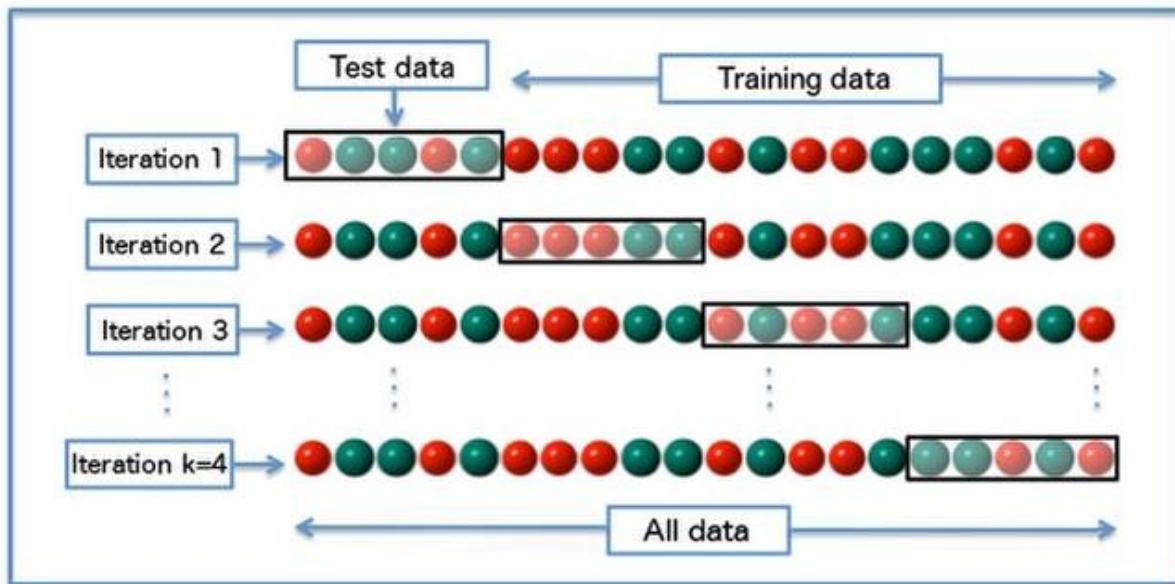
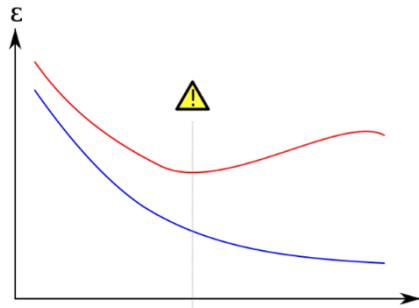
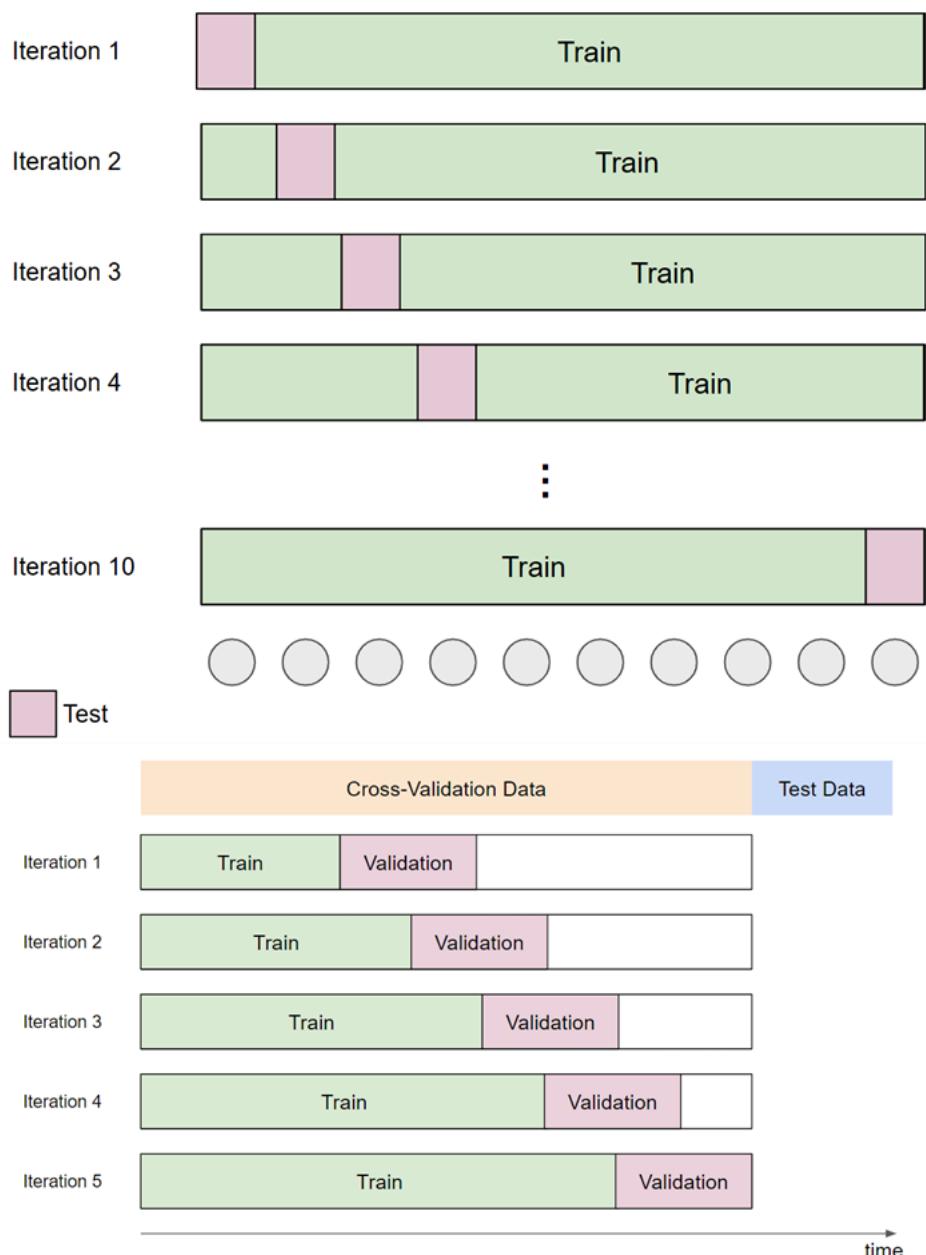


Chapter 1: Evaluating Machine Learning Models

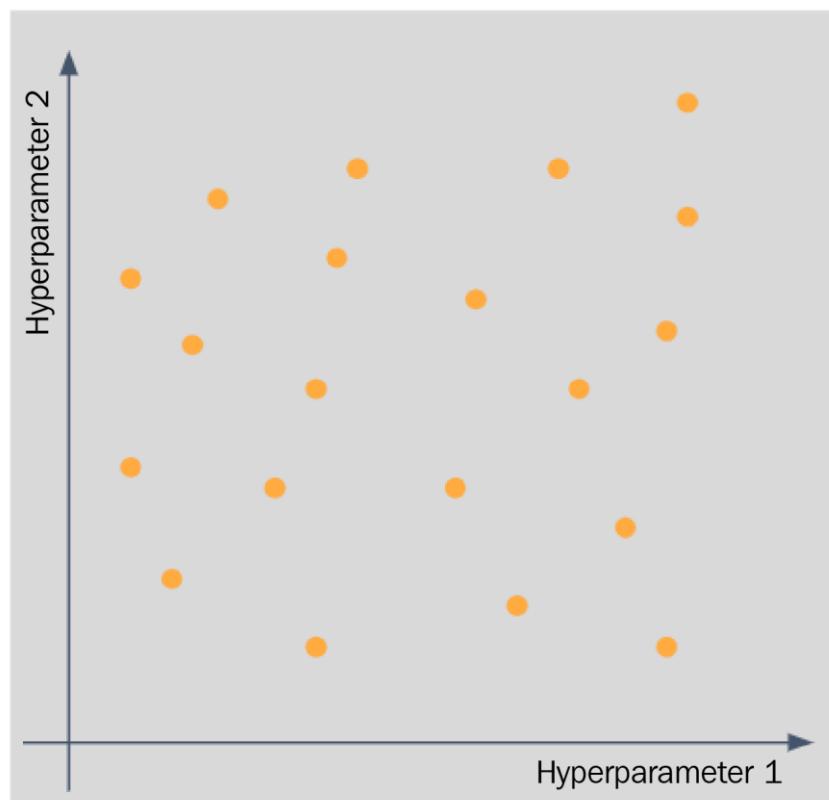
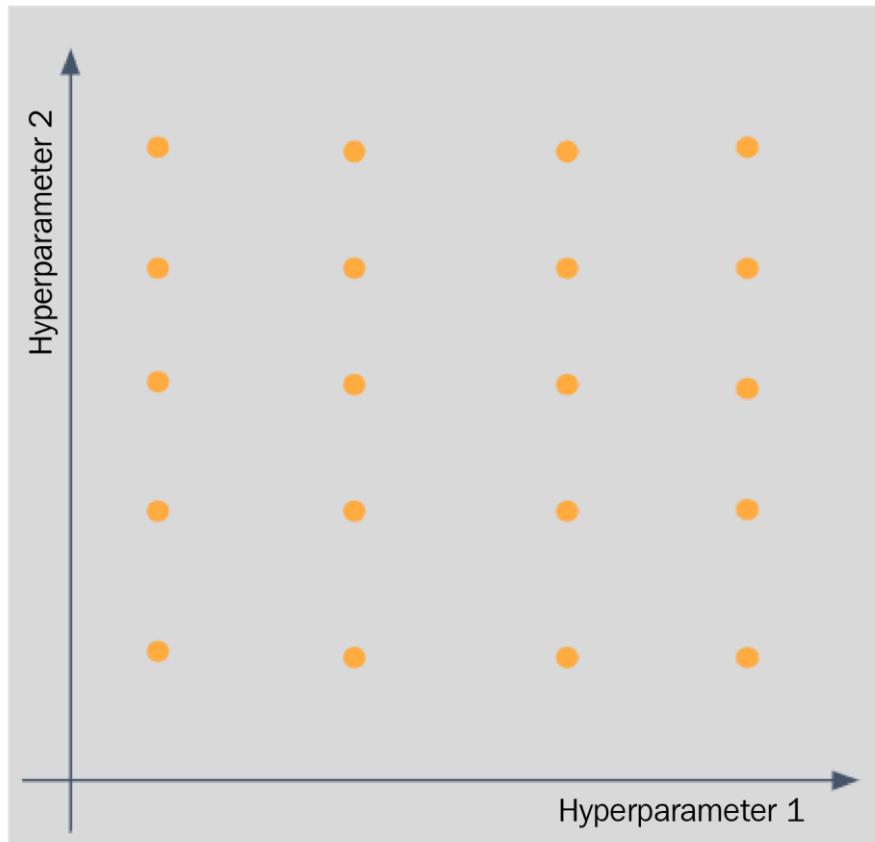




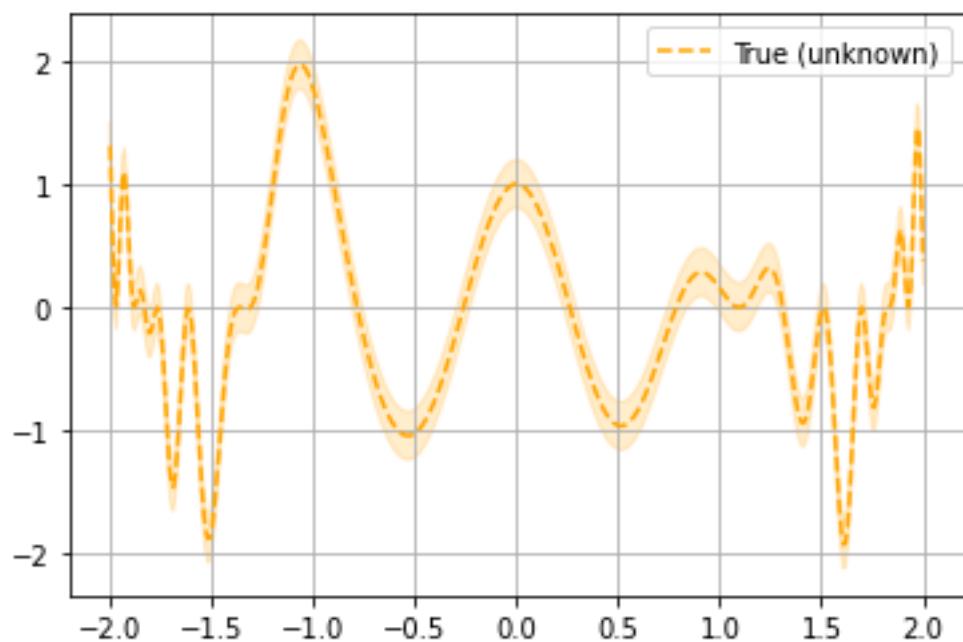
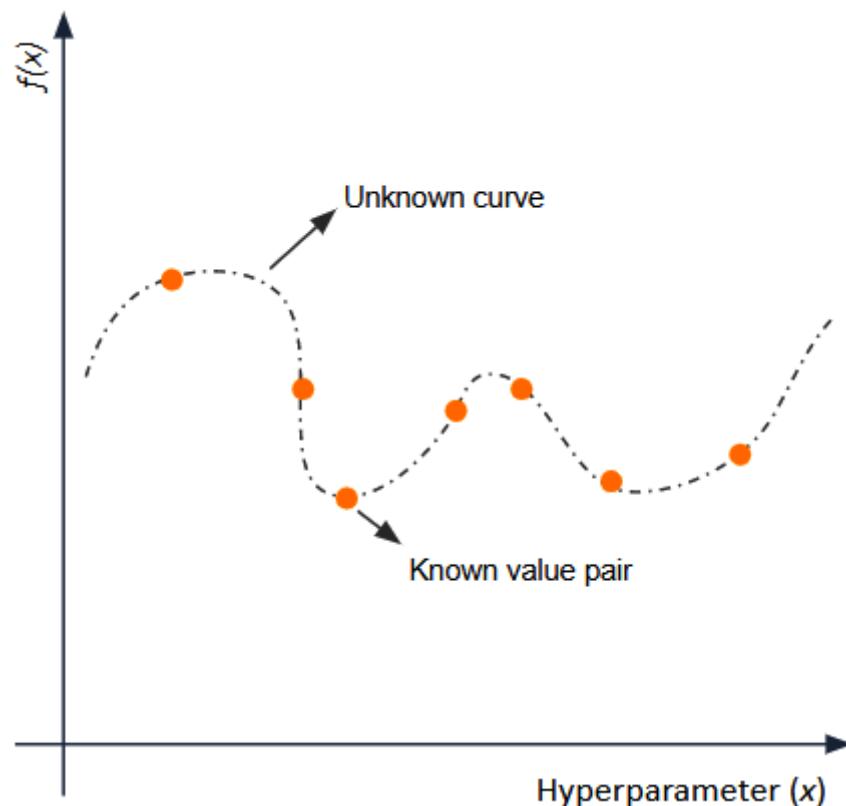
Chapter 2: Introducing Hyperparameter Tuning

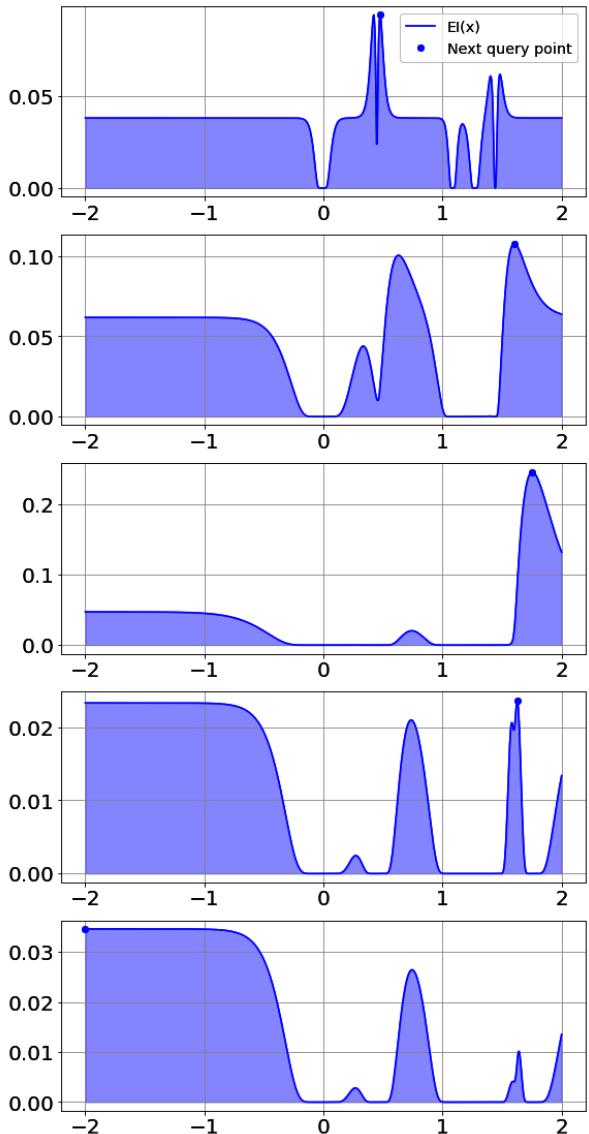
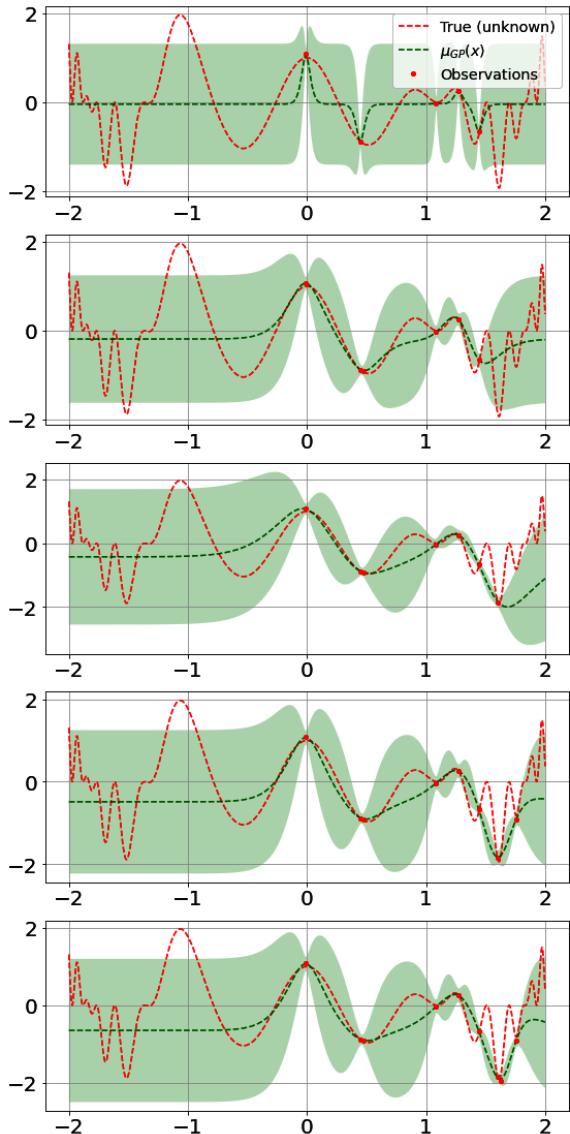
No images...

Chapter 3: Exploring Exhaustive Search

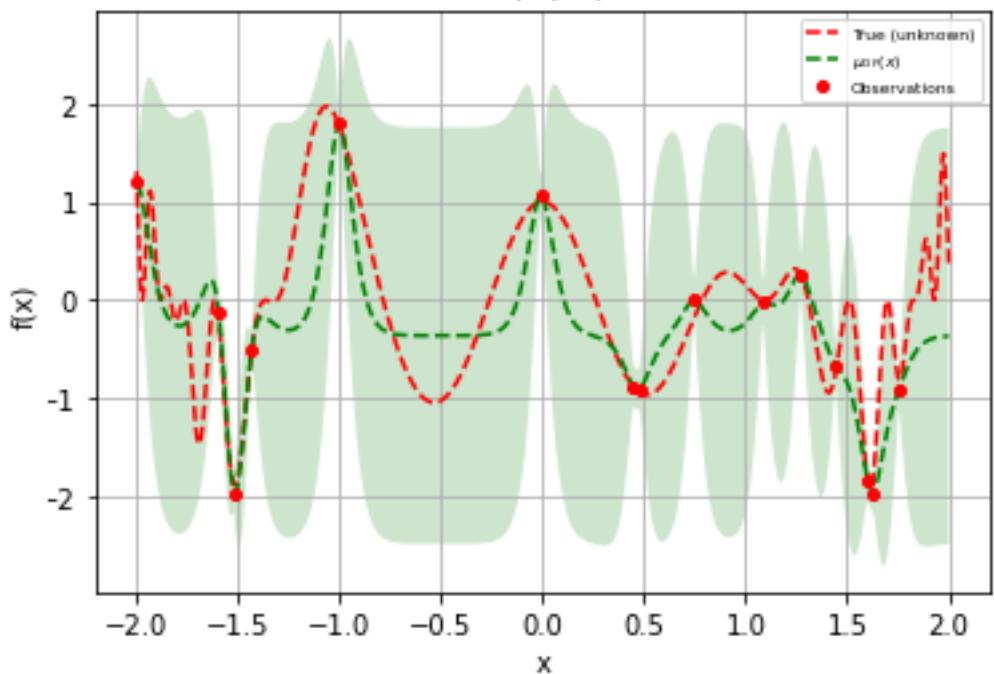


Chapter 4: Exploring Bayesian Optimization

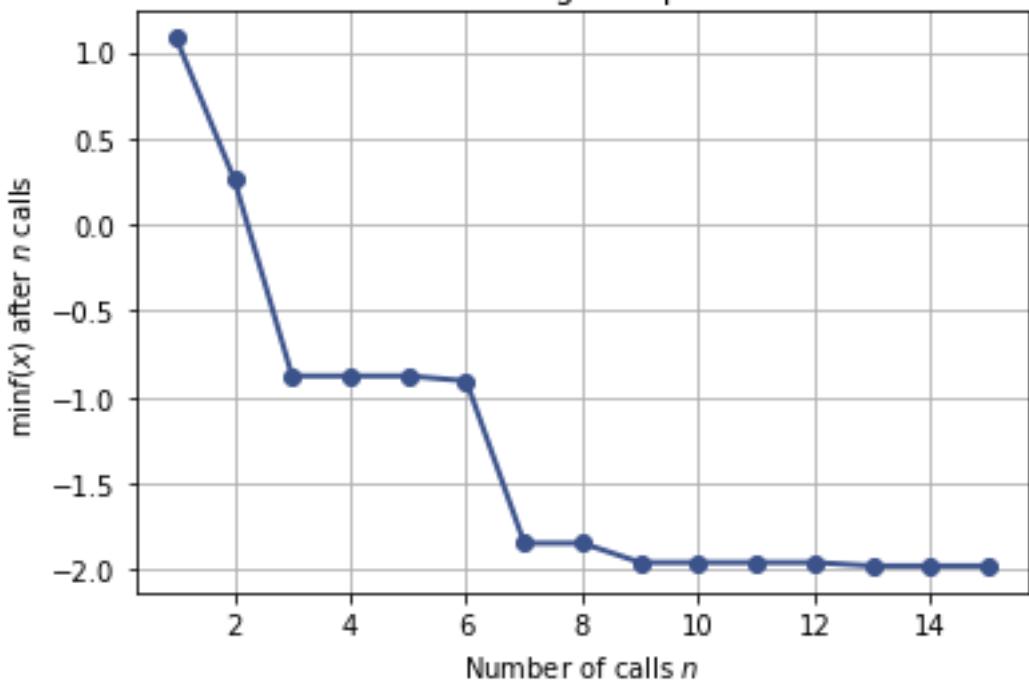


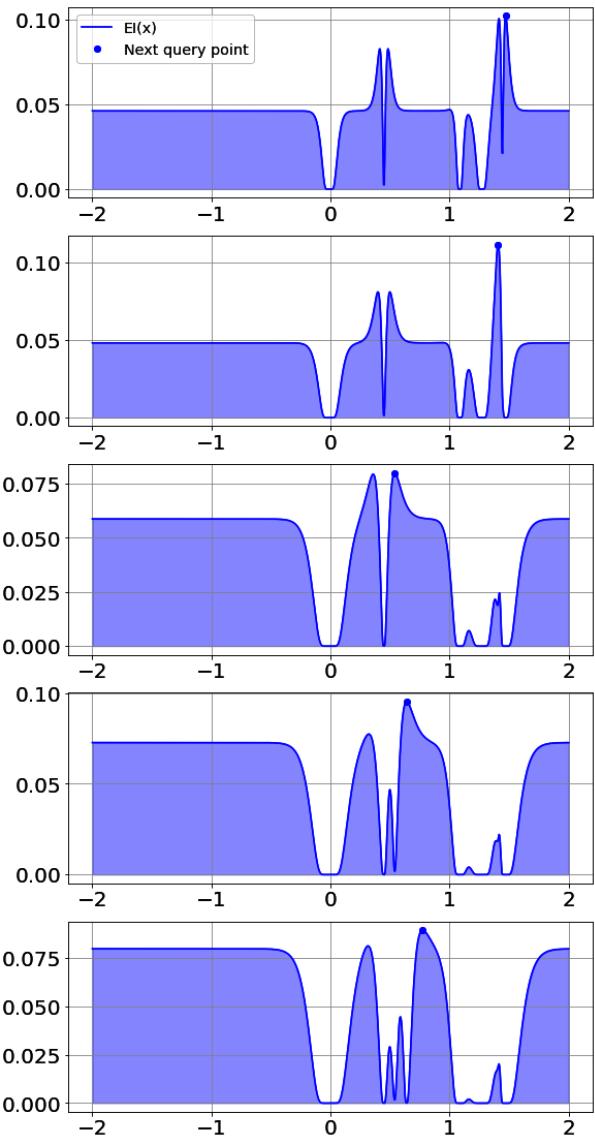
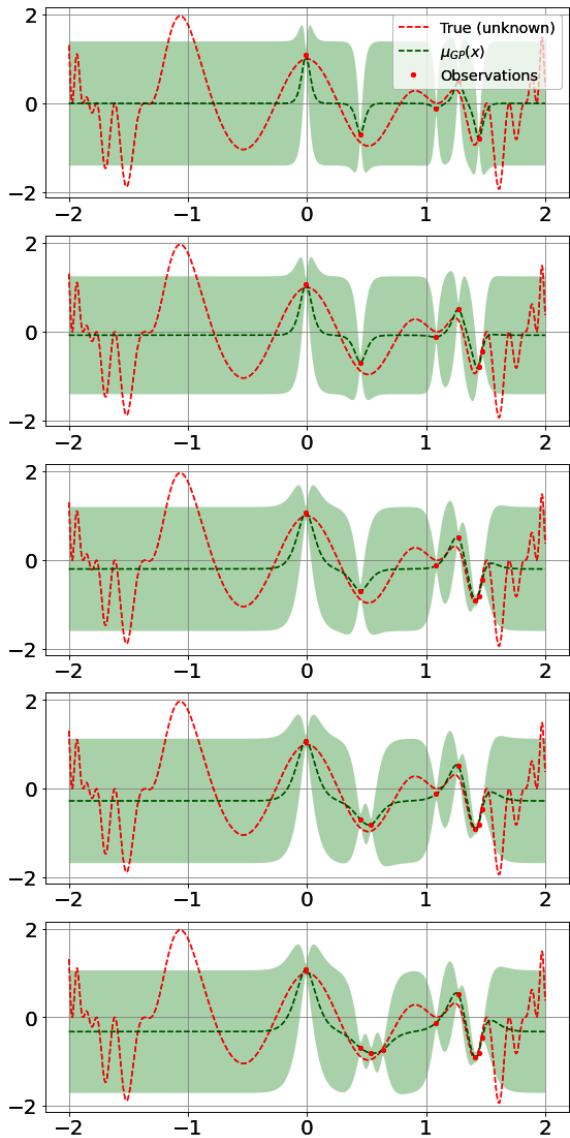


$$x^* = -1.5218, f(x^*) = -1.9765$$

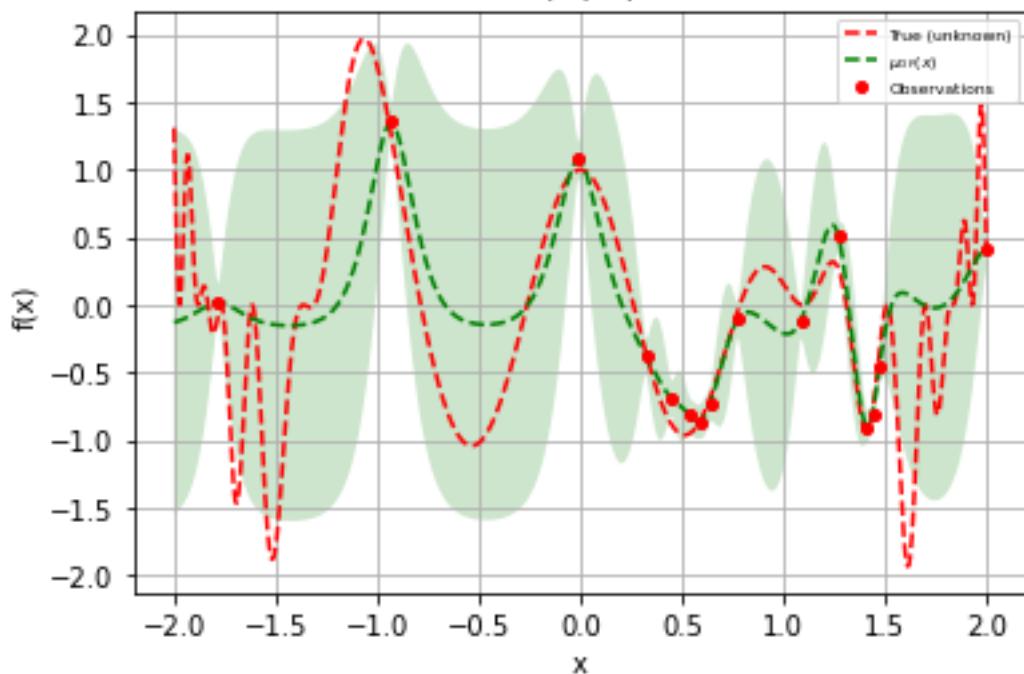


Convergence plot

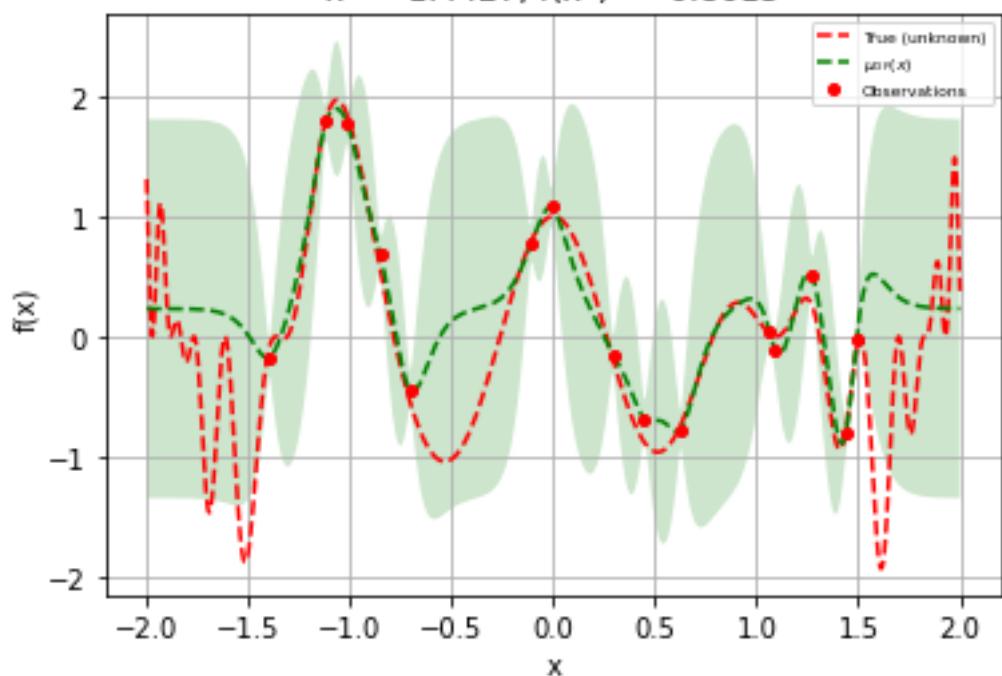


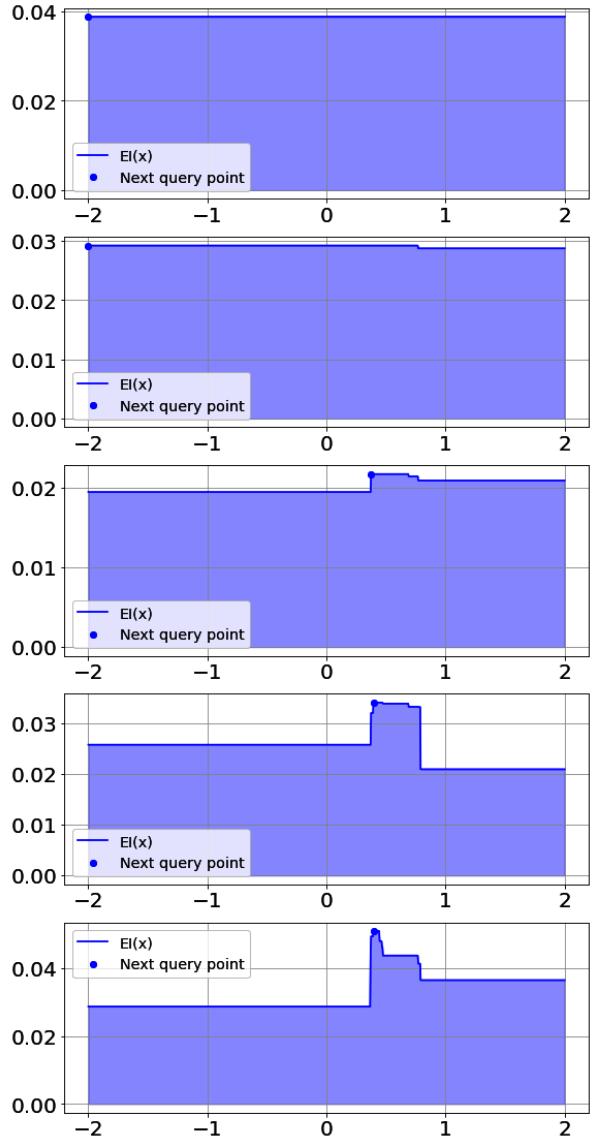
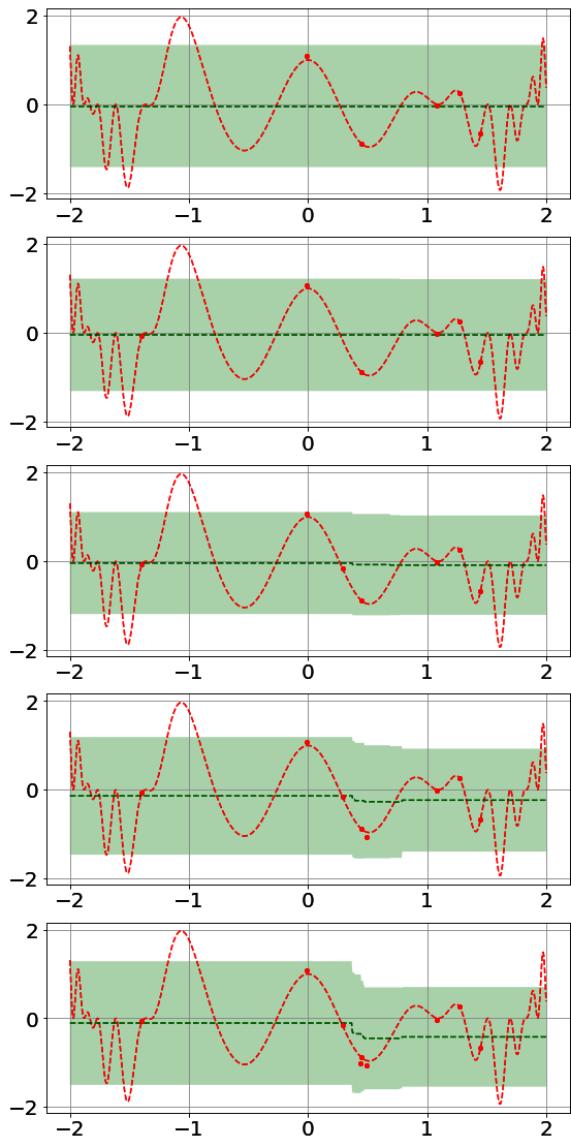


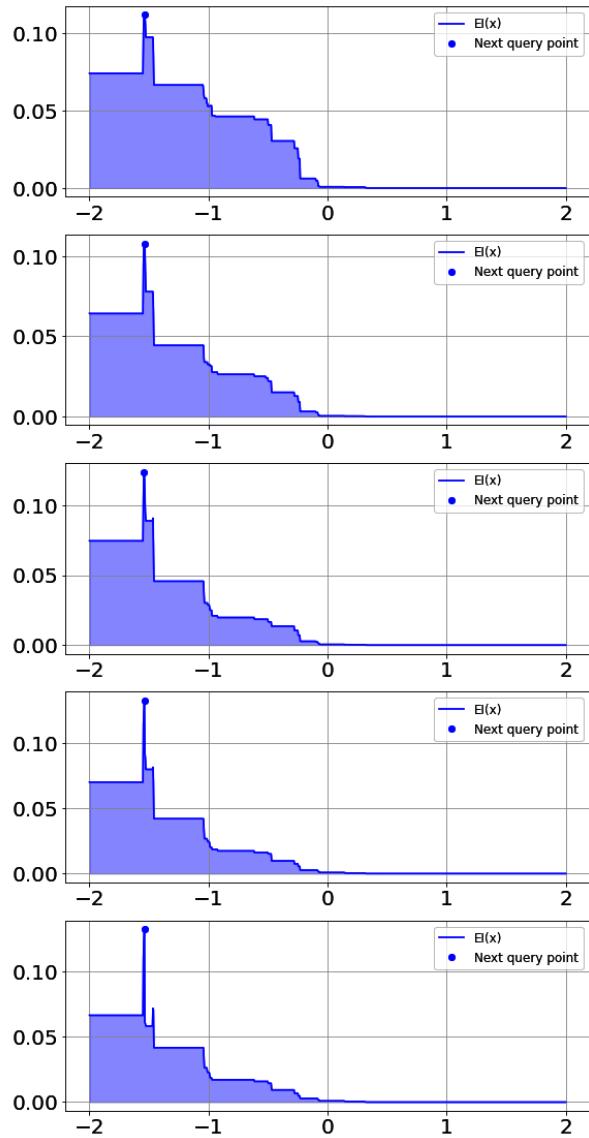
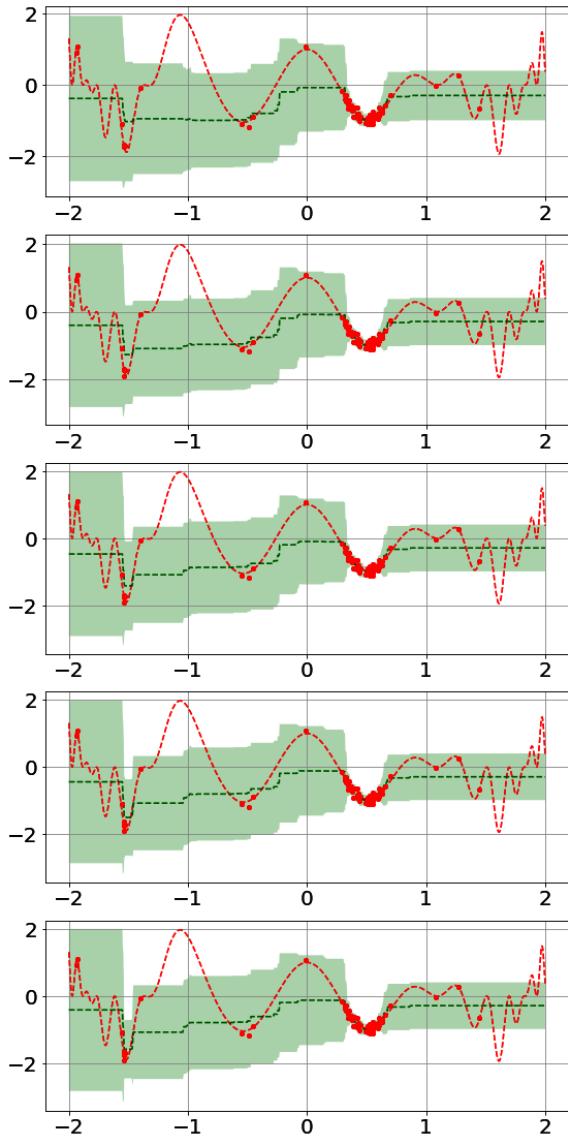
$$x^* = 1.4090, f(x^*) = -0.9011$$



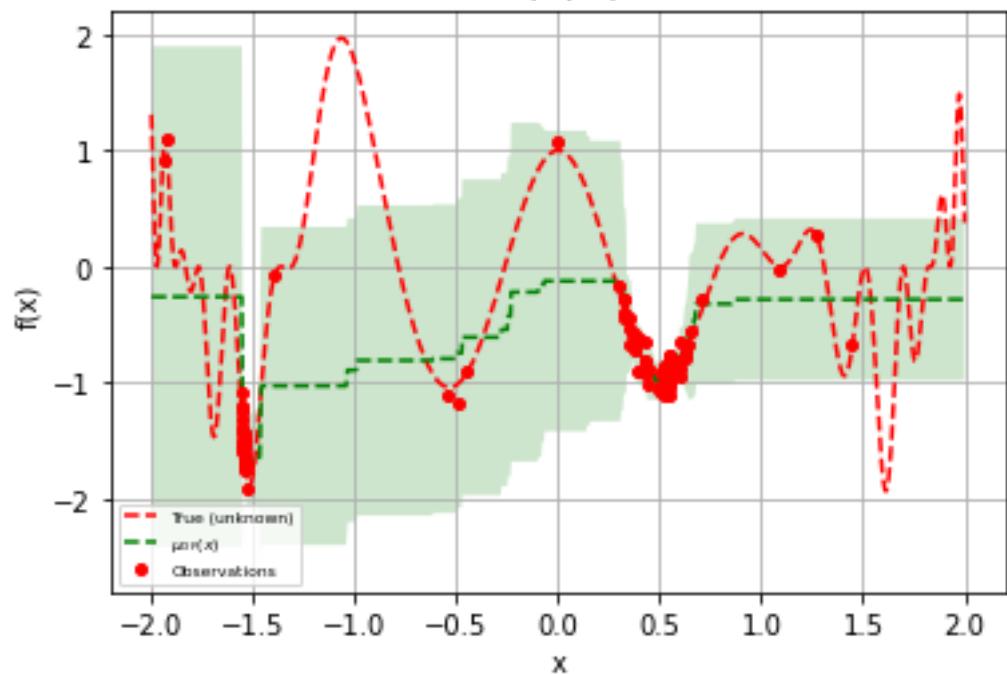
$$x^* = 1.4427, f(x^*) = -0.8015$$



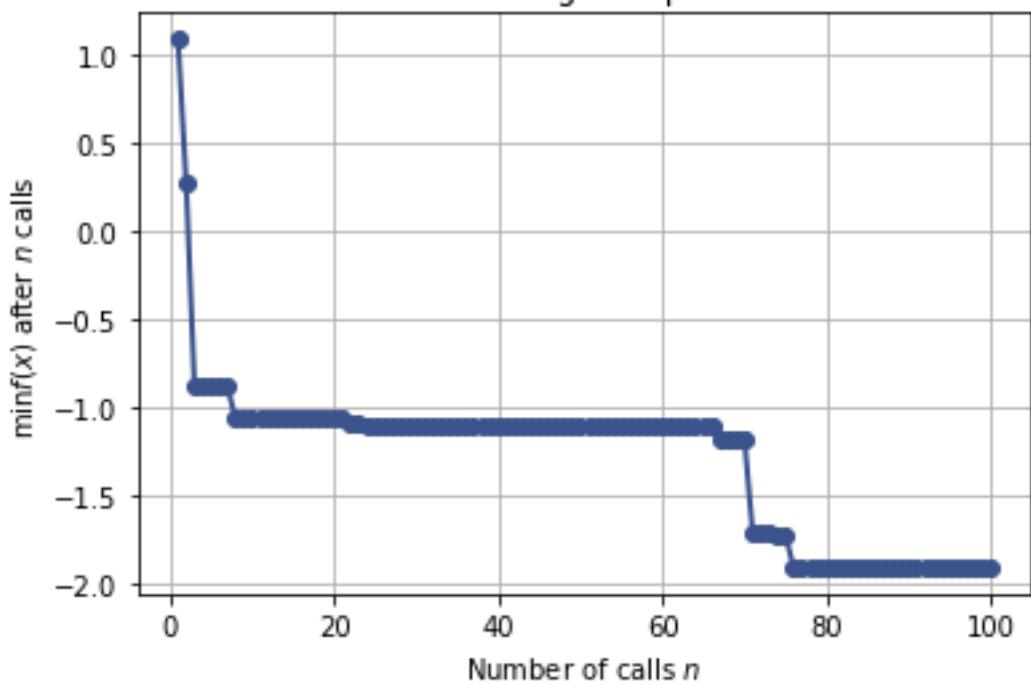


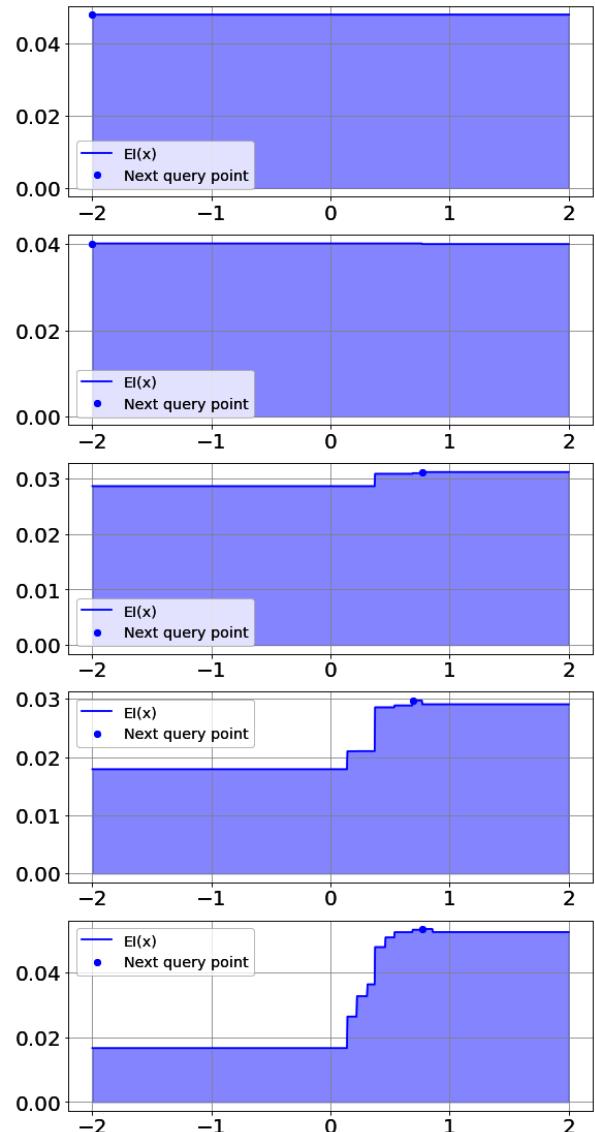
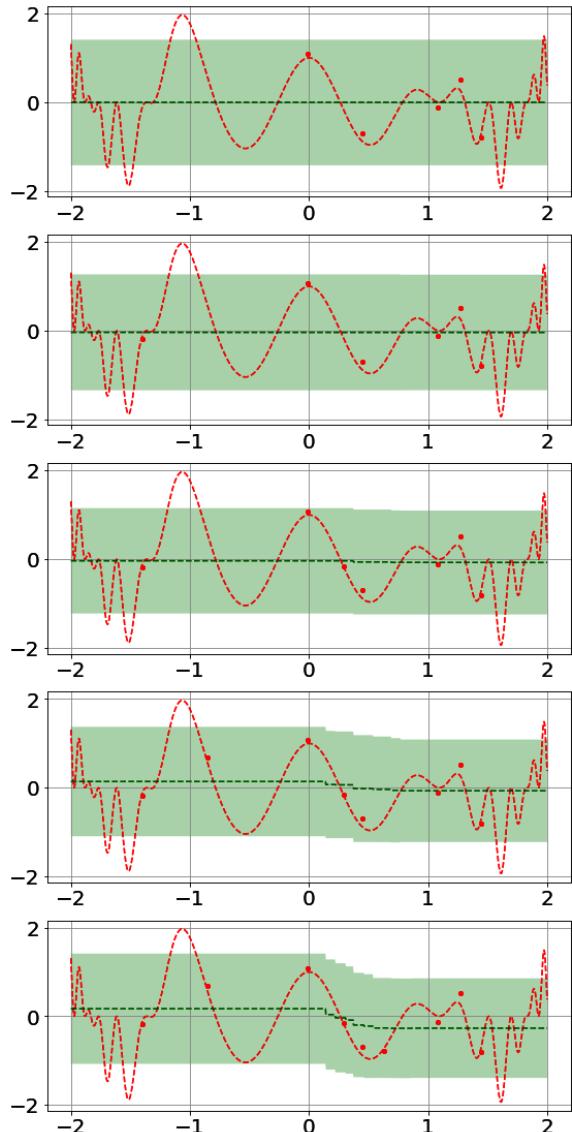


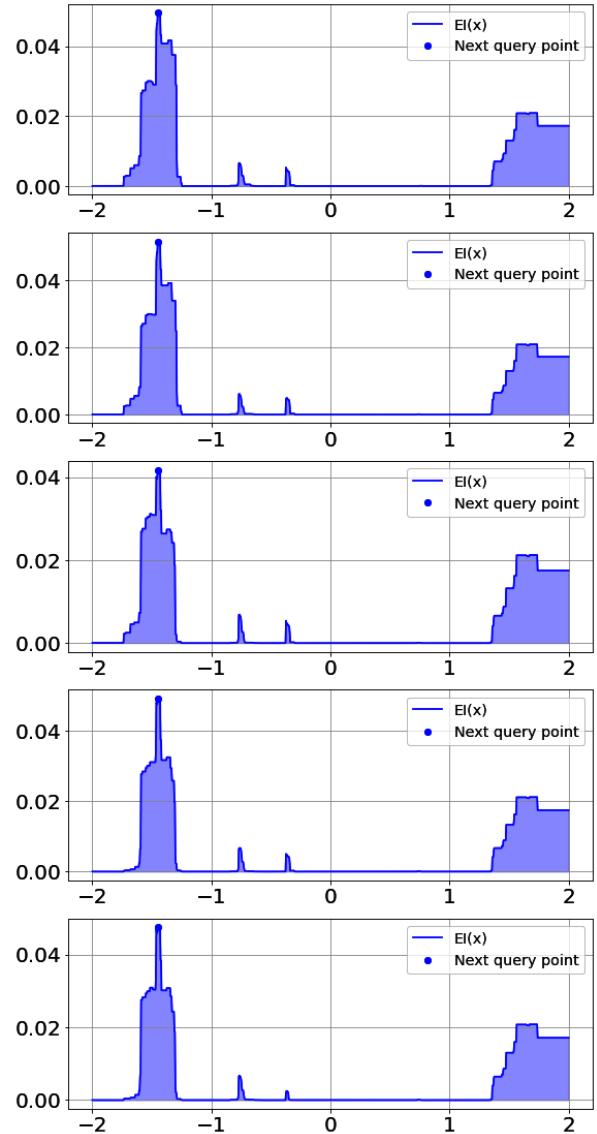
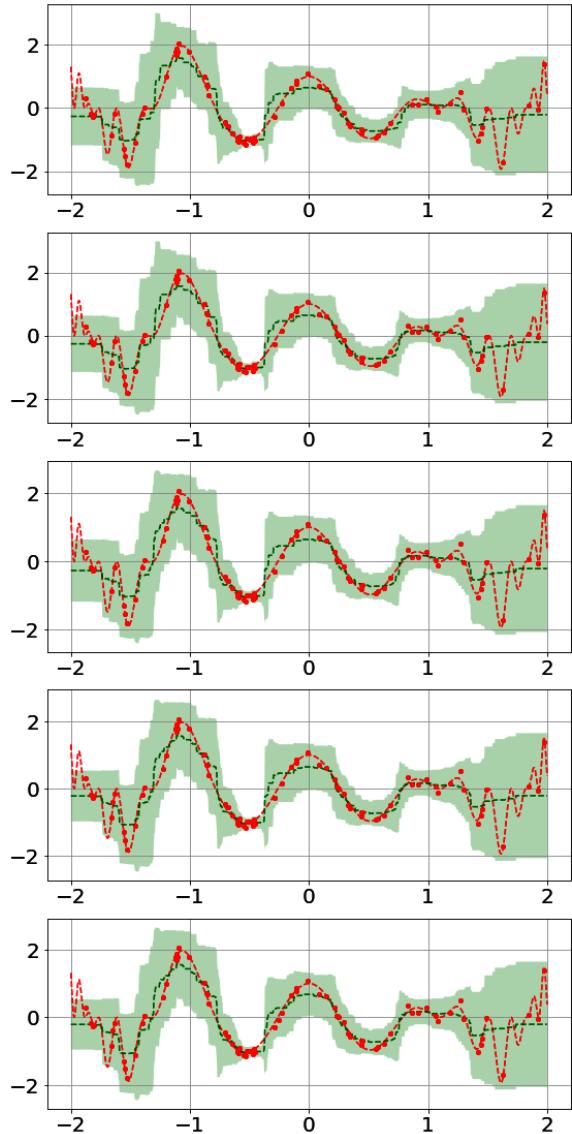
$$x^* = -1.5356, f(x^*) = -1.9008$$

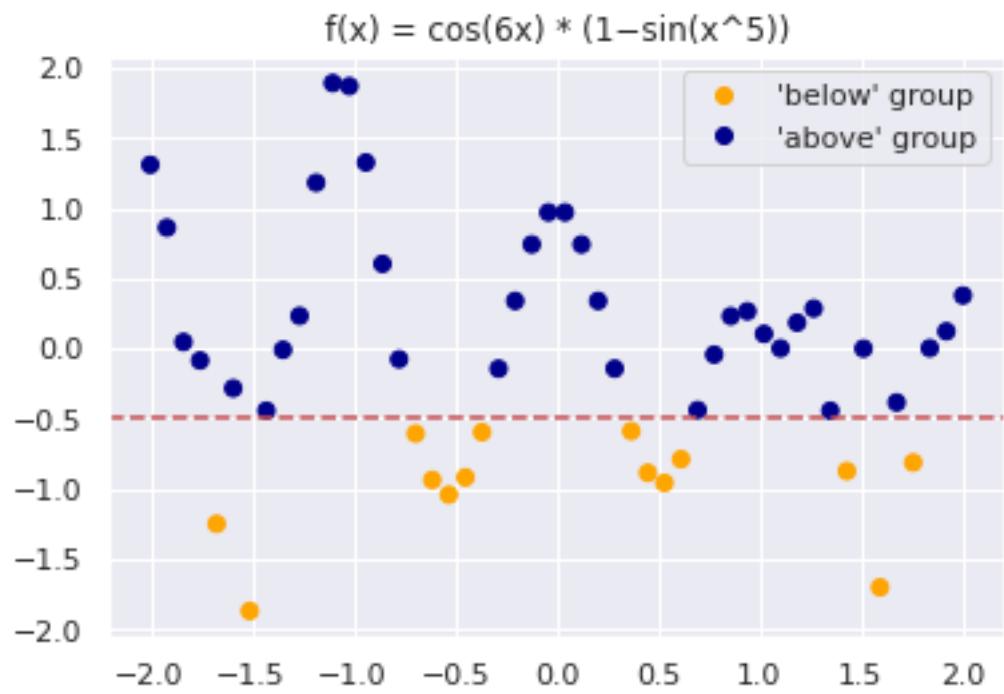
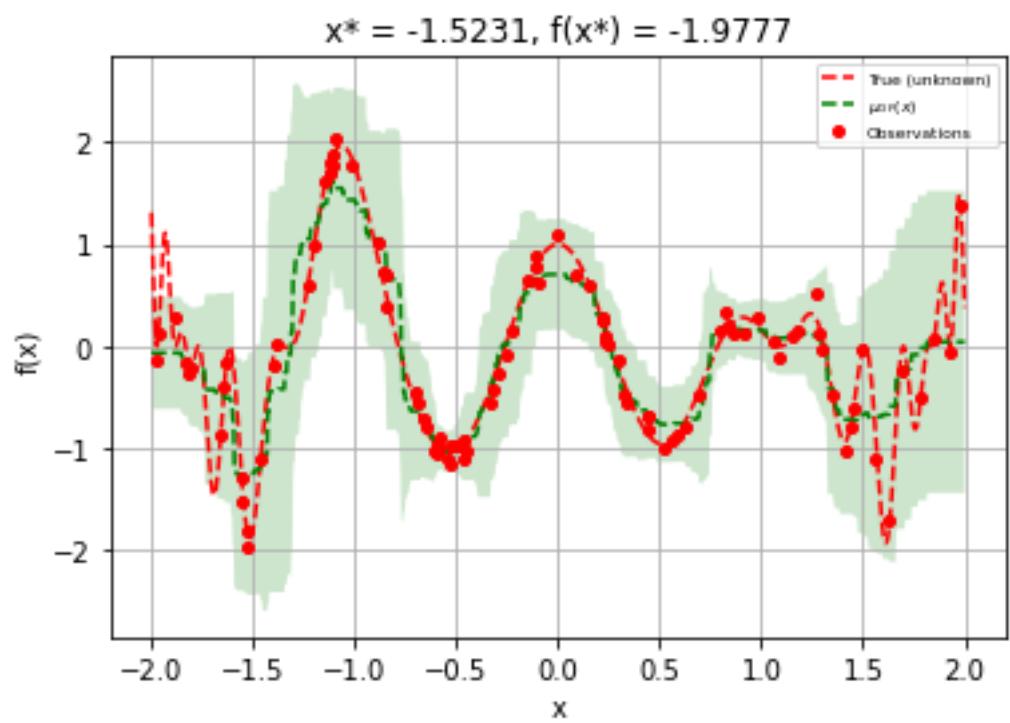


Convergence plot

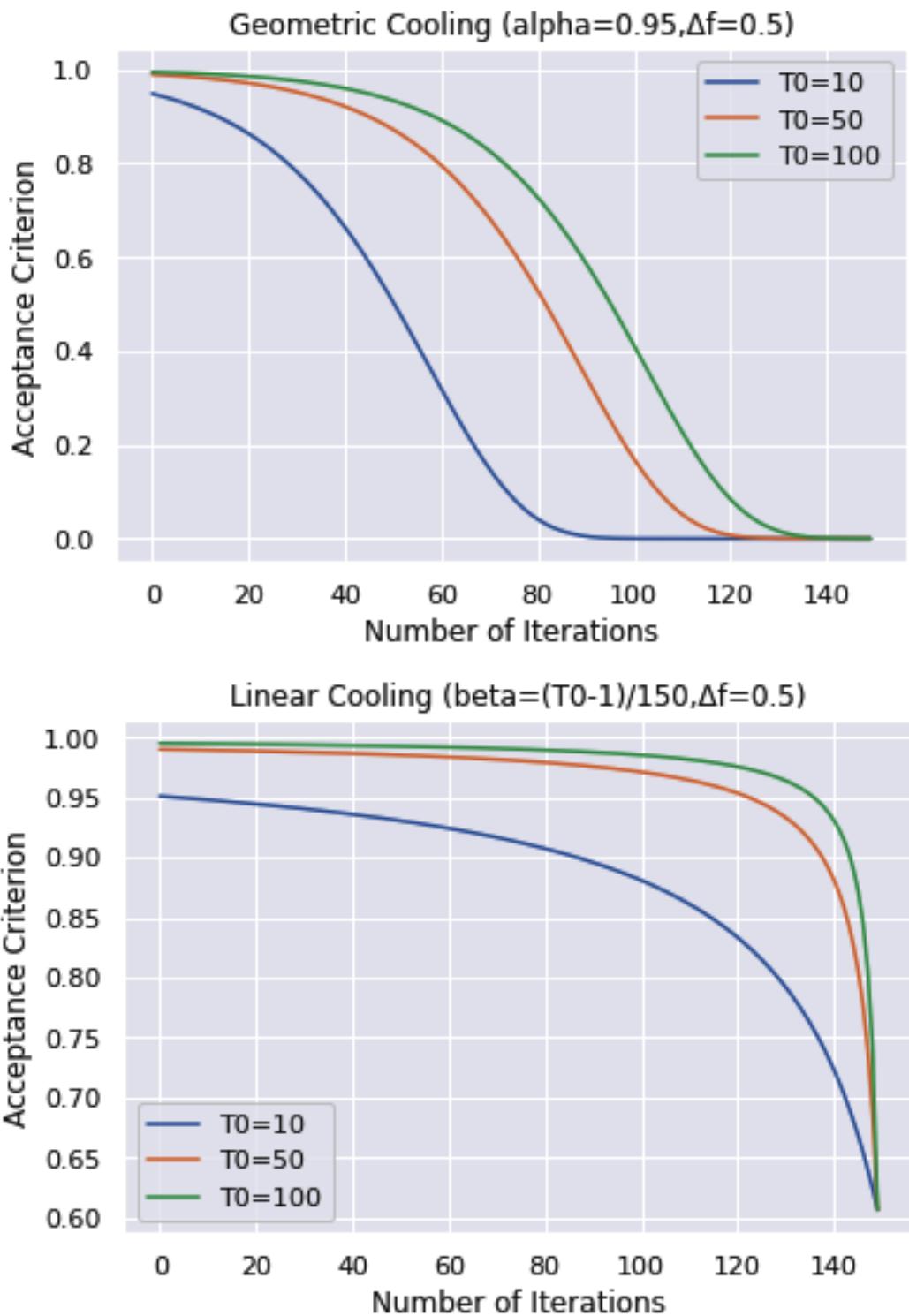




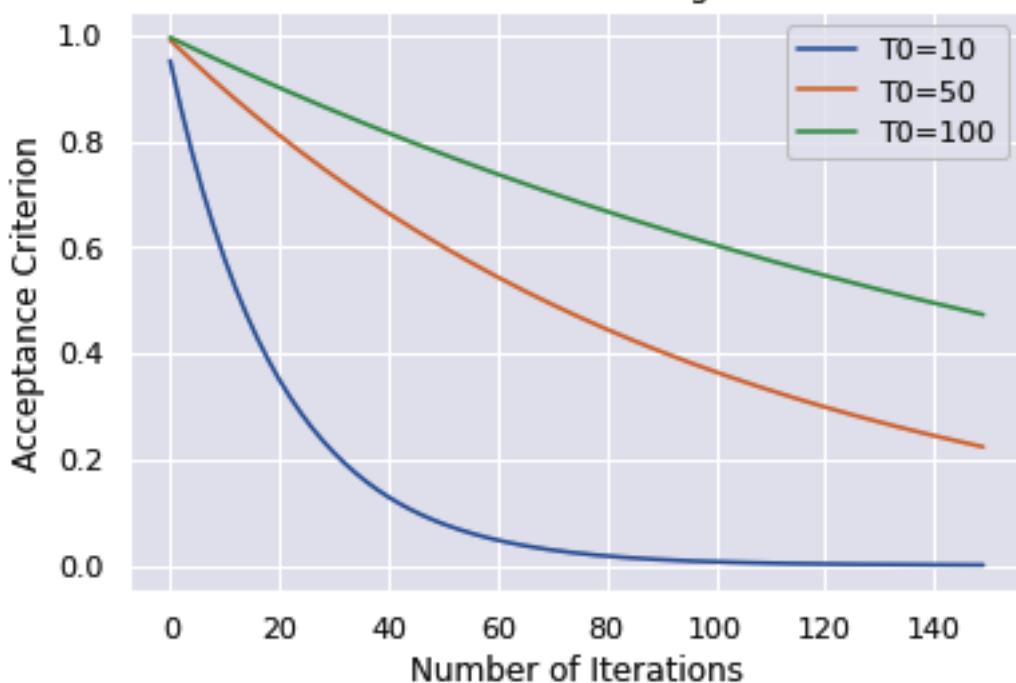




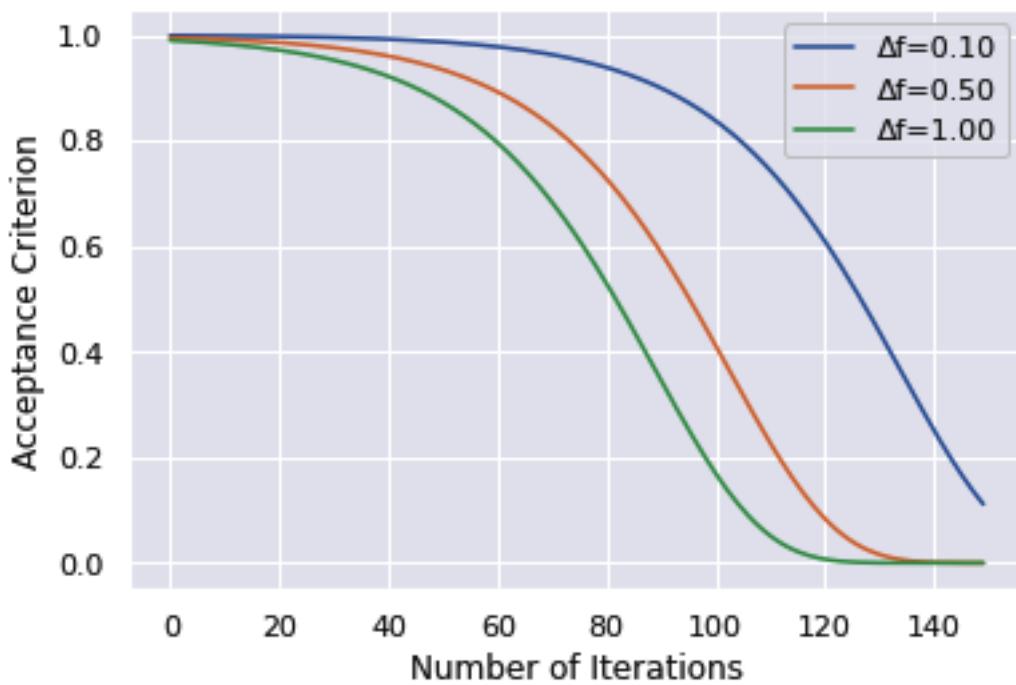
Chapter 5: Exploring Heuristic Search

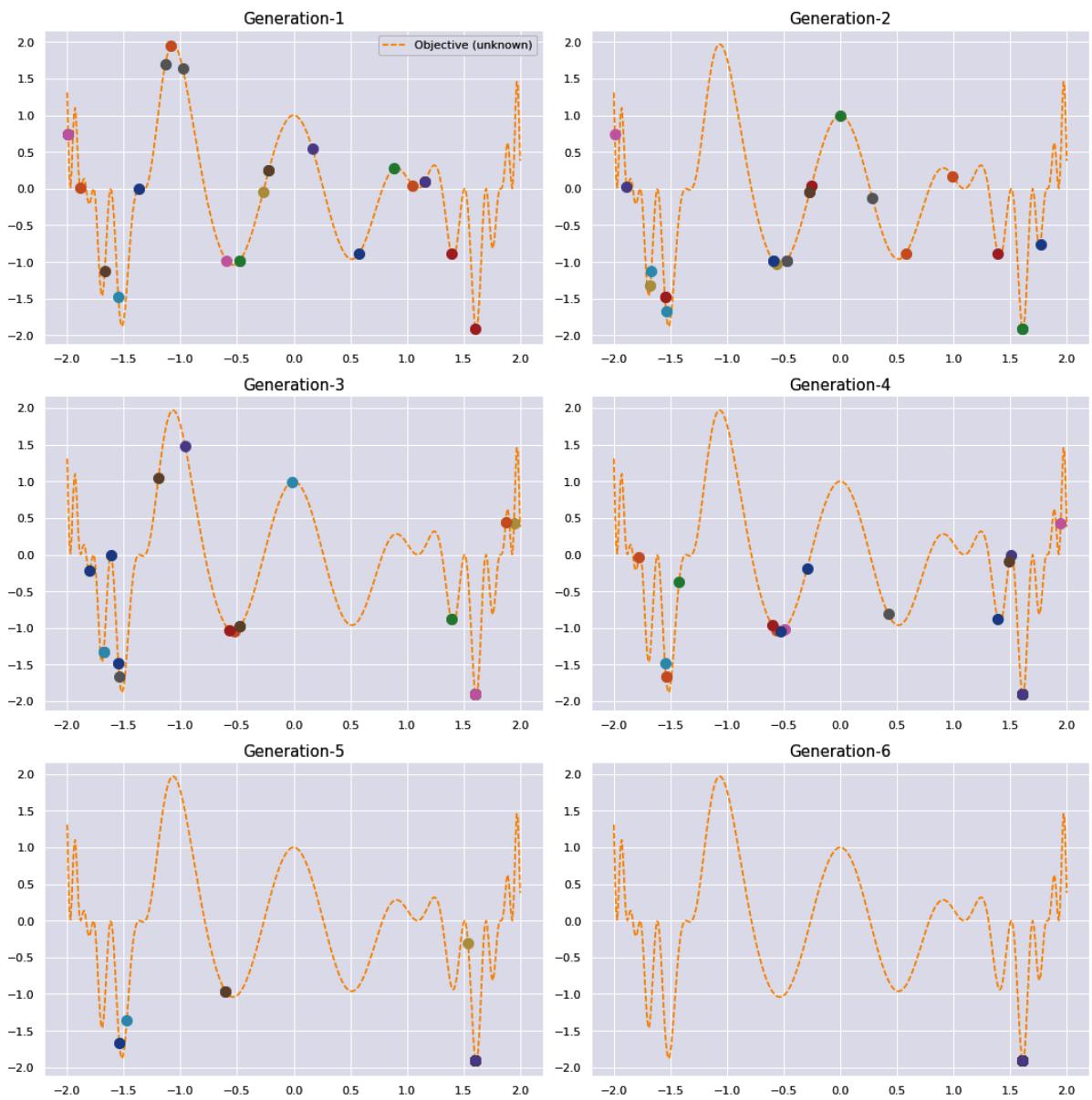
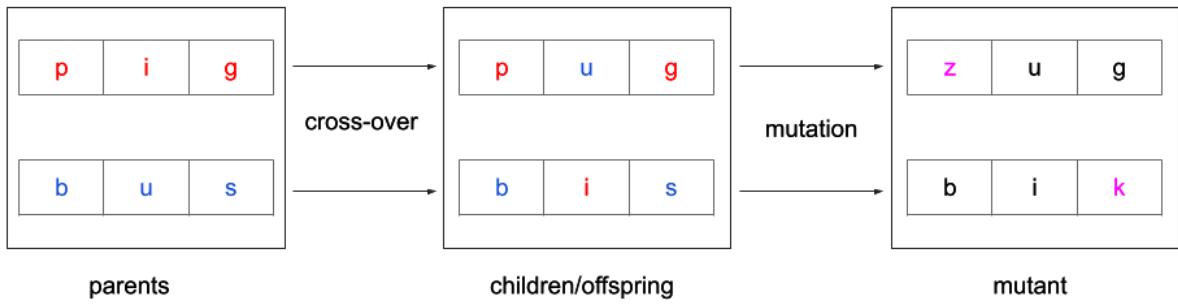


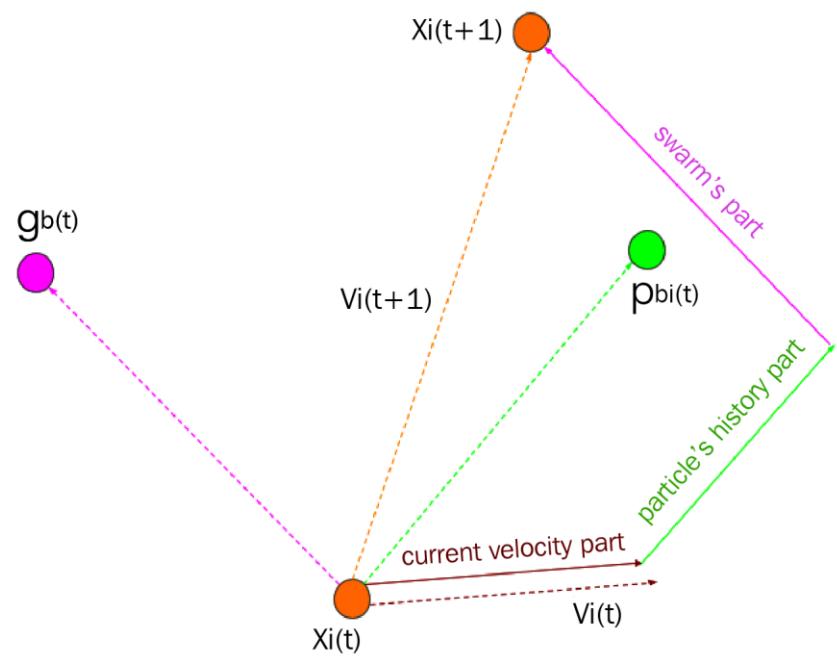
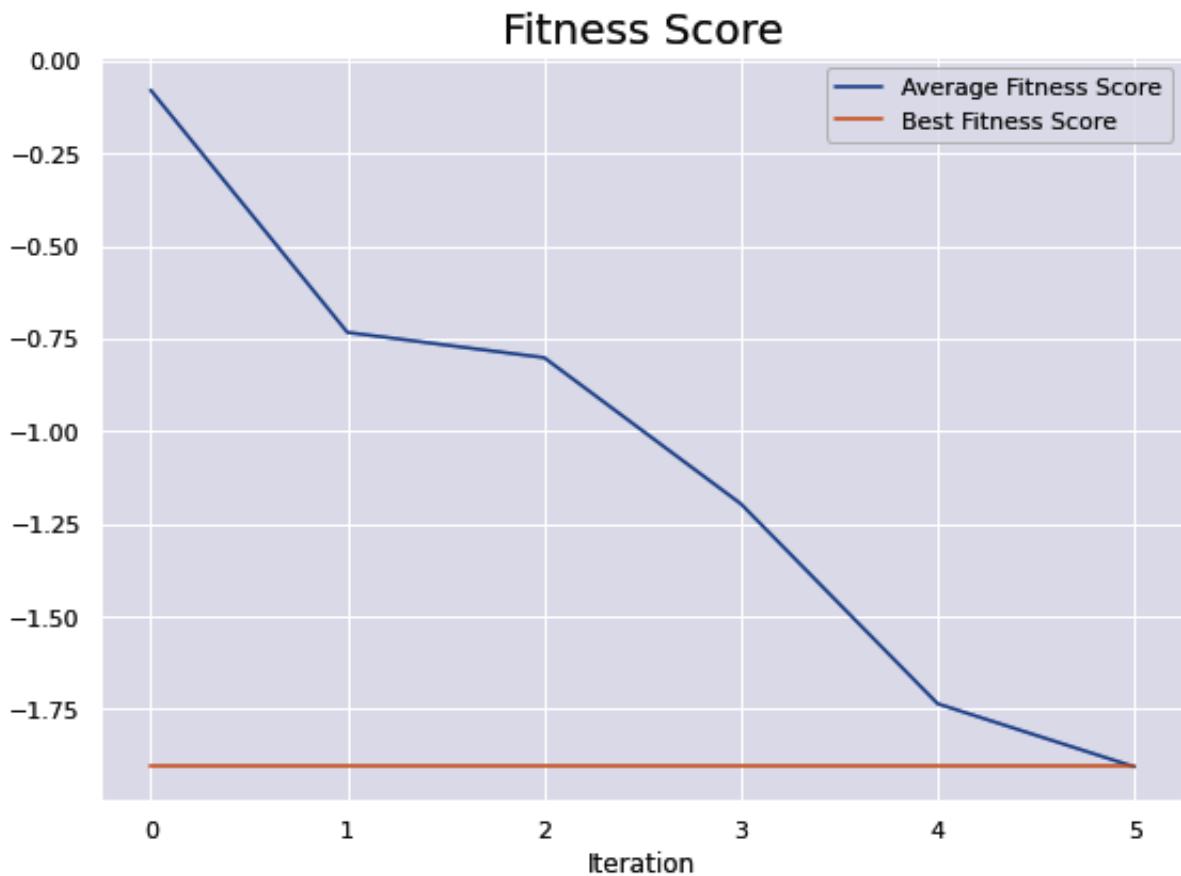
Fast Simulated Annealing ($\Delta f=0.5$)

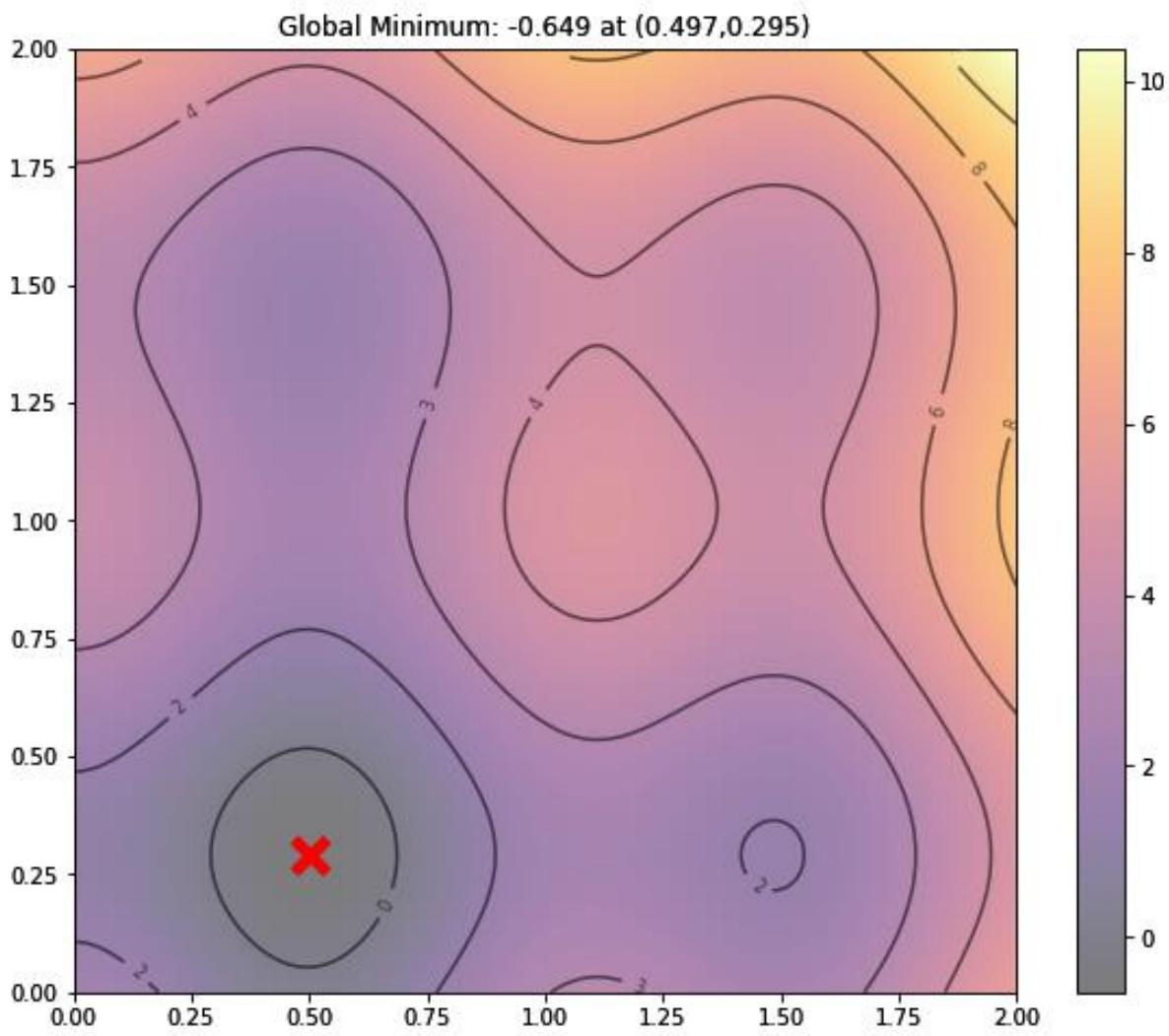


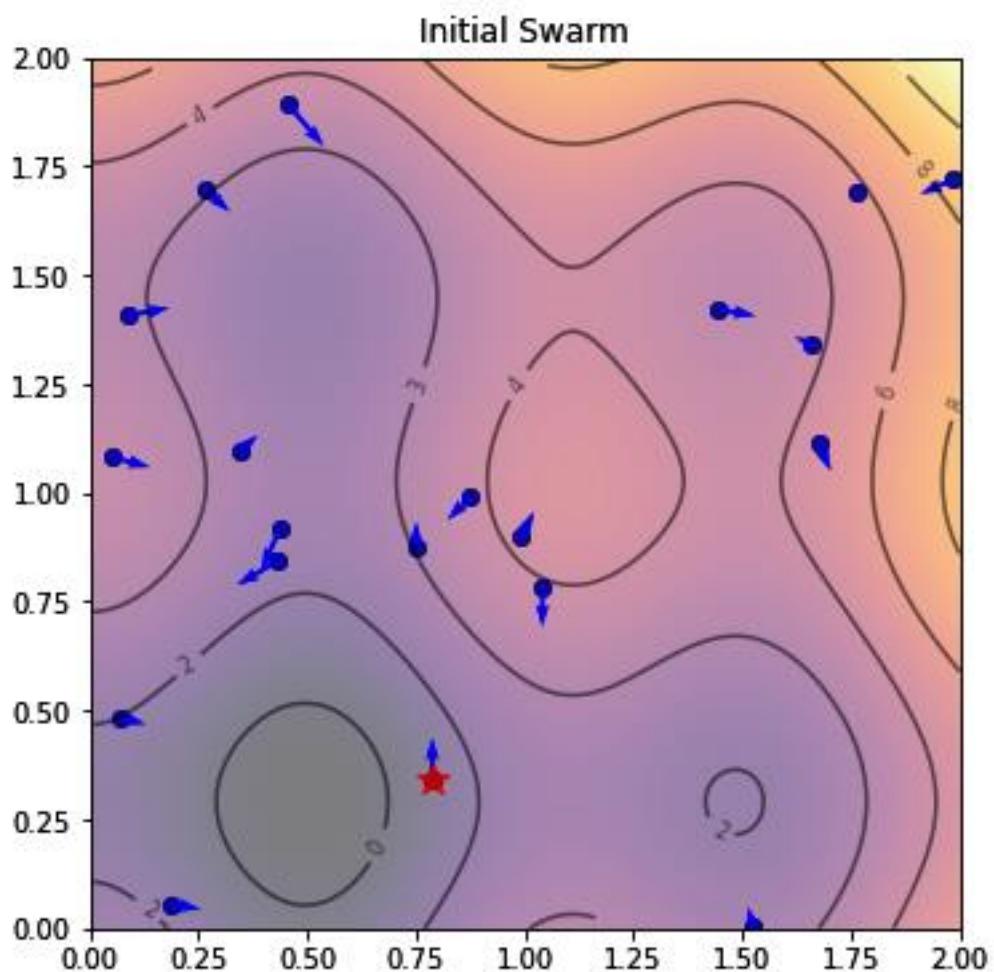
Annealing Schedule: Geometric Cooling $T_0=100$

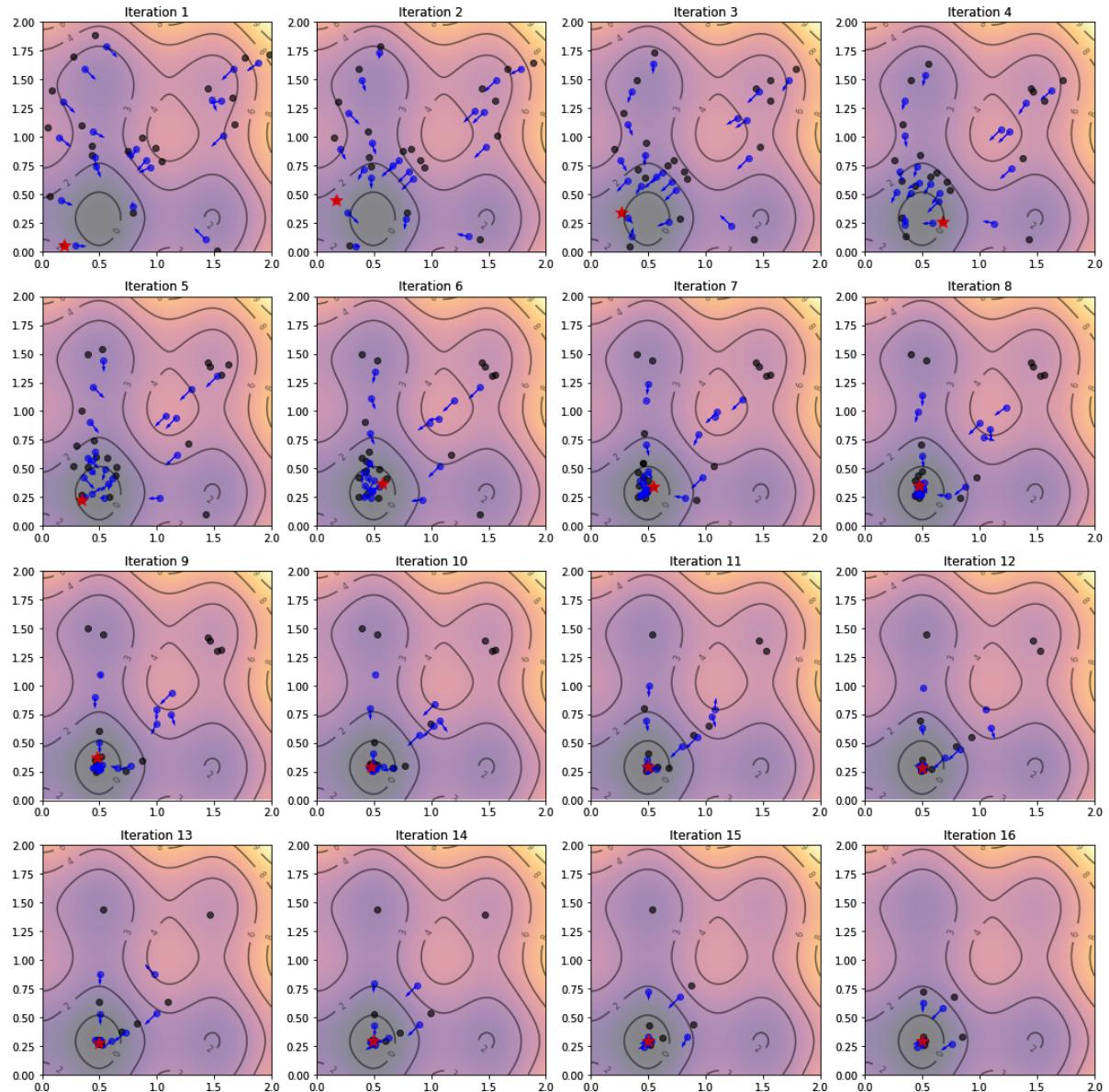




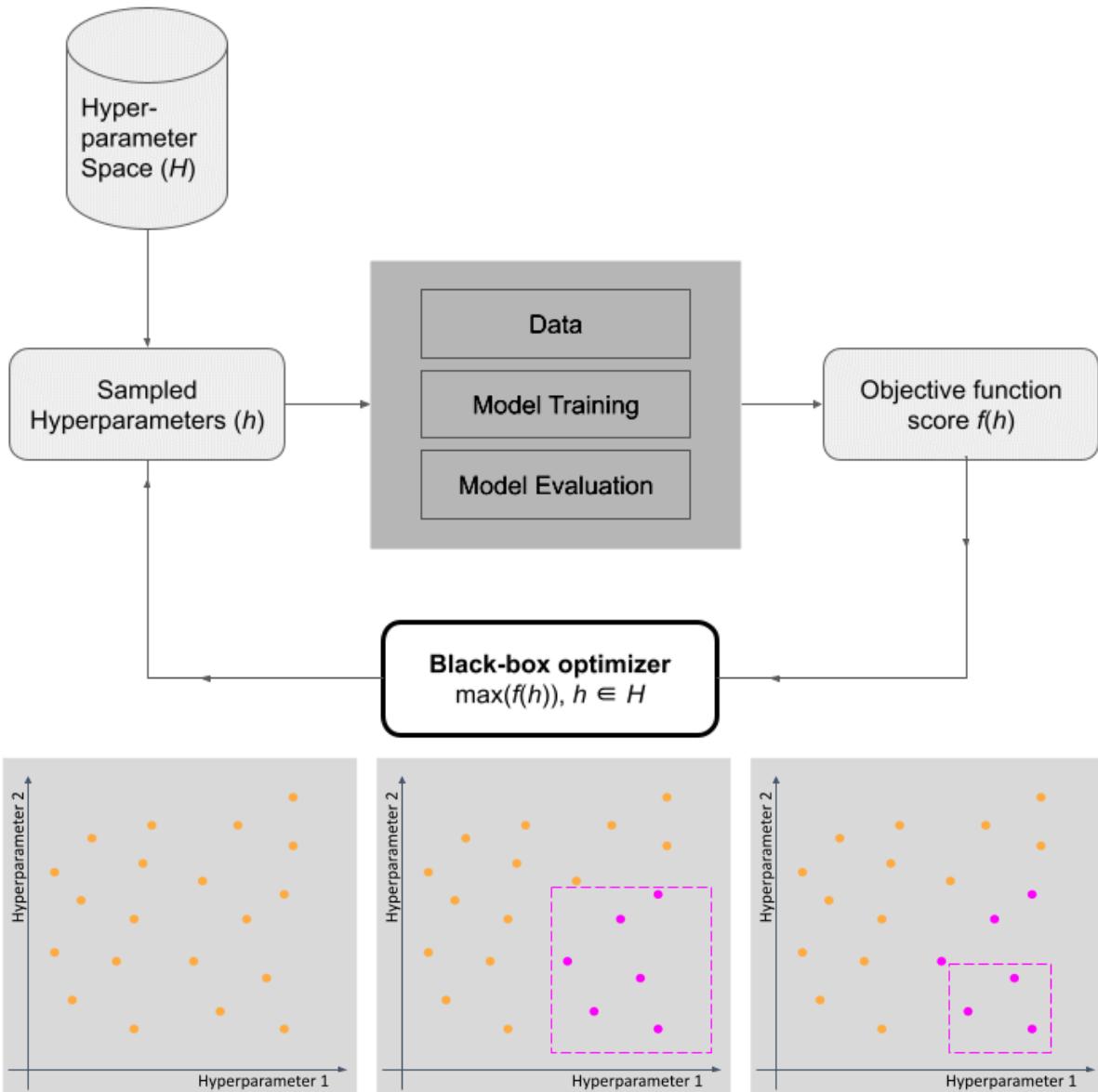


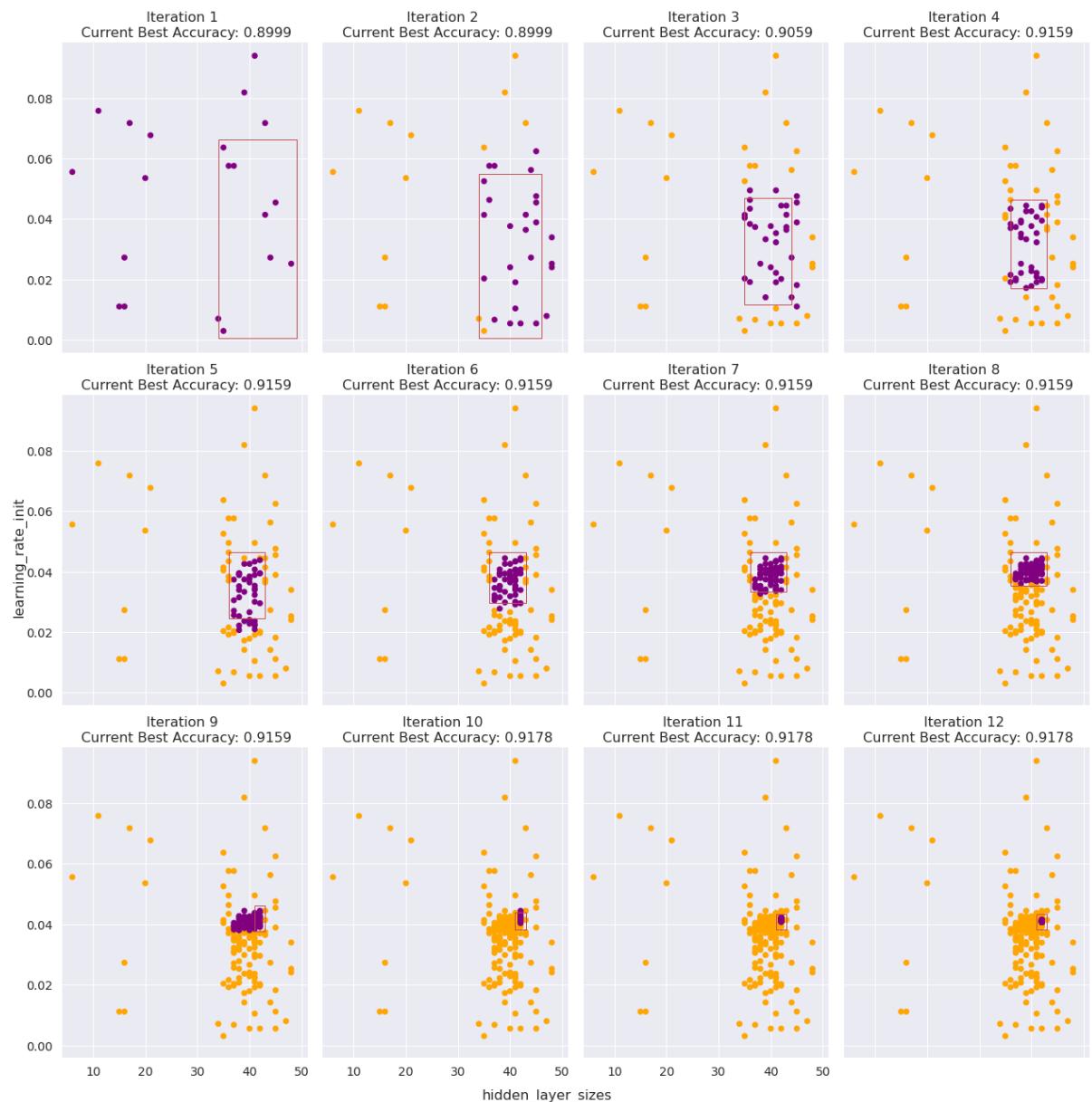


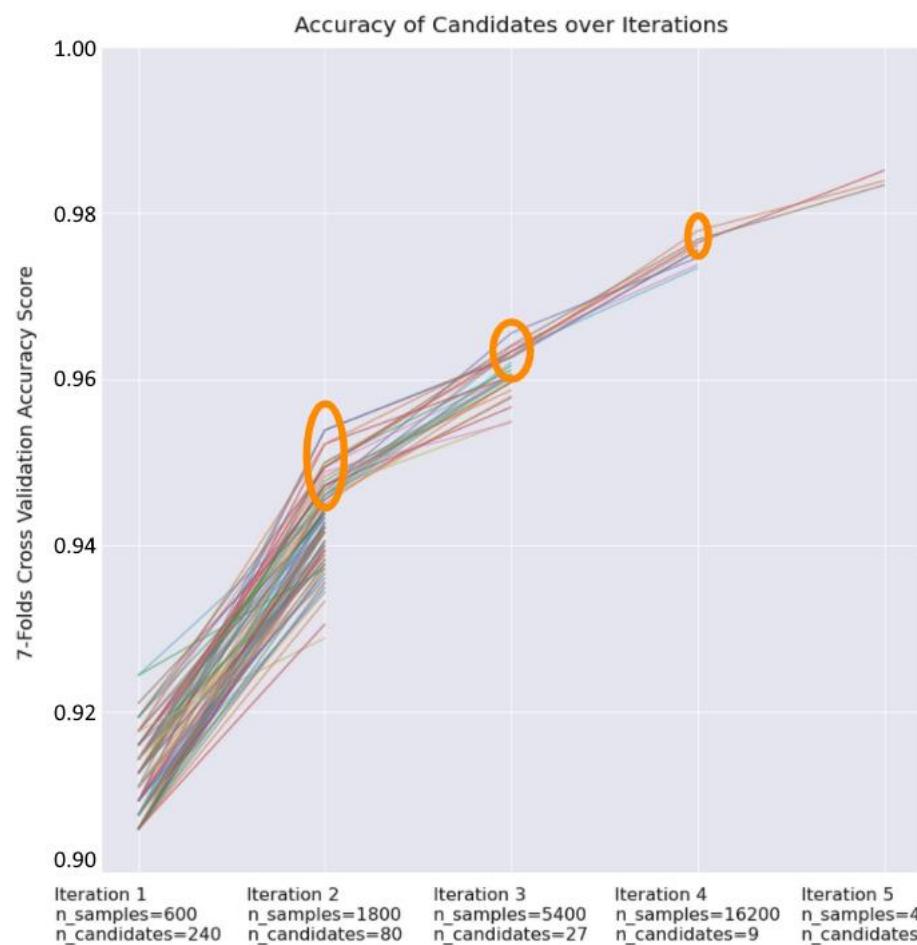
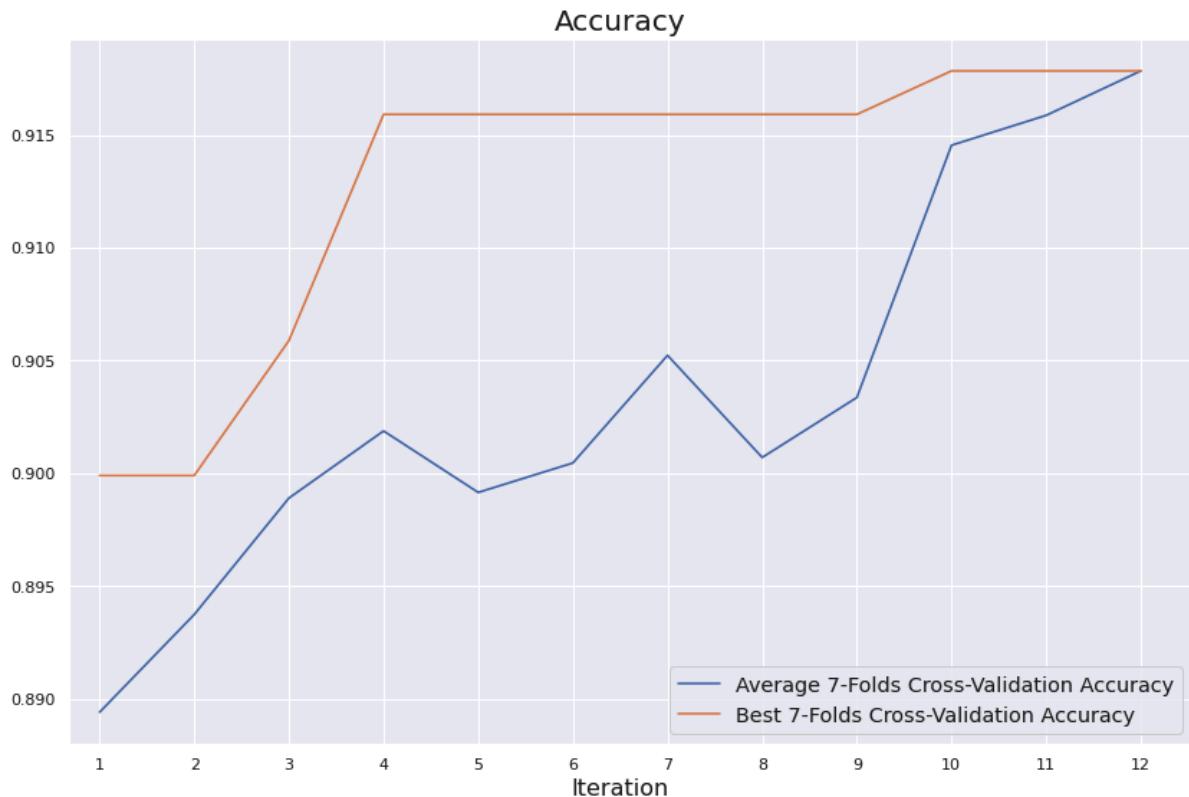




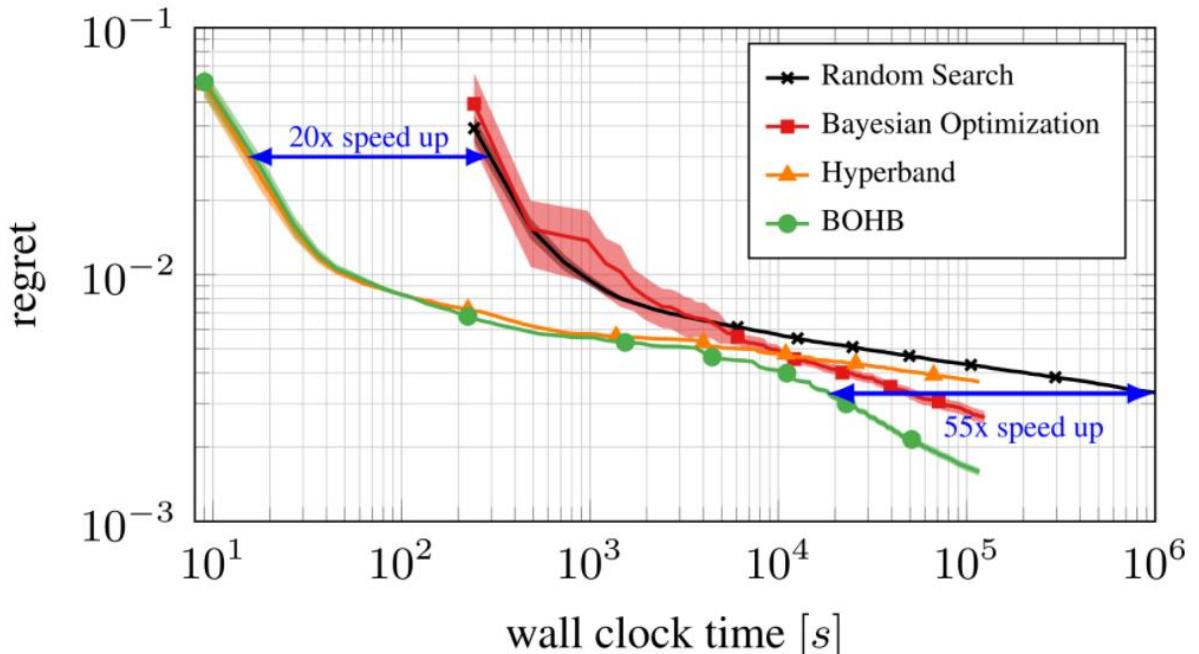
Chapter 6: Exploring Multi-Fidelity Optimization



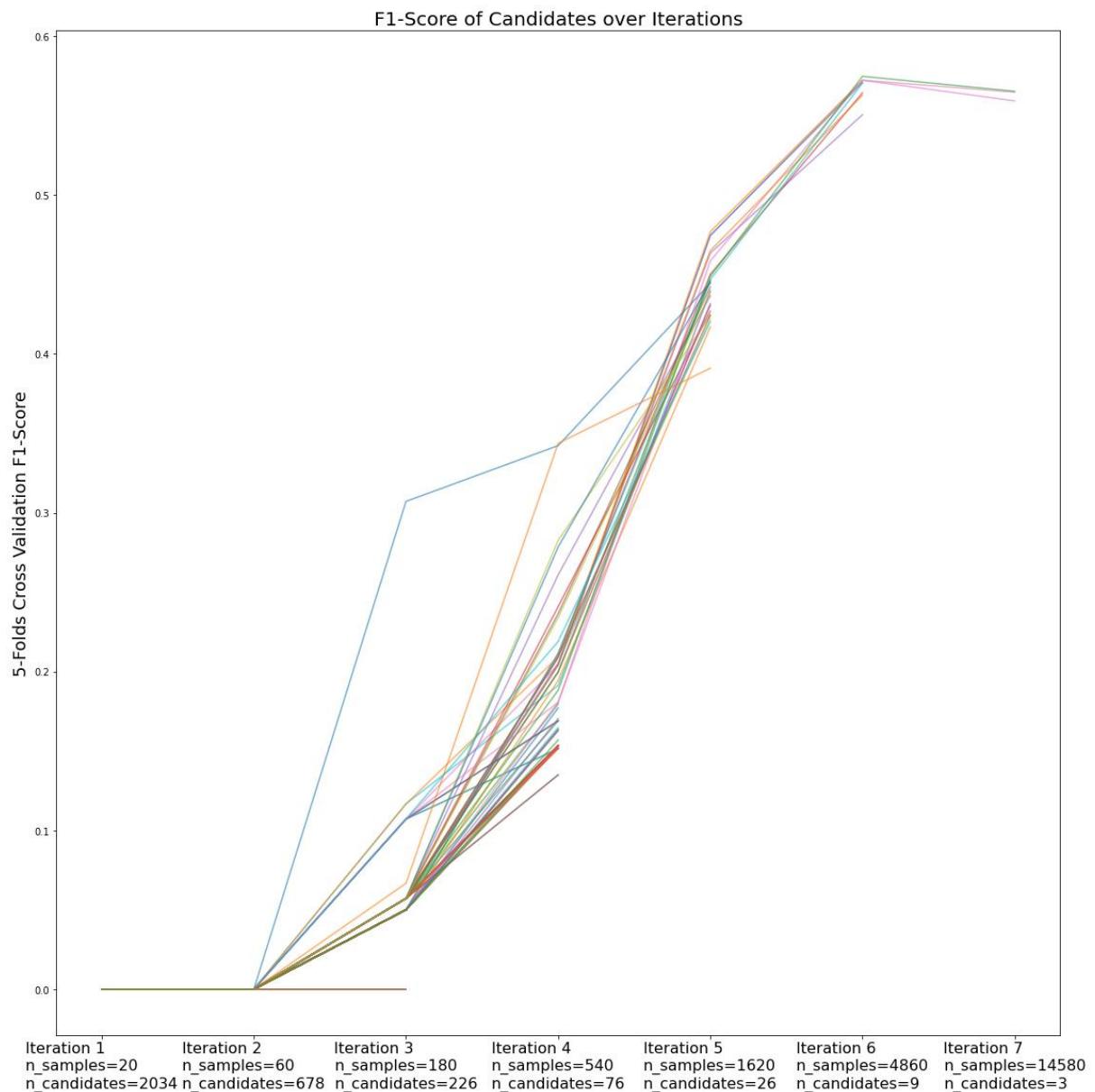




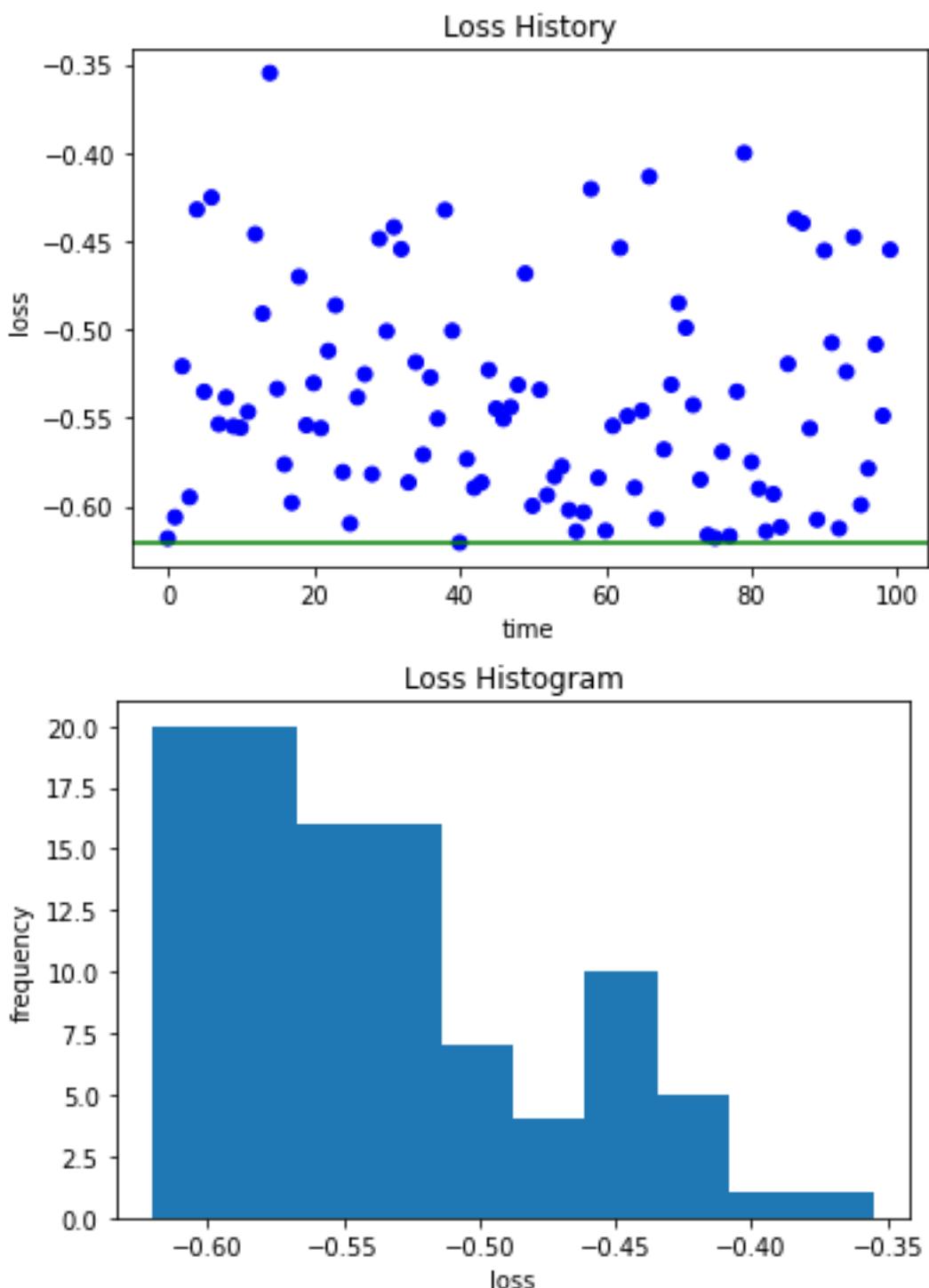
SH Iteration	Bracket-1		Bracket-2		Bracket-3		Bracket-4	
	n_1	r_1	n_2	r_2	n_3	r_3	n_4	r_4
1	27	1	12	3	6	9	4	27
2	9	3	4	9	2	27		
3	3	9	1	27				
4	1	27						

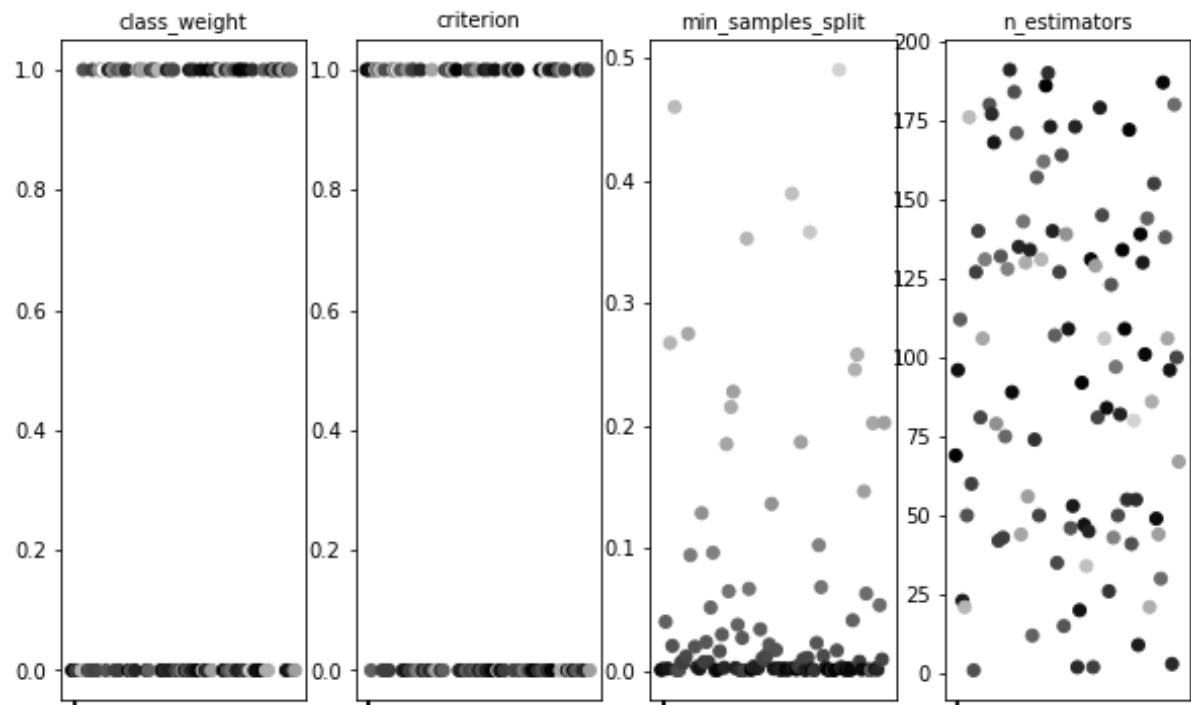


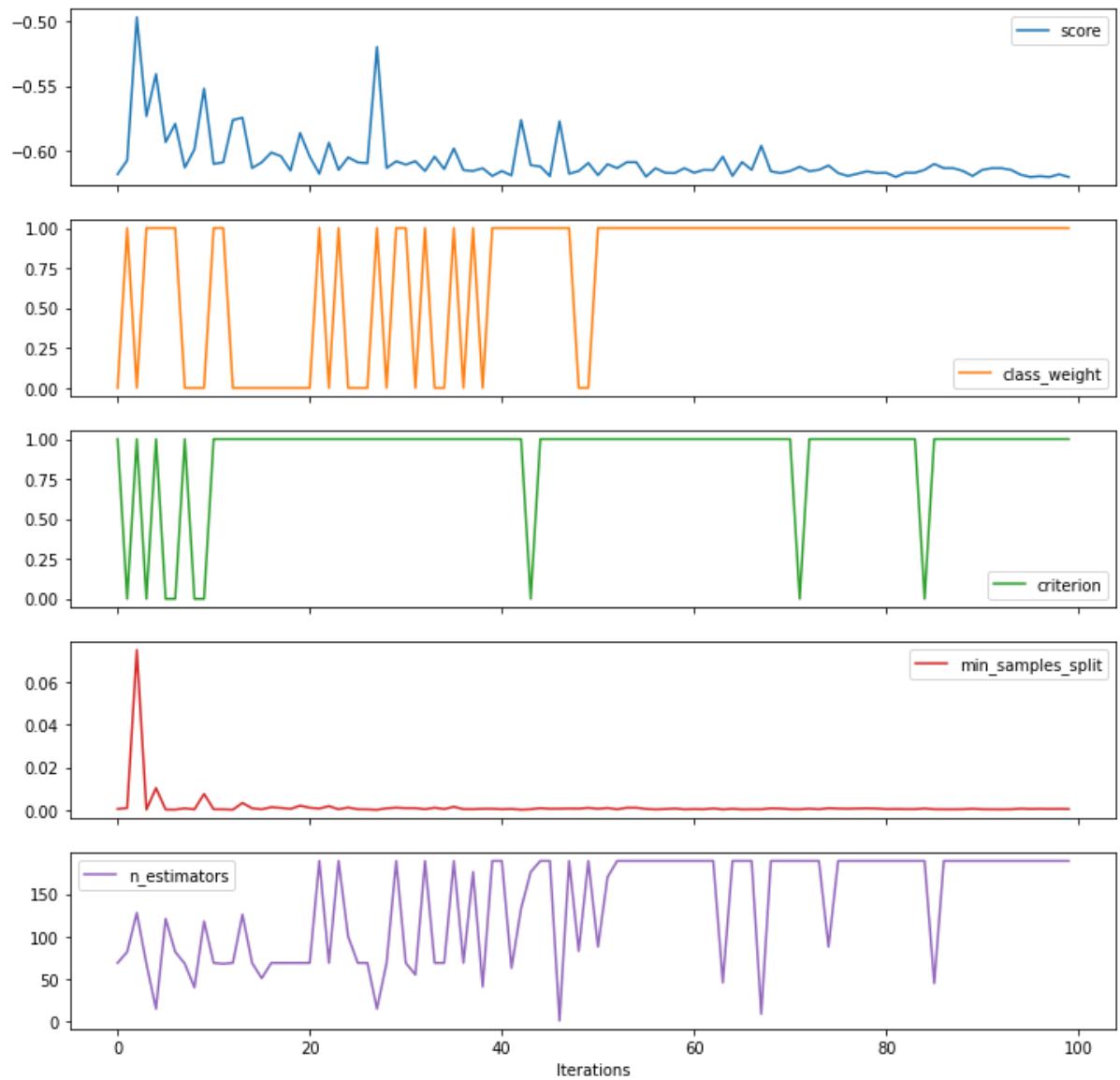
Chapter 7: Hyperparameter Tuning via Scikit



Chapter 8: Hyperparameter Tuning via Hyperopt



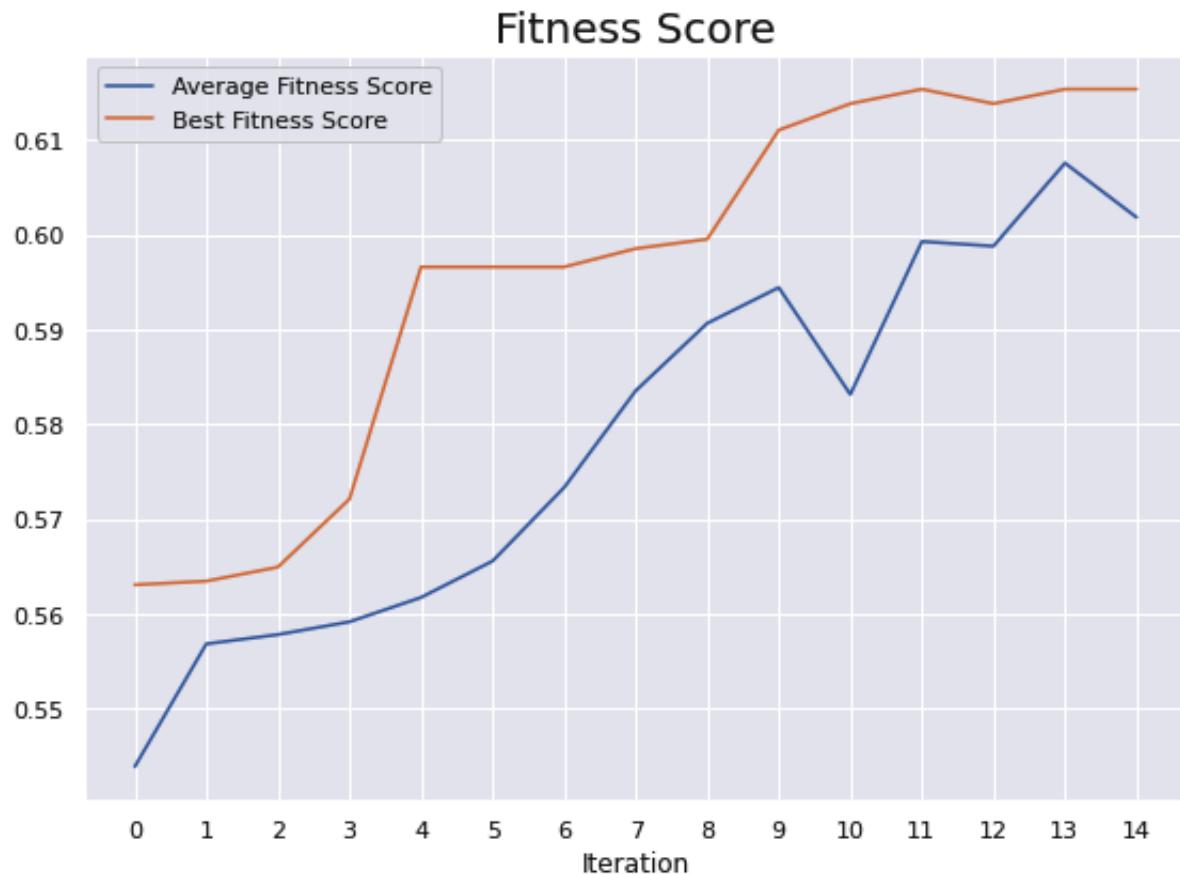




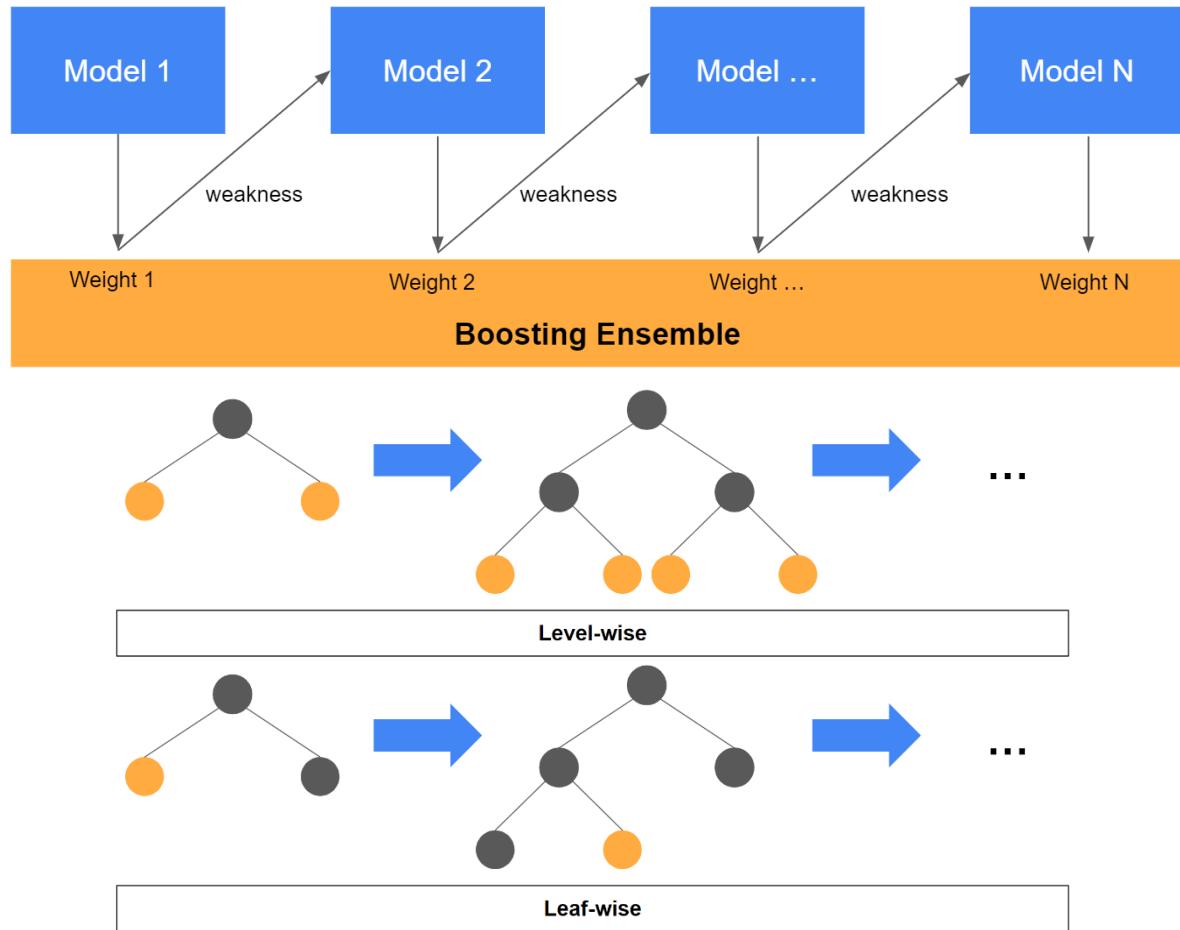
Chapter 9: Hyperparameter Tuning via Optuna

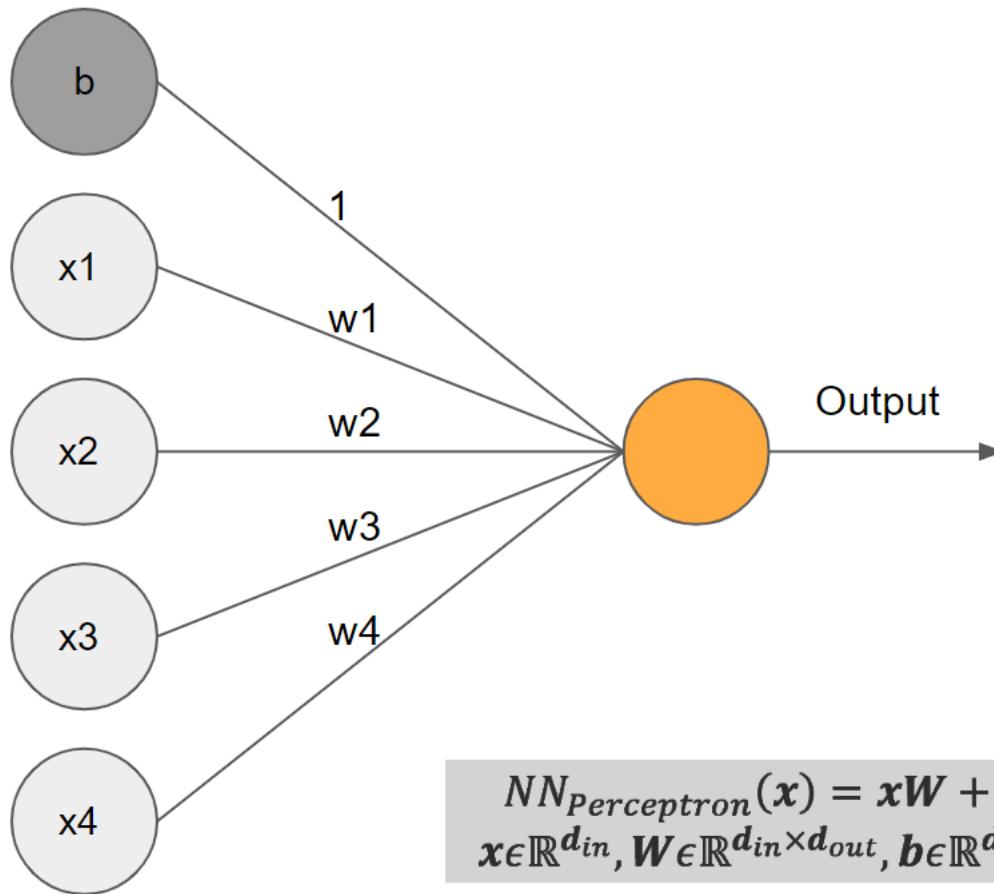
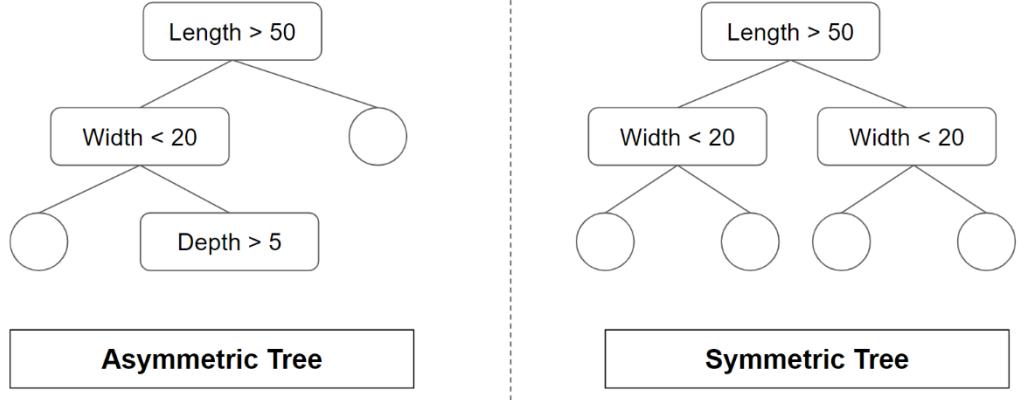
No images...

Chapter 10: Advanced Hyperparameter Tuning with DEAP and Microsoft NNI

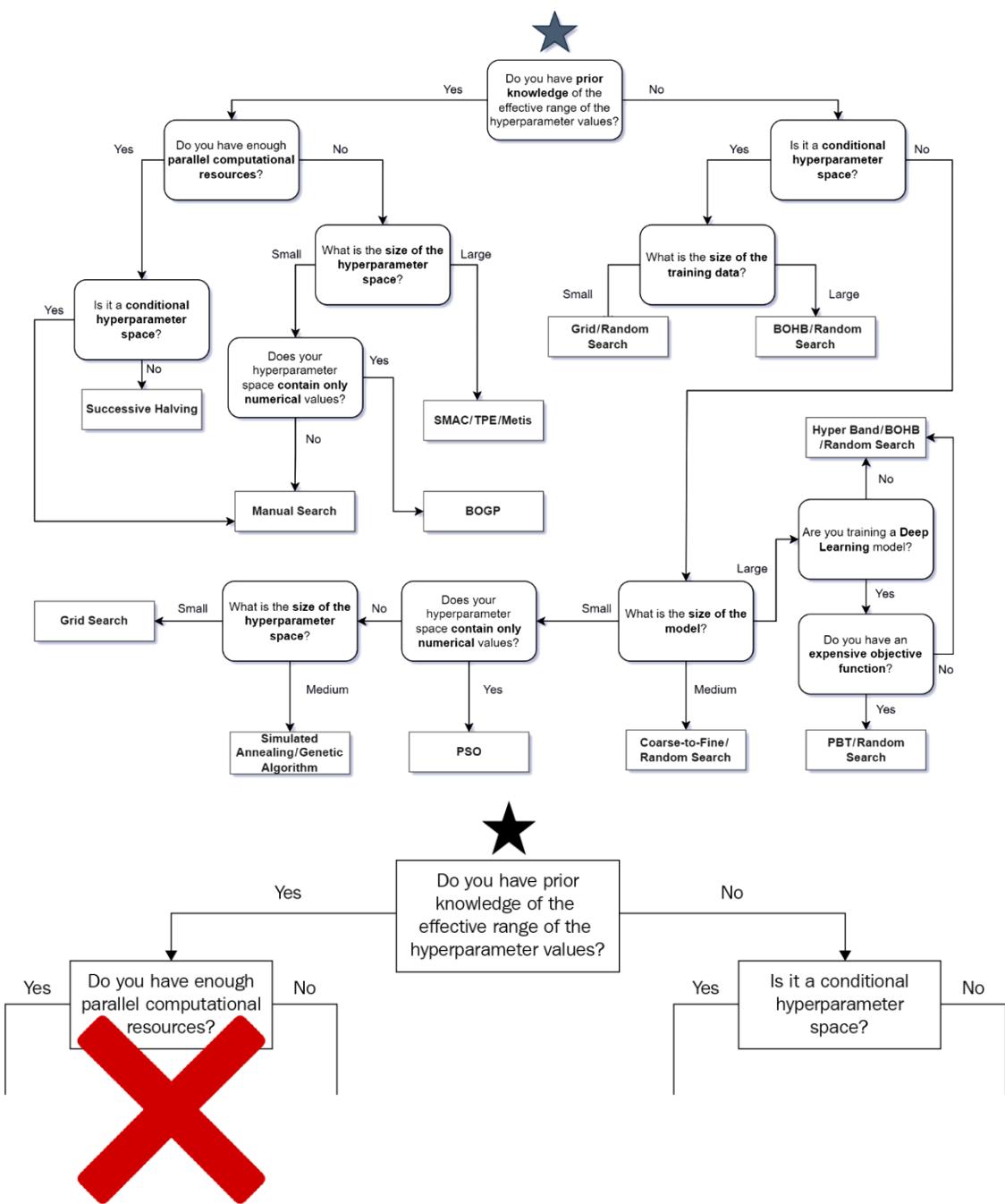


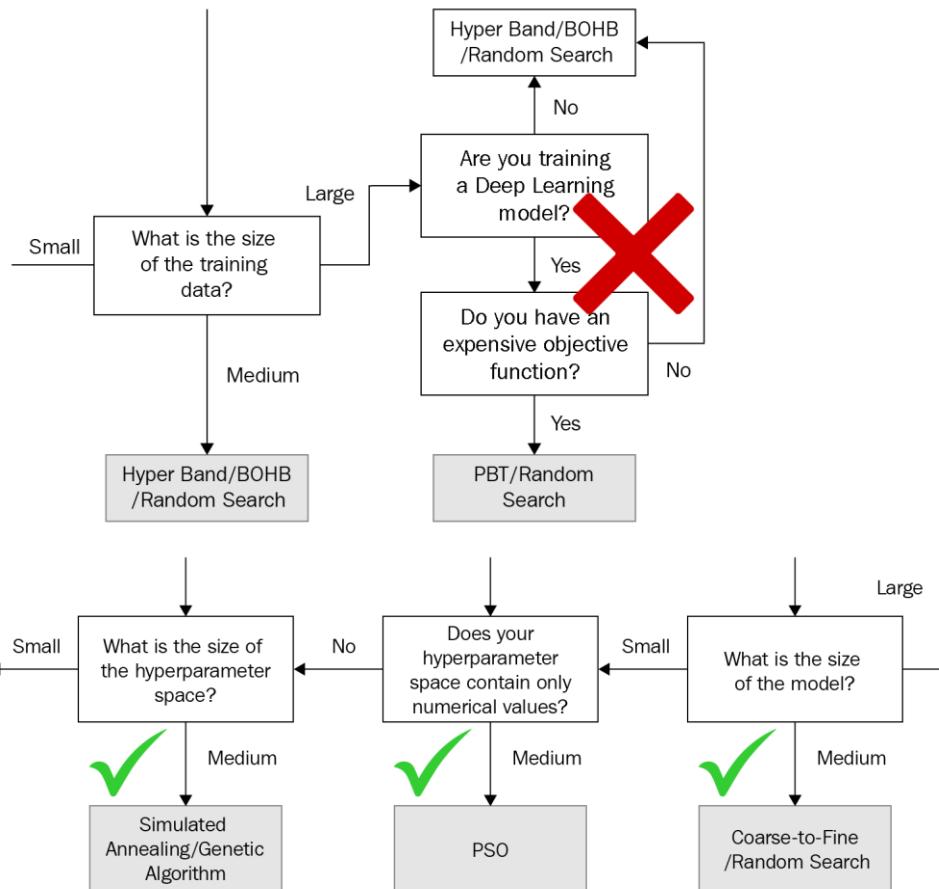
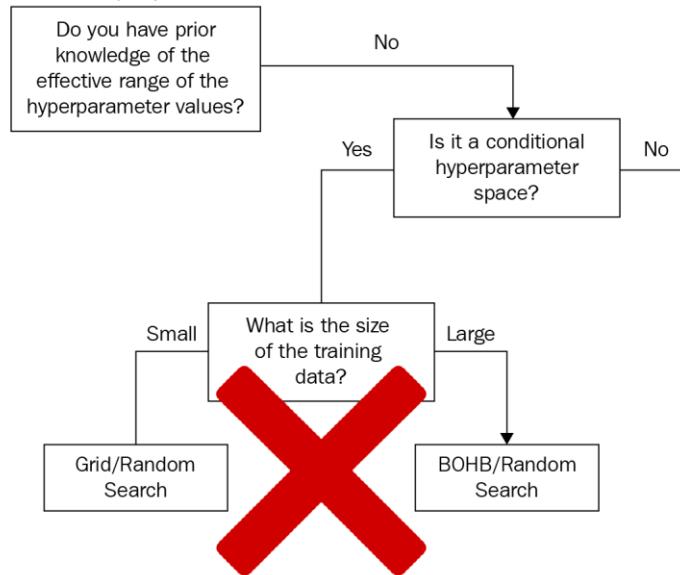
Chapter 11: Understanding Hyperparameters of Popular Algorithms

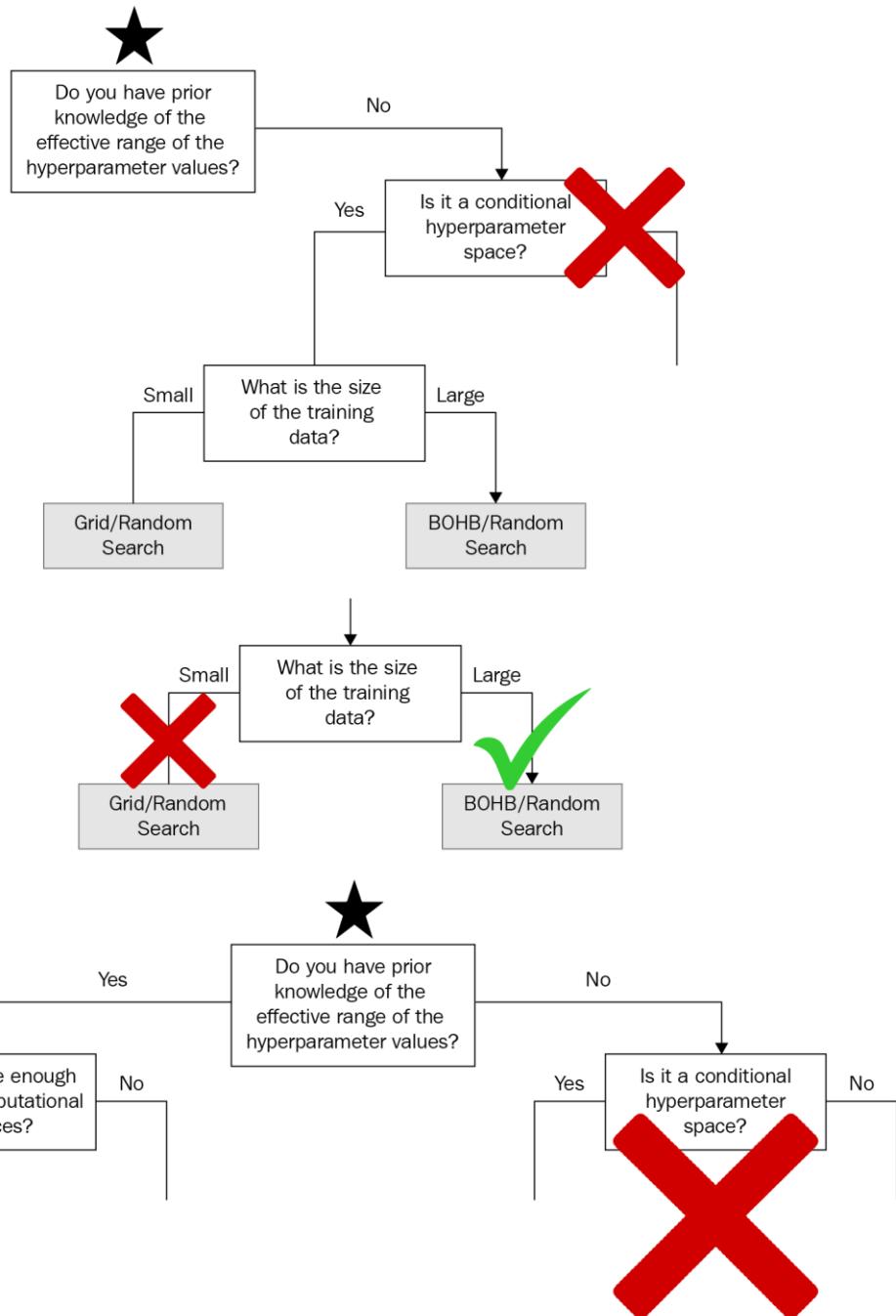


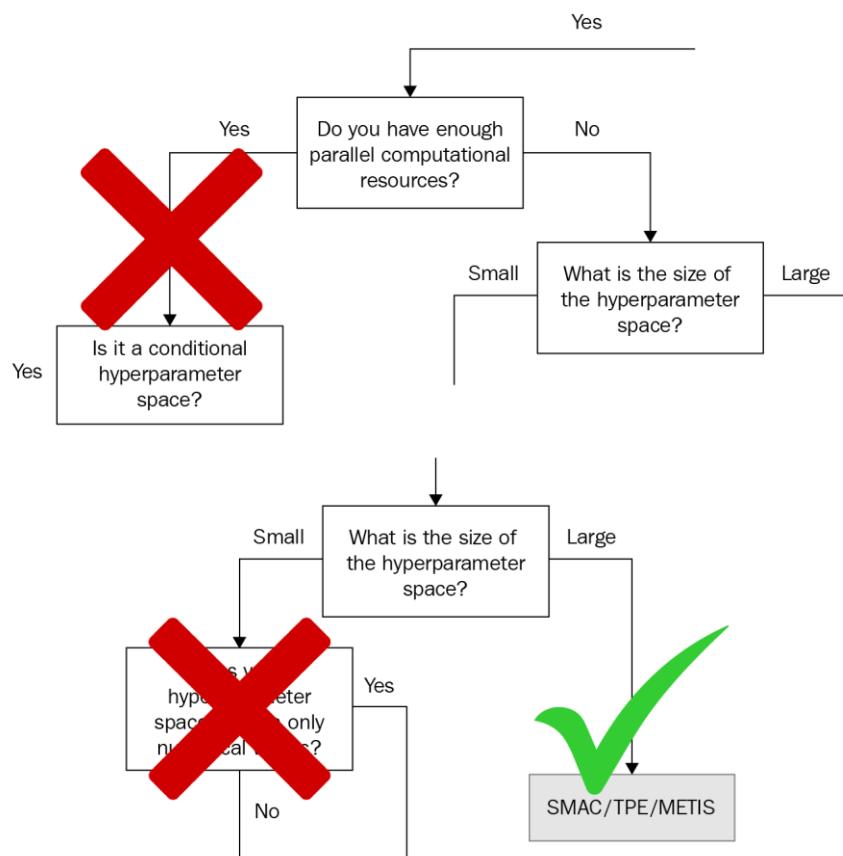


Chapter 12: Introducing Hyperparameter Tuning Decision Map









Chapter 13: Tracking Hyperparameter Tuning Experiments

The screenshot shows the Neptune AI web interface. At the top, there is a navigation bar with a back arrow, forward arrow, a refresh icon, and the URL "app.neptune.ai/-/projects". Below the URL, there is a user profile icon and a "INDIVIDUAL" button. The main menu includes "Projects" (with a notification badge), "People", "Subscription", and "Settings".

Below the menu, there is a search bar and a "Sort by" dropdown set to "Recently visited".

On the left, there is a "New project" button. On the right, there is a card for a project named "example-project-tensorflow-keras", which is described as "Example project using TensorFlow / Keras." It shows statistics: 10 runs, 0 datasets, 1 collaborator, and a neural network icon. The project is marked as "Private".

A modal window titled "Create new project" is open in the foreground. It contains fields for "Project name" (set to "hpo-test-1"), "Project key" (set to "HPOT"), and "Project color" (a dark blue square). Under "Project privacy", the "Private" radio button is selected. The "Description" field contains the text "Hyperparameter tuning experiment example 1.". At the bottom of the modal are "Cancel" and "Create" buttons.

Step 1: Install the client library

```
pip install neptune-client neptune-optuna
```

Step 2: Create a run, then log whatever model building metadata you care about.

[train_optuna.py](#)

```
import optuna

import neptune.new as neptune
import neptune.new.integrations.optuna as optuna_utils

run = neptune.init(
    project="████████/test",
    api_token="eyJhcGlfYWRkcmVzcyI6Imh0dHBzOi8vYXBwLm5lcHR1bmUuYWkiLCJhcGlfdXJ")
    # your credentials

params = {"direction": "minimize", "n_trials": 20}
run["parameters"] = params

def objective(trial):
    param = {
```

Step 3: Run it

```
python train_optuna.py
```

Step 4: See your metadata displayed here in Neptune!

PINNED COLUMNS ⓘ	A	A	Owner	Monitoring Time	[A]	SUGGESTED COLUMNS
□	HPOT-2	2022/06/26 13:55:57	██████████	29s		...ropout .../epochs ...ng_rate
□	HPOT-1	2022/06/26 13:50:46	██████████	42s		0.600857 10 0.0000347... 0.233026 10 0.000010832

 hpo-test-1 ▾

< Back to runs << 

● HPOT-1 Untitled 

Last modified: 2022/06/26 13:51:28
Running time: 19s

 All metadata

 Charts

 Images

 Monitoring

 Source code

 Artifacts

 Create your own dashboard!

 Add new dashboard

hpo-test-1

Runs 2 Models Project metadata Notebooks 0 Set

Compare runs <<

2 out of 2 runs

Horizontal split

Compare runs 2

Run table

	<input type="checkbox"/> Rows with diff only <input type="checkbox"/> Show cell changes	HPOT-2	HPOT-1
Creation Time	2022/06/26 13:55:57	2022/06/26 13:50:46	
Owner			
Monitoring Time	29	42	
best/params/dropout	0.600857	0.233026	
best/params/epochs	10	10	
...params/learning_rate	0.0000347923	0.000010832	
...0/datetime_complete	2022/06/26 13:55:58	2022/06/26 13:50:47	
...rials/0/datetime_start	2022/06/26 13:55:58	2022/06/26 13:50:47	
...distributions/dropout	UniformDistribution(...)	UniformDistribution(h...)	
.../distributions/epochs	IntUniformDistributio...	IntUniformDistributio...	
...butions/learning_rate	LogUniformDistributi...	LogUniformDistributi...	
best/trials/0/duration	0:00:00.000566	0:00:00.000769	
...ls/0/params/dropout	0.226547	0.472201	

Charts

Images

Parallel coordinates

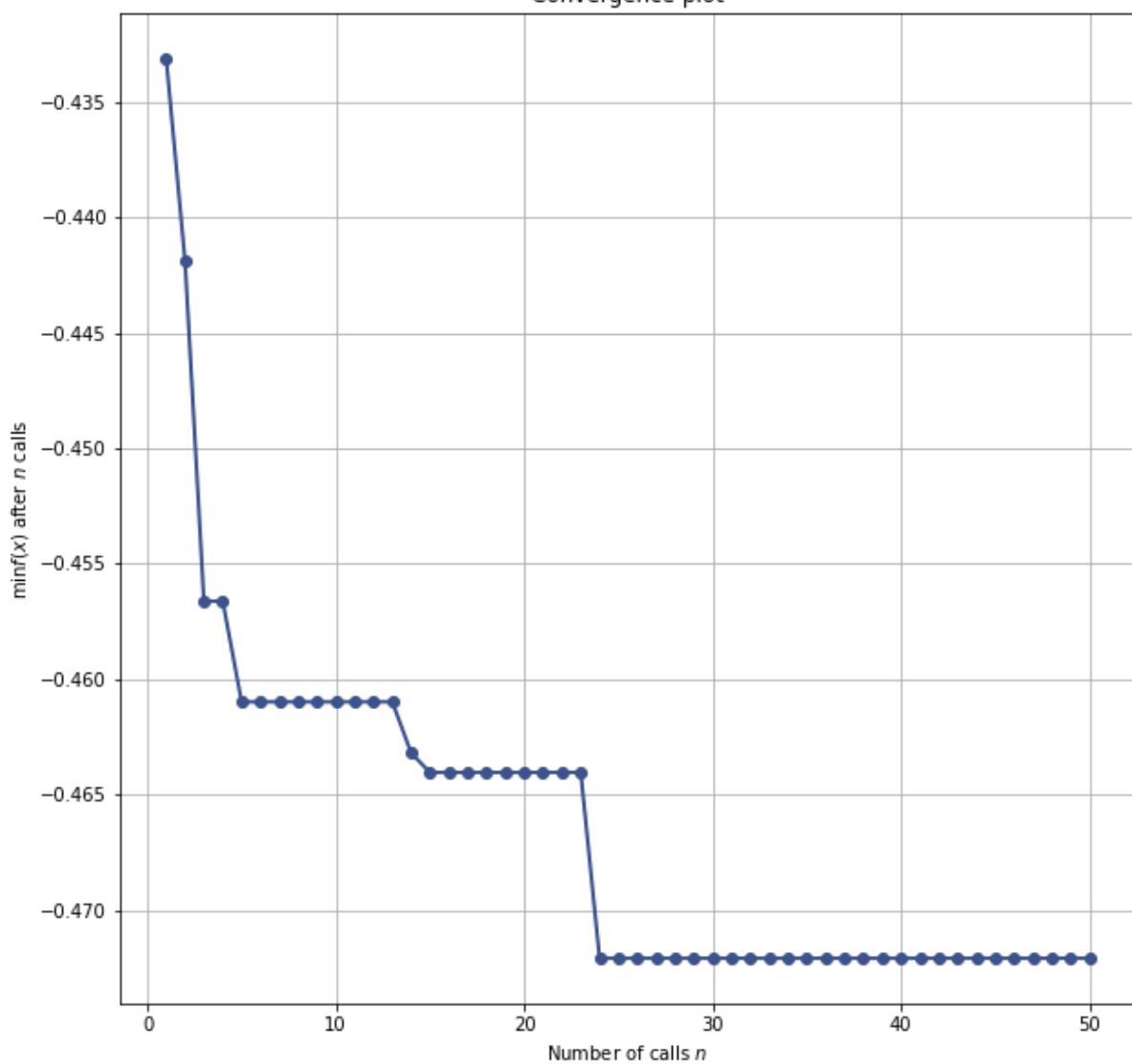
Side-by-side

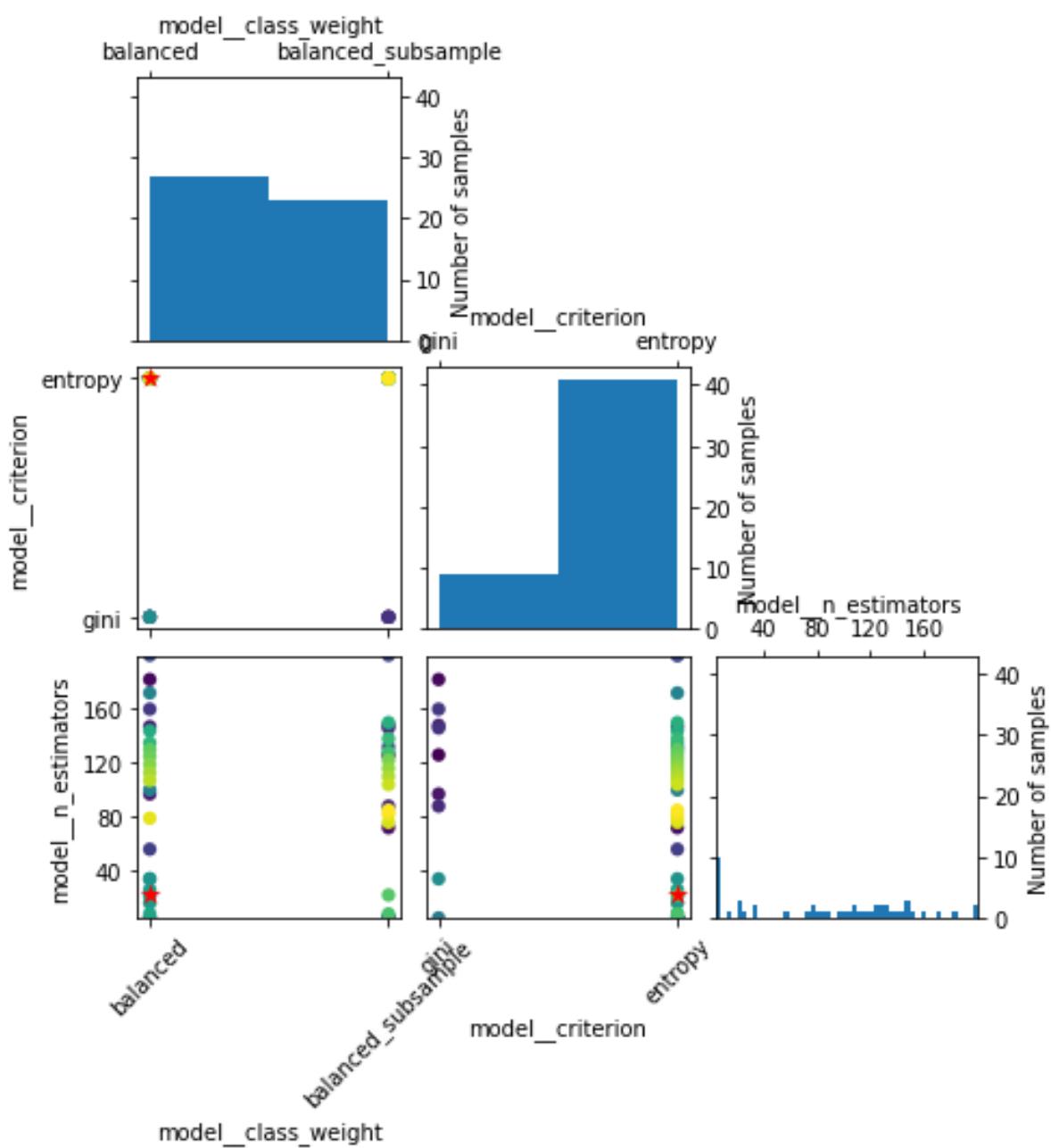
Artifacts

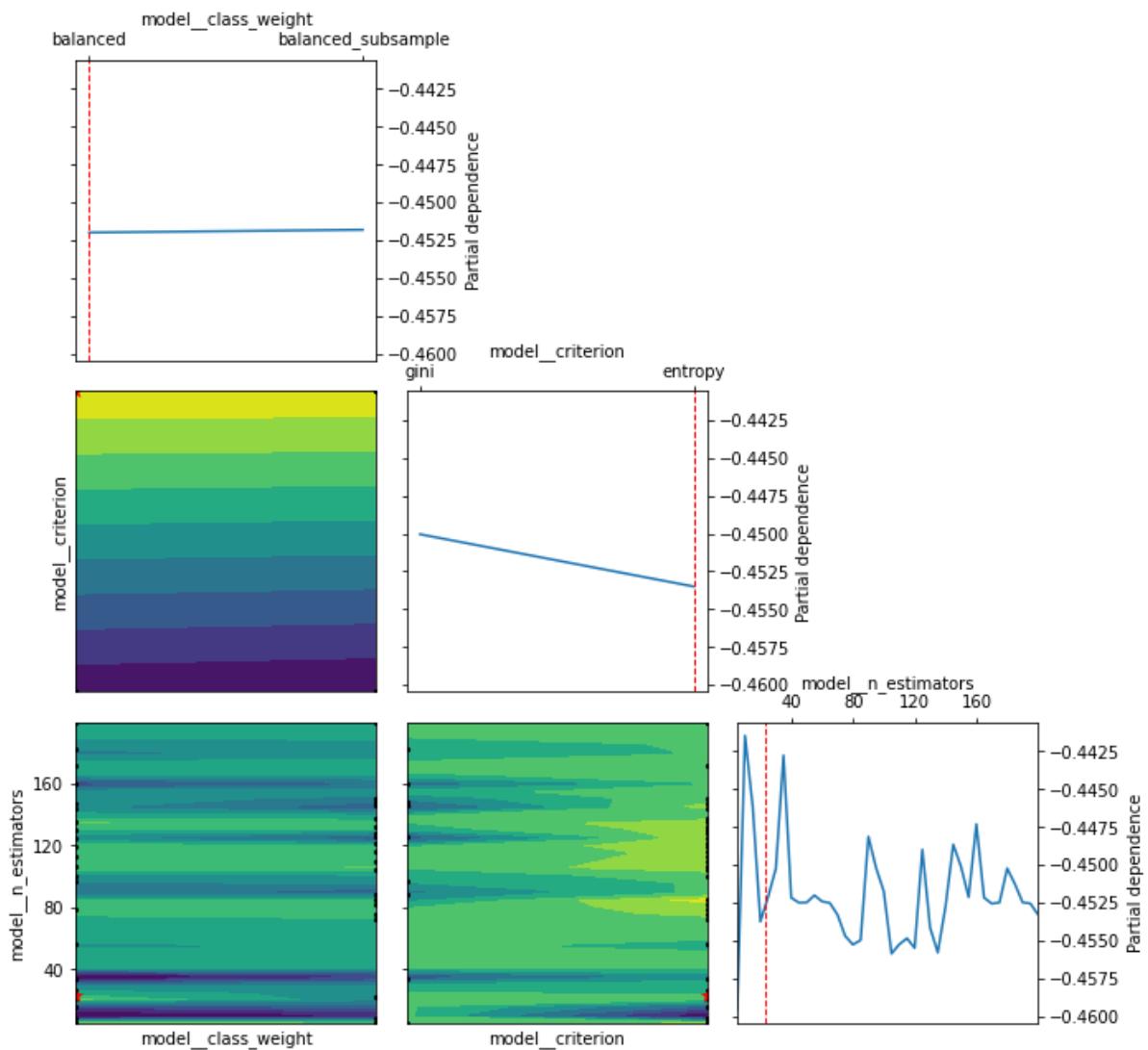
Create your own dashboard!

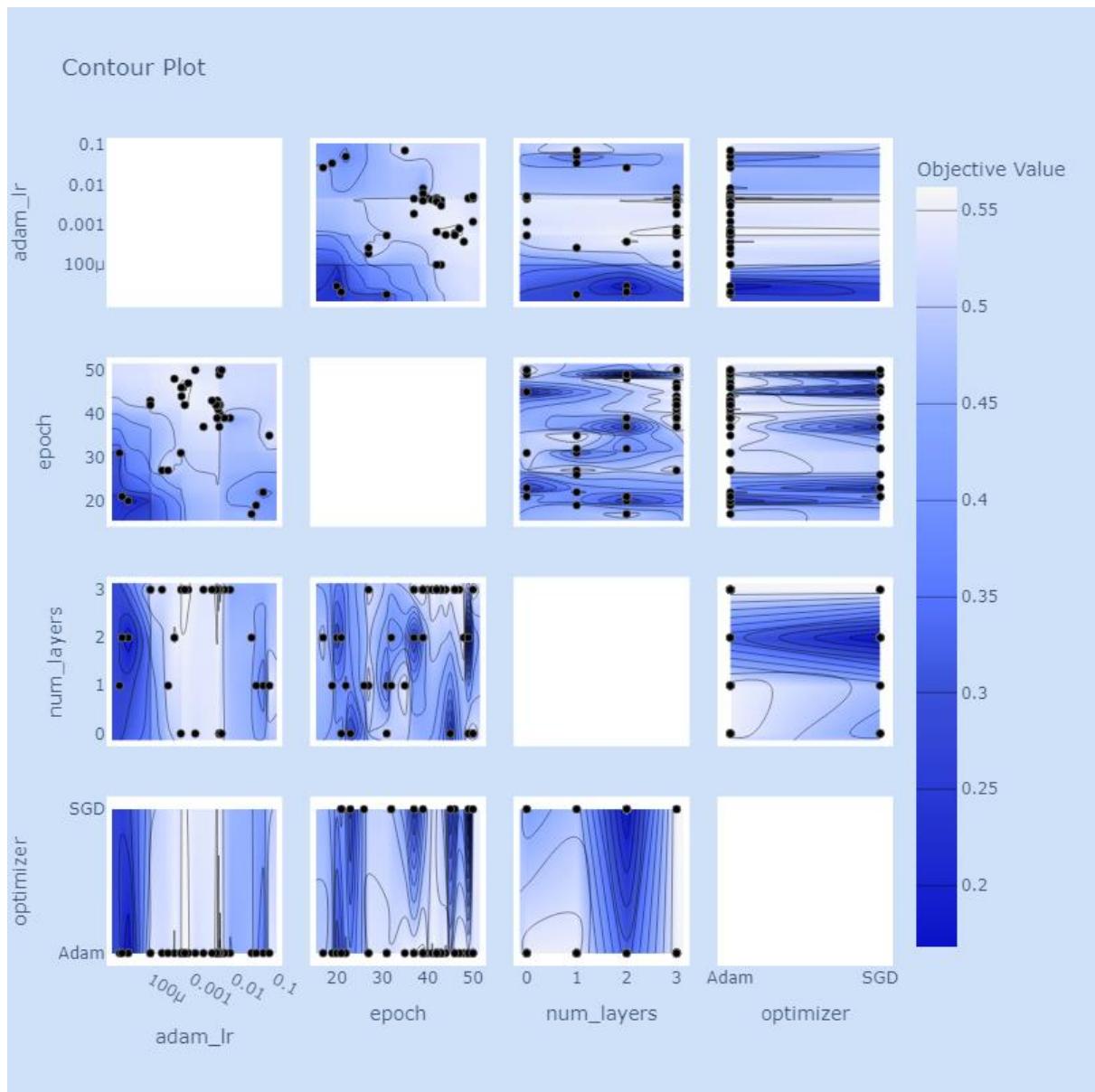
+ Add new dashboard

Convergence plot

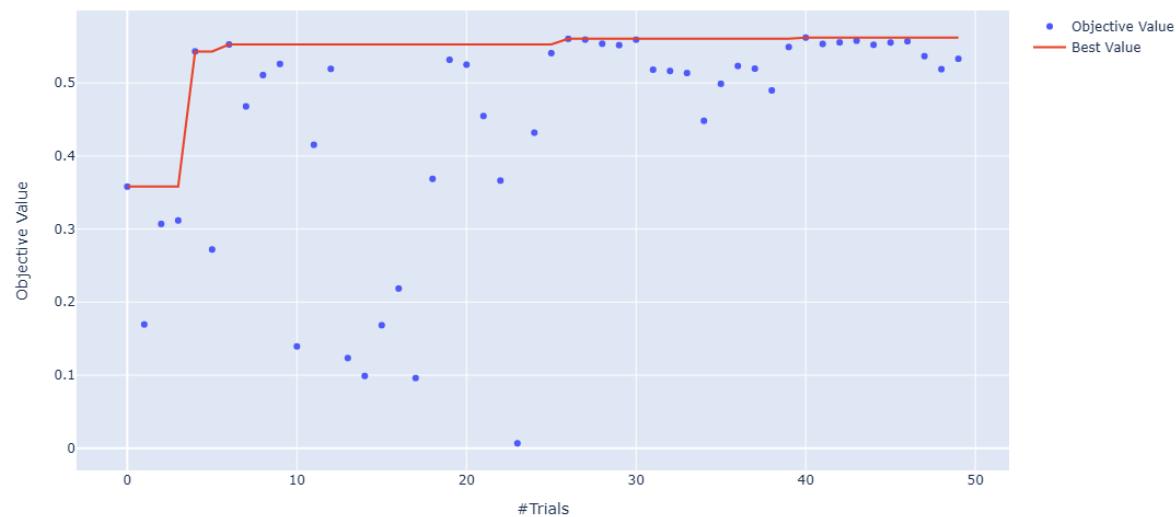




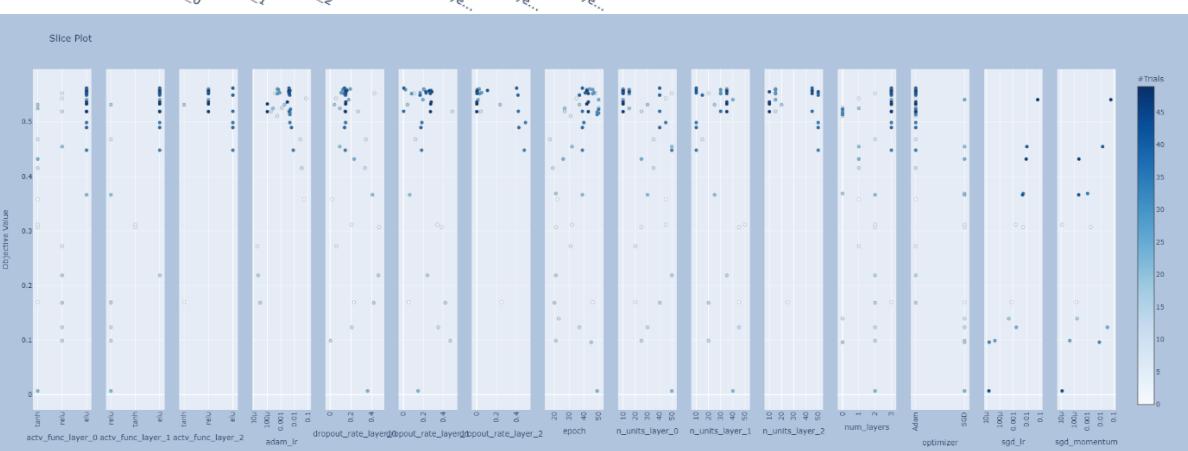
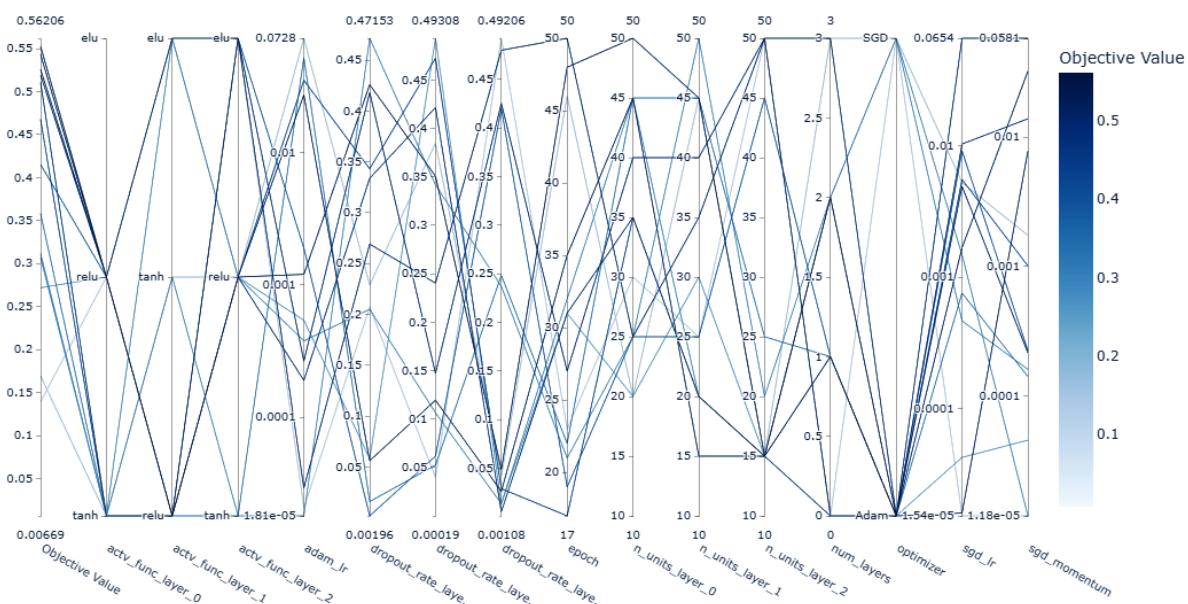




Optimization History Plot



Parallel Coordinate Plot



Experiment

Name nni_sklearn_random_search	Status RUNNING	Start time 6/28/2022, 11:11:54 AM
ID vsn976w1	Best metric 0.568944	End time N/A

Duration

Max duration 60 min

Trial numbers

31 / 100

Running 9	Succeeded 22	Stopped 0
Failed 0	Waiting 0	

Max trial No. 100

Concurrency 10

Log directory /home/... nni-experiments/vsn976w1 Training platform local

Trial command python '/mnt/c/Users/Louis\ Owen/Desktop/Packt/Hy... Tuner Random'

Top trials

Auto refresh Experiment summary About All experiments >

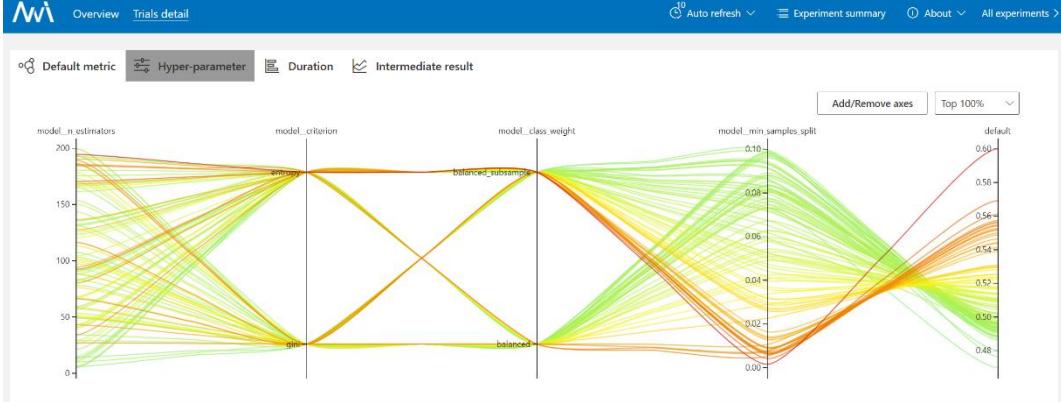
Default metric Duration Optimization curve

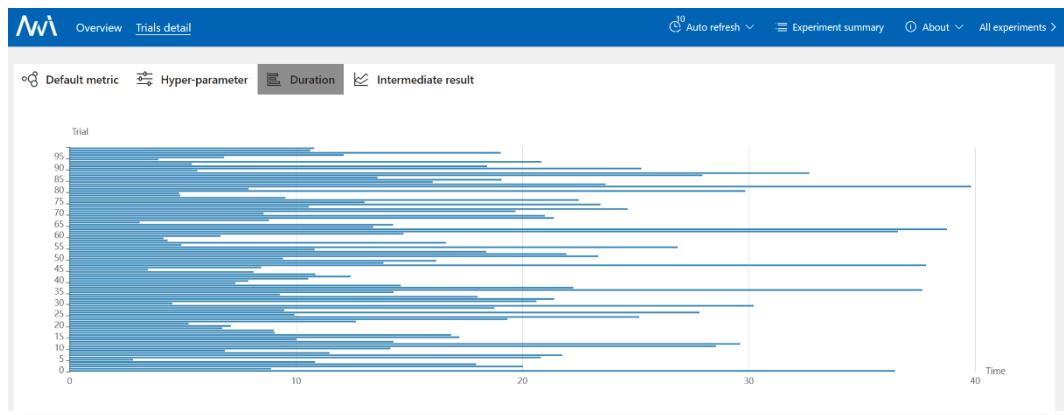
Trial jobs

Trial No.	ID	Duration	Status	Default metric	Operation
> 0	XO2Vz	36s	SUCCEEDED	0.568944 (FINAL)	
> 1	Ugxf	8s	SUCCEEDED	0.49956 (FINAL)	
> 2	WQdtb	20s	SUCCEEDED	0.495974 (FINAL)	
> 3	JUf7	17s	SUCCEEDED	0.490935 (FINAL)	

Default metric Duration Add/Remove columns Compare TensorBoard

Auto refresh Experiment summary About All experiments >





Trial jobs

Filter Search Add/Remove columns Compare TensorBoard

Trial No.	ID	Duration	Status	Default metric	Operation
0	XO2Vz	36s	SUCCEEDED	0.568944 (FINAL)	

Parameters Log

```
model_n_estimators: 170
model_criterion: "entropy"
model_class_weight: "balanced_subsample"
model_min_samples_split: 0.004097352393619469
```

Copy as json

Auto refresh

Experiment summary

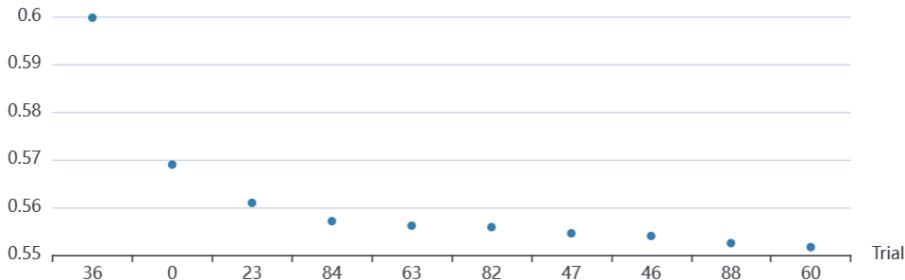
About

All experiments >

Top trials

Max Min Display top 10

Default metric



Trial No.	ID	Duration	Status	Default metric
36	K1PhU	37s	SUCCEEDED	0.599735
0	XO2Vz	36s	SUCCEEDED	0.568944
23	HVqhn	19s	SUCCEEDED	0.560928
84	N6JD8	16s	SUCCEEDED	0.557108

The screenshot shows a user interface with a blue header bar. In the top right corner of the header, there is a dropdown menu labeled "Auto refresh" with the value "10". Below the header, there are several UI elements:

- A section titled "Top trials" with a "Default metric" slider set between 0.6 and 0.59.
- A dropdown menu under "Auto refresh" with the following options:
 - Disable auto refresh
 - Refresh every 10s (selected)
 - Refresh every 20s
 - Refresh every 30s
 - Refresh every 1min
- Buttons for "Max" and "Min" sorting.
- A "Display top" dropdown set to "10".
- Links for "Experiment summary" (highlighted with a red box), "About", and "All experiments".

The main content area below the header is currently empty, showing the "Top trials" section.

Chapter 14: Conclusions and Next Steps

