Benchmark Function Test

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Impact Analysis

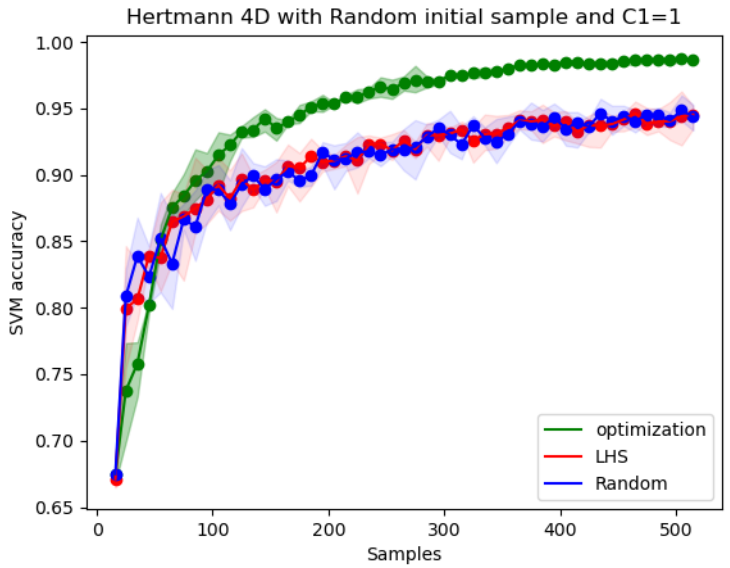
- Impact of **initial sampling method**
  - Quality of initial SVM model
- Impact of **weight on uncertainty**
- Impact of **classification difficulty**
  - Volume of feasible region / Volume of search space

Impact of Initial Sampling Strategy

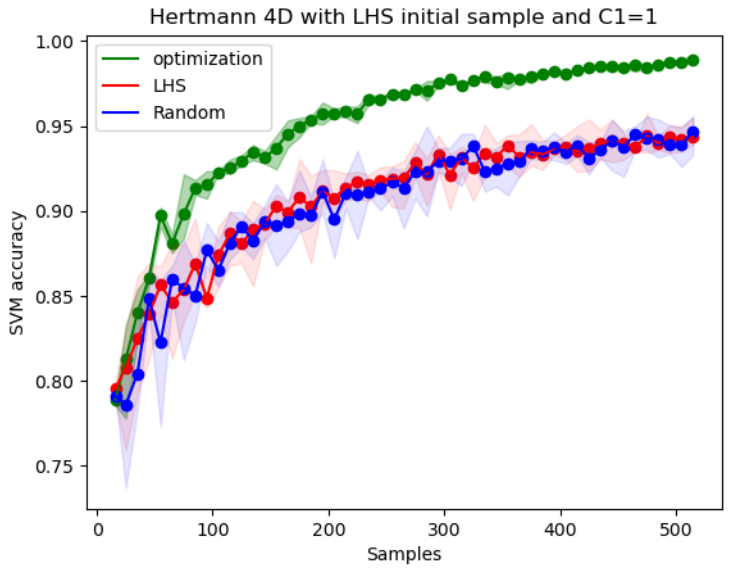
- Initial samples are needed to train the initial SVM model
  - Common sampling techniques can be used
    - Random
    - Latin Hypercube Sampling (LHS)
    - Full factorial sampling (DOE)

Impact of Initial Sampling Strategy

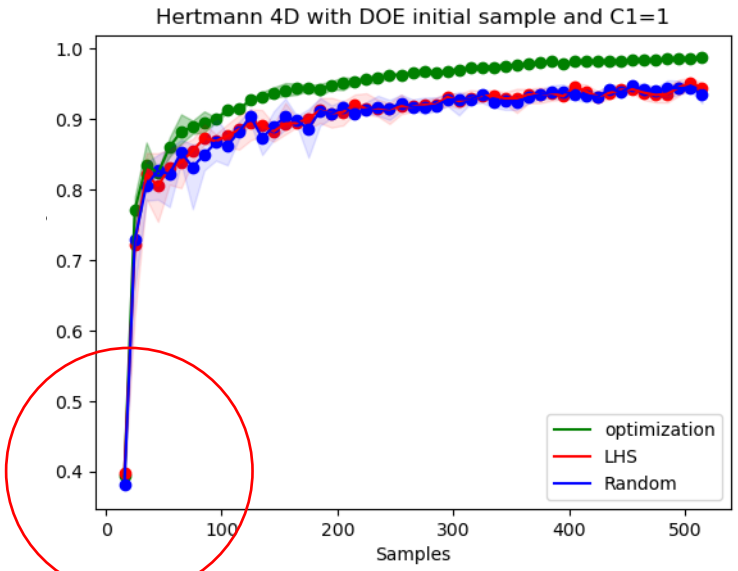
Initial data points are selected using Random/LHS/DOE sampling, respectively
Then, **additional points** are selected by optimization/LHS/Random sampling



Initial: Random



Initial: LHS



Initial: DOE

- DOE initialization has low accuracy in the initial SVM model
  - Because all initial points are at the variable bounds
- We can choose LHS or Random sampling

Impact of Weight on Uncertainty

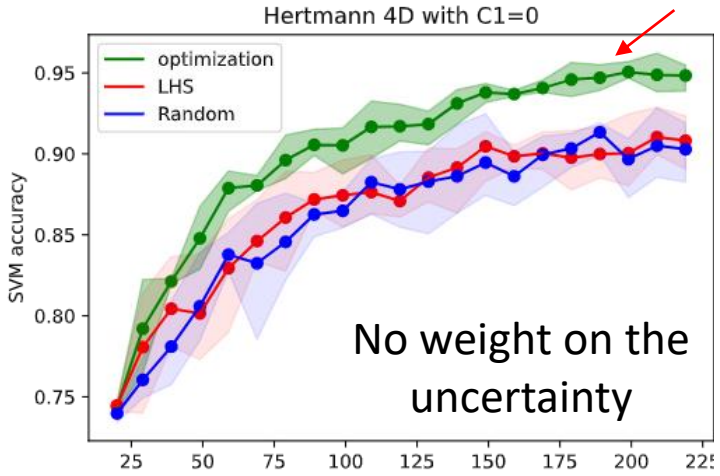
- If more weight is on the uncertainty, the algorithm will try to sample points that have more uncertainty even if they are not very close to the SVM decision boundary

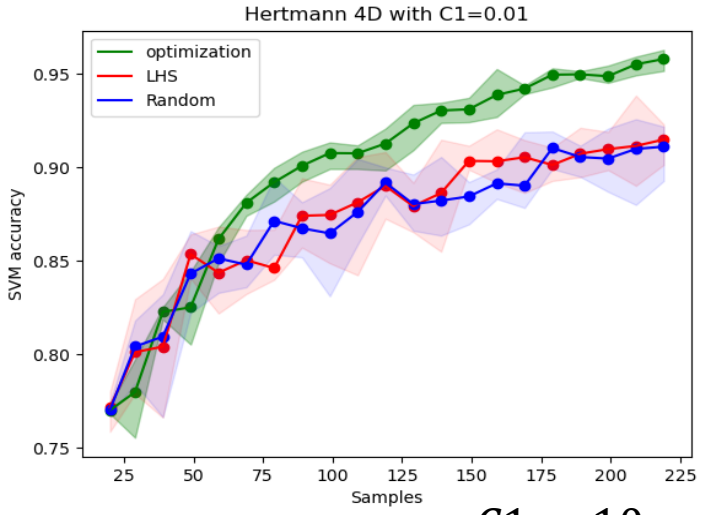
- The improvement of the accuracy can be slower, but the trained model will have less uncertainty

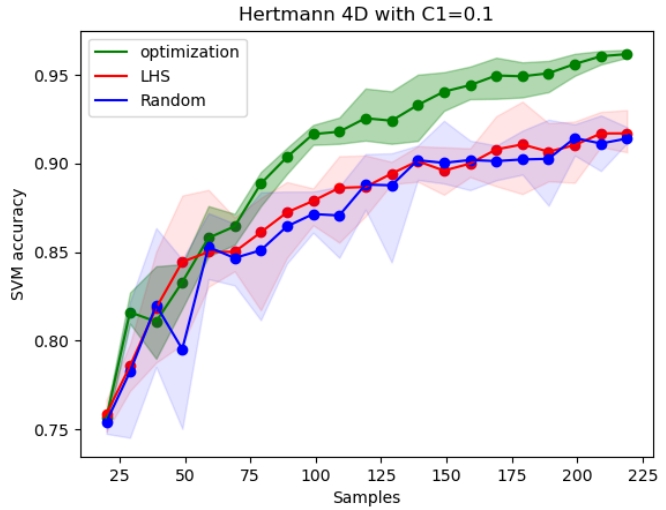
Impact of Weight on Uncertainty

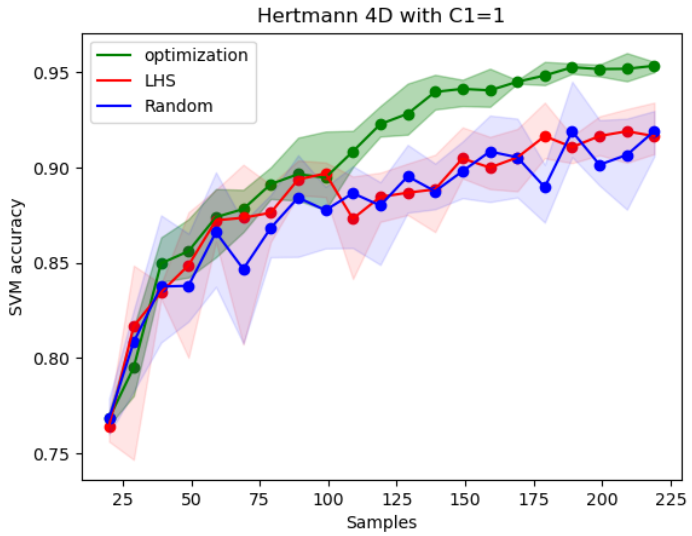
- Hertmann 4D

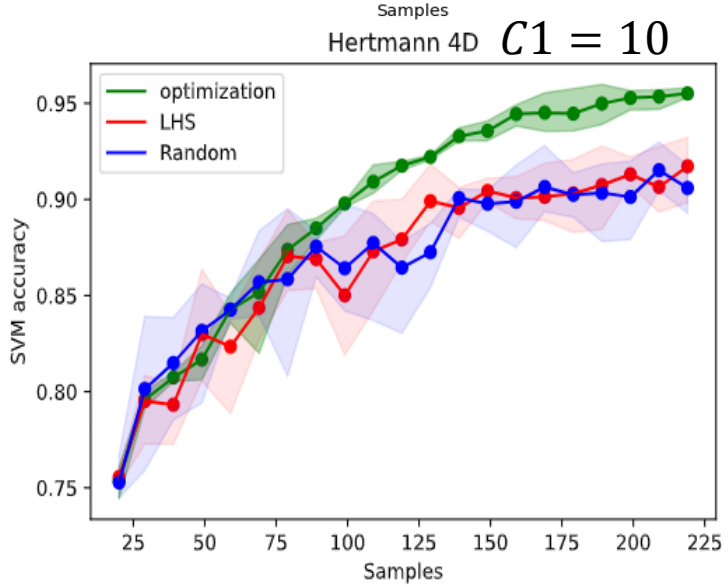
Flattened earlier

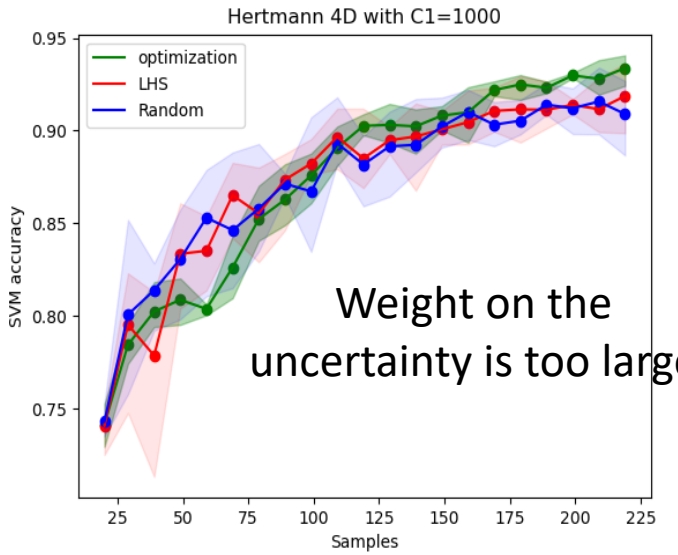












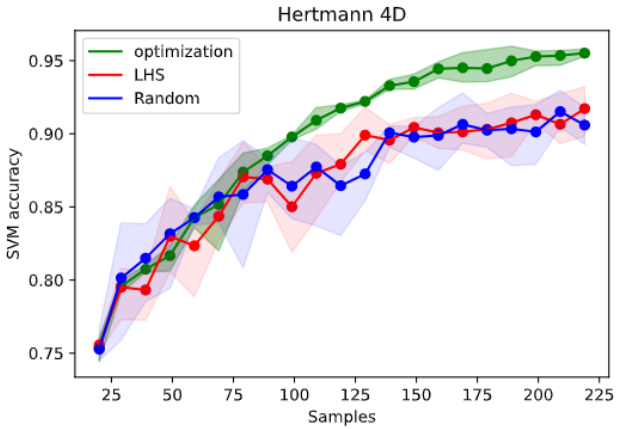
Impact of Weight on Uncertainty

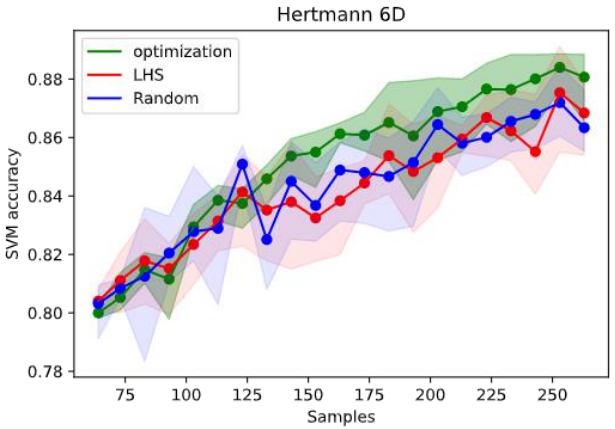
Hertmann 4D

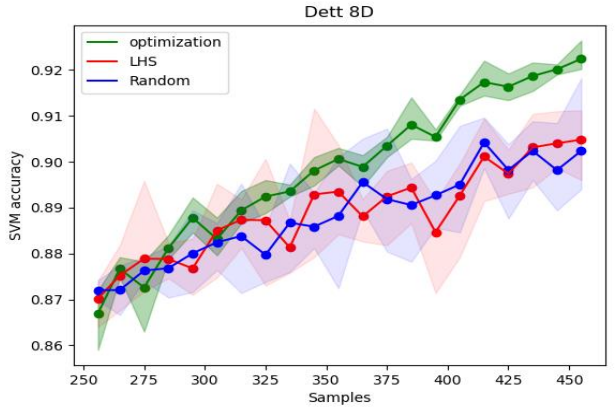
Hertmann 6D

Dette 8D

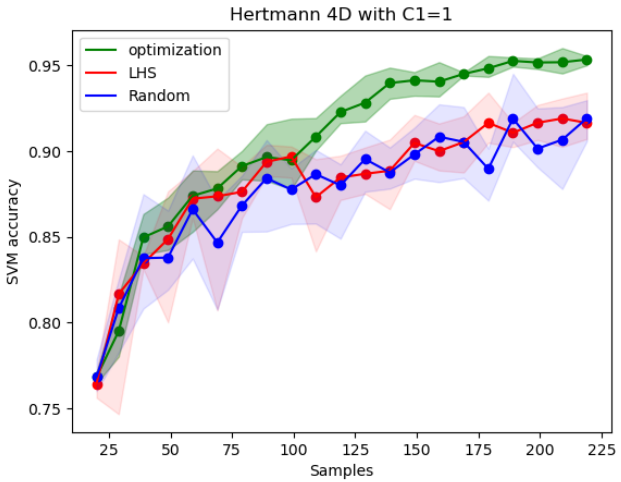
$C1 = 10$

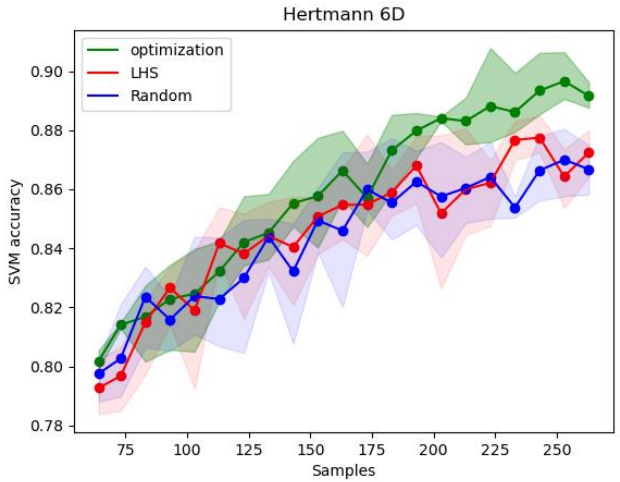


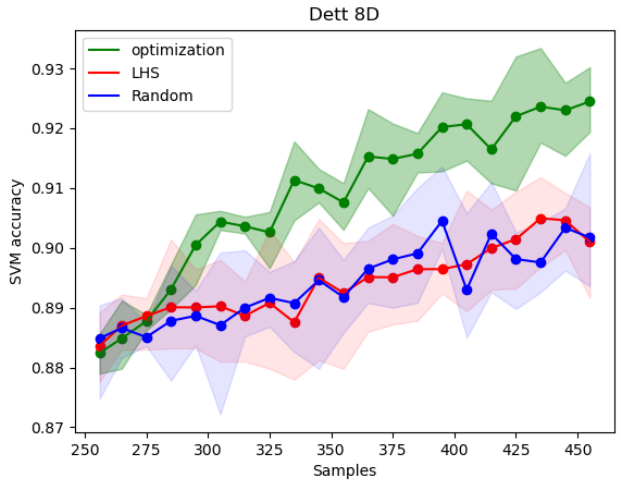




$C1 = 1$



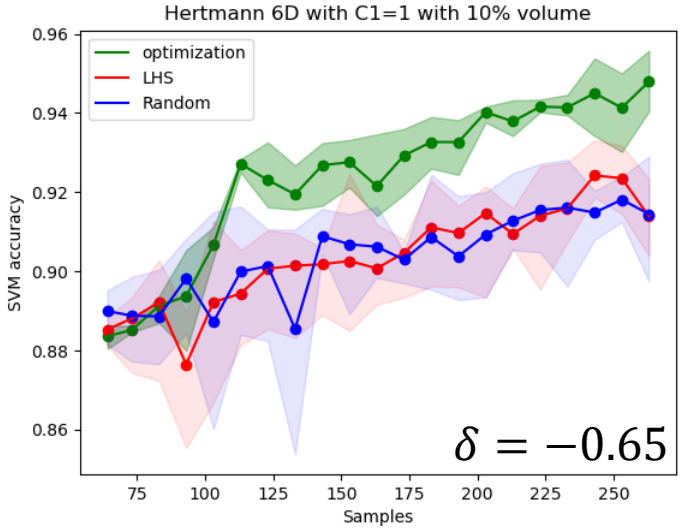


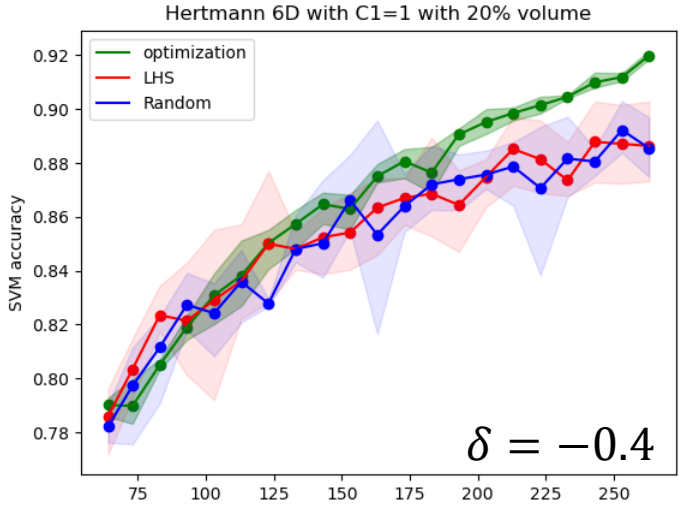


Impact of Classification Difficulty

- The performance of the algorithm depends on the shape of feasible region

$$\text{Volume} = \mathrm{E}\left[\frac{\#\text{ of feasible points}}{1000\text{ random samples}}\right]$$





$$\begin{cases}\text{Feasible if } f(x) \le \delta \\ \text{otherwise, infeasible}\end{cases}$$