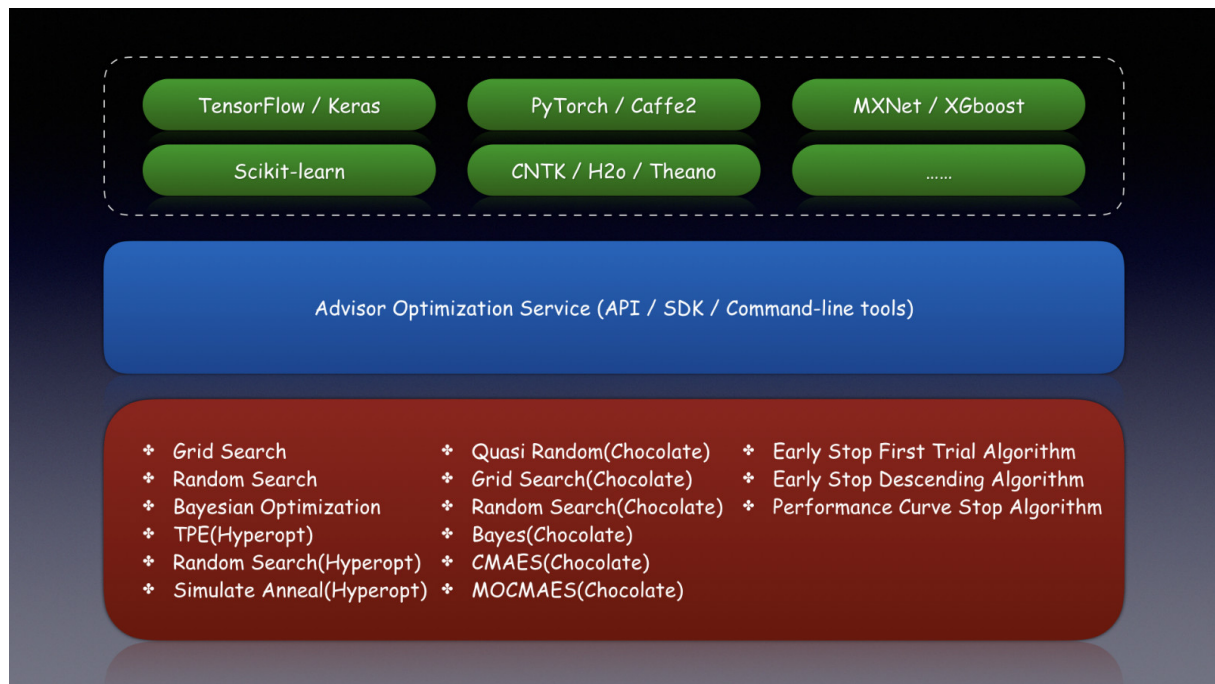# Advisor

Introduction

Advisor is the hyper parameters tuning system for black box optimization.

It is the open-source implementation of Google Vizier with these features.

- Easy to use with API, SDK, WEB and CLI
- Support abstractions of Study and Trial
- Included search and early stop algorithms
- Recommend parameters with trained model
- Same programming interfaces as Google Vizier
- Command-line tool just like Microsoft NNI.

Supported Algorithms

- ⊠ Grid Search
- ⊠ Random Search
- ⊠ Bayesian Optimization
- ⊠ TPE(Hyperopt)
- ⊠ Random Search(Hyperopt)

- ☒ Simulate Anneal(Hyperopt)
- ☒ Quasi Random(Chocolate)
- ☒ Grid Search(Chocolate)
- ☒ Random Search(Chocolate)
- ☒ Bayes(Chocolate)
- ☒ CMAES(Chocolate)
- ☒ MOCMAES(Chocolate)
- ☐ SMAC Algorithm
- ☒ Bayesian Optimization(Skopt)
- ☒ Early Stop First Trial Algorithm
- ☒ Early Stop Descending Algorithm
- ☐ Performance Curve Stop Algorithm

Quick Start

It is easy to setup advisor service in local machine.

```
1  pip install advisor
2
3  advisor_admin server start
```

Then go to `http://127.0.0.1:8000` in the browser and submit tuning jobs.

```
1  git clone --depth 1 https://github.com/tobegit3hub/advisor.git && cd ./
     advisor/
2
3  advisor run -f ./advisor_client/examples/python_function/config.json
4
5  advisor study describe -s demo
```

Advisor Server

Run server with official package.

```
1  advisor_admin server start
```

Or run with official docker image.

```
1  docker run -d -p 8000:8000 tobegit3hub/advisor
```

Or run with docker-compose.

```
1
```

```
2  wget https://raw.githubusercontent.com/tobegit3hub/advisor/master/
       docker-compose.yml
3
4  docker-compose up -d
```

Or run in Kubernetes cluster.

```
1  wget https://raw.githubusercontent.com/tobegit3hub/advisor/master/
       kubernetes_advisor.yaml
2
3  kubectl create -f ./kubernetes_advisor.yaml
```

Or run from scratch with source code.

```
1  git clone --depth 1 https://github.com/tobegit3hub/advisor.git && cd ./
       advisor/
2
3  pip install -r ./requirements.txt
4
5  ./manage.py migrate
6
7  ./manage.py runserver 0.0.0.0:8000
```

Advisor Client

Install with `pip` or use docker container.

```
1  pip install advisor
2
3  docker run -it --net=host tobegit3hub/advisor bash
```

Use the command-line tool.

```
1  export ADVISOR_ENDPOINT="http://127.0.0.1:8000"
2
3  advisor study list
4
5  advisor study describe -s "demo"
6
7  advisor trial list --study_name "demo"
```

Use admin tool to start/stop server.

```
1  advisor_admin server start
2
3  advisor_admin server stop
```

Use the Python SDK.

```
1  client = AdvisorClient()
2
3  # Create the study
4  study_configuration = {
5          "goal": "MAXIMIZE",
6          "params": [
7                  {
8                          "parameterName": "hidden1",
9                          "type": "INTEGER",
10                         "minValue": 40,
11                         "maxValue": 400,
12                         "scalingType": "LINEAR"
13                 }
14         ]
15 }
16 study = client.create_study("demo", study_configuration)
17
18 # Get suggested trials
19 trials = client.get_suggestions(study, 3)
20
21 # Complete the trial
22 trial = trials[0]
23 trial_metrics = 1.0
24 client.complete_trial(trial, trial_metrics)
```

Please checkout examples for more usage.

Configuration

Study configuration describe the search space of parameters. It supports four types and here is the example.

```
1  {
2    "goal": "MAXIMIZE",
3    "randomInitTrials": 1,
4    "maxTrials": 5,
5    "maxParallelTrials": 1,
6    "params": [
7      {
8        "parameterName": "hidden1",
9        "type": "INTEGER",
10       "minValue": 1,
11       "maxValue": 10,
12       "scalingType": "LINEAR"
13     },
14     {
15       "parameterName": "learning_rate",
16       "type": "DOUBLE",
```

```
17          "minValue": 0.01,
18          "maxValue": 0.5,
19          "scalingType": "LINEAR"
20        },
21        {
22          "parameterName": "hidden2",
23          "type": "DISCRETE",
24          "feasiblePoints": "8, 16, 32, 64",
25          "scalingType": "LINEAR"
26        },
27        {
28          "parameterName": "optimizer",
29          "type": "CATEGORICAL",
30          "feasiblePoints": "sgd, adagrad, adam, ftrl",
31          "scalingType": "LINEAR"
32        },
33        {
34          "parameterName": "batch_normalization",
35          "type": "CATEGORICAL",
36          "feasiblePoints": "true, false",
37          "scalingType": "LINEAR"
38        }
39      ]
40    }
```

Here is the configuration file in JSON format for `advisor run`.

```
1  {
2    "name": "demo",
3    "algorithm": "BayesianOptimization",
4    "trialNumber": 10,
5    "concurrency": 1,
6    "path": "./advisor_client/examples/python_function/",
7    "command": "./min_function.py",
8    "search_space": {
9        "goal": "MINIMIZE",
10       "randomInitTrials": 3,
11       "params": [
12           {
13               "parameterName": "x",
14               "type": "DOUBLE",
15               "minValue": -10.0,
16               "maxValue": 10.0,
17               "scalingType": "LINEAR"
18           }
19       ]
20    }
21  }
```

Or use the equivalent configuration file in YAML format.

```
1  name: "demo"
2  algorithm: "BayesianOptimization"
3  trialNumber: 10
4  path: "./advisor_client/examples/python_function/"
5  command: "./min_function.py"
6  search_space:
7    goal: "MINIMIZE"
8    randomInitTrials: 3
9    params:
10     - parameterName: "x"
11       type: "DOUBLE"
12       minValue: -10.0
13       maxValue: 10.0
```

Screenshots

List all the studies and create/delete the studies easily.

List the detail of study and all the related trials.

Study: NeuralNetworkStudy

Attribute	Value
Id	1
Name	NeuralNetworkStudy

Study Configuration	`{`
	`  maxTrials: 5,`
	`  params: [...],`
	`  goal: "MAXIMIZE",`
	`  maxParallelTrials: 1`
	`}`
	
	Expand All **Collapse All**

Algorithm	RandomSearchAlgorithm
Status	PENDING
Created Time	2017-09-18T09:11:06.536Z
Updated Time	2017-09-18T09:11:06.537Z

Trials Number

1

Generate Suggestions

Trials

Id	Study Id	Name	Parameter Values	Objective Value	Status	Created Time	Updated Time	Operation
1	1	RandomSearchTrial	{"hidden1": 145.81861545250678}	None	PENDING	2017-09-18T09:11:37.776Z	2017-09-18T09:11:37.778Z	🗑
2	1	RandomSearchTrial	{"hidden1": 98.38727740764602}	None	PENDING	2017-09-18T09:11:37.781Z	2017-09-18T09:11:37.783Z	🗑

List all the trials and create/delete the trials easily.

Studies	Trials	Configuration

Trials

Id	Study Id	Name	Parameter Values	Objective Value	Status	Created Time	Updated Time	Operation
1	1	RandomSearchTrial	{"hidden1": 145.81861545250678}	None	PENDING	Sept. 18, 2017, 9:11 a.m.	Sept. 18, 2017, 9:11 a.m.	🗑
2	1	RandomSearchTrial	{"hidden1": 98.38727740764602}	None	PENDING	Sept. 18, 2017, 9:11 a.m.	Sept. 18, 2017, 9:11 a.m.	🗑
3	2	RandomSearchTrial	{"hidden1": 40}	None	PENDING	Sept. 18, 2017, 9:13 a.m.	Sept. 18, 2017, 9:13 a.m.	🗑
4	2	RandomSearchTrial	{"hidden1": 400}	None	PENDING	Sept. 18, 2017, 9:13 a.m.	Sept. 18, 2017, 9:13 a.m.	🗑
5	2	RandomSearchTrial	{"hidden1": 40}	None	PENDING	Sept. 18, 2017, 9:15 a.m.	Sept. 18, 2017, 9:15 a.m.	🗑
6	2	RandomSearchTrial	{"hidden1": 130}	None	PENDING	Sept. 18, 2017, 9:15 a.m.	Sept. 18, 2017, 9:15 a.m.	🗑
7	2	RandomSearchTrial	{"hidden1": 220}	None	PENDING	Sept. 18, 2017, 9:15 a.m.	Sept. 18, 2017, 9:15 a.m.	🗑
8	2	RandomSearchTrial	{"hidden1": 310}	None	PENDING	Sept. 18, 2017, 9:15 a.m.	Sept. 18, 2017, 9:15 a.m.	🗑
9	2	RandomSearchTrial	{"hidden1": 400}	None	PENDING	Sept. 18, 2017, 9:15 a.m.	Sept. 18, 2017, 9:15 a.m.	🗑

Create Resources

* Study Id

1

* Name

trial

Submit

List the detail of trial and all the related metrics.

Trial: RandomSearchTrial

Attribute	Value
Id	1
Study Id	1
Name	RandomSearchTrial
Parameter Values	{"hidden1": 145.81861545250678}
Objective Value	None
Status	PENDING
Created Time	2017-09-18T09:11:37.778Z
Updated Time	2017-09-18T09:11:37.778Z

Training step 1

Objective number 0.9

Create Trial Metric

Trial Metrics

Id	Training Step	Objective value	Created Time	Updated Time	Operation
1	10	0.5	2017-09-18T09:11:37.776Z	2017-09-18T09:11:37.778Z	🗑
2	20	0.6	2017-09-18T09:11:37.776Z	2017-09-18T09:11:37.778Z	🗑
3	30	0.85	2017-09-18T09:11:37.776Z	2017-09-18T09:11:37.778Z	🗑
4	40	0.89	2017-09-18T09:11:37.776Z	2017-09-18T09:11:37.778Z	🗑

Development

You can edit the source code and test without re-deploying the server and client.

```
1  git clone git@github.com:tobegit3hub/advisor.git
2
3  cd ./advisor/advisor_client/
4
5  python ./setup.py develop
6
7  export PYTHONPATH="/Library/Python/2.7/site-packages/:$PYTHONPATH"
```