Introduction to Neural Network Intelligence

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What is NNI?

- Neural Network Intelligence
- Toolkit - automate Feature Engineering, Neural Architecture Search, **Hyperparameter Tuning** and Model Compression

- Supports a range of frameworks and libraries
- Variety of search and optimization algorithms
- Runs on Linux, macOS and Windows

Creating an Experiment

- Trial code = experiment.py

```
+ import nni

  def main(args):
      # load data
      train_loader = torch.utils.data.DataLoader(datasets.MNIST(...), batch_size=args['batch_size'], shuffle=True)
      test_loader = torch.tuils.data.DataLoader(datasets.MNIST(...), batch_size=1000, shuffle=True)
      # build model
      model = Net(hidden_size=args['hidden_size'])
      optimizer = optim.SGD(model.parameters(), lr=args['lr'], momentum=args['momentum'])
      # train
      for epoch in range(10):
          train(args, model, device, train_loader, optimizer, epoch)
          test_acc = test(args, model, device, test_loader)
-         print(test_acc)
+         nni.report_intermediate_result(test_acc)
-     print('final accuracy:', test_acc)
+     nni.report_final_result(test_acc)

  if __name__ == '__main__':
-     params = {'batch_size': 32, 'hidden_size': 128, 'lr': 0.001, 'momentum': 0.5}
+     params = nni.get_next_parameter()
      main(params)
```

Code source: https://nni.readthedocs.io/en/latest/Tutorial/QuickStart.html

Creating an Experiment

- Define the search space = example_config.yml

```yaml
searchSpace:
    batch_size:
        _type: choice
        _value: [16, 32, 64, 128]
    hidden_size:
        _type: choice
        _value: [128, 256, 512, 1024]
    lr:
        _type: choice
        _value: [0.0001, 0.001, 0.01, 0.1]
    momentum:
        _type: uniform
        _value: [0, 1]
```

https://nni.readthedocs.io/en/latest/Tutorial/SearchSpaceSpec.html

Code source: https://nni.readthedocs.io/en/latest/Tutorial/QuickStart.html

Creating an Experiment

- Define the experiment = example_config.yml

```yaml
experimentName: experiment           # An optional name to distinguish the experiments
trialCommand: python3 experiment.py  # NOTE: change "python3" to "python" if you are using Windows
trialConcurrency: 2                  # Run 2 trials concurrently
maxTrialNumber: 10                   # Generate at most 10 trials
maxExperimentDuration: 1h            # Stop generating trials after 1 hour
tuner:                               # Configure the tuning algorithm
   name: TPE
   classArgs:                        # Algorithm specific arguments
      optimize_mode: maximize
trainingService:                     # Configure the training platform
   platform: local
```

https://nni.readthedocs.io/en/latest/builtin_tuner.html
https://nni.readthedocs.io/en/latest/reference/experiment_config.html#local-mode

Code source: https://nni.readthedocs.io/en/latest/Tutorial/QuickStart.html

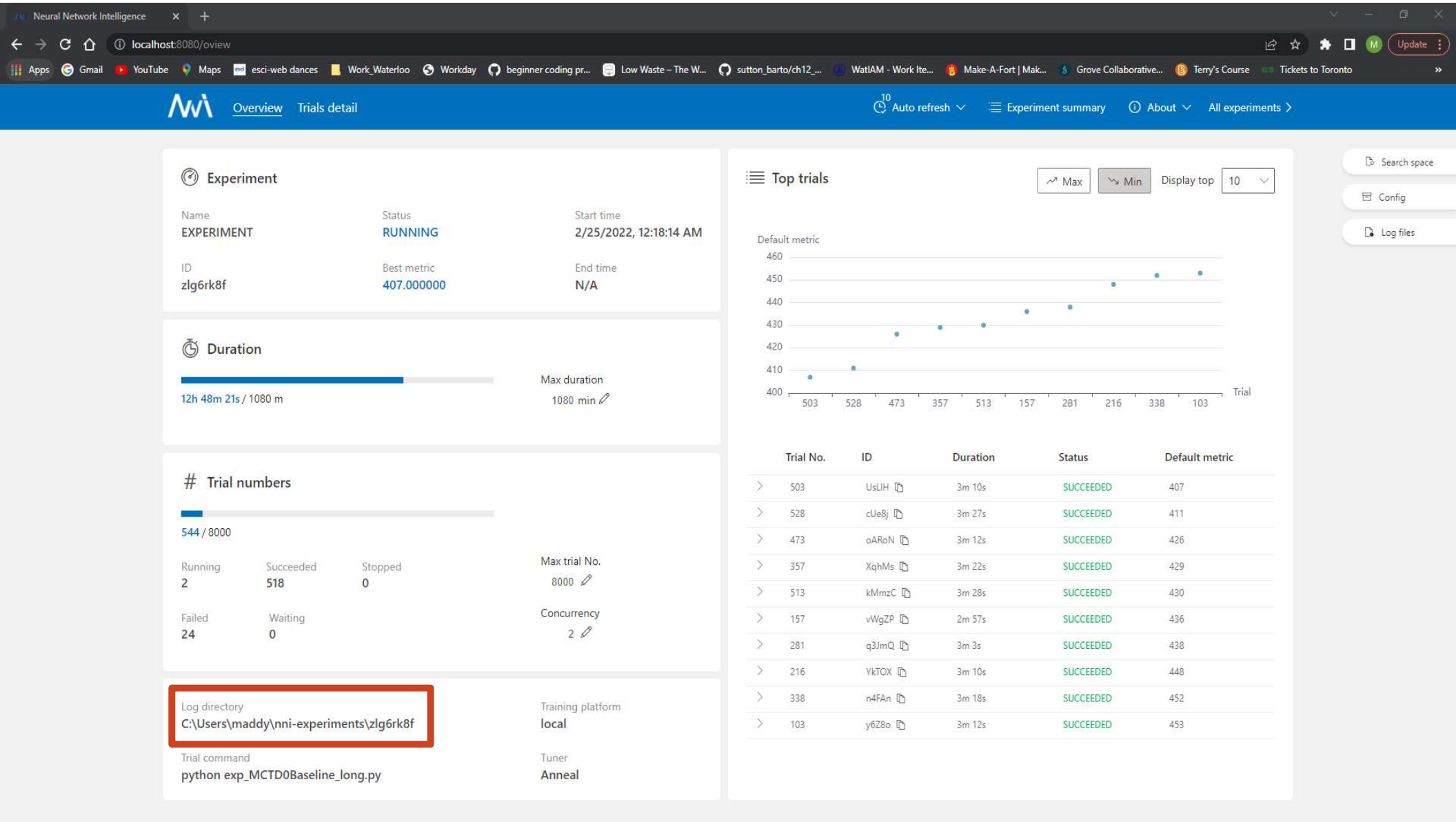
Creating an Experiment

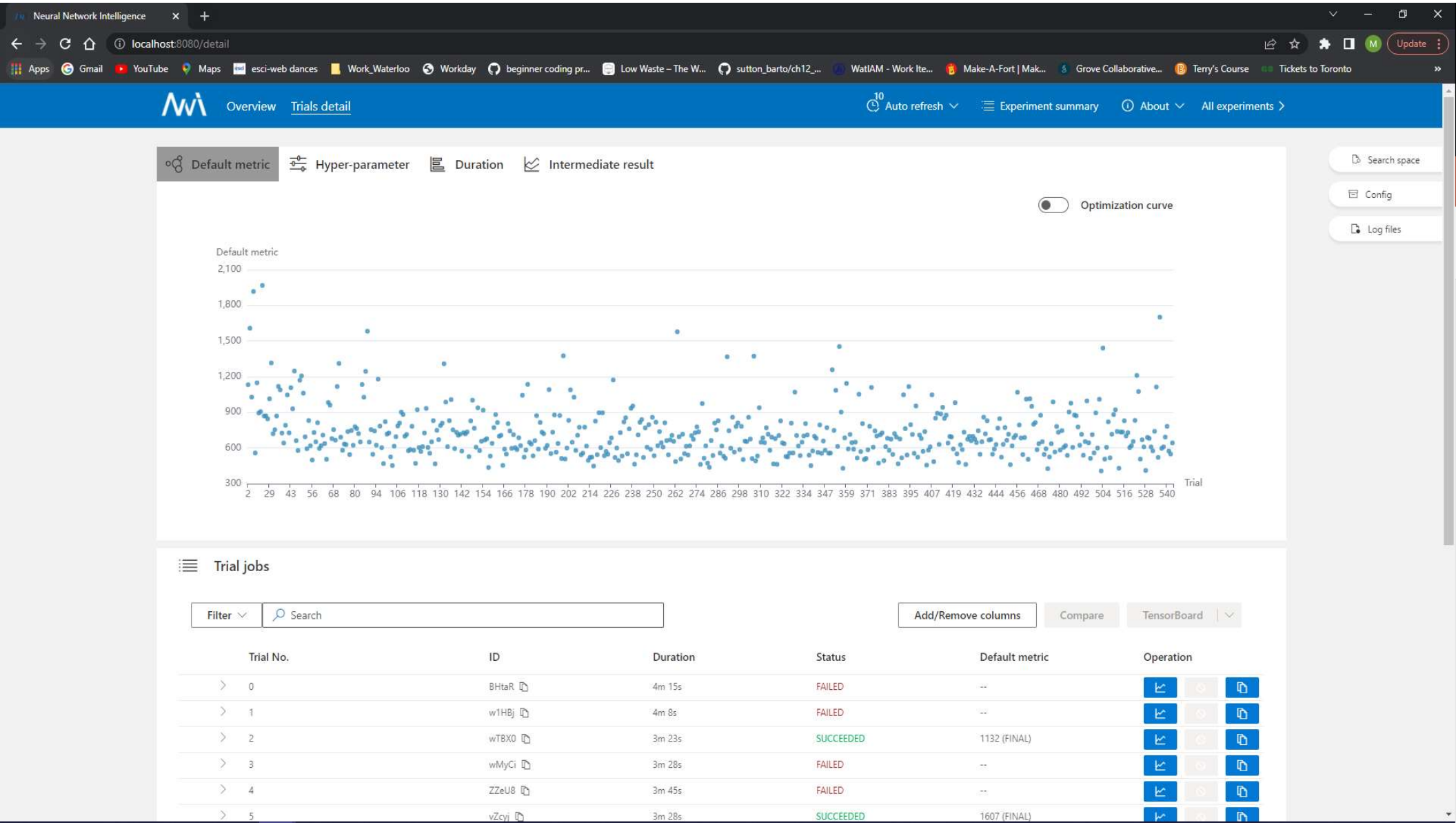
- Run the experiment

```
nnictl create --config ~/config_experiment.yml


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 egchD4qy
The Web UI urls are: [Your IP]:8080
-----------------------------------------------------------------------
```

Code source: https://nni.readthedocs.io/en/latest/Tutorial/QuickStart.html


Neural Network Intelligence
localhost:8080/oview
Update
Apps Gmail YouTube Maps esci-web dances Work_Waterloo Workday beginner coding pr... Low Waste – The W... sutton_barto/ch12_... WatIAM - Work Ite... Make-A-Fort | Mak... Grove Collaborative... Terry's Course Tickets to Toronto
Overview
Trials detail
Auto refresh
Experiment summary
About
All experiments
Search space
Config
Log files
Experiment
Name
EXPERIMENT
Status
RUNNING
Start time
2/25/2022, 12:18:14 AM
ID
zlg6rk8f
Best metric
407.000000
End time
N/A
Duration
12h 48m 21s / 1080 m
Max duration
1080 min
Trial numbers
544 / 8000
Running
2
Succeeded
518
Stopped
0
Failed
24
Waiting
0
Max trial No.
8000
Concurrency
2
Log directory
C:\Users\maddy\nni-experiments\zlg6rk8f
Training platform
local
Trial command
python exp_MCTD0Baseline_long.py
Tuner
Anneal
Top trials
Max
Min
Display top
10
Default metric
460
450
440
430
420
410
400
503
528
473
357
513
157
281
216
338
103
Trial
Trial No.
ID
Duration
Status
Default metric
503 UsLIH 3m 10s SUCCEEDED 407
528 cUe8j 3m 27s SUCCEEDED 411
473 oARoN 3m 12s SUCCEEDED 426
357 XqhMs 3m 22s SUCCEEDED 429
513 kMmzC 3m 28s SUCCEEDED 430
157 vWgZP 2m 57s SUCCEEDED 436
281 q3JmQ 3m 3s SUCCEEDED 438
216 YkTOX 3m 10s SUCCEEDED 448
338 n4FAn 3m 18s SUCCEEDED 452
103 y6Z8o 3m 12s SUCCEEDED 453


Neural Network Intelligence
localhost:8080/detail
Update
Apps
Gmail
YouTube
Maps
esci-web dances
Work_Waterloo
Workday
beginner coding pr...
Low Waste – The W...
sutton_barto/ch12_...
WatIAM - Work Ite...
Make-A-Fort | Mak...
Grove Collaborative...
Terry's Course
Tickets to Toronto
Overview
Trials detail
Auto refresh
Experiment summary
About
All experiments
Default metric
Hyper-parameter
Duration
Intermediate result
Search space
Config
Log files
Optimization curve
Default metric
2,100
1,800
1,500
1,200
900
600
300
2 29 43 56 68 80 94 106 118 130 142 154 166 178 190 202 214 226 238 250 262 274 286 298 310 322 334 347 359 371 383 395 407 419 432 444 456 468 480 492 504 516 528 540
Trial
Trial jobs
Filter
Search
Add/Remove columns
Compare
TensorBoard
Trial No.
ID
Duration
Status
Default metric
Operation
0 BHtaR 4m 15s FAILED --
1 w1HBj 4m 8s FAILED --
2 wTBX0 3m 23s SUCCEEDED 1132 (FINAL)
3 wMyCi 3m 28s FAILED --
4 ZZeU8 3m 45s FAILED --
5 vZcyj 3m 28s SUCCEEDED 1607 (FINAL)

Debugging

- View from the Web UI

```
cmd.exe : Traceback (most recent call last):
At C:\Users\maddy\nni-experiments\0895xe6j\trials\QJREF\run.ps1:11 char:1
+ cmd.exe /c python experiment.py 1>C:\Users\maddy\nni-experiments\0895 ...
+ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
    + CategoryInfo          : NotSpecified: (Traceback (most recent call last)::String) [], RemoteException
    + FullyQualifiedErrorId : NativeCommandError

  File "experiment.py", line 22, in <module>
    main(params)
  File "experiment.py", line 18, in main
    nni.report_final_result(test_los)
NameError: name 'test_los' is not defined
```

fault metric

78603 (LATEST)

- Locate log files:
  - Default: C:\Users*USERNAME*\nni-experiments
  - Navigate to trial folder
  - Open stderr file in a text-viewer (i.e. notepad) to view any error messages

Thank you!

Links and References

- nnSpider emoticons: https://github.com/microsoft/nni/tree/v2.5/docs/img/emoicons
- NNI website: https://nni.readthedocs.io/en/latest/index.html
- NNI github: https://github.com/microsoft/nni/tree/master

- Code examples were copied from NNI website

https://nni.readthedocs.io/en/latest/Tutorial/QuickStart.html