Physics-Informed Neural Networks of Burgers and Poisson
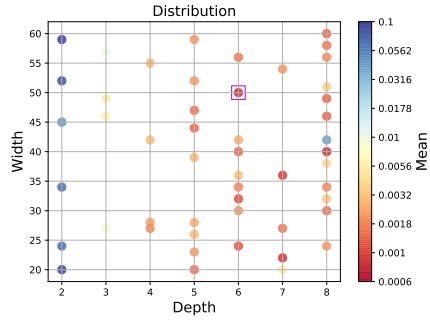
Ziqiao Weng

2018/11/25
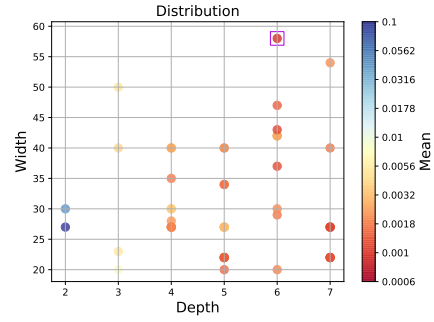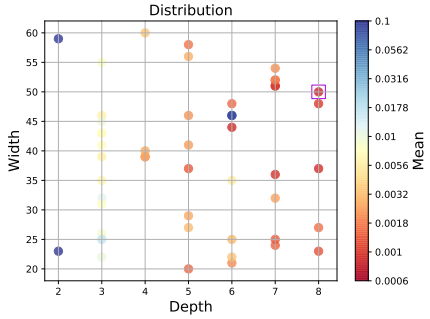
1 Burgers

1.1 Mean

Setting: Each method has been run for 50 iterations. The error is the mean error of each point run for 10 times. The range of Depth is [2,8] and that of Width is [20,60]. The point with the purple box represents the point with the minimum error. Besides, for Bayesian Optimization, the exploration is greater than the exploitation.
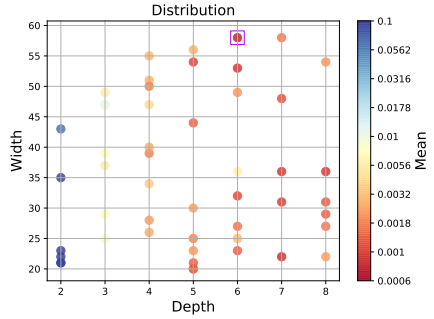

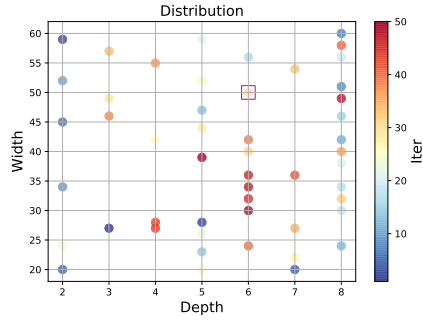(a) Bayesian Optimization

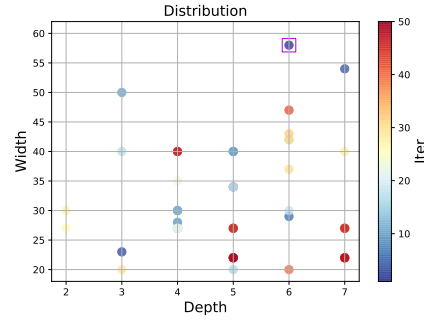(b) Genetic Algorithm

(c) Hyperband
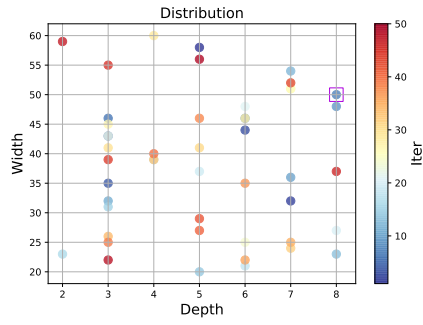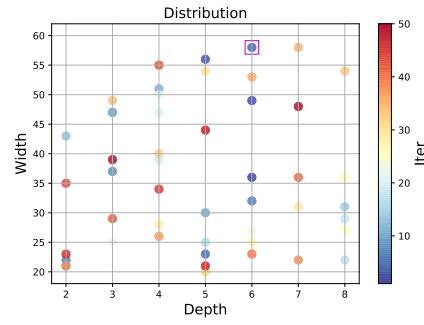

(d) Random Search

1.2 Iterations

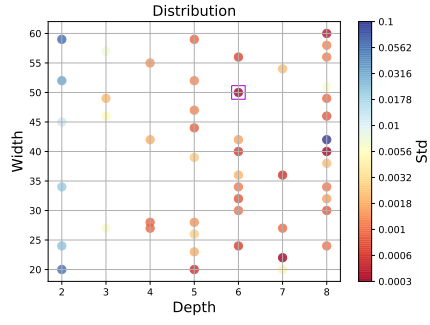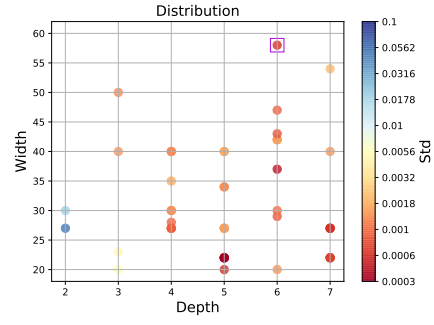(a) Bayesian Optimization

(b) Genetic Algorithm
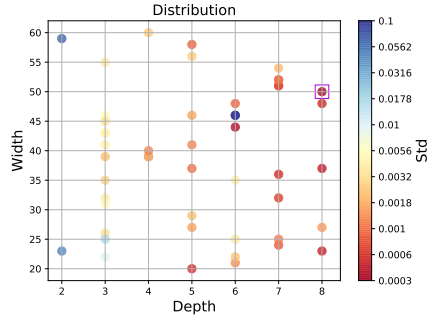

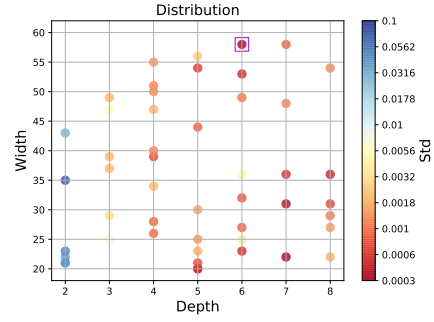(c) Hyperband

(d) Random Search

1.3 Std

(a) Bayesian Optimization
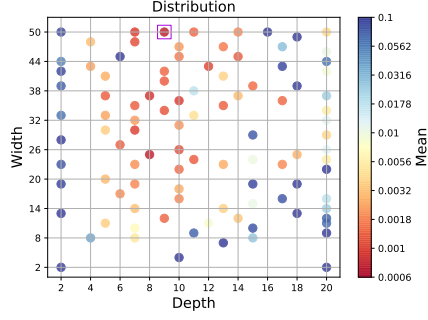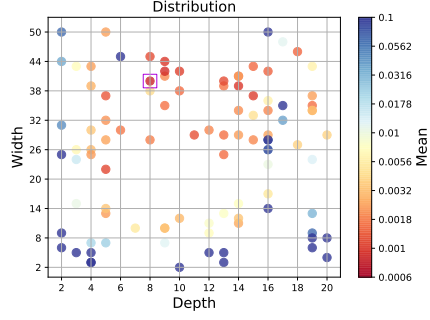
(b) Genetic Algorithm

(c) Hyperband

(d) Random Search

1.4 Mean(100 iterations)

Setting: Each method has been run for 100 iterations. The error is the mean error of each point run for 10 times. The range of Depth is [2,20] and that of Width is [2,50]. The point with the purple box represents the point with the minimum error. Besides, for Bayesian Optimization, the exploration is less than the exploitation.
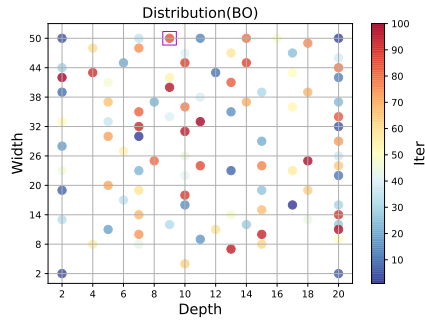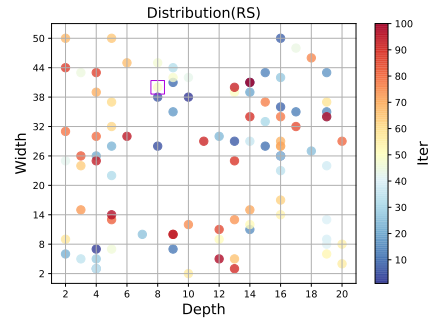

(a) Bayesian Optimization (b) Random Search
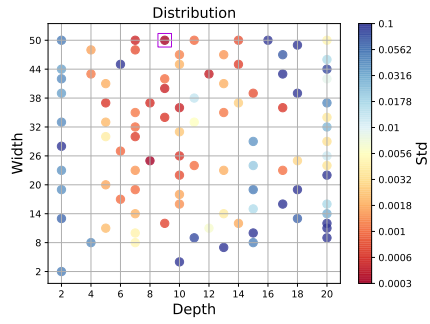
5

1.5 Iterations(100 iterations)

(a) Bayesian Optimization
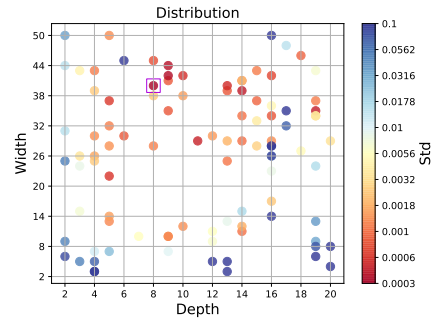
(b) Random Search
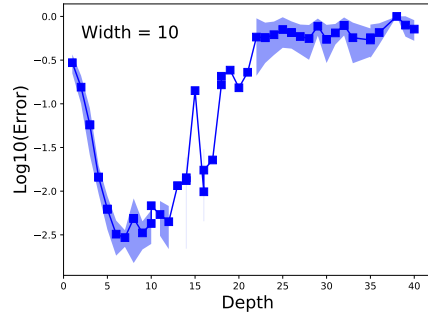
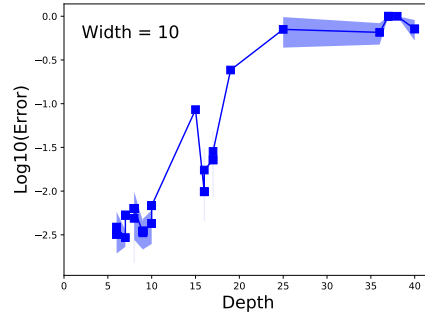## 1.6   Std(100 iterations)
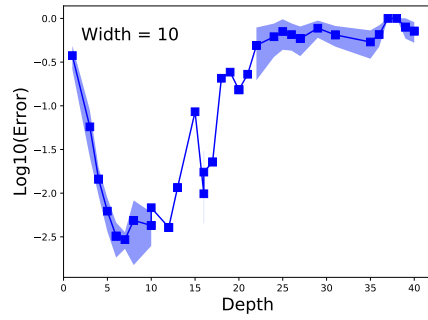

(a) Bayesian Optimization   (b) Random Search
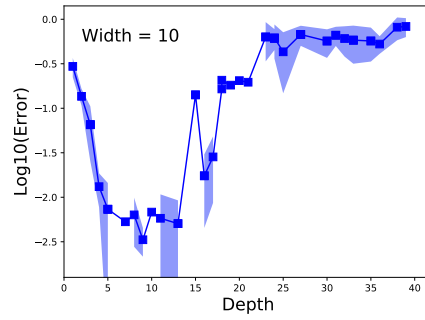
1.7 Fix Width

(a) Bayesian Optimization
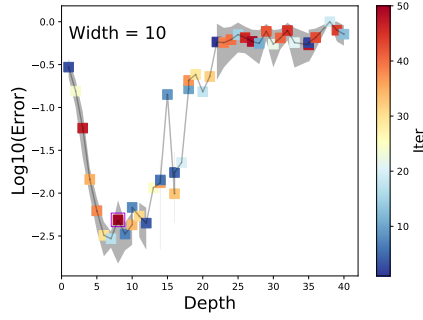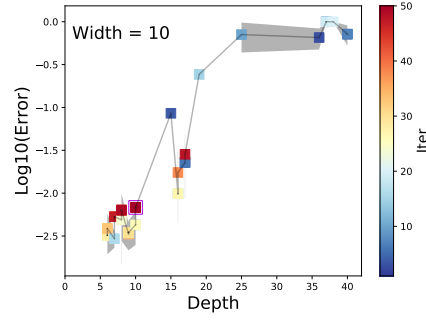

(b) Genetic Algorithm

(c) Hyperband

(d) Random Search
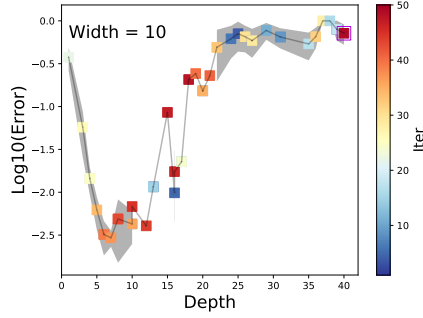
1.8   Fix Width(Iterations)

Setting: Each method has been run for 50 iterations. The error is the mean error of each point run for 10 times. The range of Depth is [1,40] and the Width is fixed to 10. The point with the purple box represents the last point. Besides, for Bayesian Optimization, the exploration is greater than the exploitation.
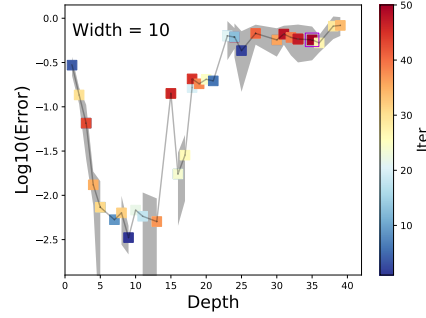

(a) Bayesian Optimization
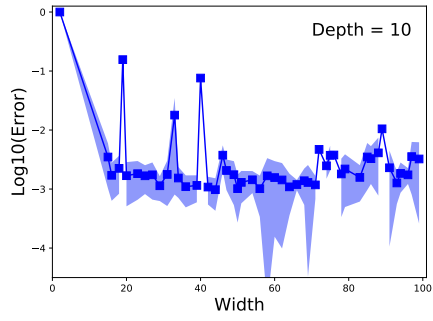
(b) Genetic Algorithm

(c) Hyperband

(d) Random Search

1.9 Fix Depth

(a) Bayesian Optimization

(b) Genetic Algorithm

(c) Hyperband

(d) Random Search

1.10   Fix Depth(Iterations)

Setting: Each method has been run for 50 iterations. The error is the mean error of each point run for 10 times. The range of Width is [2,100] and the Depth is fixed to 10. The point with the purple box represents the last point. Besides, for Bayesian Optimization, the exploration is greater than the exploitation.

(a) Bayesian Optimization
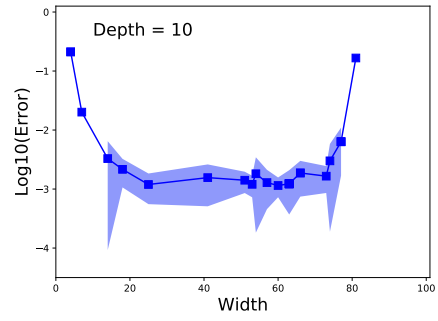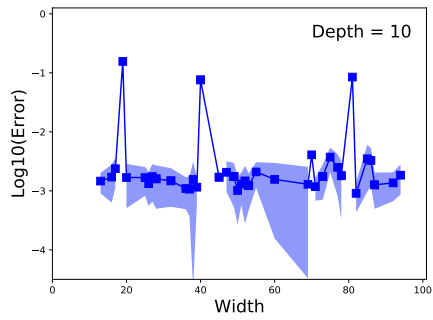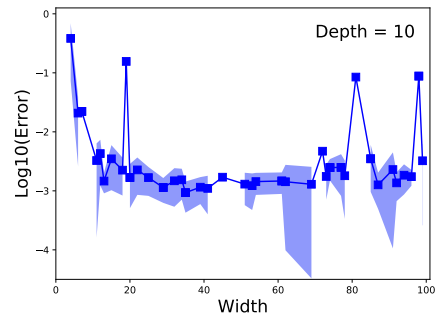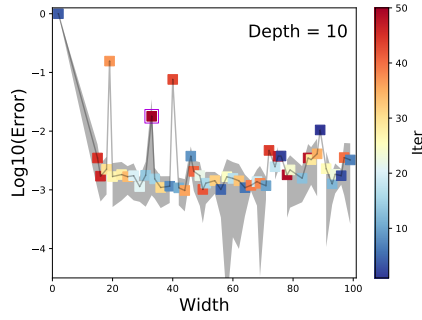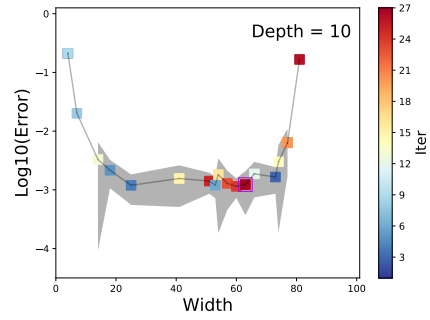
(b) Genetic Algorithm
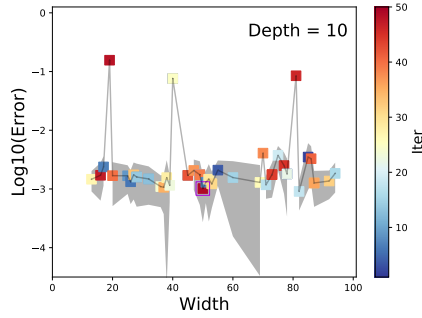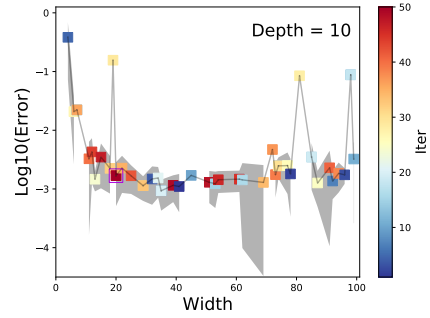
(c) Hyperband

(d) Random Search

2 Poisson

2.1 Mean

Setting: Each method has been run for 50 iterations. The error is the mean error of each point run for 10 times. The range of Depth is [2,8] and that of Width is [20,60]. The point with the purple box represents the point with the minimum error. Besides, for Bayesian Optimization, the exploration is greater than the exploitation.

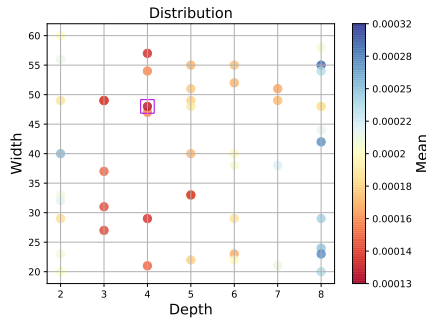(a) Bayesian Optimization

(b) Genetic Algorithm
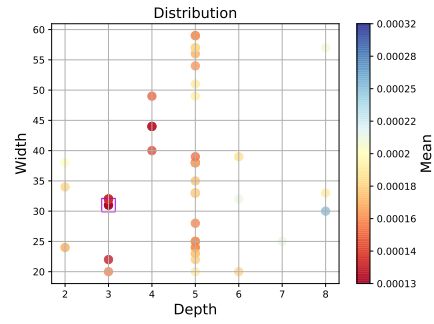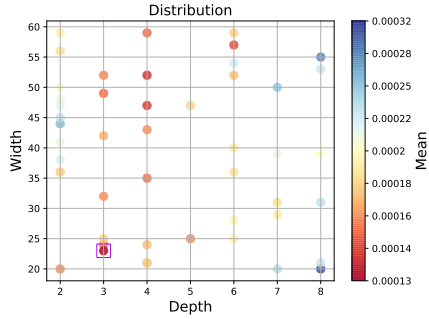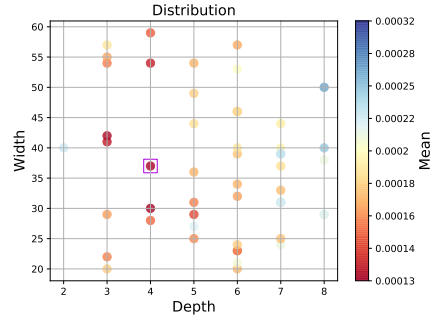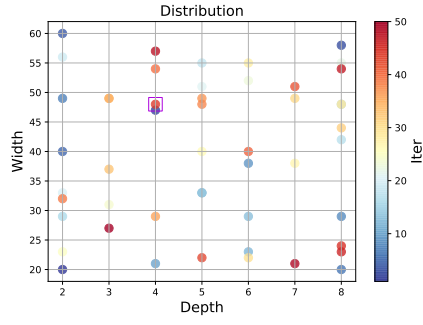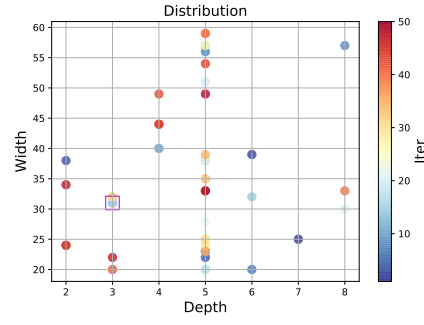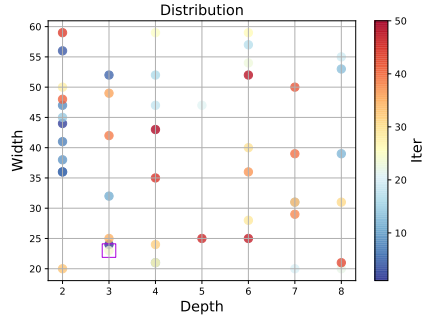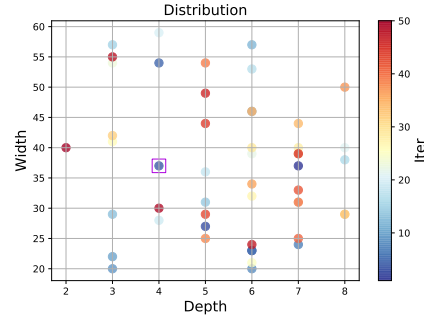

(c) Hyperband

(d) Random Search

2.2 Iterations

(a) Bayesian Optimization
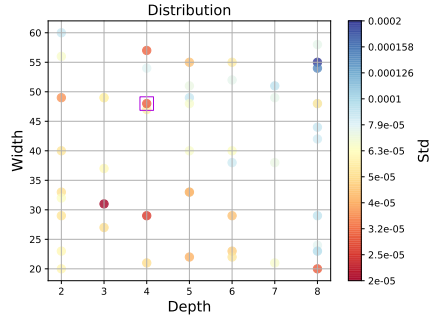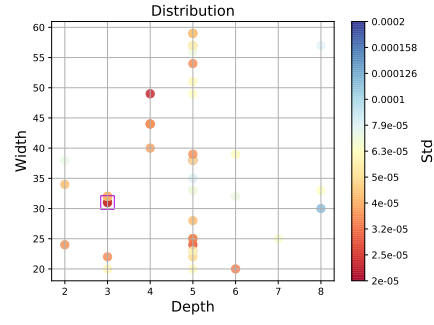
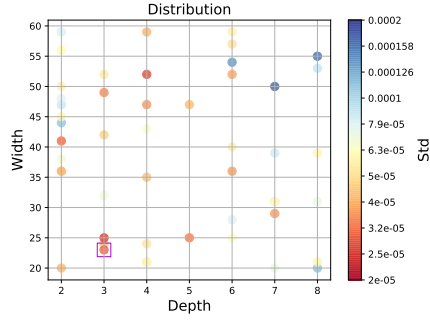(b) Genetic Algorithm

(c) Hyperband

(d) Random Search

2.3 Std

(a) Bayesian Optimization

(b) Genetic Algorithm

(c) Hyperband

(d) Random Search

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2.4 Fix Width

(a) Bayesian Optimization

(b) Genetic Algorithm

(c) Hyperband

(d) Random Search

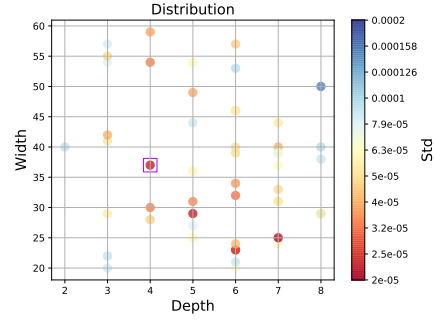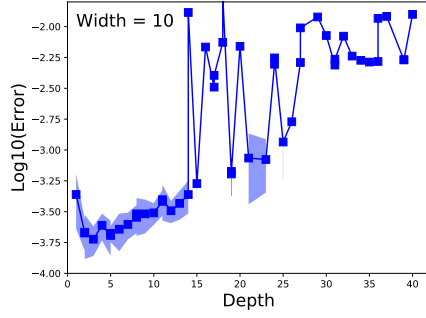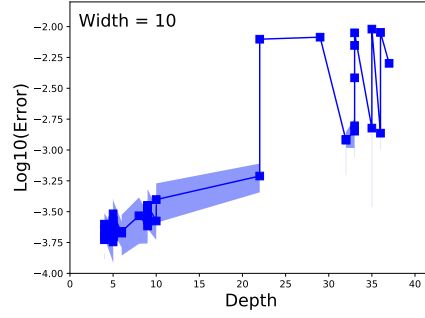## 2.5 Fix Width(Iterations)

Setting: Each method has been run for 50 iterations. The error is the mean error of each point run for 10 times. The range of Depth is [1,40] and the Width is fixed to 10. The point with the purple box represents the last point. Besides, for Bayesian Optimization, the exploration is greater than the exploitation.

(a) Bayesian Optimization
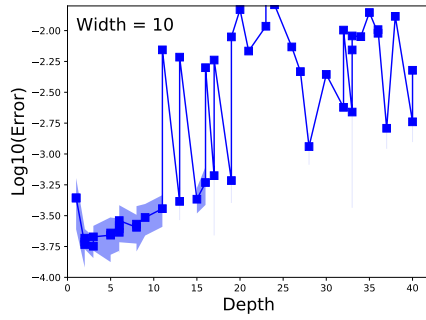
(b) Genetic Algorithm

(c) Hyperband
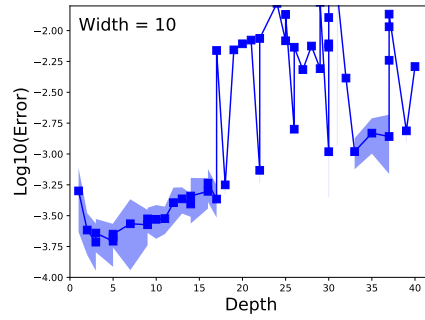
(d) Random Search

2.6   Fix Depth

(a) Bayesian Optimization
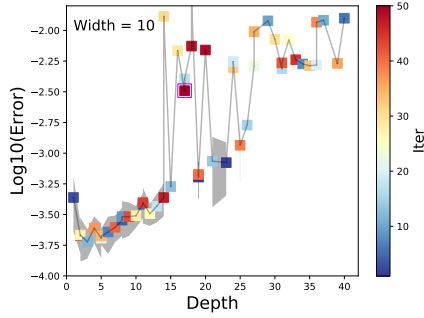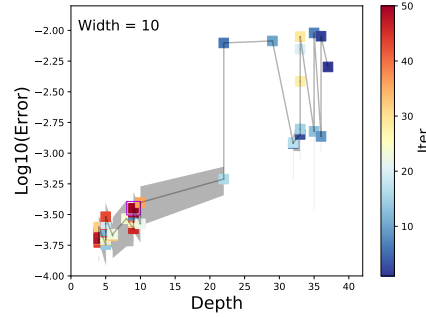
(b) Genetic Algorithm

(c) Hyperband
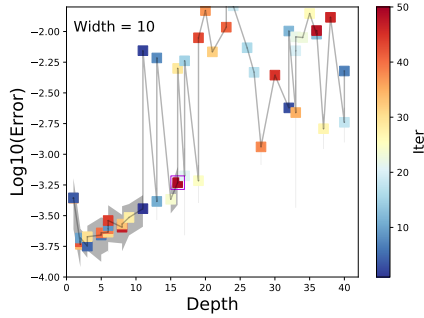
(d) Random Search

2.7 Fix Depth(Iterations)

Setting: Each method has been run for 50 iterations. The error is the mean error of each point run for 10 times. The range of Width is [2,100] and the Depth is fixed to 10. The point with the purple box represents the last point. Besides, for Bayesian Optimization, the exploration is greater than the exploitation.
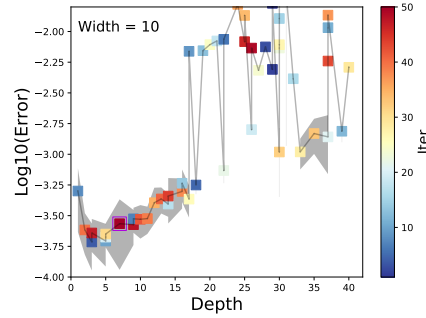

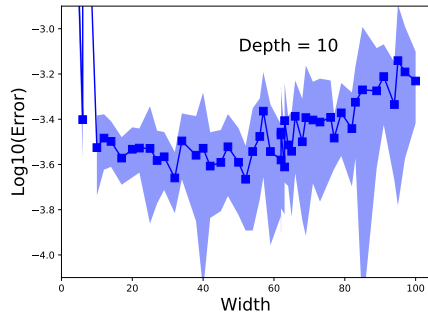(a) Bayesian Optimization

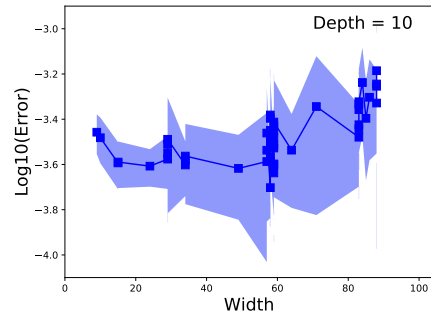(b) Genetic Algorithm

(c) Hyperband

(d) Random Search
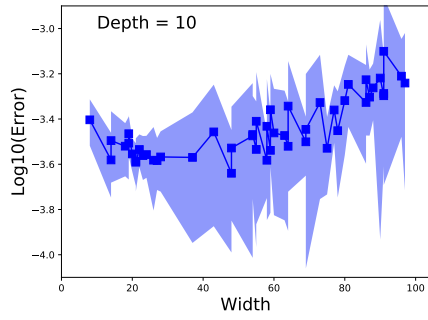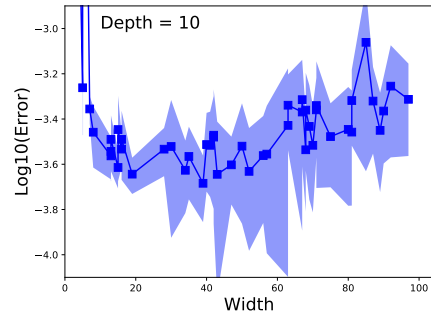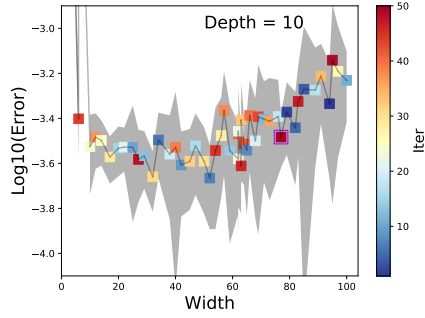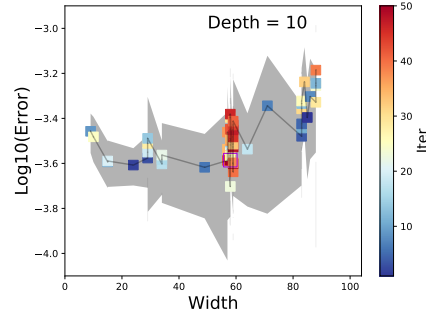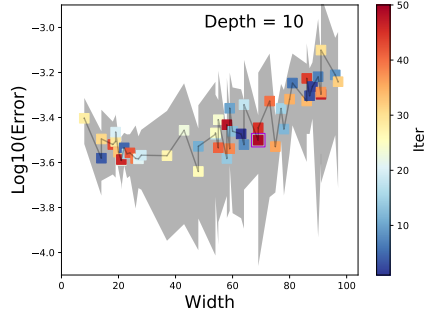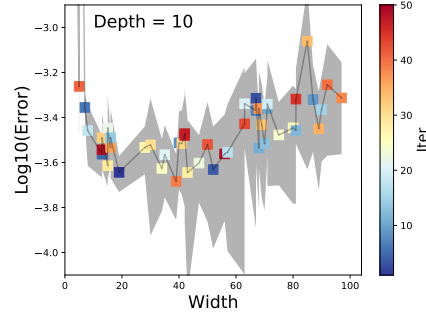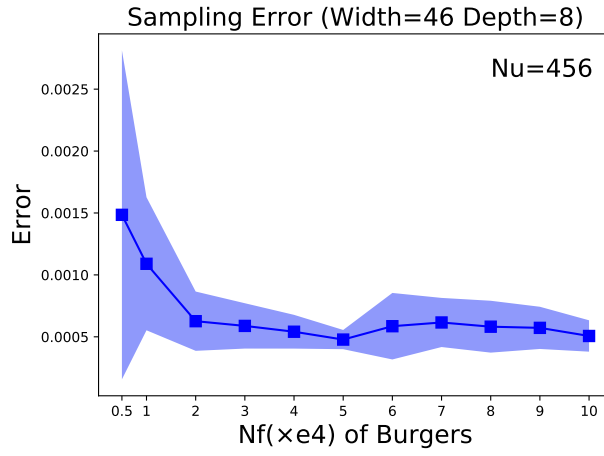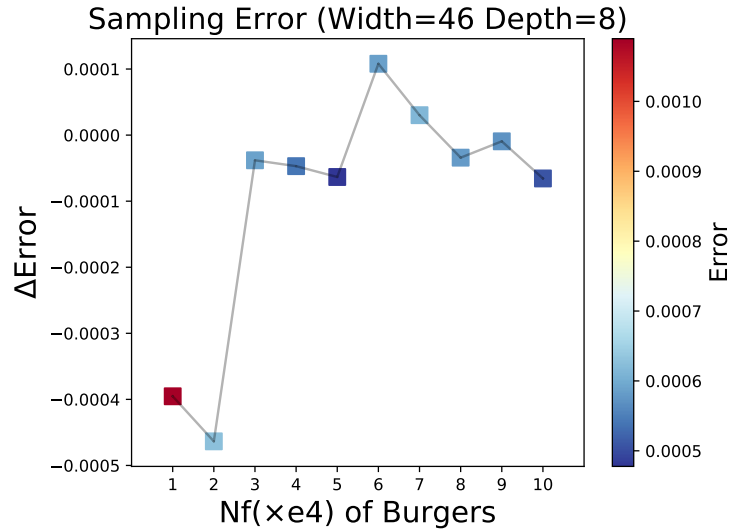
3 Sample Error

3.1 Collocation points Nf of Burgers

Setting: The error is the mean error of each point run for 10 times. The Width is fixed to 46 and the Depth is fixed to 8. The initial and boundary training points Nu is fixed to 456.
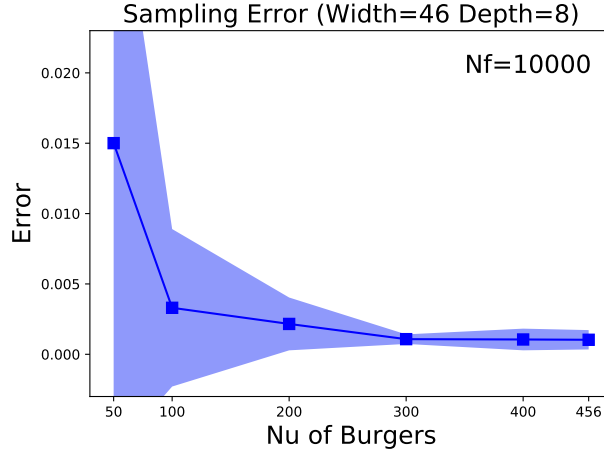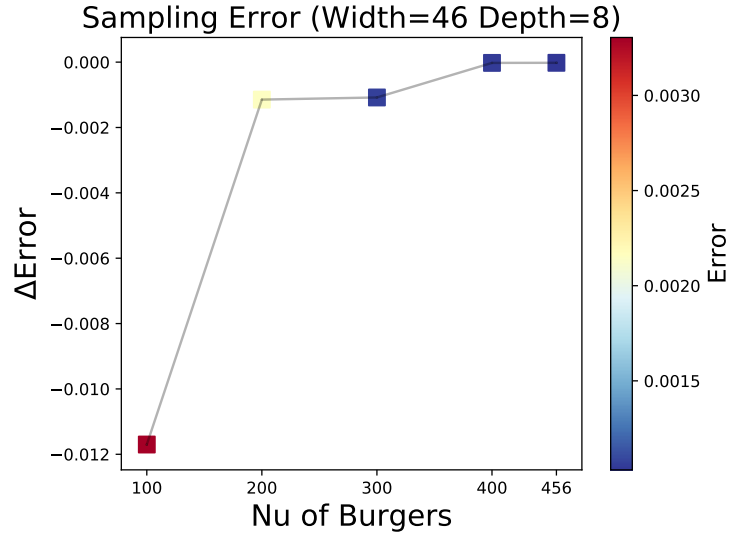

(a) Mean Error

(b) $\Delta Error_{i+1}$=$Error_{i+1}$-$Error_i$

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3.2 Initial and boundary training points Nu of Burgers

Setting: The error is the mean error of each point run for 10 times. The Width is fixed to 46 and the Depth is fixed to 8. The collocation points Nf is fixed to 10000.
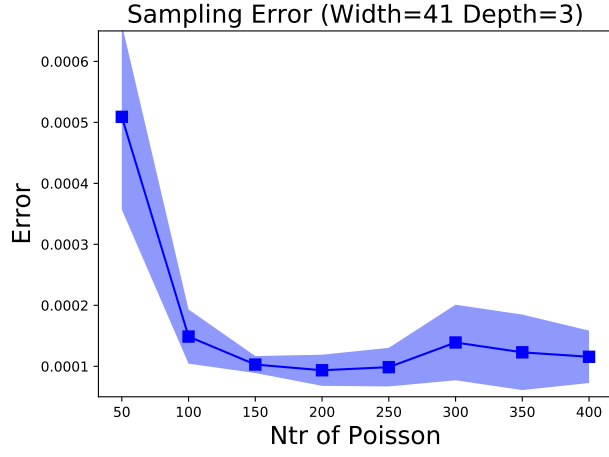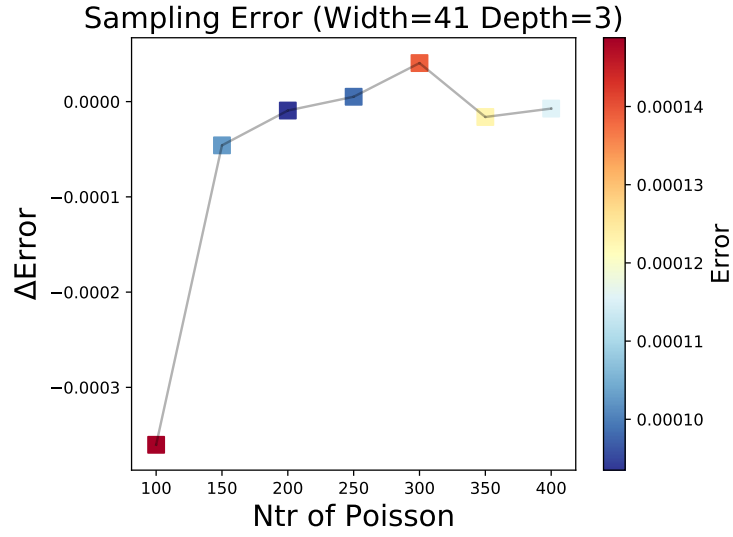

(a) Mean Error

(b) $\Delta Error_{i+1}=Error_{i+1}-Error_i$

3.3 Sampled points Ntr of Poisson

Setting: The error is the mean error of each point run for 10 times. The Width is fixed to 41 and the Depth is fixed to 3.

(a) Mean Error

(b) $\Delta Error_{i+1}$=$Error_{i+1}$-$Error_i$