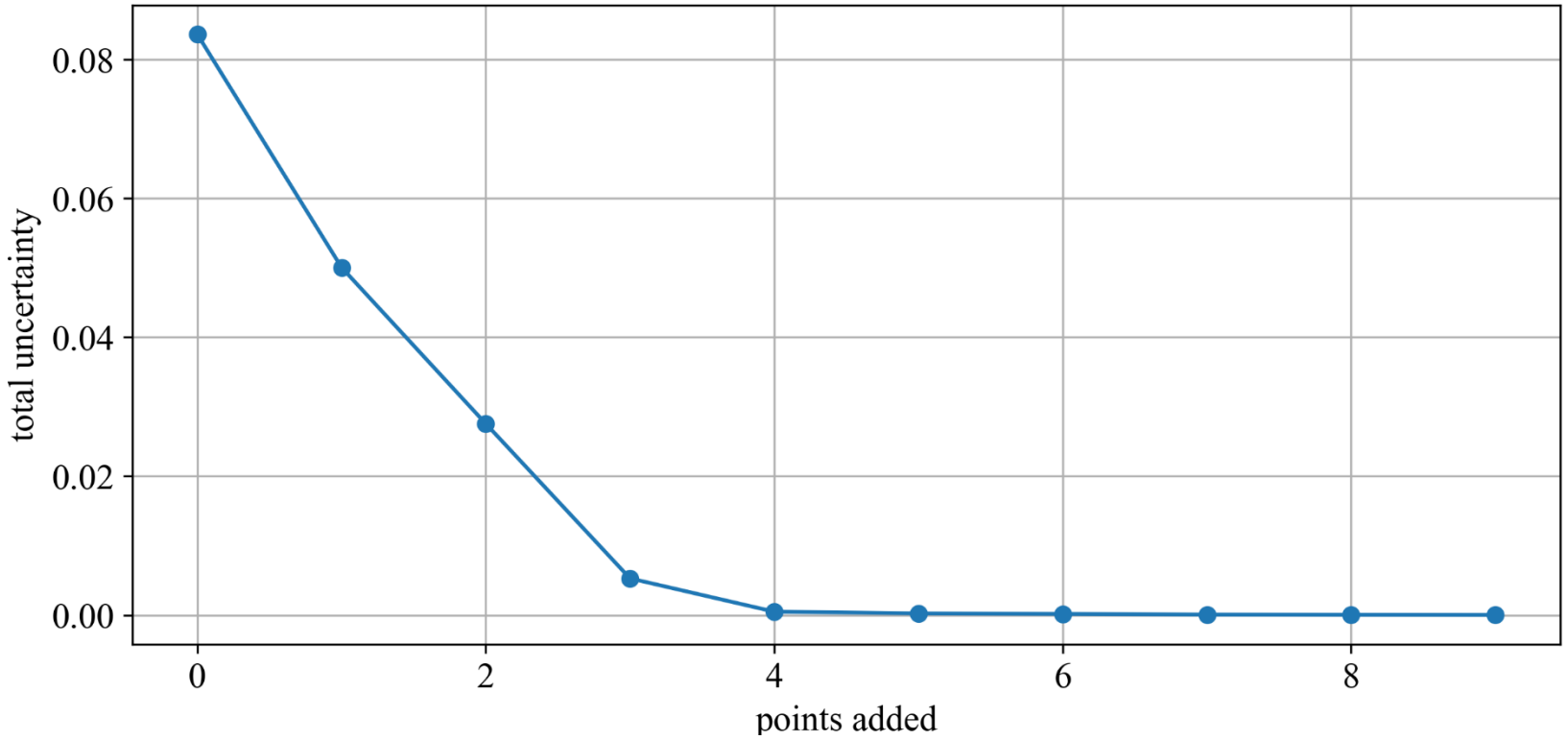
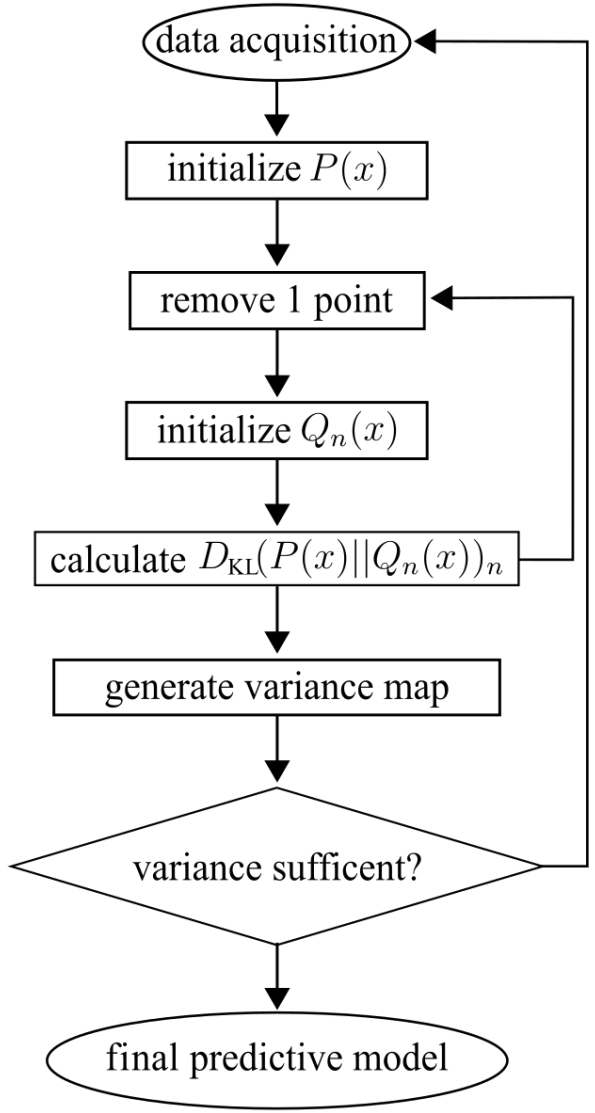
Motivation

- Reduce the number of data points needed to characterize experimental domains
  - Specifically, in cases where sampling is expensive or otherwise arduous



Algorithm

- The algorithm uses LOO resampling to estimate uncertainty of the model spatially
- It compares the full model, $P(x)$, to a model missing one-point, $Q_n(x)$, using KL-divergence
- The divergence is then assigned to the point removed and the set of points is interpolated to predict the uncertainty of the entire field

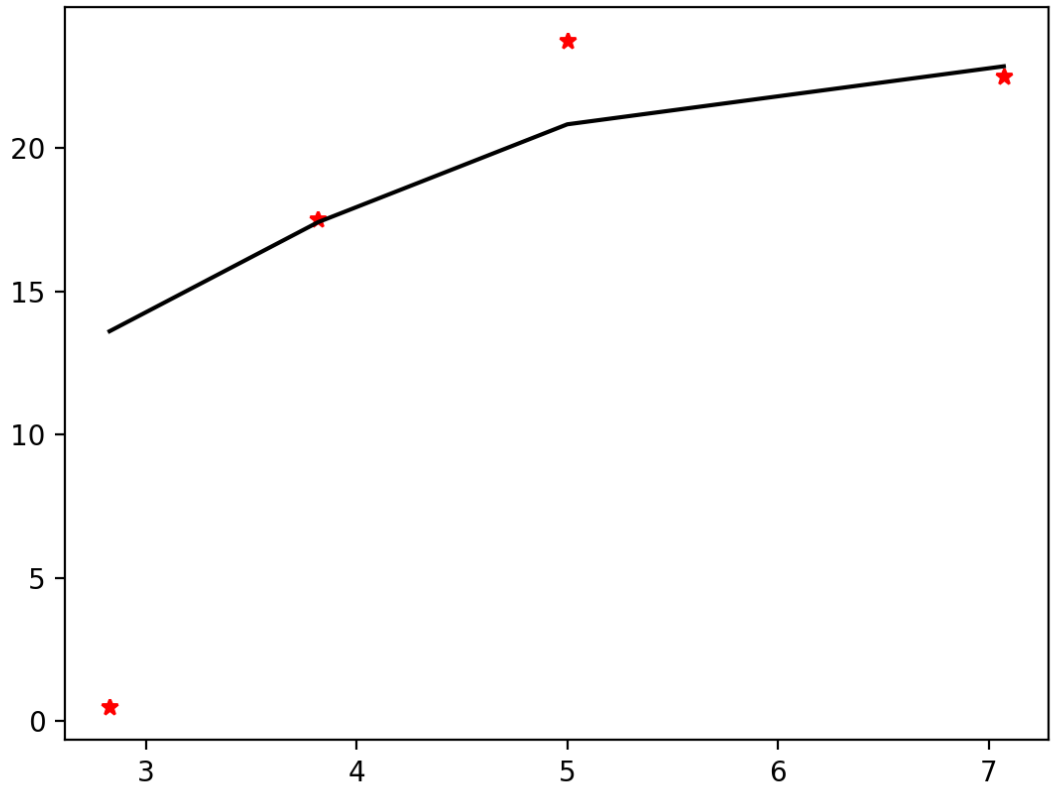


KRISP-U

- fit():
  - Fits the kriging model to the dataset and predicts over a grid.
- evaluate():
  - Evaluates the model using cross-validation and computes uncertainties.
- interpolate_uncertainty()
  - Interpolates uncertainties over a spatial grid.
- print_stats()
  - Prints statistics of the fitted model.
- get_stats()
  - Analyzes the variogram of the fitted model.

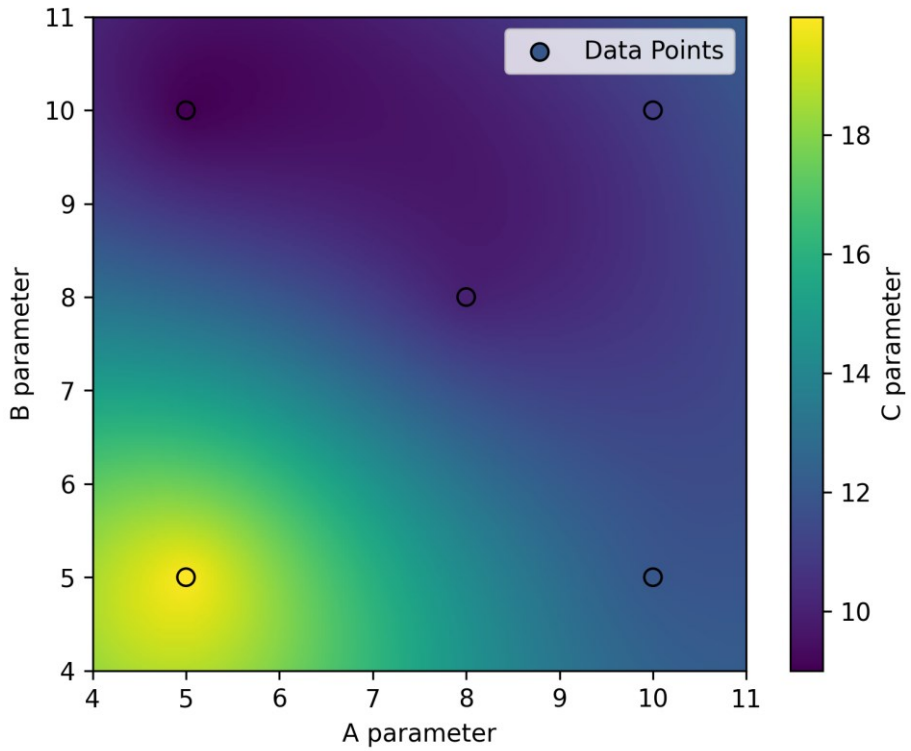
Model Selection

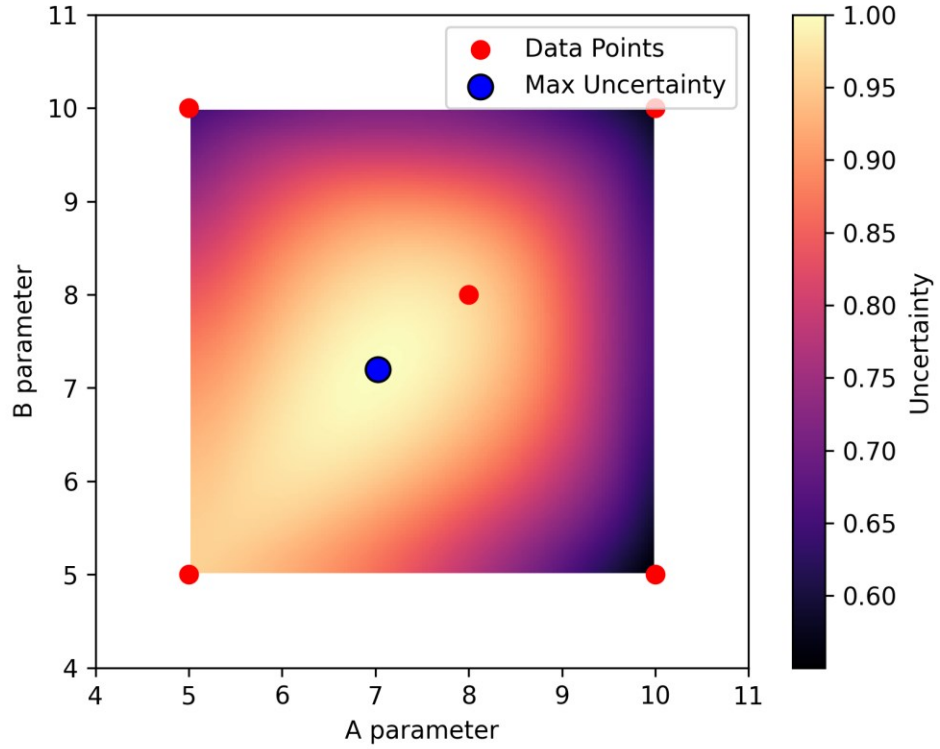
- Proper variogram selection is essential the model will be meaningless otherwise
  - If enable_plotting is True the variogram will be plotted for you
  - Scikit has a great tutorial on variogram selection
  - Any variogram in the PyKrige library can be used
- Universal or Ordinary Kriging can be selected
  - The difference is Ordinary kriging assumes a constant mean while Universal Kriging assumes the mean drifts



Fitting and Evaluation

- The model both predicts the expected values and the error spatially, additionally it recommends the optimal testing location (where uncertainty is maximum)





Simulated Iterative Sampling

- Has tendency to resample locations
- Effectively reduces total uncertainty in simulated cases