Notebooks

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automl.ipynb | *hyperparameter_tu | PY scoring.py | PY train.py | 1:notebook140475 | 2:notebook140475

Editors | Compute: notebook140475 - Running | Python 3

notebook140475 · Jupyter kernel idle Python 3.

- Users
  - odl_user_140475
    - Microsoft-Azure-Machine-Learn...
      - .amlignore
      - automl.ipynb
      - azureml-automl.yml
      - hyperparameter_tuning.ipynb
      - PY scoring.py
      - PY train.py

Hyperparameter Tuning using HyperDrive

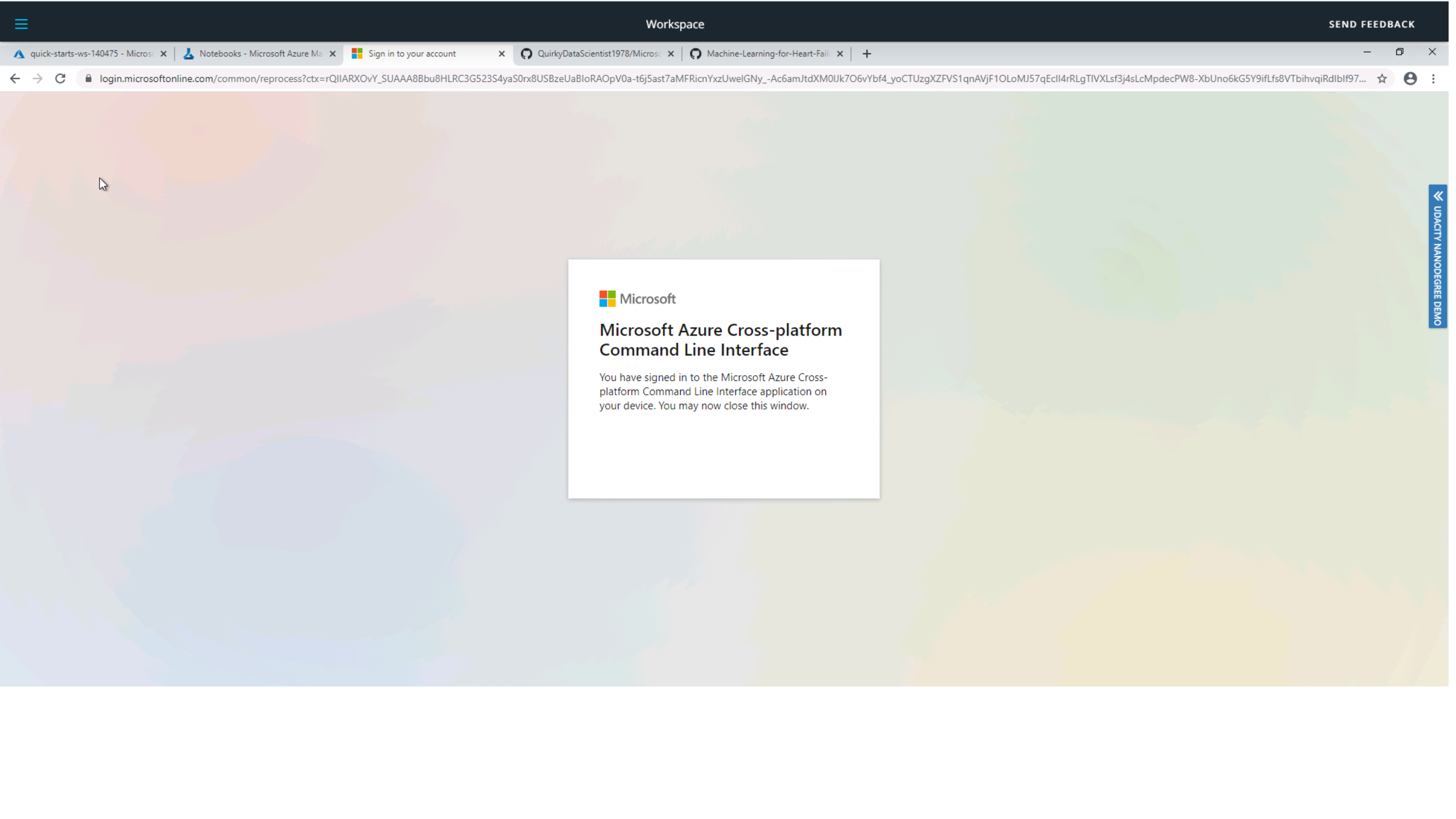
TODO: Import Dependencies. In the cell below, import all the dependencies that you will need to complete the project.

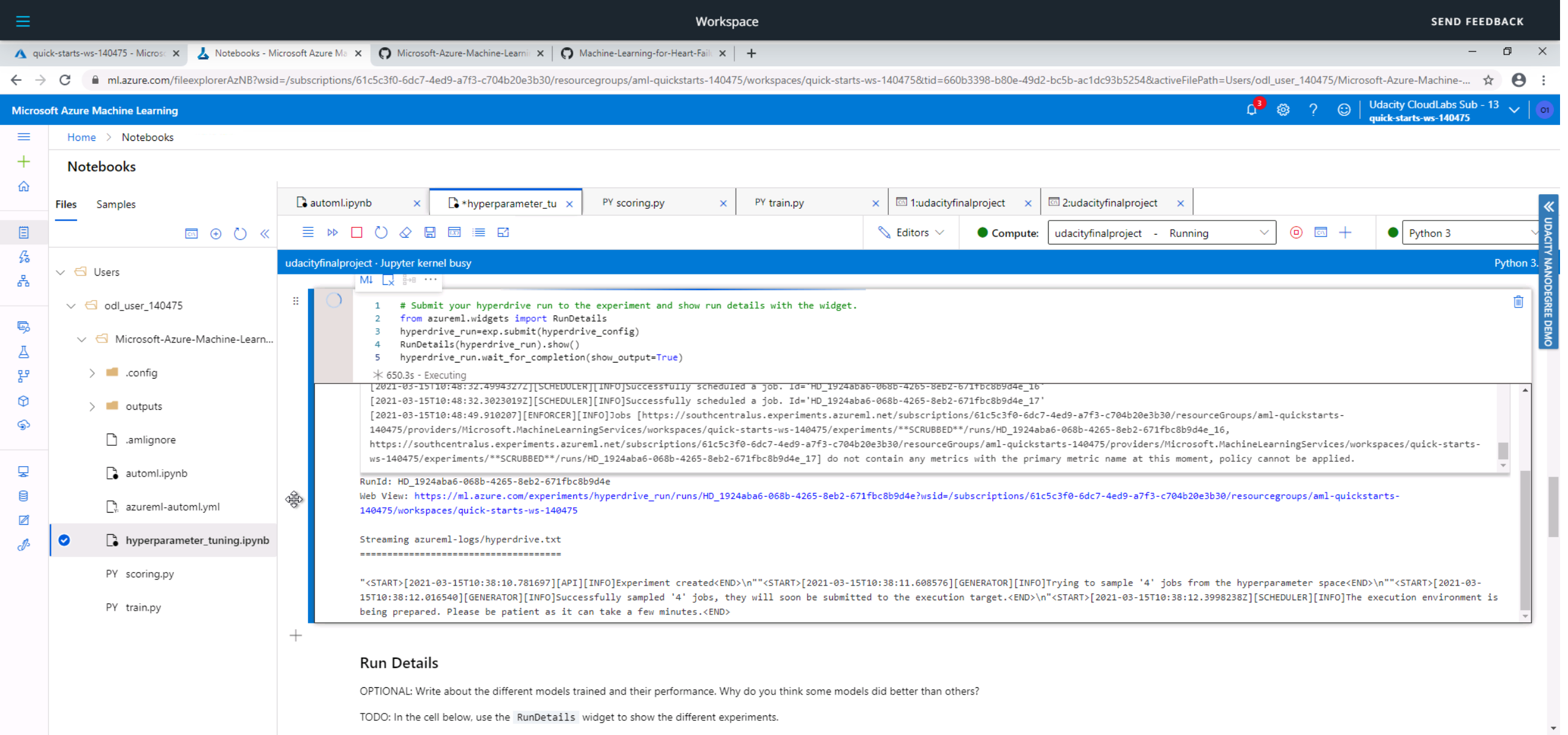
```
1  from azureml.core import Workspace, Experiment
2
3  ws = Workspace.from_config()
4  exp = Experiment(ws, name="hyperdrive_run")
5
6  print('Workspace name: ' + ws.name,
7        'Azure region: ' + ws.location,
8        'Subscription id: ' + ws.subscription_id,
9        'Resource group: ' + ws.resource_group, sep = '\n')
10
11 run = exp.start_logging()
```

✓ 33.8s

```
Performing interactive authentication. Please follow the instructions on the terminal.
To sign in, use a web browser to open the page https://microsoft.com/devicelogin and enter the code AF2YJTET5 to authenticate.
You have logged in. Now let us find all the subscriptions to which you have access...
Interactive authentication successfully completed.
Workspace name: quick-starts-ws-140475
Azure region: southcentralus
Subscription id: 61c5c3f0-6dc7-4ed9-a7f3-c704b20e3b30
Resource group: aml-quickstarts-140475
```

Dataset


Workspace
SEND FEEDBACK
quick-starts-ws-140475 - Micros
Notebooks - Microsoft Azure Ma
Sign in to your account
QuirkyDataScientist1978/Micros
Machine-Learning-for-Heart-Fail
login.microsoftonline.com/common/reprocess?ctx=rQIIARXOvY_SUAAA8Bbu8HLRC3G523S4yaS0rx8USBzeUaBIoRAOpV0a-t6j5ast7aMFRicnYxzUwelGNy_-Ac6amJtdXM0IJk7O6vYbf4_yoCTUzgXZFVS1qnAVjF1OLoMJ57qEcII4rRLgTIVXLsf3j4sLcMpdecPW8-XbUno6kG5Y9ifLfs8VTbihvqiRdIbIf97...
Microsoft
Microsoft Azure Cross-platform Command Line Interface
You have signed in to the Microsoft Azure Cross-platform Command Line Interface application on your device. You may now close this window.
UDACITY NANODEGREE DEMO


Workspace
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Microsoft Azure Machine Learning
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.amlignore
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azureml-automl.yml
hyperparameter_tuning.ipynb
scoring.py
train.py
# Submit your hyperdrive run to the experiment and show run details with the widget.
from azureml.widgets import RunDetails
hyperdrive_run=exp.submit(hyperdrive_config)
RunDetails(hyperdrive_run).show()
hyperdrive_run.wait_for_completion(show_output=True)
650.3s - Executing
[2021-03-15T10:48:32.3023019Z][SCHEDULER][INFO]Successfully scheduled a job. Id='HD_1924aba6-068b-4265-8eb2-671fbc8b9d4e_17'
[2021-03-15T10:48:49.910207][ENFORCER][INFO]Jobs [https://southcentralus.experiments.azureml.net/subscriptions/61c5c3f0-6dc7-4ed9-a7f3-c704b20e3b30/resourceGroups/aml-quickstarts-140475/providers/Microsoft.MachineLearningServices/workspaces/quick-starts-ws-140475/experiments/**SCRUBBED**/runs/HD_1924aba6-068b-4265-8eb2-671fbc8b9d4e_16, https://southcentralus.experiments.azureml.net/subscriptions/61c5c3f0-6dc7-4ed9-a7f3-c704b20e3b30/resourceGroups/aml-quickstarts-140475/providers/Microsoft.MachineLearningServices/workspaces/quick-starts-ws-140475/experiments/**SCRUBBED**/runs/HD_1924aba6-068b-4265-8eb2-671fbc8b9d4e_17] do not contain any metrics with the primary metric name at this moment, policy cannot be applied.
RunId: HD_1924aba6-068b-4265-8eb2-671fbc8b9d4e
Web View: https://ml.azure.com/experiments/hyperdrive_run/runs/HD_1924aba6-068b-4265-8eb2-671fbc8b9d4e?wsid=/subscriptions/61c5c3f0-6dc7-4ed9-a7f3-c704b20e3b30/resourcegroups/aml-quickstarts-140475/workspaces/quick-starts-ws-140475
Streaming azureml-logs/hyperdrive.txt
"<START>[2021-03-15T10:38:10.781697][API][INFO]Experiment created<END>\n""<START>[2021-03-15T10:38:11.608576][GENERATOR][INFO]Trying to sample '4' jobs from the hyperparameter space<END>\n""<START>[2021-03-15T10:38:12.016540][GENERATOR][INFO]Successfully sampled '4' jobs, they will soon be submitted to the execution target.<END>\n"<START>[2021-03-15T10:38:12.3998238Z][SCHEDULER][INFO]The execution environment is being prepared. Please be patient as it can take a few minutes.<END>
Run Details
OPTIONAL: Write about the different models trained and their performance. Why do you think some models did better than others?
TODO: In the cell below, use the RunDetails widget to show the different experiments.
UDACITY NANODEGREE DEMO

Notebooks

Files Samples

automl.ipynb | *hyperparameter_tu | scoring.py | train.py | 1:udacityfinalproject | 2:udacityfinalproject

Editors | Compute: udacityfinalproject - Running | Python 3

udacityfinalproject · Jupyter kernel idle Python 3

- Users
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      - automl.ipynb
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      - hyperparameter_tuning.ipynb
      - scoring.py
      - train.py

```
1  # Submit your hyperdrive run to the experiment and show run details with the widget.
2  from azureml.widgets import RunDetails
3  hyperdrive_run=exp.submit(hyperdrive_config)
4  RunDetails(hyperdrive_run).show()
5  hyperdrive_run.wait_for_completion(show_output=True)
```

✓ 1,406.5s


```
'target': 'aml-compute',
'status': 'Completed',
'startTimeUtc': '2021-03-15T10:38:10.585957Z',
'endTimeUtc': '2021-03-15T11:01:02.515572Z',
'properties': {'primary_metric_config': '{"name": "Accuracy", "goal": "maximize"}',
 'resume_from': 'null',
 'runTemplate': 'HyperDrive',
 'azureml.runsource': 'hyperdrive',
 'platform': 'AML',
 'ContentSnapshotId': 'e01789bd-1d8b-4f1f-a12d-988cac2198d6',
 'score': '0.7575757575757576',
 'best_child_run_id': 'HD_1924aba6-068b-4265-8eb2-671fbc8b9d4e_0',
 'best_metric_status': 'Succeeded'},
'inputDatasets': [],
'outputDatasets': [],
'logFiles': {'azureml-logs/hyperdrive.txt': 'https://mlstrg140475.blob.core.windows.net/azureml/ExperimentRun/dcid.HD_1924aba6-068b-4265-8eb2-671fbc8b9d4e/azureml-logs/hyperdrive.txt?sv=2019-02-02&sr=b&sig=8XmY2j%2BOUTQvzv10CAFqguFqiKnSNeA0%2B68chP7Qupg%3D&st=2021-03-15T10%3A51%3A17Z&se=2021-03-15T19%3A01%3A17Z&sp=r'},
'submittedBy': 'ODL_User 140475'}
```


Run Details

OPTIONAL: Write about the different models trained and their performance. Why do you think some models did better than others?

TODO: In the cell below, use the `RunDetails` widget to show the different experiments.

Notebooks

Files | Samples

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      - scoring.py
      - train.py

automl.ipynb | *hyperparameter_tu | scoring.py | train.py | 1:udacityfinalproject | 2:udacityfinalproject

Editors | Compute: udacityfinalproject - Running | Python 3

udacityfinalproject · Jupyter kernel idle

Run Details

OPTIONAL: Write about the different models trained and their performance. Why do you think some models did better than others?

TODO: In the cell below, use the `RunDetails` widget to show the different experiments.

```
1  from azureml.widgets import RunDetails
2  RunDetails(hyperdrive_run).show()
```

✓ 0.2s

Run 34 Completed — Show log — View run details

```
[2021-03-15T10:59:59.301711][GENERATOR][INFO]Max number of jobs '50' reached for experiment.
[2021-03-15T10:59:59.451740][GENERATOR][INFO]All jobs generated.
[2021-03-15T11:00:12.000913][ENFORCER][INFO]Jobs [https://southcentralus.experiments.azureml.net/subscriptions/61c5c3f0-6dc7-4ed9-a7f3-c704b20e3b30/resourceGroups/aml-quickstarts-140475/providers/Microsoft.MachineLearningServices/workspaces/quick-starts-ws-140475/experiments/**SCRUBBED**/runs/HD_1924aba6-068b-4265-8eb2-671fbc8b9d4e_47, https://southcentralus.experiments.azureml.net/subscriptions/61c5c3f0-6dc7-4ed9-a7f3-c704b20e3b30/resourceGroups/aml-quickstarts-140475/providers/Microsoft.MachineLearningServices/workspaces/quick-starts-ws-140475/experiments/**SCRUBBED**/runs/HD_1924aba6-068b-4265-8eb2-671fbc8b9d4e_48, https://southcentralus.experiments.azureml.net/subscriptions/61c5c3f0-6dc7-4ed9-a7f3-c704b20e3b30/resourceGroups/aml-quickstarts-140475/providers/Microsoft.MachineLearningServices/workspaces/quick-starts-ws-140475/experiments/**SCRUBBED**/runs/HD_1924aba6-068b-4265-8eb2-671fbc8b9d4e_49] do not contain any metrics with the primary metric name at this moment, policy cannot be applied.
[2021-03-15T11:01:02.689907][CONTROLLER][INFO]Experiment was 'ExperimentStatus.RUNNING', is 'ExperimentStatus.FINISHED'.

Run is completed.
```

Best Model

TODO: In the cell below, get the best model from the hyperdrive experiments and display all the properties of the model.

Notebooks

Files Samples

automl.ipynb | hyperparameter_tun | scoring.py | train.py | 1:udacityfinalproject | 2:udacityfinalproject

Editors | Compute: udacityfinalproject - Running | Python 3

udacityfinalproject · Jupyter kernel idle Python 3.

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      - azureml-automl.yml
      - hyperparameter_tuning.ipynb
      - scoring.py
      - train.py

Best Model

TODO: In the cell below, get the best model from the hyperdrive experiments and display all the properties of the model.

[18]

```
import joblib
# Get your best run and save the model from that run.
best_run=hyperdrive_run.get_best_run_by_primary_metric()
best_run_metrics=best_run.get_metrics()
parameter_values=best_run.get_details()['runDefinition']['arguments']

print('Best Run ID:',best_run.id)
print('\n Accuracy:',best_run_metrics['Accuracy'])
```

✓ 1.2s

```
Best Run ID: HD_1924aba6-068b-4265-8eb2-671fbc8b9d4e_0

 Accuracy: 0.7575757575757576
```

```
print(best_run)
best_run
```

✓ 0.1s

```
Run(Experiment: hyperdrive_run,
Id: HD_1924aba6-068b-4265-8eb2-671fbc8b9d4e_0,
Type: azureml.scriptrun,
Status: Completed)
```

Experiment	Id	Type	Status	Details Page	Docs Page

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Workspace SEND FEEDBACK

quick-starts-ws-140481 - Microso | hyperdrive_run - Microsoft Azure | Run 1 - Microsoft Azure Machine | QuirkyDataScientist1978/Microso | Machine-Learning-for-Heart-Fail

ml.azure.com/experiments/id/2b45106f-d9a6-4cf6-8210-f06776b18821?wsid=/subscriptions/81cefad3-d2c9-4f77-a466-99a7f541c7bb/resourcegroups/aml-quickstarts-140481/workspaces/quick-starts-ws-140481&tid=660b3398-b80e-49d2-bc5b-ac1dc93b5254

Microsoft Azure Machine Learning

Udacity CloudLabs Sub - 12
quick-starts-ws-140481

Home > Experiments > hyperdrive_run

hyperdrive_run

Edit columns | Refresh | Add chart | Current view: default | Save view | Edit view | Share view

Search | Add filter | Include child runs | View only my runs

Run status

Running 1 | Completed 1

Failed 0 | Canceled 0

Queued 0 | Other 0

Max iterations:

No data available. Select runs with data to see the chart.

Regularization Strength:

No data available. Select runs with data to see the chart.

Show only selected rows (2 selected)

Page Size: 25

Run	Run ID	Status	Submitted time ↓	Durati...	Submitted by	Compute target	Run type	Last(Max itera...	Last(Regulariz...	Tags
Run 2	HD_a8c6873c-8739-48d5-97d1-e0a6...	Completed	Mar 15, 2021 11:31 ...	17m 39s	ODL_User 140481	aml-compute	Hyperdrive			HD_a8c6873c-8739-48d5-97d1-e0a6bf4ec738_0 : {"--C": 0.7178912510968828,
Run 1	bc047aec-e5c8-4fca-aa6c-bff07e8c992d	Running	Mar 15, 2021 11:29 ...	58m 27s	ODL_User 140481	local				

UDACITY NANODEGREE DEMO

Workspace

SEND FEEDBACK

quick-starts-ws-140481 - Microso | Run 2 - Microsoft Azure Machine | Run 1 - Microsoft Azure Machine | QuirkyDataScientist1978/Microso | Machine-Learning-for-Heart-Fail

ml.azure.com/experiments/id/2b45106f-d9a6-4cf6-8210-f06776b18821/runs/HD_a8c6873c-8739-48d5-97d1-e0a6bf4ec738?wsid=/subscriptions/81cefad3-d2c9-4f77-a466-99a7f541c7bb/resourcegroups/aml-quickstarts-140481/workspaces/quick-starts-ws-140481&tid=660b3398-b80...

Microsoft Azure Machine Learning

Udacity CloudLabs Sub - 12
quick-starts-ws-140481

Home > Experiments > hyperdrive_run > Run 2

Run 2

Completed

Refresh | Cancel

Details | **Child runs** | Metrics | Outputs + logs | Snapshot

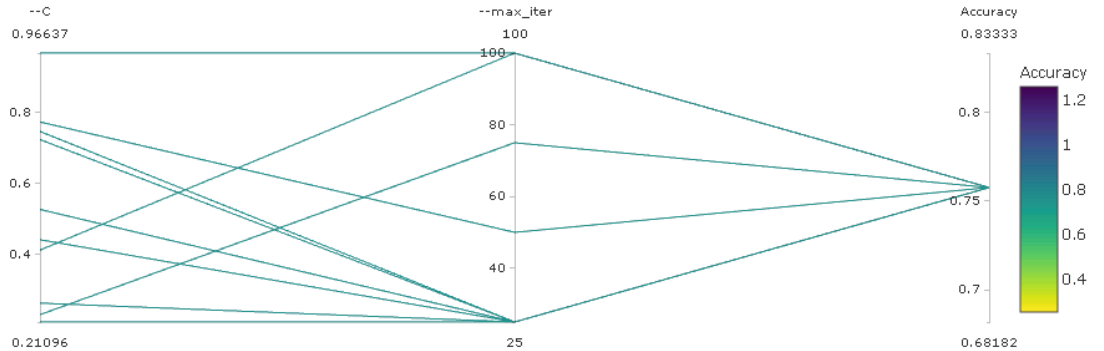
View top 10 runs

Accuracy

Add filter

Parallel coordinates chart

Child runs



Run	Run ID	Status	Accuracy	C	max_iter	Parent run ID	Created time	Duration	Submitted by	Compute target	Tags

UDACITY NANODEGREE DEMO

Workspace

SEND FEEDBACK

quick-starts-ws-140481 - Microso | Notebooks - Microsoft Azure Ma | QuirkyDataScientist1978/Microso | Machine-Learning-for-Heart-Fail

ml.azure.com/fileexplorerAzNB?wsid=/subscriptions/81cefad3-d2c9-4f77-a466-99a7f541c7bb/resourcegroups/aml-quickstarts-140481/workspaces/quick-starts-ws-140481&tid=660b3398-b80e-49d2-bc5b-ac1dc93b5254&activeFilePath=Users/odl_user_140481/Microsoft-Azure-Machine...

Microsoft Azure Machine Learning

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quick-starts-ws-140481

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Editors | Compute: udacityfinalproject - Running | Python 3

udacityfinalproject · Jupyter kernel busy — Python 3

- Users
  - odl_user_140481
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      - .amlignore
      - automl.ipynb
      - azureml-automl.yml
      - hyperparameter_tuning.ipynb
      - scoring.py
      - train.py

```
    **automl_settings
)
```

0.2s

```
from azureml.core.experiment import Experiment
# choose a name for experiment
experiment_name = 'automl_run'
experiment=Experiment(ws, experiment_name)

# TODO: Submit your experiment
remote_run = experiment.submit(automl_config, show_output=True)
```

996.5s - Executing

```
Running on remote.
No run_configuration provided, running on aml-compute with default configuration
Running on remote compute: aml-compute
Parent Run ID: AutoML_722606a6-1bb6-4835-8b92-e41ca6e8d9ee
```

Run Details

OPTIONAL: Write about the different models trained and their performance. Why do you think some models did better than others?

TODO: In the cell below, use the `RunDetails` widget to show the different experiments.

[ ]

```
from azureml.widgets import RunDetails
RunDetails(remote_run).show()
remote_run.wait_for_completion(show_output=True)
```

UDACITY NANODEGREE DEMO

Run 3 Completed

Refresh Cancel

Details | Data guardrails | Models | Outputs + logs | Child runs | Snapshot

Properties

Status
Completed

Created
Mar 15, 2021 1:53 PM

Started
Mar 15, 2021 1:53 PM

Duration
39m 40.67s

Compute target
aml-compute

Run ID
AutoML_a6331d1e-4776-4531-8a6d-85efd1d3a9bb

Script name
--

Created by
ODL_User 140481

Input datasets
Input name: training_data, ID: 00d4de04-4d02-443e-a738-f34fbebef47e

Output datasets
None

Arguments

Best model summary

Algorithm name
VotingEnsemble

Accuracy
0.75333 View all other metrics

Sampling
100.00 %

Registered models
No registration yet

Deploy status
No deployment yet

Run summary

Task type
Classification View all run settings

Primary metric
Accuracy

Experiment name
azure-ml-run-console

Description

AutoMLa6331d1e489:1

Details | Artifacts | **Endpoints** | Explanations (preview) | Fairness (preview) | Datasets

Refresh | Deploy | Download

Name	Description	Created on	Created by	Updated on	Compute type	Compute target	Tags
auto-ml-deploy		Mar 15, 2021 2:49 PM	ODL_User 140481	Mar 15, 2021 2:49 PM	ACI		

Workspace SEND FEEDBACK

quick-starts-ws-140481 - Microso | auto-ml-deploy - Microsoft Azur | QuirkyDataScientist1978/Microso

ml.azure.com/model/AutoMLa6331d1e489:1/deployments/auto-ml-deploy/consume?wsid=/subscriptions/81cefad3-d2c9-4f77-a466-99a7f541c7bb/resourcegroups/aml-quickstarts-140481/workspaces/quick-starts-ws-140481&tid=660b3398-b80e-49d2-bc5b-ac1dc93b5254

Microsoft Azure Machine Learning

Udacity CloudLabs Sub - 12
quick-starts-ws-140481

Home > Models > AutoMLa6331d1e489:1 > Endpoints > auto-ml-deploy

auto-ml-deploy

Details Test **Consume** Deployment logs

Basic consumption info

REST endpoint
Endpoint URL is not available yet.

Authentication types

(•) Using key ( ) Using token

Primary key
acPeJJ1a1WGPaZhOdPwcduldlqCmHBBR Regenerate
Secondary key
oYvw9HLFH1zBnYczeCevNATbYfkKYvBP Regenerate

UDACITY NANODEGREE DEMO

model.pkl

Show all

auto-ml-deploy

Details | Test | Consume | Deployment logs

Attributes

Service ID
auto-ml-deploy

Description
--

Deployment state
Healthy

Compute type
ACI

Created by
ODL_User 140481

Model ID
AutoMLa6331d1e489:1

Created on
3/15/2021 2:49:58 PM

Last updated on
3/15/2021 2:49:58 PM

Image ID
--

REST endpoint
http://0684f120-411c-4663-a3b1-4737bb70722b.southcentralus.azurecontainer.io/score

Key-based authentication enabled
true

Tags

No data

Properties

runId
AutoML_a6331d1e-4776-4531-8a6d-85efd1d3a9bb_89

hasInferenceSchema
True

hasHttps
False

auto-ml-deploy

Details | Test | Consume | Deployment logs

Model ID
AutoMLa6331d1e489:1

Created on
3/15/2021 2:49:58 PM

Last updated on
3/15/2021 2:49:58 PM

Image ID
--

REST endpoint
http://0684f120-411c-4663-a3b1-4737bb70722b.southcentralus.azurecontainer.io/score

Key-based authentication enabled
true

Swagger URI
http://0684f120-411c-4663-a3b1-4737bb70722b.southcentralus.azurecontainer.io/swagger.json

CPU
1.8

Memory
4 GB

Application Insights enabled
true

Application Insights url
https://portal.azure.com#resource/subscriptions/81cefad3-d2c9-4f77-a466-99a7f541c7bb/resourcegroups/aml-quickstarts-140481/providers/microsoft.insights/components/mlappinsight140481

auto-ml-deploy

Details Test Consume **Deployment logs**

```
2021-03-15T14:53:43,887759200+00:00 - rsyslog/run
2021-03-15T14:53:43,895081500+00:00 - iot-server/run
2021-03-15T14:53:43,899221600+00:00 - gunicorn/run
2021-03-15T14:53:43,915286300+00:00 - nginx/run
/usr/sbin/nginx: /azureml-envs/azureml_661474bbe74e96b5d8added5888dfc85/lib/libcrypto.so.1.0.0: no version information available (required by /usr/sbin/nginx)
/usr/sbin/nginx: /azureml-envs/azureml_661474bbe74e96b5d8added5888dfc85/lib/libcrypto.so.1.0.0: no version information available (required by /usr/sbin/nginx)
/usr/sbin/nginx: /azureml-envs/azureml_661474bbe74e96b5d8added5888dfc85/lib/libssl.so.1.0.0: no version information available (required by /usr/sbin/nginx)
/usr/sbin/nginx: /azureml-envs/azureml_661474bbe74e96b5d8added5888dfc85/lib/libssl.so.1.0.0: no version information available (required by /usr/sbin/nginx)
/usr/sbin/nginx: /azureml-envs/azureml_661474bbe74e96b5d8added5888dfc85/lib/libssl.so.1.0.0: no version information available (required by /usr/sbin/nginx)
rsyslogd: /azureml-envs/azureml_661474bbe74e96b5d8added5888dfc85/lib/libuuid.so.1: no version information available (required by rsyslogd)
EdgeHubConnectionString and IOTEDGE_IOTHUBHOSTNAME are not set. Exiting...
2021-03-15T14:53:45,612443700+00:00 - iot-server/finish 1 0
2021-03-15T14:53:45,615679300+00:00 - Exit code 1 is normal. Not restarting iot-server.
Starting gunicorn 19.9.0
Listening at: http://127.0.0.1:31311 (68)
Using worker: sync
worker timeout is set to 300
Booting worker with pid: 97
SPARK_HOME not set. Skipping PySpark Initialization.
Generating new fontManager, this may take some time...
Initializing logger
2021-03-15 14:53:50,604 | root | INFO | Starting up app insights client
2021-03-15 14:53:50,605 | root | INFO | Starting up request id generator
2021-03-15 14:53:50,605 | root | INFO | Starting up app insight hooks
2021-03-15 14:53:50,605 | root | INFO | Invoking user's init function
2021-03-15 14:53:59,985 | azureml.core | WARNING | Failure while loading azureml_run_type_providers. Failed to load entrypoint automl = azureml.train.automl.run:AutoMLRun._from_run_dto with exception (cryptography 3.2 (/azureml-envs/azureml_661474bbe74e96b5d8added5888dfc85/lib/python3.6/site-packages), Requirement.parse('cryptography<4.0.0,>=3.3.1; extra == "crypto"'), {'PyJWT'}).
Failure while loading azureml_run_type_providers. Failed to load entrypoint automl = azureml.train.automl.run:AutoMLRun._from_run_dto with exception (cryptography 3.2 (/azureml-envs/azureml_661474bbe74e96b5d8added5888dfc85/lib/python3.6/site-packages), Requirement.parse('cryptography<4.0.0,>=3.3.1; extra == "crypto"'), {'PyJWT'}).
2021-03-15 14:54:00,672 | root | INFO | Users's init has completed successfully
2021-03-15 14:54:00,692 | root | INFO | Skipping middleware: dbg_model_info as it's not enabled.
2021-03-15 14:54:00,693 | root | INFO | Skipping middleware: dbg_resource_usage as it's not enabled.
2021-03-15 14:54:00,695 | root | INFO | Scoring timeout is found from os.environ: 60000 ms
```

auto-ml-deploy

Details Test Consume **Deployment logs**

```
rsyslogd: /azureml-envs/azureml_661474bbe74e96b5d8added5888dfc85/lib/libuuid.so.1: no version information available (required by rsyslogd)
EdgeHubConnectionString and IOTEDGE_IOTHUBHOSTNAME are not set. Exiting...
2021-03-15T14:53:45,612443700+00:00 - iot-server/finish 1 0
2021-03-15T14:53:45,615679300+00:00 - Exit code 1 is normal. Not restarting iot-server.
Starting gunicorn 19.9.0
Listening at: http://127.0.0.1:31311 (68)
Using worker: sync
worker timeout is set to 300
Booting worker with pid: 97
SPARK_HOME not set. Skipping PySpark Initialization.
Generating new fontManager, this may take some time...
Initializing logger
2021-03-15 14:53:50,604 | root | INFO | Starting up app insights client
2021-03-15 14:53:50,605 | root | INFO | Starting up request id generator
2021-03-15 14:53:50,605 | root | INFO | Starting up app insight hooks
2021-03-15 14:53:50,605 | root | INFO | Invoking user's init function
2021-03-15 14:53:59,985 | azureml.core | WARNING | Failure while loading azureml_run_type_providers. Failed to load entrypoint automl = azureml.train.automl.run:AutoMLRun._from_run_dto with exception (cryptography 3.2 (/azureml-envs/azureml_661474bbe74e96b5d8added5888dfc85/lib/python3.6/site-packages), Requirement.parse('cryptography<4.0.0,>=3.3.1; extra == "crypto"'), {'PyJWT'}).
Failure while loading azureml_run_type_providers. Failed to load entrypoint automl = azureml.train.automl.run:AutoMLRun._from_run_dto with exception (cryptography 3.2 (/azureml-envs/azureml_661474bbe74e96b5d8added5888dfc85/lib/python3.6/site-packages), Requirement.parse('cryptography<4.0.0,>=3.3.1; extra == "crypto"'), {'PyJWT'}).
2021-03-15 14:54:00,672 | root | INFO | Users's init has completed successfully
2021-03-15 14:54:00,692 | root | INFO | Skipping middleware: dbg_model_info as it's not enabled.
2021-03-15 14:54:00,693 | root | INFO | Skipping middleware: dbg_resource_usage as it's not enabled.
2021-03-15 14:54:00,695 | root | INFO | Scoring timeout is found from os.environ: 60000 ms
2021-03-15 14:54:02,767 | root | INFO | 200
127.0.0.1 - - [15/Mar/2021:14:54:02 +0000] "GET /swagger.json HTTP/1.0" 200 2678 "-" "Go-http-client/1.1"
2021-03-15 14:55:02,669 | root | INFO | 200
127.0.0.1 - - [15/Mar/2021:14:55:02 +0000] "GET /swagger.json HTTP/1.0" 200 2678 "-" "Go-http-client/1.1"
2021-03-15 14:55:38,098 | root | INFO | 200
127.0.0.1 - - [15/Mar/2021:14:55:38 +0000] "GET /swagger.json HTTP/1.0" 200 2678 "-" "Go-http-client/1.1"
2021-03-15 14:55:43,580 | root | INFO | 200
127.0.0.1 - - [15/Mar/2021:14:55:43 +0000] "GET /swagger.json HTTP/1.0" 200 2678 "-" "Go-http-client/1.1"

```

Run Details

OPTIONAL: Write about the different models trained and their performance. Why do you think some models did better than others?

TODO: In the cell below, use the `RunDetails` widget to show the different experiments.

In [7]:
```
from azureml.widgets import RunDetails
RunDetails(remote_run).show()
remote_run.wait_for_completion(show_output=True)
```

```
_AutoMLWidget(widget_settings={'childWidgetDisplay': 'popup', 'send_telemetry': False, 'log_level': 'INFO', 's…

****************************************************************************************************
DATA GUARDRAILS:

TYPE:         Class balancing detection
STATUS:       PASSED
DESCRIPTION:  Your inputs were analyzed, and all classes are balanced in your training data.
              Learn more about imbalanced data: https://aka.ms/AutomatedMLImbalancedData

****************************************************************************************************

TYPE:         Missing feature values imputation
STATUS:       PASSED
DESCRIPTION:  No feature missing values were detected in the training data.
              Learn more about missing value imputation: https://aka.ms/AutomatedMLFeaturization

****************************************************************************************************

TYPE:         High cardinality feature detection
STATUS:       PASSED
DESCRIPTION:  Your inputs were analyzed, and no high cardinality features were detected.
              Learn more about high cardinality feature handling: https://aka.ms/AutomatedMLFeaturization

****************************************************************************************************

****************************************************************************************************
ITERATION: The iteration being evaluated.
PIPELINE: A summary description of the pipeline being evaluated.
DURATION: Time taken for the current iteration.
METRIC: The result of computing score on the fitted pipeline.
BEST: The best observed score thus far.
****************************************************************************************************

 ITERATION   PIPELINE                                       DURATION      METRIC      BEST
         0   MaxAbsScaler LightGBM                          0:00:42       0.8259    0.8259
         1   MinMaxScaler RandomForest                      0:00:45       0.8527    0.8527
         2   MinMaxScaler RandomForest                      0:00:51       0.8438    0.8527
         3   MinMaxScaler RandomForest                      0:01:03       0.8571    0.8571
         4   MinMaxScaler RandomForest                      0:01:03       0.8348    0.8571
         5   RobustScaler LightGBM                          0:00:53       0.8214    0.8571
         6   RobustScaler GradientBoosting                  0:02:41       0.8661    0.8661
         7   MaxAbsScaler LightGBM                          0:00:54       0.8661    0.8661
         8   StandardScalerWrapper LightGBM                 0:00:49       0.8616    0.8661
         9   MinMaxScaler LightGBM                          0:00:51       0.8393    0.8661
        10   RobustScaler LogisticRegression                0:00:54       0.8170    0.8661
        11   MinMaxScaler SVM                               0:00:40       0.7054    0.8661
        12   MinMaxScaler SVM                               0:00:48       0.7545    0.8661
```

****

ITERATION	PIPELINE	DURATION	METRIC	BEST
0	MaxAbsScaler LightGBM	0:00:42	0.8259	0.8259
1	MinMaxScaler RandomForest	0:00:45	0.8527	0.8527
2	MinMaxScaler RandomForest	0:00:51	0.8438	0.8527
3	MinMaxScaler RandomForest	0:01:03	0.8571	0.8571
4	MinMaxScaler RandomForest	0:01:03	0.8348	0.8571
5	RobustScaler LightGBM	0:00:53	0.8214	0.8571
6	RobustScaler GradientBoosting	0:02:41	0.8661	0.8661
7	MaxAbsScaler LightGBM	0:00:54	0.8661	0.8661
8	StandardScalerWrapper LightGBM	0:00:49	0.8616	0.8661
9	MinMaxScaler LightGBM	0:00:51	0.8393	0.8661
10	RobustScaler LogisticRegression	0:00:54	0.8170	0.8661
11	MinMaxScaler SVM	0:00:40	0.7054	0.8661
12	MinMaxScaler SVM	0:00:48	0.7545	0.8661
13	MinMaxScaler SVM	0:00:42	0.7589	0.8661
14	StandardScalerWrapper LogisticRegression	0:00:42	0.8125	0.8661
15	SparseNormalizer LightGBM	0:00:45	0.8393	0.8661
16	StandardScalerWrapper ExtremeRandomTrees	0:00:47	0.6696	0.8661
17	RobustScaler RandomForest	0:00:45	0.8571	0.8661
18	MaxAbsScaler LightGBM	0:00:53	0.8438	0.8661
19	StandardScalerWrapper ExtremeRandomTrees	0:00:52	0.8304	0.8661
20	MinMaxScaler LightGBM	0:00:52	0.7723	0.8661
21	MaxAbsScaler GradientBoosting	0:00:53	0.8616	0.8661
22	RobustScaler LightGBM	0:00:45	0.8393	0.8661
23	StandardScalerWrapper RandomForest	0:00:54	0.8482	0.8661
24	StandardScalerWrapper LightGBM	0:00:51	0.7902	0.8661
25	MaxAbsScaler GradientBoosting	0:00:48	0.8571	0.8661
26	StandardScalerWrapper KNN	0:00:45	0.6384	0.8661
27	MaxAbsScaler LightGBM	0:00:40	0.7188	0.8661
28	MaxAbsScaler ExtremeRandomTrees	0:00:45	0.8259	0.8661
29	StandardScalerWrapper RandomForest	0:00:46	0.7946	0.8661
30	PCA GradientBoosting	0:00:44	0.6696	0.8661
31	StandardScalerWrapper LightGBM	0:00:46	0.7411	0.8661
32	StandardScalerWrapper GradientBoosting	0:00:45	0.8527	0.8661
33	MinMaxScaler ExtremeRandomTrees	0:00:51	0.8348	0.8661
34	SparseNormalizer LightGBM	0:00:50	0.8036	0.8661
35	RobustScaler GradientBoosting	0:00:57	0.8125	0.8661
36	MaxAbsScaler LightGBM	0:00:50	0.8438	0.8661
37	StandardScalerWrapper RandomForest	0:00:52	0.8482	0.8661
38	StandardScalerWrapper ExtremeRandomTrees	0:00:43	0.8259	0.8661
39		0:00:12	nan	0.8661
40		0:04:07	nan	0.8661
41		0:03:47	nan	0.8661
42		0:03:10	nan	0.8661
43		0:02:41	nan	0.8661
44		0:02:12	nan	0.8661
45		0:01:29	nan	0.8661
46		0:01:07	nan	0.8661
47		0:00:25	nan	0.8661
48	VotingEnsemble	0:01:02	0.8973	0.8973
49	StackEnsemble	0:01:02	0.8884	0.8973

Out[7]: {'runId': 'AutoML_e7c9ced7-8028-458d-9d7e-7eeabe093adf',
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'endTimeUtc': '2021-03-21T21:28:26.39959Z',
'properties': {'num_iterations': '1000',

48	VotingEnsemble	0:01:02	0.8973	0.8973
49	StackEnsemble	0:01:02	0.8884	0.8973

Out[7]:

```
{'runId': 'AutoML_e7c9ced7-8028-458d-9d7e-7eeabe093adf',
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res": 12, "dataset_samples": 224, "single_frequency_class_detected": false}',
  'ModelExplainRunId': 'AutoML_e7c9ced7-8028-458d-9d7e-7eeabe093adf_ModelExplain'},
 'inputDatasets': [{'dataset': {'id': '02789458-f5d0-4ae5-bace-c2091e8cb06d'}, 'consumptionDetails': {'type': 'RunInput', 'inputName': 't
raining_data', 'mechanism': 'Direct'}}],
 'outputDatasets': [],
 'logFiles': {},
 'submittedBy': 'Aaron Gauthier'}

```
 'outputDatasets': [],
 'logFiles': {},
 'submittedBy': 'Aaron Gauthier'}
```

Best Model

TODO: In the cell below, get the best model from the automl experiments and display all the properties of the model.

In [8]:
```
# Retrieve and save your best automl model.
best_remote_run,best_automl_model=remote_run.get_output()
best_run_metrics=remote_run.get_metrics()
for primary_metric in best_run_metrics:
    metric=best_run_metrics[primary_metric]
    print(primary_metric,metric)
```

```
experiment_status ['DatasetEvaluation', 'FeaturesGeneration', 'DatasetFeaturization', 'DatasetFeaturizationCompleted', 'DatasetCrossValid
ationSplit', 'ModelSelection', 'BestRunExplainModel', 'ModelExplanationDataSetSetup', 'PickSurrogateModel', 'EngineeredFeatureExplanation
s', 'EngineeredFeatureExplanations', 'RawFeaturesExplanations', 'RawFeaturesExplanations', 'BestRunExplainModel']
experiment_status_description ['Gathering dataset statistics.', 'Generating features for the dataset.', 'Beginning to fit featurizers and
featurize the dataset.', 'Completed fit featurizers and featurizing the dataset.', 'Generating individually featurized CV splits.', 'Begi
nning model selection.', 'Best run model explanations started', 'Model explanations data setup completed', 'Choosing LightGBM as the surr
ogate model for explanations', 'Computation of engineered features started', 'Computation of engineered features completed', 'Computation
of raw features started', 'Computation of raw features completed', 'Best run model explanations completed']
precision_score_weighted 0.9000361081932773
AUC_macro 0.9123646672988779
AUC_micro 0.926139987244898
norm_macro_recall 0.7147344713134187
log_loss 0.36574080242462076
weighted_accuracy 0.9287706300839589
balanced_accuracy 0.8573672356567094
AUC_weighted 0.9123646672988779
average_precision_score_weighted 0.9257641290153051
precision_score_micro 0.8973214285714286
f1_score_micro 0.8973214285714286
precision_score_macro 0.9072406045751634
accuracy 0.8973214285714286
matthews_correlation 0.7628214162481246
recall_score_macro 0.8573672356567094
recall_score_micro 0.8973214285714286
f1_score_weighted 0.8935750584818909
average_precision_score_micro 0.9271062753260348
f1_score_macro 0.8756258234519104
average_precision_score_macro 0.9111155173499444
recall_score_weighted 0.8973214285714286
```

In [9]:
```
#TODO: Save the best model
print(best_remote_run)
best_remote_run
```

```
Run(Experiment: automl_run,
Id: AutoML_e7c9ced7-8028-458d-9d7e-7eeabe093adf_48,
Type: azureml.scriptrun,
Status: Completed)
```

Out[9]:

Experiment	Id	Type	Status	Details Page	Docs Page
automl_run	AutoML_e7c9ced7-8028-458d-9d7e-7eeabe093adf_48	azureml.scriptrun	Completed	Link to Azure Machine Learning studio	Link to Documentation

```
print(best_remote_run)
best_remote_run
```

```
Run(Experiment: automl_run,
Id: AutoML_e7c9ced7-8028-458d-9d7e-7eeabe093adf_48,
Type: azureml.scriptrun,
Status: Completed)
```

Out[9]:

Experiment	Id	Type	Status	Details Page	Docs Page
automl_run	AutoML_e7c9ced7-8028-458d-9d7e-7eeabe093adf_48	azureml.scriptrun	Completed	Link to Azure Machine Learning studio	Link to Documentation

In [10]:

```
#TODO: Save the best model
import pickle
best_remote_run,best_automl_model=remote_run.get_output()
#joblib.dump(value=best_automl_model,filename='automl_model.joblib')
pkl_filename = "automl_model.pkl"
with open(pkl_filename,'wb') as f:
    pickle.dump(best_automl_model,f)
```

Model Deployment

Remember you have to deploy only one of the two models you trained.. Perform the steps in the rest of this notebook only if you wish to deploy this model.

TODO: In the cell below, register the model, create an inference config and deploy the model as a web service.

In [11]:

```
from azureml.core.model import Model
# Register model
model = Model.register(workspace = ws,
                       model_name = "Heart_failure_prediction",
                       model_path = "./automl_model.pkl",
                       description = "Best AutoML Model",)
```

```
Registering model Heart_failure_prediction
```

TODO: In the cell below, send a request to the web service you deployed to test it.

In [15]:

```
%%writefile amlscore.py
import json
import numpy as np
import os
import pickle
import joblib
import pandas as pd
from azureml.core.model import Model

def init():
    global model
    model_path = Model.get_model_path("automl")
    model = joblib.load(model_path)

def run(raw_data):
    try:
        data = json.loads(raw_data)['data']
        data = pd.DataFrame.from_dict(data)
        # make prediction
        result = model.predict(data)
```

69-12ef-47da-a5dc-8a13e5d7b780/azureml-logs/hyperdrive.txt?sv=2019-02-02&sr=b&sig=S4KjmW44lQYMH5V%2F%2BAwqn%2BCQUWyzxGveXbnH5MrzyqA%3D&st
=2021-03-21T20%3A27%3A11Z&se=2021-03-22T04%3A37%3A11Z&sp=r'},
'submittedBy': 'Aaron Gauthier'}

Run Details

OPTIONAL: Write about the different models trained and their performance. Why do you think some models did better than others?

TODO: In the cell below, use the `RunDetails` widget to show the different experiments.

In [6]:
```
from azureml.widgets import RunDetails
RunDetails(hyperdrive_run).show()
```

```
_HyperDriveWidget(widget_settings={'childWidgetDisplay': 'popup', 'send_telemetry': False, 'log_level': 'INFO'…
```

Best Model

TODO: In the cell below, get the best model from the hyperdrive experiments and display all the properties of the model.

In [7]:
```
import joblib
# Get your best run and save the model from that run.
best_run=hyperdrive_run.get_best_run_by_primary_metric()
best_run_metrics=best_run.get_metrics()
parameter_values=best_run.get_details()['runDefinition']['arguments']

print('Best Run ID:',best_run.id)
print('\n Accuracy:',best_run_metrics['Accuracy'])
```

```
Best Run ID: HD_95a5fc69-12ef-47da-a5dc-8a13e5d7b780_0

 Accuracy: 0.7575757575757576
```

In [8]:
```
print(best_run)
best_run
```

```
Run(Experiment: hyperdrive_run,
Id: HD_95a5fc69-12ef-47da-a5dc-8a13e5d7b780_0,
Type: azureml.scriptrun,
Status: Completed)
```

Out[8]:

Experiment	Id	Type	Status	Details Page	Docs Page
hyperdrive_run	HD_95a5fc69-12ef-47da-a5dc-8a13e5d7b780_0	azureml.scriptrun	Completed	Link to Azure Machine Learning studio	Link to Documentation

In [9]:
```
#TODO: Save the best model
model=best_run.register_model(model_name='hyperdrive_model',model_path='./outputs/model.joblib')
```

```
recall_score_micro 0.8973214285714286
f1_score_weighted 0.8935750584818909
average_precision_score_micro 0.9271062753260348
f1_score_macro 0.8756258234519104
average_precision_score_macro 0.9111155173499444
recall_score_weighted 0.8973214285714286
```

In [9]:
```
#TODO: Save the best model
print(best_remote_run)
best_remote_run
```

```
Run(Experiment: automl_run,
Id: AutoML_e7c9ced7-8028-458d-9d7e-7eeabe093adf_48,
Type: azureml.scriptrun,
Status: Completed)
```

Out[9]:

Experiment	Id	Type	Status	Details Page	Docs Page
automl_run	AutoML_e7c9ced7-8028-458d-9d7e-7eeabe093adf_48	azureml.scriptrun	Completed	Link to Azure Machine Learning studio	Link to Documentation

In [10]:
```
#TODO: Save the best model
import pickle
best_remote_run,best_automl_model=remote_run.get_output()
#joblib.dump(value=best_automl_model,filename='automl_model.joblib')
pkl_filename = "automl_model.pkl"
with open(pkl_filename,'wb') as f:
    pickle.dump(best_automl_model,f)
```

Model Deployment

Remember you have to deploy only one of the two models you trained.. Perform the steps in the rest of this notebook only if you wish to deploy this model.

TODO: In the cell below, register the model, create an inference config and deploy the model as a web service.

In [11]:
```
from azureml.core.model import Model
# Register model
model = Model.register(workspace = ws,
                       model_name = "Heart_failure_prediction",
                       model_path = "./automl_model.pkl",
                       description = "Best AutoML Model",)
```

```
Registering model Heart_failure_prediction
```

TODO: In the cell below, send a request to the web service you deployed to test it.

In [15]:
```
%%writefile amlscore.py
import json
import numpy as np
import os
import pickle
import joblib
import pandas as pd
from azureml.core.model import Model

def init():
    global model
    model_path = Model.get_model_path("automl")
```

```
Registering model Heart_failure_prediction
```

TODO: In the cell below, send a request to the web service you deployed to test it.

In [15]:
```
%%writefile amlscore.py
import json
import numpy as np
import os
import pickle
import joblib
import pandas as pd
from azureml.core.model import Model

def init():
    global model
    model_path = Model.get_model_path("automl")
    model = joblib.load(model_path)

def run(raw_data):
    try:
        data = json.loads(raw_data)['data']
        data = pd.DataFrame.from_dict(data)
        # make prediction
        result = model.predict(data)
        return result.tolist()
    except Exception as ex:
        error = str(ex)
        return error
```

```
Writing amlscore.py
```

In [28]:
```
best_run_metrics
```

Out[28]:
```
{'experiment_status': ['DatasetEvaluation',
  'FeaturesGeneration',
  'DatasetFeaturization',
  'DatasetFeaturizationCompleted',
  'DatasetCrossValidationSplit',
  'ModelSelection',
  'BestRunExplainModel',
  'ModelExplanationDataSetSetup',
  'PickSurrogateModel',
  'EngineeredFeatureExplanations',
  'EngineeredFeatureExplanations',
  'RawFeaturesExplanations',
  'RawFeaturesExplanations',
  'BestRunExplainModel'],
 'experiment_status_description': ['Gathering dataset statistics.',
  'Generating features for the dataset.',
  'Beginning to fit featurizers and featurize the dataset.',
  'Completed fit featurizers and featurizing the dataset.',
  'Generating individually featurized CV splits.',
  'Beginning model selection.',
  'Best run model explanations started',
  'Model explanations data setup completed',
  'Choosing LightGBM as the surrogate model for explanations',
  'Computation of engineered features started',
  'Computation of engineered features completed',
  'Computation of raw features started',
  'Computation of raw features completed',
```

```
        return error
```

```
Writing amlscore.py
```

In [28]:
```
best_run_metrics
```

Out[28]:
```
{'experiment_status': ['DatasetEvaluation',
  'FeaturesGeneration',
  'DatasetFeaturization',
  'DatasetFeaturizationCompleted',
  'DatasetCrossValidationSplit',
  'ModelSelection',
  'BestRunExplainModel',
  'ModelExplanationDataSetSetup',
  'PickSurrogateModel',
  'EngineeredFeatureExplanations',
  'EngineeredFeatureExplanations',
  'RawFeaturesExplanations',
  'RawFeaturesExplanations',
  'BestRunExplainModel'],
 'experiment_status_description': ['Gathering dataset statistics.',
  'Generating features for the dataset.',
  'Beginning to fit featurizers and featurize the dataset.',
  'Completed fit featurizers and featurizing the dataset.',
  'Generating individually featurized CV splits.',
  'Beginning model selection.',
  'Best run model explanations started',
  'Model explanations data setup completed',
  'Choosing LightGBM as the surrogate model for explanations',
  'Computation of engineered features started',
  'Computation of engineered features completed',
  'Computation of raw features started',
  'Computation of raw features completed',
  'Best run model explanations completed'],
 'precision_score_weighted': 0.9000361081932773,
 'AUC_macro': 0.9123646672988779,
 'AUC_micro': 0.926139987244898,
 'norm_macro_recall': 0.7147344713134187,
 'log_loss': 0.36574080242462076,
 'weighted_accuracy': 0.9287706300839589,
 'balanced_accuracy': 0.8573672356567094,
 'AUC_weighted': 0.9123646672988779,
 'average_precision_score_weighted': 0.9257641290153051,
 'precision_score_micro': 0.8973214285714286,
 'f1_score_micro': 0.8973214285714286,
 'precision_score_macro': 0.9072406045751634,
 'accuracy': 0.8973214285714286,
 'matthews_correlation': 0.7628214162481246,
 'recall_score_macro': 0.8573672356567094,
 'recall_score_micro': 0.8973214285714286,
 'f1_score_weighted': 0.8935750584818909,
 'average_precision_score_micro': 0.9271062753260348,
 'f1_score_macro': 0.8756258234519104,
 'average_precision_score_macro': 0.9111155173499444,
 'recall_score_weighted': 0.8973214285714286}
```

In [69]:
```
from azureml.automl.core.shared import constants
best_remote_run.download_file(constants.CONDA_ENV_FILE_PATH, 'azureml-automl.yml')
```

```
inference_config = InferenceConfig(entry_script="scoring.py")
```

In [77]:
```
from azureml.core.webservice import Webservice, AciWebservice
deployment_config = AciWebservice.deploy_configuration(cpu_cores=1, memory_gb = 1)
print(deployment_config)
```

```
<azureml.core.webservice.aci.AciServiceDeploymentConfiguration object at 0x7f689c2cefd0>
```

In [43]:
```
best_remote_run, model = remote_run.get_output()
best_remote_run_metrics = best_remote_run.get_metrics()

print(model)
print('Best Run Id: ', best_remote_run.id)
print('\n Accuracy:', best_remote_run_metrics['accuracy'])
```

```
Pipeline(memory=None,
         steps=[('datatransformer',
                 DataTransformer(enable_dnn=None, enable_feature_sweeping=None,
                                 feature_sweeping_config=None,
                                 feature_sweeping_timeout=None,
                                 featurization_config=None, force_text_dnn=None,
                                 is_cross_validation=None,
                                 is_onnx_compatible=None, logger=None,
                                 observer=None, task=None, working_dir=None)),
                ('prefittedsoftvotingclassifier',...
                                                                        num_leaves=104,
                                                                        objective=None,
                                                                        random_state=None,
                                                                        reg_alpha=0,
                                                                        reg_lambda=0.42105263157894735,
                                                                        silent=True,
                                                                        subsample=1,
                                                                        subsample_for_bin=200000,
                                                                        subsample_freq=0,
                                                                        verbose=-10))],
                                                           verbose=False))],
                                             flatten_transform=None,
                                             weights=[0.14285714285714285,
                                                      0.14285714285714285,
                                                      0.14285714285714285,
                                                      0.14285714285714285,
                                                      0.14285714285714285,
                                                      0.2857142857142857]))],
         verbose=False)
Best Run Id:  AutoML_e7c9ced7-8028-458d-9d7e-7eeabe093adf_48

 Accuracy: 0.8973214285714286
```

In [44]:
```
import joblib
joblib.dump(model,'outputs/automl_model.pkl')
print(best_remote_run.get_tags())
```

```
{'_aml_system_azureml.automlComponent': 'AutoML', '_aml_system_ComputeTargetStatus': '{"AllocationState":"steady","PreparingNodeCount":
0,"RunningNodeCount":2,"CurrentNodeCount":2}', 'mlflow.source.type': 'JOB', 'mlflow.source.name': 'automl_driver.py', 'ensembled_iteratio
ns': '[7, 6, 21, 8, 25, 15]', 'ensembled_algorithms': "['LightGBM', 'GradientBoosting', 'GradientBoosting', 'LightGBM', 'GradientBoostin
g', 'LightGBM']", 'ensemble_weights': '[0.1428571428571428, 0.1428571428571428, 0.1428571428571428, 0.1428571428571428, 0.14285714285
714285, 0.2857142857142857]', 'best_individual_pipeline_score': '0.8660714285714286', 'best_individual_iteration': '7', '_aml_system_auto
ml_is_child_run_end_telemetry_event_logged': 'True', 'model_explain_run_id': 'AutoML_e7c9ced7-8028-458d-9d7e-7eeabe093adf_ModelExplain',
'model_explanation': 'True'}
```

In [44]:
```
import joblib
joblib.dump(model,'outputs/automl_model.pkl')
print(best_remote_run.get_tags())
```

```
{'_aml_system_azureml.automlComponent': 'AutoML', '_aml_system_ComputeTargetStatus': '{"AllocationState":"steady","PreparingNodeCount":
0,"RunningNodeCount":2,"CurrentNodeCount":2}', 'mlflow.source.type': 'JOB', 'mlflow.source.name': 'automl_driver.py', 'ensembled_iteratio
ns': '[7, 6, 21, 8, 25, 15]', 'ensembled_algorithms': "['LightGBM', 'GradientBoosting', 'GradientBoosting', 'LightGBM', 'GradientBoostin
g', 'LightGBM']", 'ensemble_weights': '[0.14285714285714285, 0.14285714285714285, 0.14285714285714285, 0.14285714285714285, 0.14285714285
714285, 0.2857142857142857]', 'best_individual_pipeline_score': '0.8660714285714286', 'best_individual_iteration': '7', '_aml_system_auto
ml_is_child_run_end_telemetry_event_logged': 'True', 'model_explain_run_id': 'AutoML_e7c9ced7-8028-458d-9d7e-7eeabe093adf_ModelExplain',
'model_explanation': 'True'}
```

In [45]:
```
from azureml.core.model import Model

model = Model.register(workspace = ws,
                       model_path ="outputs/automl_model.pkl",
                       model_name = "automl")
```

```
Registering model automl
```

In [46]:
```
%%writefile amlscore.py
import json
import numpy as np
import os
import pickle
import joblib
import pandas as pd
from azureml.core.model import Model

def init():
    global model
    model_path = Model.get_model_path("automl")
    model = joblib.load(model_path)

def run(raw_data):
    try:
        data = json.loads(raw_data)['data']
        data = pd.DataFrame.from_dict(data)
        # make prediction
        result = model.predict(data)
        return result.tolist()
    except Exception as ex:
        error = str(ex)
        return error
```

```
Overwriting amlscore.py
```

In [81]:
```
from azureml.core.environment import Environment
from azureml.core.model import InferenceConfig
from azureml.core.webservice import AciWebservice, Webservice
from azureml.core.model import Model
from azureml.automl.core.shared import constants
from azureml.core.conda_dependencies import CondaDependencies

#best_remote_run.download_file("outputs/scoring_file_v_1_0_0.py", "inference/score.py")

best_remote_run.download_file(constants.CONDA_ENV_FILE_PATH, "myenv.yml")
myenv = Environment.from_conda_specification(name="myenv", file_path="myenv.yml")
```

```
service = Model.deploy(ws, "automl-final", [model], inference_config, aciconfig)

service.wait_for_deployment(True)
```

```
Tips: You can try get_logs(): https://aka.ms/debugimage#dockerlog or local deployment: https://aka.ms/debugimage#debug-locally to debug i
f deployment takes longer than 10 minutes.
Running
2021-03-21 23:29:41+00:00 Registering the environment.
2021-03-21 23:29:42+00:00 Use the existing image.
2021-03-21 23:29:43+00:00 Generating deployment configuration.
2021-03-21 23:29:44+00:00 Submitting deployment to compute..
2021-03-21 23:29:48+00:00 Checking the status of deployment automl-final..
2021-03-21 23:33:11+00:00 Checking the status of inference endpoint automl-final.
Succeeded
ACI service creation operation finished, operation "Succeeded"
```

In [82]:
```
print(service.get_logs())
```

```
2021-03-21T23:33:08,042853800+00:00 - iot-server/run
2021-03-21T23:33:08,046530500+00:00 - gunicorn/run
2021-03-21T23:33:08,056009600+00:00 - rsyslog/run
2021-03-21T23:33:08,098713600+00:00 - nginx/run
/usr/sbin/nginx: /azureml-envs/azureml_fe9df1de9dcfc7f534c43ede471eccd6/lib/libcrypto.so.1.0.0: no version information available (require
d by /usr/sbin/nginx)
/usr/sbin/nginx: /azureml-envs/azureml_fe9df1de9dcfc7f534c43ede471eccd6/lib/libcrypto.so.1.0.0: no version information available (require
d by /usr/sbin/nginx)
/usr/sbin/nginx: /azureml-envs/azureml_fe9df1de9dcfc7f534c43ede471eccd6/lib/libssl.so.1.0.0: no version information available (required b
y /usr/sbin/nginx)
/usr/sbin/nginx: /azureml-envs/azureml_fe9df1de9dcfc7f534c43ede471eccd6/lib/libssl.so.1.0.0: no version information available (required b
y /usr/sbin/nginx)
/usr/sbin/nginx: /azureml-envs/azureml_fe9df1de9dcfc7f534c43ede471eccd6/lib/libssl.so.1.0.0: no version information available (required b
y /usr/sbin/nginx)
rsyslogd: /azureml-envs/azureml_fe9df1de9dcfc7f534c43ede471eccd6/lib/libuuid.so.1: no version information available (required by rsyslog
d)
EdgeHubConnectionString and IOTEDGE_IOTHUBHOSTNAME are not set. Exiting...
2021-03-21T23:33:09,682169500+00:00 - iot-server/finish 1 0
2021-03-21T23:33:09,698742400+00:00 - Exit code 1 is normal. Not restarting iot-server.
Starting gunicorn 19.9.0
Listening at: http://127.0.0.1:31311 (65)
Using worker: sync
worker timeout is set to 300
Booting worker with pid: 96
SPARK_HOME not set. Skipping PySpark Initialization.
Generating new fontManager, this may take some time...
Initializing logger
2021-03-21 23:33:17,504 | root | INFO | Starting up app insights client
2021-03-21 23:33:17,504 | root | INFO | Starting up request id generator
2021-03-21 23:33:17,505 | root | INFO | Starting up app insight hooks
2021-03-21 23:33:17,505 | root | INFO | Invoking user's init function
2021-03-21 23:33:23,594 | root | INFO | Users's init has completed successfully
2021-03-21 23:33:23,598 | root | INFO | Skipping middleware: dbg_model_info as it's not enabled.
2021-03-21 23:33:23,599 | root | INFO | Skipping middleware: dbg_resource_usage as it's not enabled.
2021-03-21 23:33:23,603 | root | INFO | Scoring timeout is found from os.environ: 60000 ms
2021-03-21 23:33:25,982 | root | INFO | Swagger file not present
2021-03-21 23:33:25,983 | root | INFO | 404
127.0.0.1 - - [21/Mar/2021:23:33:25 +0000] "GET /swagger.json HTTP/1.0" 404 19 "-" "Go-http-client/1.1"
2021-03-21 23:33:32,871 | root | INFO | Swagger file not present
2021-03-21 23:33:32,872 | root | INFO | 404
127.0.0.1 - - [21/Mar/2021:23:33:32 +0000] "GET /swagger.json HTTP/1.0" 404 19 "-" "Go-http-client/1.1"
```

In [82]:
```
print(service.get_logs())
```

```
2021-03-21T23:33:08,042853800+00:00 - iot-server/run
2021-03-21T23:33:08,046530500+00:00 - gunicorn/run
2021-03-21T23:33:08,056009600+00:00 - rsyslog/run
2021-03-21T23:33:08,098713600+00:00 - nginx/run
/usr/sbin/nginx: /azureml-envs/azureml_fe9df1de9dcfc7f534c43ede471eccd6/lib/libcrypto.so.1.0.0: no version information available (require
d by /usr/sbin/nginx)
/usr/sbin/nginx: /azureml-envs/azureml_fe9df1de9dcfc7f534c43ede471eccd6/lib/libcrypto.so.1.0.0: no version information available (require
d by /usr/sbin/nginx)
/usr/sbin/nginx: /azureml-envs/azureml_fe9df1de9dcfc7f534c43ede471eccd6/lib/libssl.so.1.0.0: no version information available (required b
y /usr/sbin/nginx)
/usr/sbin/nginx: /azureml-envs/azureml_fe9df1de9dcfc7f534c43ede471eccd6/lib/libssl.so.1.0.0: no version information available (required b
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/usr/sbin/nginx: /azureml-envs/azureml_fe9df1de9dcfc7f534c43ede471eccd6/lib/libssl.so.1.0.0: no version information available (required b
y /usr/sbin/nginx)
rsyslogd: /azureml-envs/azureml_fe9df1de9dcfc7f534c43ede471eccd6/lib/libuuid.so.1: no version information available (required by rsyslog
d)
EdgeHubConnectionString and IOTEDGE_IOTHUBHOSTNAME are not set. Exiting...
2021-03-21T23:33:09,682169500+00:00 - iot-server/finish 1 0
2021-03-21T23:33:09,698742400+00:00 - Exit code 1 is normal. Not restarting iot-server.
Starting gunicorn 19.9.0
Listening at: http://127.0.0.1:31311 (65)
Using worker: sync
worker timeout is set to 300
Booting worker with pid: 96
SPARK_HOME not set. Skipping PySpark Initialization.
Generating new fontManager, this may take some time...
Initializing logger
2021-03-21 23:33:17,504 | root | INFO | Starting up app insights client
2021-03-21 23:33:17,504 | root | INFO | Starting up request id generator
2021-03-21 23:33:17,505 | root | INFO | Starting up app insight hooks
2021-03-21 23:33:17,505 | root | INFO | Invoking user's init function
2021-03-21 23:33:23,594 | root | INFO | Users's init has completed successfully
2021-03-21 23:33:23,598 | root | INFO | Skipping middleware: dbg_model_info as it's not enabled.
2021-03-21 23:33:23,599 | root | INFO | Skipping middleware: dbg_resource_usage as it's not enabled.
2021-03-21 23:33:23,603 | root | INFO | Scoring timeout is found from os.environ: 60000 ms
2021-03-21 23:33:25,982 | root | INFO | Swagger file not present
2021-03-21 23:33:25,983 | root | INFO | 404
127.0.0.1 - - [21/Mar/2021:23:33:25 +0000] "GET /swagger.json HTTP/1.0" 404 19 "-" "Go-http-client/1.1"
2021-03-21 23:33:32,871 | root | INFO | Swagger file not present
2021-03-21 23:33:32,872 | root | INFO | 404
127.0.0.1 - - [21/Mar/2021:23:33:32 +0000] "GET /swagger.json HTTP/1.0" 404 19 "-" "Go-http-client/1.1"
```

In [84]:
```
scoring_uri = service.scoring_uri

print(f'\nservice state: {service.state}\n')
print(f'scoring URI: \n{service.scoring_uri}\n')
print(f'swagger URI: \n{service.swagger_uri}\n')

print(service.scoring_uri)
print(service.swagger_uri)
```

```
service state: Healthy

scoring URI:
http://ed97d3f5-3563-4835-b96a-9f868437c176.southcentralus.azurecontainer.io/score
```

In [84]:
```
scoring_uri = service.scoring_uri

print(f'\nservice state: {service.state}\n')
print(f'scoring URI: \n{service.scoring_uri}\n')
print(f'swagger URI: \n{service.swagger_uri}\n')

print(service.scoring_uri)
print(service.swagger_uri)
```

```
service state: Healthy

scoring URI:
http://ed97d3f5-3563-4835-b96a-9f868437c176.southcentralus.azurecontainer.io/score

swagger URI:
http://ed97d3f5-3563-4835-b96a-9f868437c176.southcentralus.azurecontainer.io/swagger.json

http://ed97d3f5-3563-4835-b96a-9f868437c176.southcentralus.azurecontainer.io/score
http://ed97d3f5-3563-4835-b96a-9f868437c176.southcentralus.azurecontainer.io/swagger.json
```

In [85]:
```
import requests
import json

data={"data":
  [{'age': 87.0,
  'anaemia': 0,
  'creatinine_phosphokinase': 981,
  'diabetes': 0,
  'ejection_fraction': 55,
  'high_blood_pressure': 1,
  'platelets': 368000,
  'serum_creatinine': 3.5,
  'serum_sodium': 137,
  'sex': 0,
  'smoking': 0,
  'time': 4}]
  }

input_data=json.dumps(data)

with open("data.json","w") as file:
    file.write(input_data)

headers={"Content-Type":"application/json"}

result=requests.post(scoring_uri, input_data, headers=headers)
print("The output is: ",result.json())
```

```
The output is:  [1]
```

In [86]:
```
result.status_code
```

Out[86]:
```
200
```

TODO: In the cell below, print the logs of the web service and delete the service

In [88]:
```
#Logs of the webservice
```

TODO: In the cell below, print the logs of the web service and delete the service

In [88]:
```
#Logs of the webservice
logs=service.get_logs()
print(logs)
```

```
2021-03-21T23:33:08,042853800+00:00 - iot-server/run
2021-03-21T23:33:08,046530500+00:00 - gunicorn/run
2021-03-21T23:33:08,056009600+00:00 - rsyslog/run
2021-03-21T23:33:08,098713600+00:00 - nginx/run
/usr/sbin/nginx: /azureml-envs/azureml_fe9df1de9dcfc7f534c43ede471eccd6/lib/libcrypto.so.1.0.0: no version information available (require
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/usr/sbin/nginx: /azureml-envs/azureml_fe9df1de9dcfc7f534c43ede471eccd6/lib/libcrypto.so.1.0.0: no version information available (require
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/usr/sbin/nginx: /azureml-envs/azureml_fe9df1de9dcfc7f534c43ede471eccd6/lib/libssl.so.1.0.0: no version information available (required b
y /usr/sbin/nginx)
/usr/sbin/nginx: /azureml-envs/azureml_fe9df1de9dcfc7f534c43ede471eccd6/lib/libssl.so.1.0.0: no version information available (required b
y /usr/sbin/nginx)
/usr/sbin/nginx: /azureml-envs/azureml_fe9df1de9dcfc7f534c43ede471eccd6/lib/libssl.so.1.0.0: no version information available (required b
y /usr/sbin/nginx)
rsyslogd: /azureml-envs/azureml_fe9df1de9dcfc7f534c43ede471eccd6/lib/libuuid.so.1: no version information available (required by rsyslog
d)
EdgeHubConnectionString and IOTEDGE_IOTHUBHOSTNAME are not set. Exiting...
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2021-03-21 23:33:17,505 | root | INFO | Invoking user's init function
2021-03-21 23:33:23,594 | root | INFO | Users's init has completed successfully
2021-03-21 23:33:23,598 | root | INFO | Skipping middleware: dbg_model_info as it's not enabled.
2021-03-21 23:33:23,599 | root | INFO | Skipping middleware: dbg_resource_usage as it's not enabled.
2021-03-21 23:33:23,603 | root | INFO | Scoring timeout is found from os.environ: 60000 ms
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127.0.0.1 - - [21/Mar/2021:23:33:25 +0000] "GET /swagger.json HTTP/1.0" 404 19 "-" "Go-http-client/1.1"
2021-03-21 23:33:32,871 | root | INFO | Swagger file not present
2021-03-21 23:33:32,872 | root | INFO | 404
127.0.0.1 - - [21/Mar/2021:23:33:32 +0000] "GET /swagger.json HTTP/1.0" 404 19 "-" "Go-http-client/1.1"
2021-03-21 23:38:17,917 | root | INFO | Validation Request Content-Type
2021-03-21 23:38:17,917 | root | INFO | Scoring Timer is set to 60.0 seconds
2021-03-21 23:38:17,996 | root | INFO | 200
127.0.0.1 - - [21/Mar/2021:23:38:17 +0000] "POST /score HTTP/1.0" 200 3 "-" "python-requests/2.25.1"
```

In [ ]:
```
#delete the deployed webservice
service.delete()
```

Endpoints

Real-time endpoints | Pipeline endpoints

Delete | Edit columns | Refresh | Reset to default view

Add filter

Showing 1-6 endpoints

Page size: 25

Name	Description	Created on	Created by	Updated on ↓	Compute type	Compute target	Tags
automl-final	heart-failure-model-final-one	Mar 21, 2021 7:29 PM	Aaron Gauthier	Mar 21, 2021 7:29 PM	ACI		
heart-deploy-service-fi...		Mar 21, 2021 7:27 PM	Aaron Gauthier	Mar 21, 2021 7:27 PM	ACI		
heart-deploy-service-fi...		Mar 21, 2021 7:25 PM	Aaron Gauthier	Mar 21, 2021 7:25 PM	ACI		
automl	heart-failure-model-final-one	Mar 21, 2021 7:10 PM	Aaron Gauthier	Mar 21, 2021 7:10 PM	ACI		
heart-deploy-service-fi...		Mar 21, 2021 6:12 PM	Aaron Gauthier	Mar 21, 2021 6:12 PM	ACI		
heart-deploy-service		Mar 21, 2021 6:02 PM	Aaron Gauthier	Mar 21, 2021 6:02 PM	ACI		

automl-final

Details Test Consume Deployment logs

Attributes

Service ID
automl-final

Description
heart-failure-model-final-one

Deployment state
Healthy

Compute type
ACI

Created by
Aaron Gauthier

Model ID
automl:1

Created on
3/21/2021 7:29:39 PM

Last updated on
3/21/2021 7:29:39 PM

Image ID
--

REST endpoint
http://ed97d3f5-3563-4835-b96a-9f868437c176.southcentralus.azurecontainer.io/score

Key-based authentication enabled
false

Swagger URI
--

CPU
1

Memory
1 GB

Tags

No data

Properties

hasInferenceSchema
False

hasHttps
False

Apps Bookmarks Run Your First N1Q... Download Tableau... Run Your First N1Q... Download Tableau... Download Tableau... Analysis and Classifi... Download Tableau... Email Protovis Analysis and Classifi... Protovis Suitability of McLea... Other bookmarks

Microsoft Azure Machine Learning

Azure subscription 1
udacitycapstoneproject

Home > Notebooks

Notebooks

Files Samples

- outputs
  - automl_model.pkl
  - automlmodel.pkl
  - model.joblib
- training
- .amlignore
- amlscore.py
- automl.ipynb
- automl.log
- automl_errors.log
- automl_model.pkl
- azureml-automl.yml
- azureml_automl.log
- hyperparameter_tuning.ipy...
- model.pkl
- scoring.py
- train.csv
- train.py

PY scoring.py | PY train.py | *automl.ipynb | *hyperparameter_tu | 1:udacityproject | azureml-automl.yml

PY score.py | .amlignore

Editors | Compute: udacityproject - Running

udacityproject · Jupyter kernel idle

Automated ML

TODO: Import Dependencies. In the cell below, import all the dependencies that you will need to complete the project.

[1]

```
import os
import joblib
from azureml.core import Workspace, Experiment
from azureml.data.dataset_factory import TabularDatasetFactory
from azureml.core.compute import ComputeTarget, AmlCompute
from azureml.train.automl import AutoMLConfig
from azureml.core.compute_target import ComputeTargetException
from azureml.contrib.pipeline.steps import ParallelRunStep, ParallelRunConfig

from matplotlib import pyplot as plt
import numpy as np
import pandas as pd

ws = Workspace.from_config()
print(ws.name, ws.resource_group, ws.location, ws.subscription_id, sep = '\n')
```

✓ 6 sec

```
udacitycapstoneproject
udacitycapstoneproject
southcentralus
dbee21d3-7701-4598-ac5f-784c0f3d62e3
```

Dataset

Overview

TODO: In this markdown cell, give an overview of the dataset you are using. Also mention the task you will be performing.

TODO: Get data. In the cell below, write code to access the data you will be using in this project. Remember that the dataset needs to be external.

[2]

```
#create compute cluster
amlcompute_cluster_name="aml-compute"
```

Notifications

Enable pop-up notifications

Dismiss notifications (7)

- Endpoint "automl-final" deployment Completed
  Deploy details
  March 21, 2021 7:33 PM
- Automated ML run 1 in experiment "automl_run" Completed
  Run details
  March 21, 2021 5:28 PM
- AutoMLFeaturization run 3 in experiment "automl_run" Completed
  Run details
  March 21, 2021 5:03 PM
- Script run 2 in experiment "automl_run" Completed
  Run details
  March 21, 2021 5:02 PM
- Hyperdrive run 2 in experiment "hyperdrive_run" Completed
  Run details
  March 21, 2021 4:37 PM
- Script run 2 in experiment "dataset_profile" Completed
  Run details
  March 21, 2021 3:48 PM
- Script run 1 in experiment "dataset_profile" Completed
  Run details
  March 21, 2021 3:48 PM