

# NNI自动调参工具

导师:付

## 一个目的

告别调参侠





# 目录

- 1 NNI工具简介
- 2 NNI使用方法
- 3 NNI结合Baseline
- 4 NNI调参结果分析



# 1、NNI简介

Introduction of NNI

## NNI简介





NNI (Neural Network Intelligence) 是一个轻量但强大的工具包,帮助用户**自动**的进行<u>特征工程,神经网络架构搜索</u>,超参调优以及模型压缩。

### NNI使用场景



- •想要在自己的代码、模型中试验不同的自动机器学习算法。
- •想要在不同的环境中加速运行自动机器学习。
- ·想要更容易**实现或试验新的自动机器学习算法**的研究员或数据科学家,包括:超参调优算法,神经网络搜索算法以及模型压缩算法。
- •在机器学习平台中**支持自动机器学习**。

### NNI功能简介



### 支持框架及库

- Supported Frameworks
  - PyTorch
  - Keras
  - TensorFlow
  - MXNet
  - Caffe2
     More...
- Supported Libraries
  - Scikit-learn
  - XGBoost
  - LightGBM
     More...

### 调参方法

#### Hyperparameter Tuning

#### Exhaustive search

- Random Search
- Grid Search
- o Batch

#### Heuristic search

- Naïve Evolution
- Anneal
- Hyperband
- PBT

#### **Bayesian optimization**

- BOHB
- o TPE
- SMAC
- Metis Tuner
- GP Tuner

#### **RL Based**

PPO Tuner

### 网络架构搜索

#### Neural Architecture Search

- ENAS
- DARTS
- P-DARTS
- CDARTS
- SPOS
- ProxylessNAS
- Network Morphism
- TextNAS

### 训练平台

- Local Machine
- Remote Servers
- Kubernetes based services
  - OpenPAI
  - Kubeflow
  - FrameworkController on K8S (AKS etc.)
  - DLWorkspace (aka. DLTS)

### 模型压缩,特征工程,早停算法

#### **Model Compression**

#### Pruning

- AGP Pruner
- Slim Pruner
- FPGM Pruner
- NetAdapt Pruner
- SimulatedAnnealing Pruner
- ADMM Pruner
- AutoCompress Pruner

#### **Ouantization**

- OAT Quantizer
- DoReFa Quantizer

#### Feature Engineering (Beta)

- GradientFeatureSelector
- GBDTSelector

#### Early Stop Algorithms

- Median Stop
- Curve Fitting

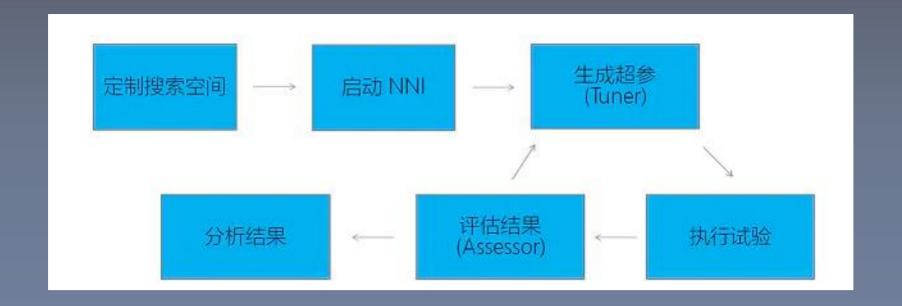


# 2、NNI使用方法

usage method of NNI

## NNI流程





### NNI使用方法



### 实现NNI自动调参,只需三步操作



Step 2.
Update Codes

Step 3.

Define Experiment

```
config.yml ×
() search_space.json ×
                                                                    mnist.py x
                                                                                                                                          authorName: default
                                                                    187
                                                                                                                                          experimentName: example mnist
                                                                    188
                                                                                          nni.report_intermediate_result(test_acc)
            "dropout_rate":{"_type":"uniform","_value":[0.
  2
                                                                                                                                          trialConcurrency: 1
                                                                                          logger.debug('test accuracy %g', test acc)
            "conv size":{" type":"choice"," value":[2,3,5,7
                                                                                                                                          maxExecDuration: 1h
                                                                                          logger.debug('Pipe send intermediate result dor 4
  4
            "hidden size":{" type":"choice"," value":[124,
                                                                                                                                          maxTrialNum: 100
                                                                                                                                          #choice: local, remote
                                                                                  test acc = mnist network.accuracy.eval(
  5
            "learning rate":{" type":"choice"," value":[0.6
                                                                    192
                                                                    193
                                                                                                                                          trainingServicePlatform: local
                                                                                      feed dict={mnist network.images: mnist.test.images, 7
  6
                                                                    194
                                                                                                mnist_network.labels: mnist.test.labels, 8
                                                                                                                                          searchSpacePath: ~/nni/examples/trials/mnist/search_space.json
                                                                    195
                                                                                                mnist_network.keep_prob: 1.0})
                                                                                                                                          #choice: true, false
                                                                    196
                                                                                                                                     10
                                                                                                                                          useAnnotation: false
                                                                    197
                                                                                  nni.report final result(test acc)
                                                                                                                                     11
                                                                                                                                           tuner:
                                                                                  logger.debug('Final result is %g', test_acc)
                                                                    198
                                                                                                                                            #choice: TPE, Random, Anneal, Evolution
                                                                                                                                     12
                                                                    199
                                                                                  logger.debug('Send final result done.')
                                                                                                                                     13
                                                                                                                                            builtinTunerName: TPE
                                                                    200
                                                                                                                                     14
                                                                                                                                            classArgs:
                                                                    201
                                                                                                                                     15
                                                                                                                                              #choice: maximize, minimize
                                                                    202 # def generate_default_params(): --
                                                                                                                                     16
                                                                                                                                              optimize mode: maximize
                                                                    217
                                                                                                                                     17
                                                                                                                                           trial:
                                                                    218
                                                                                                                                             command: python3 mnist.py
                                                                    219
                                                                          if __name__ == '__main__':
                                                                                                                                     19
                                                                                                                                            codeDir: ~/nni/examples/trials/mnist
                                                                    228
                                                                                                                                     20
                                                                                                                                            gpuNum: 0
                                                                    221
                                                                                  # get parameters form tuner
                                                                    222
                                                                                  RCV_PARAMS = nni.get_parameters()
                                                                    223
                                                                                  logger.debug(RCV PARAMS)
                                                                    224
                                                                                  # run
```

## NNI关键配置文件介绍



搜索空间文件

系统的配置文件

```
🚽 config.yml 🔀
       authorName: default
       experimentName: example mnist pytorch
       trialConcurrency: 1
      maxExecDuration: 1h
      maxTrialNum: 10
       #choice: local, remote, pai
       trainingServicePlatform: local
       searchSpacePath: search space.json
       #choice: true, false
10
      useAnnotation: false
11
12
        #choice: TPE, Random, Anneal, Evolution, BatchTuner, MetisTuner, GPTuner
13
        #SMAC (SMAC should be installed through nnictl)
14
        builtinTunerName: TPE
15
     classArgs:
16
           #choice: maximize, minimize
17
           optimize mode: maximize
     -trial:
18
19
        command: python mnist.py
20
         codeDir: .
21
        gpuNum: 0
22
```



# 3、NNI结合Baseline

NNI combined with baseline

### NNI结合Baseline



•第一步:下载安装NNI,参照https://github.com/microsoft/nni

•第二步:找到baseline中的超参数,并改为通过NNI传入超参

•第三步: 在项目中新建search space.json, config.yml

•第四步:配置search\_space.json,将上一步找到的超参配置搜索范围

•第五步: 在训练文件中加入上报指标

•第六步:配置config.yml

•第七步:运行NNI,并进入webui查看是否成功运行

•第八步:等待 •第九步:分析

### NNI结合Baseline



nnictl create -config/nni/examples/trials/mnist/config.yml

```
evan@evan-xps-13-9343: ~
文件(F) 编辑(E) 查看(V) 搜索(S) 终端(T) 帮助(H)
.vml
INFO: expand searchSpacePath: search space.ison to /home/evan/nni/examples/trial
s/mnist/search space.json
INFO: expand codeDir: . to /home/evan/nni/examples/trials/mnist/.
INFO: Starting restful server...
INFO: Successfully started Restful server!
INFO: Setting local config...
INFO: Successfully set local config!
INFO: Starting experiment...
INFO: Successfully started experiment!
The experiment id is kUdiD9Tw
The Web UI urls are: http://127.0.0.1:8080 http://192.168.1.9:8080
You can use these commands to get more information about the experiment
-----
        commands
                                     description
1. nnictl experiment show
                              show the information of experiments
2. nnictl trial ls
                              list all of trial jobs
nnictl top
                              monitor the status of running experiments
4. nnictl log stderr
                              show stderr log content
5. nnictl log stdout
                              show stdout log content
6. nnictl stop
                              stop an experiment
7. nnictl trial kill
                              kill a trial job by id
8. nnictl --help
                              get help information about nnictl
```

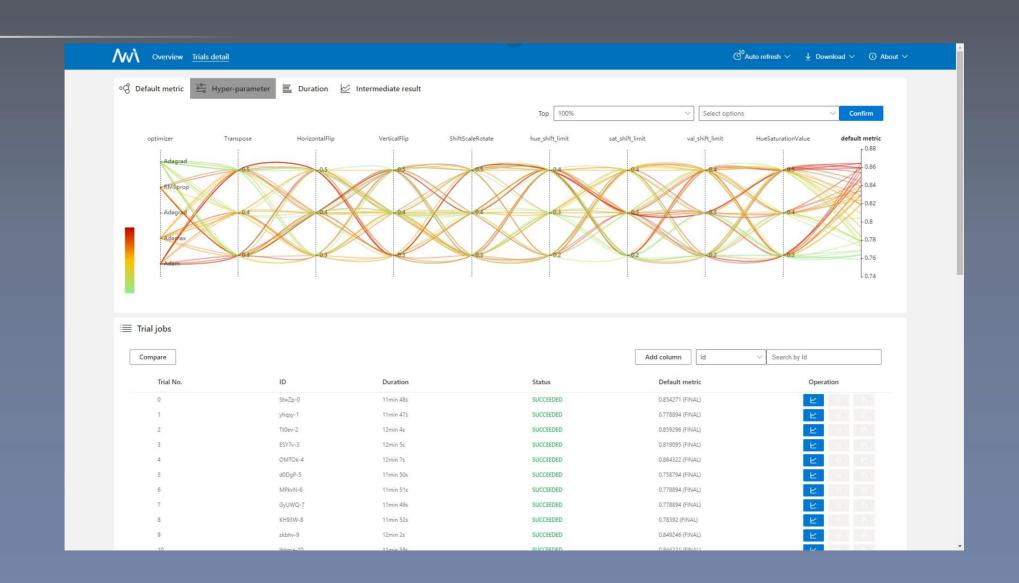


# 4、NNI调参结果分析

Analysis of NNI parameter adjustment results

## NNI调参结果分析





## NNI调参结果分析



