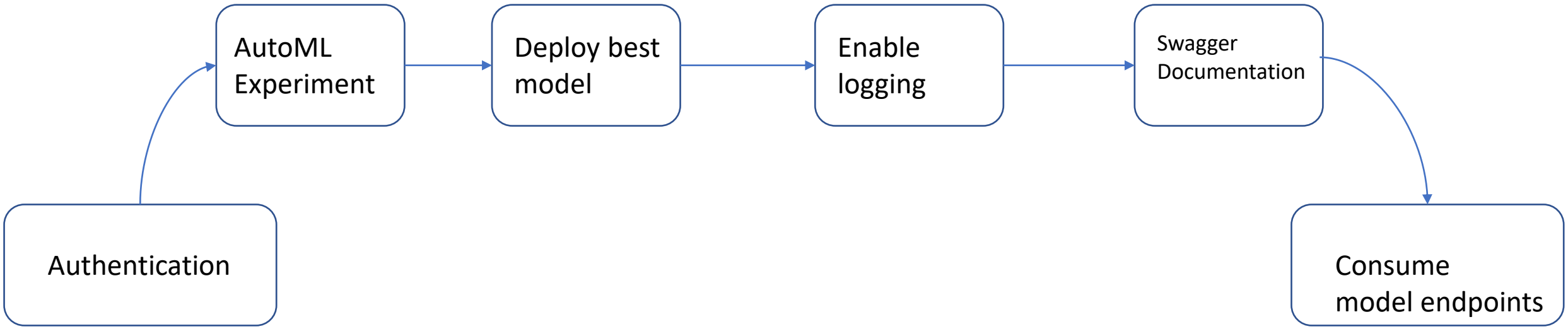
Architecture Diagram



Notebooks

Files Samples

Microsoft-Azure-Machine-Le...
.amlignore
aml-pipelines-with-automa...
automl_errors.log
bankmarketing_train.csv
benchmark.sh
config.json
endpoint.py
logs.py
swagger.json
swagger
serve.py
swagger.sh

aml-pipelines-with-a | 1:udacityproject2 | 2:udacityproject2 | 3:udacityproject2 | 4:udacityproject2

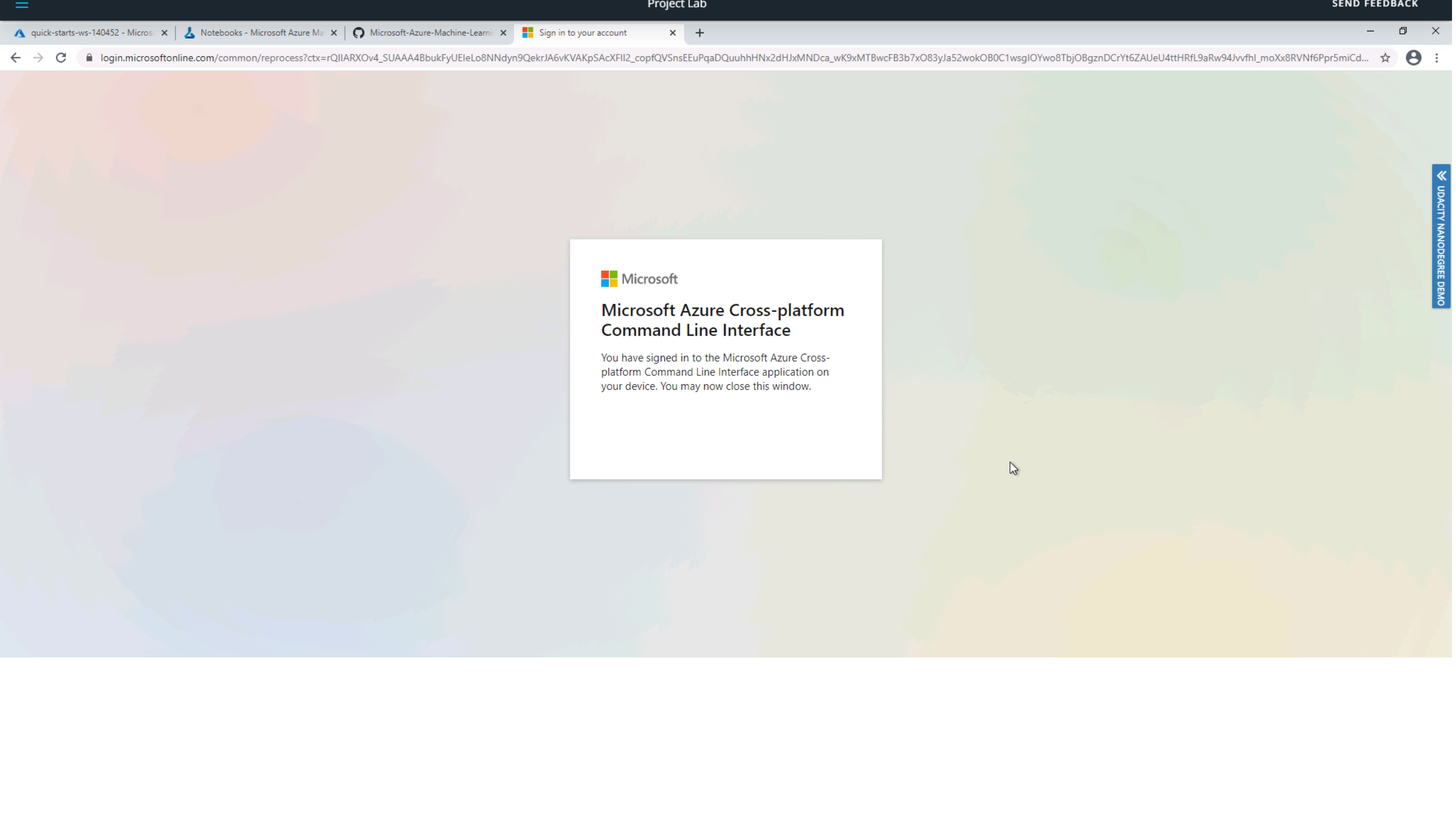
Help | View active sessions (4) | Focus mode | Compute: udacityproject2 - Running

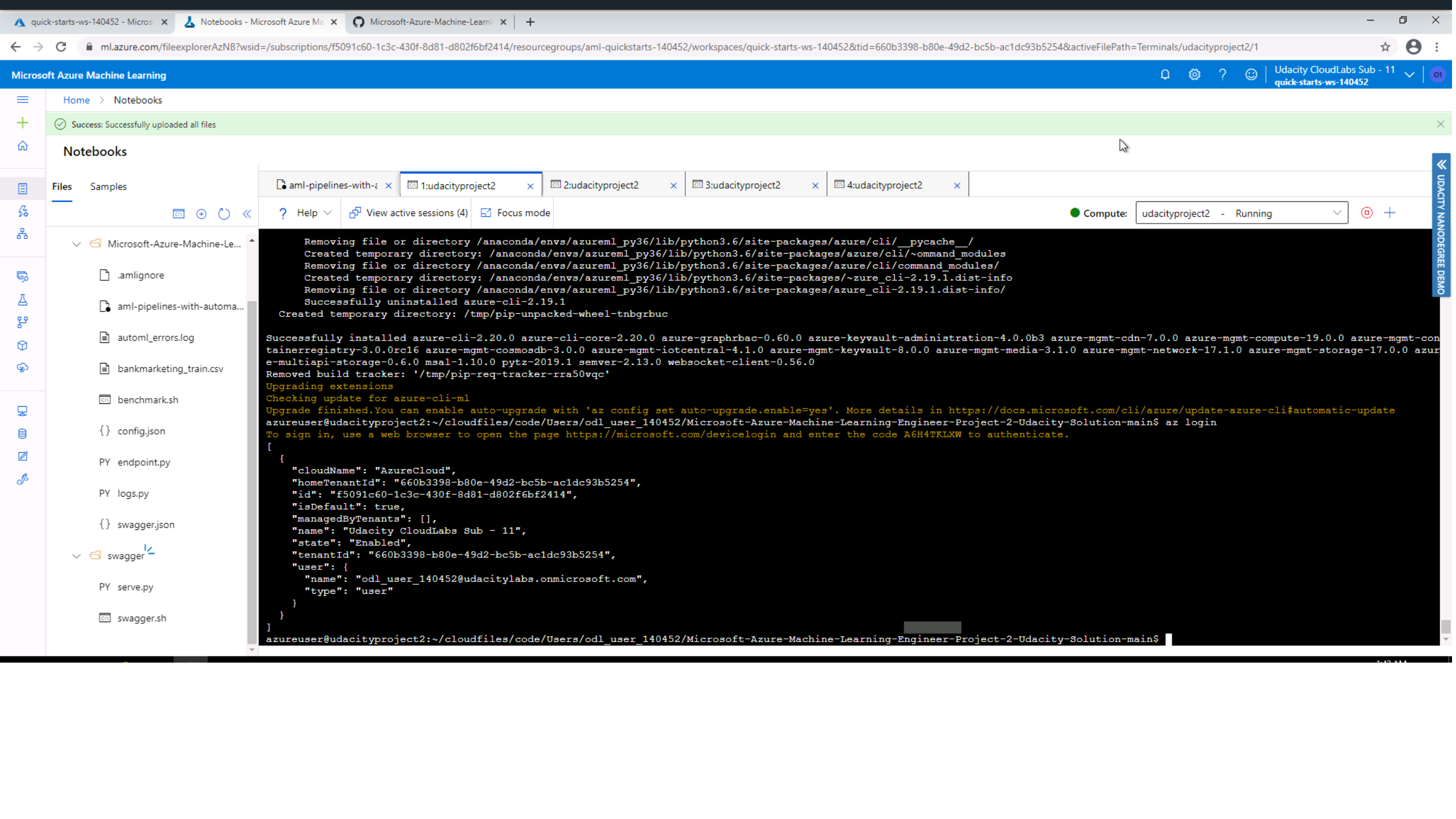
```
    Removing file or directory /anaconda/envs/azureml_py36/lib/python3.6/site-packages/azure/mgmt/compute/
    Created temporary directory: /anaconda/envs/azureml_py36/lib/python3.6/site-packages/~zure_mgmt_compute-18.2.0.dist-info
    Removing file or directory /anaconda/envs/azureml_py36/lib/python3.6/site-packages/azure_mgmt_compute-18.2.0.dist-info/
    Successfully uninstalled azure-mgmt-compute-18.2.0
  Created temporary directory: /tmp/pip-unpacked-wheel-4ebjxx38

  Attempting uninstall: azure-cli
    Found existing installation: azure-cli 2.19.1
    Uninstalling azure-cli-2.19.1:
      Created temporary directory: /tmp/pip-uninstall-f0gq2jpp
      Removing file or directory /anaconda/envs/azureml_py36/bin/az
      Removing file or directory /anaconda/envs/azureml_py36/bin/az.bat
      Removing file or directory /anaconda/envs/azureml_py36/bin/az.completion.sh
      Created temporary directory: /tmp/pip-uninstall-8clxzky0
      Removing file or directory /anaconda/envs/azureml_py36/lib/python3.6/site-packages/azure/cli/__main__.py
      Created temporary directory: /anaconda/envs/azureml_py36/lib/python3.6/site-packages/azure/cli/~_pycache__
      Removing file or directory /anaconda/envs/azureml_py36/lib/python3.6/site-packages/azure/cli/__pycache__/
      Created temporary directory: /anaconda/envs/azureml_py36/lib/python3.6/site-packages/azure/cli/~ommand_modules
      Removing file or directory /anaconda/envs/azureml_py36/lib/python3.6/site-packages/azure/cli/command_modules/
      Created temporary directory: /anaconda/envs/azureml_py36/lib/python3.6/site-packages/~zure_cli-2.19.1.dist-info
      Removing file or directory /anaconda/envs/azureml_py36/lib/python3.6/site-packages/azure_cli-2.19.1.dist-info/
      Successfully uninstalled azure-cli-2.19.1
  Created temporary directory: /tmp/pip-unpacked-wheel-tnbgrbuc

Successfully installed azure-cli-2.20.0 azure-cli-core-2.20.0 azure-graphrbac-0.60.0 azure-keyvault-administration-4.0.0b3 azure-mgmt-cdn-7.0.0 azure-mgmt-compute-19.0.0 azure-mgmt-con
tainerregistry-3.0.0rc16 azure-mgmt-cosmosdb-3.0.0 azure-mgmt-iotcentral-4.1.0 azure-mgmt-keyvault-8.0.0 azure-mgmt-media-3.1.0 azure-mgmt-network-17.1.0 azure-mgmt-storage-17.0.0 azur
e-multiapi-storage-0.6.0 msal-1.10.0 pytz-2019.1 semver-2.13.0 websocket-client-0.56.0
Removed build tracker: '/tmp/pip-req-tracker-rra50vqc'
Upgrading extensions
Checking update for azure-cli-ml
Upgrade finished.You can enable auto-upgrade with 'az config set auto-upgrade.enable=yes'. More details in https://docs.microsoft.com/cli/azure/update-azure-cli#automatic-update
azureuser@udacityproject2:~/cloudfiles/code/Users/odl_user_140452/Microsoft-Azure-Machine-Learning-Engineer-Project-2-Udacity-Solution-main$ az login
To sign in, use a web browser to open the page https://microsoft.com/devicelogin and enter the code A6H4TKLXW to authenticate.
```

UDACITY NANODEGREE DEMO


Project Lab
SEND FEEDBACK
quick-starts-ws-140452 - Micros
Notebooks - Microsoft Azure Ma
Microsoft-Azure-Machine-Learni
Sign in to your account
login.microsoftonline.com/common/reprocess?ctx=rQIIARXOv4_SUAAA4BbukFyUEIeLo8NNdyn9QekrJA6vKVAKpSAcXFII2_copfQVSnsEEuPqaDQuuhhHNx2dHJxMNDca_wK9xMTBwcFB3b7xO83yJa52wokOB0C1wsgIOYwo8TbjOBgznDCrYt6ZAUeU4ttHRfL9aRw94JvvfhI_moXx8RVNf6Ppr5miCd...
UDACITY NANODEGREE DEMO
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.


quick-starts-ws-140452 - Micros
Notebooks - Microsoft Azure Ma
Microsoft-Azure-Machine-Learni
ml.azure.com/fileexplorerAzNB?wsid=/subscriptions/f5091c60-1c3c-430f-8d81-d802f6bf2414/resourcegroups/aml-quickstarts-140452/workspaces/quick-starts-ws-140452&tid=660b3398-b80e-49d2-bc5b-ac1dc93b5254&activeFilePath=Terminals/udacityproject2/1
Microsoft Azure Machine Learning
Udacity CloudLabs Sub - 11
quick-starts-ws-140452
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Notebooks
Success: Successfully uploaded all files
Notebooks
Files
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config.json
endpoint.py
logs.py
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swagger
serve.py
swagger.sh
aml-pipelines-with-a
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3:udacityproject2
4:udacityproject2
Help
View active sessions (4)
Focus mode
Compute:
udacityproject2 - Running
UDACITY NANODEGREE DEMO
Removing file or directory /anaconda/envs/azureml_py36/lib/python3.6/site-packages/azure/cli/__pycache__/
Created temporary directory: /anaconda/envs/azureml_py36/lib/python3.6/site-packages/azure/cli/~ommand_modules
Removing file or directory /anaconda/envs/azureml_py36/lib/python3.6/site-packages/azure/cli/command_modules/
Created temporary directory: /anaconda/envs/azureml_py36/lib/python3.6/site-packages/~zure_cli-2.19.1.dist-info
Removing file or directory /anaconda/envs/azureml_py36/lib/python3.6/site-packages/azure_cli-2.19.1.dist-info/
Successfully uninstalled azure-cli-2.19.1
Created temporary directory: /tmp/pip-unpacked-wheel-tnbgrbuc
Successfully installed azure-cli-2.20.0 azure-cli-core-2.20.0 azure-graphrbac-0.60.0 azure-keyvault-administration-4.0.0b3 azure-mgmt-cdn-7.0.0 azure-mgmt-compute-19.0.0 azure-mgmt-containerregistry-3.0.0rc16 azure-mgmt-cosmosdb-3.0.0 azure-mgmt-iotcentral-4.1.0 azure-mgmt-keyvault-8.0.0 azure-mgmt-media-3.1.0 azure-mgmt-network-17.1.0 azure-mgmt-storage-17.0.0 azure-multiapi-storage-0.6.0 msal-1.10.0 pytz-2019.1 semver-2.13.0 websocket-client-0.56.0
Removed build tracker: '/tmp/pip-req-tracker-rra50vqc'
Upgrading extensions
Checking update for azure-cli-ml
Upgrade finished.You can enable auto-upgrade with 'az config set auto-upgrade.enable=yes'. More details in https://docs.microsoft.com/cli/azure/update-azure-cli#automatic-update
azureuser@udacityproject2:~/cloudfiles/code/Users/odl_user_140452/Microsoft-Azure-Machine-Learning-Engineer-Project-2-Udacity-Solution-main$ az login
To sign in, use a web browser to open the page https://microsoft.com/devicelogin and enter the code A6H4TKLXW to authenticate.
[
{
"cloudName": "AzureCloud",
"homeTenantId": "660b3398-b80e-49d2-bc5b-ac1dc93b5254",
"id": "f5091c60-1c3c-430f-8d81-d802f6bf2414",
"isDefault": true,
"managedByTenants": [],
"name": "Udacity CloudLabs Sub - 11",
"state": "Enabled",
"tenantId": "660b3398-b80e-49d2-bc5b-ac1dc93b5254",
"user": {
"name": "odl_user_140452@udacitylabs.onmicrosoft.com",
"type": "user"
}
}
]
azureuser@udacityproject2:~/cloudfiles/code/Users/odl_user_140452/Microsoft-Azure-Machine-Learning-Engineer-Project-2-Udacity-Solution-main$

quick-starts-ws-140452 - Micros | Notebooks - Microsoft Azure Ma | Microsoft-Azure-Machine-Learni

ml.azure.com/fileexplorerAzNB?wsid=/subscriptions/f5091c60-1c3c-430f-8d81-d802f6bf2414/resourcegroups/aml-quickstarts-140452/workspaces/quick-starts-ws-140452&tid=660b3398-b80e-49d2-bc5b-ac1dc93b5254&activeFilePath=Terminals/udacityproject2/1

Microsoft Azure Machine Learning

Udacity CloudLabs Sub - 11
quick-starts-ws-140452

Home > Notebooks

Success: Successfully uploaded all files

Notebooks

Files Samples

- Microsoft-Azure-Machine-Le...
  - .amlignore
  - aml-pipelines-with-automa...
  - automl_errors.log
  - bankmarketing_train.csv
  - benchmark.sh
  - config.json
  - endpoint.py
  - logs.py
  - swagger.json
- swagger
  - serve.py
  - swagger.sh

aml-pipelines-with-a | 1:udacityproject2 | 2:udacityproject2 | 3:udacityproject2 | 4:udacityproject2

Help | View active sessions (4) | Focus mode | Compute: udacityproject2 - Running

```
Successfully installed azure-cli-2.20.0 azure-cli-core-2.20.0 azure-graphrbac-0.60.0 azure-keyvault-administration-4.0.0b3 azure-mgmt-cdn-7.0.0 azure-mgmt-compute-19.0.0 azure-mgmt-cc
tainerregistry-3.0.0rc16 azure-mgmt-cosmosdb-3.0.0 azure-mgmt-iotcentral-4.1.0 azure-mgmt-keyvault-8.0.0 azure-mgmt-media-3.1.0 azure-mgmt-network-17.1.0 azure-mgmt-storage-17.0.0 azu
e-multiapi-storage-0.6.0 msal-1.10.0 pytz-2019.1 semver-2.13.0 websocket-client-0.56.0
Removed build tracker: '/tmp/pip-req-tracker-rra50vqc'
Upgrading extensions
Checking update for azure-cli-ml
Upgrade finished.You can enable auto-upgrade with 'az config set auto-upgrade.enable=yes'. More details in https://docs.microsoft.com/cli/azure/update-azure-cli#automatic-update
azureuser@udacityproject2:~/cloudfiles/code/Users/odl_user_140452/Microsoft-Azure-Machine-Learning-Engineer-Project-2-Udacity-Solution-main$ az login
To sign in, use a web browser to open the page https://microsoft.com/devicelogin and enter the code A6H4TKLXW to authenticate.
[
  {
    "cloudName": "AzureCloud",
    "homeTenantId": "660b3398-b80e-49d2-bc5b-ac1dc93b5254",
    "id": "f5091c60-1c3c-430f-8d81-d802f6bf2414",
    "isDefault": true,
    "managedByTenants": [],
    "name": "Udacity CloudLabs Sub - 11",
    "state": "Enabled",
    "tenantId": "660b3398-b80e-49d2-bc5b-ac1dc93b5254",
    "user": {
      "name": "odl_user_140452@udacitylabs.onmicrosoft.com",
      "type": "user"
    }
  }
]
azureuser@udacityproject2:~/cloudfiles/code/Users/odl_user_140452/Microsoft-Azure-Machine-Learning-Engineer-Project-2-Udacity-Solution-main$ az extension add -n azure-cli-ml
Extension 'azure-cli-ml' is already installed.
azureuser@udacityproject2:~/cloudfiles/code/Users/odl_user_140452/Microsoft-Azure-Machine-Learning-Engineer-Project-2-Udacity-Solution-main$ az ad sp create-for-rbac --sdk-auth --name
ml-auth
Changing "ml-auth" to a valid URI of "http://ml-auth", which is the required format used for service principal names
Found an existing application instance of "ec5653cf-7a63-4c1b-bef0-3ebc300115d5". We will patch it
Insufficient privileges to complete the operation.
azureuser@udacityproject2:~/cloudfiles/code/Users/odl_user_140452/Microsoft-Azure-Machine-Learning-Engineer-Project-2-Udacity-Solution-main$
```

UDACITY NANODEGREE DEMO

quick-starts-ws-140452 - Micros | Notebooks - Microsoft Azure Ma | Microsoft-Azure-Machine-Learni

ml.azure.com/fileexplorerAzNB?wsid=/subscriptions/f5091c60-1c3c-430f-8d81-d802f6bf2414/resourcegroups/aml-quickstarts-140452/workspaces/quick-starts-ws-140452&tid=660b3398-b80e-49d2-bc5b-ac1dc93b5254&activeFilePath=Terminals/udacityproject2/1

Microsoft Azure Machine Learning

Udacity CloudLabs Sub - 11
quick-starts-ws-140452

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Notebooks

Files Samples

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  - automl_errors.log
  - bankmarketing_train.csv
  - benchmark.sh
  - config.json
  - endpoint.py
  - logs.py
  - swagger.json
- swagger
  - serve.py
  - swagger.sh

aml-pipelines-with-a | 1:udacityproject2 | 2:udacityproject2 | 3:udacityproject2 | 4:udacityproject2

Help | View active sessions (4) | Focus mode | Compute: udacityproject2 - Running

```
ml-auth
Changing "ml-auth" to a valid URI of "http://ml-auth", which is the required format used for service principal names
Found an existing application instance of "ec5653cf-7a63-4c1b-bef0-3ebc300115d5". We will patch it
Insufficient privileges to complete the operation.
azureuser@udacityproject2:~/cloudfiles/code/Users/odl_user_140452/Microsoft-Azure-Machine-Learning-Engineer-Project-2-Udacity-Solution-main$ az ad sp show --id ec5653cf-7a63-4c1b-bef0-
3ebc300115d5
{
  "accountEnabled": "True",
  "addIns": [],
  "alternativeNames": [],
  "appDisplayName": "ml-auth",
  "appId": "ec5653cf-7a63-4c1b-bef0-3ebc300115d5",
  "appOwnerTenantId": "660b3398-b80e-49d2-bc5b-ac1dc93b5254",
  "appRoleAssignmentRequired": false,
  "appRoles": [],
  "applicationTemplateId": null,
  "deletionTimestamp": null,
  "displayName": "ml-auth",
  "errorUrl": null,
  "homepage": "https://ml-auth",
  "informationalUrls": {
    "marketing": null,
    "privacy": null,
    "support": null,
    "termsOfService": null
  },
  "keyCredentials": [],
  "logoutUrl": null,
  "notificationEmailAddresses": [],
  "oauth2Permissions": [
    {
      "adminConsentDescription": "Allow the application to access ml-auth on behalf of the signed-in user.",
      "adminConsentDisplayName": "Access ml-auth",
      "id": "b9219d3e-0908-4e44-8b98-3a7b5237e95a",
```

UDACITY NANODEGREE DEMO

quick-starts-ws-140452 - Micros | Notebooks - Microsoft Azure Ma | Microsoft-Azure-Machine-Learni

ml.azure.com/fileexplorerAzNB?wsid=/subscriptions/f5091c60-1c3c-430f-8d81-d802f6bf2414/resourcegroups/aml-quickstarts-140452/workspaces/quick-starts-ws-140452&tid=660b3398-b80e-49d2-bc5b-ac1dc93b5254&activeFilePath=Terminals/udacityproject2/1

Microsoft Azure Machine Learning

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Notebooks

Files Samples

- Microsoft-Azure-Machine-Le...
  - .amlignore
  - aml-pipelines-with-automa...
  - automl_errors.log
  - bankmarketing_train.csv
  - benchmark.sh
  - config.json
  - endpoint.py
  - logs.py
  - swagger.json
- swagger
  - serve.py
  - swagger.sh

aml-pipelines-with-a | 1:udacityproject2 | 2:udacityproject2 | 3:udacityproject2 | 4:udacityproject2

Help | View active sessions (4) | Focus mode | Compute: udacityproject2 - Running

```
  "oauth2Permissions": [
    {
      "adminConsentDescription": "Allow the application to access ml-auth on behalf of the signed-in user.",
      "adminConsentDisplayName": "Access ml-auth",
      "id": "b9219d3e-0908-4e44-8b98-3a7b5237e95a",
      "isEnabled": true,
      "type": "User",
      "userConsentDescription": "Allow the application to access ml-auth on your behalf.",
      "userConsentDisplayName": "Access ml-auth",
      "value": "user_impersonation"
    }
  ],
  "objectId": "0a631dc5-0d4d-4d92-ade2-2e0c0b2e6d5c",
  "objectType": "ServicePrincipal",
  "odata.metadata": "https://graph.windows.net/660b3398-b80e-49d2-bc5b-ac1dc93b5254/$metadata#directoryObjects/@Element",
  "odata.type": "Microsoft.DirectoryServices.ServicePrincipal",
  "passwordCredentials": [],
  "preferredSingleSignOnMode": null,
  "preferredTokenSigningKeyEndDateTime": null,
  "preferredTokenSigningKeyThumbprint": null,
  "publisherName": "Udacity",
  "replyUrls": [],
  "samlMetadataUrl": null,
  "samlSingleSignOnSettings": null,
  "servicePrincipalNames": [
    "http://ml-auth",
    "ec5653cf-7a63-4c1b-bef0-3ebc300115d5"
  ],
  "servicePrincipalType": "Application",
  "signInAudience": "AzureADMyOrg",
  "tags": [],
  "tokenEncryptionKeyId": null
}
azureuser@udacityproject2:~/cloudfiles/code/Users/odl_user_140452/Microsoft-Azure-Machine-Learning-Engineer-Project-2-Udacity-Solution-main$
```

UDACITY NANODEGREE DEMO

bankmarketing-final-deployment

Details | Test | Consume | Deployment logs

Attributes

Service ID
bankmarketing-final-deployment

Description
--

Deployment state
Healthy

Compute type
ACI

Created by
ODL_User 140452

Model ID
3e4e91a7df7143037:1

Created on
3/15/2021 2:57:28 AM

Last updated on
3/15/2021 2:57:28 AM

Image ID
--

REST endpoint
http://f5ec9ed6-6c56-4f3d-9eee-def620628244.southcentralus.azurecontainer.io/score

Key-based authentication enabled
true

Tags

No data

Properties

runId
3e4e91a7-df71-4301-99b7-2d38c2fac599_37

hasInferenceSchema
True

hasHttps
False

bankmarketing-final-deployment

Details | Test | Consume | Deployment logs

Model ID
3e4e91a7df7143037:1

Created on
3/15/2021 2:57:28 AM

Last updated on
3/15/2021 2:57:28 AM

Image ID
--

REST endpoint
http://f5ec9ed6-6c56-4f3d-9eee-def620628244.southcentralus.azurecontainer.io/score

Key-based authentication enabled
true

Swagger URI
http://f5ec9ed6-6c56-4f3d-9eee-def620628244.southcentralus.azurecontainer.io/swagger.json

CPU
1.8

Memory
4 GB

Application Insights enabled
true

Application Insights url
https://portal.azure.com#resource/subscriptions/f5091c60-1c3c-430f-8d81-d802f6bf2414/resourcegroups/aml-quickstarts-140452/providers/microsoft.insights/components/mlappinsight140452

Project Lab SEND FEEDBACK

quick-starts-ws-140452 - Micros | Notebooks - Microsoft Azure Ma | QuirkyDataScientist1978/Micros | localhost

ml.azure.com/fileexplorerAzNB?wsid=/subscriptions/f5091c60-1c3c-430f-8d81-d802f6bf2414/resourcegroups/aml-quickstarts-140452/workspaces/quick-starts-ws-140452&tid=660b3398-b80e-49d2-bc5b-ac1dc93b5254&activeFilePath=Terminals/udacityproject2/6

Microsoft Azure Machine Learning

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Notebooks

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      - pipeline-project
      - .amlignore
      - aml-pipelines-with-automa...
      - automl_errors.log
      - bankmarketing_train.csv
      - benchmark.sh
      - config.json
      - endpoint.py
      - logs.py
      - swagger.json

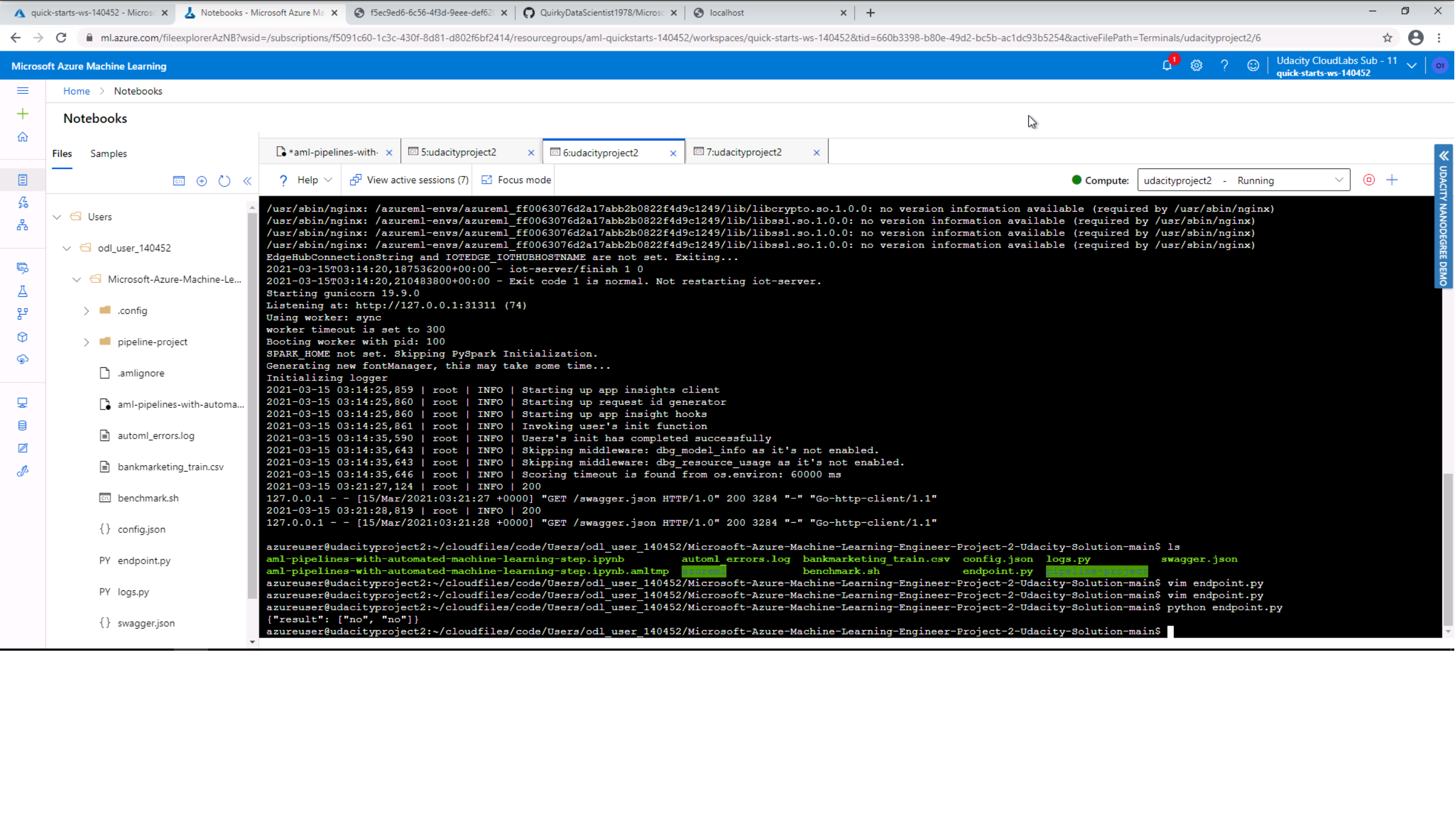
*aml-pipelines-with- | 5:udacityproject2 | 6:udacityproject2 | 7:udacityproject2

Help | View active sessions (7) | Focus mode | Compute: udacityproject2 - Running

```
Please refer to aka.ms/aml-notebook-auth for different authentication mechanisms in azureml-sdk.
2021-03-15T03:14:18,098215000+00:00 - iot-server/run
2021-03-15T03:14:18,107147200+00:00 - nginx/run
2021-03-15T03:14:18,109154600+00:00 - rsyslog/run
2021-03-15T03:14:18,152030300+00:00 - gunicorn/run
rsyslogd: /azureml-envs/azureml_ff0063076d2a17abb2b0822f4d9c1249/lib/libuuid.so.1: no version information available (required by rsyslogd)
/usr/sbin/nginx: /azureml-envs/azureml_ff0063076d2a17abb2b0822f4d9c1249/lib/libcrypto.so.1.0.0: no version information available (required by /usr/sbin/nginx)
/usr/sbin/nginx: /azureml-envs/azureml_ff0063076d2a17abb2b0822f4d9c1249/lib/libcrypto.so.1.0.0: no version information available (required by /usr/sbin/nginx)
/usr/sbin/nginx: /azureml-envs/azureml_ff0063076d2a17abb2b0822f4d9c1249/lib/libssl.so.1.0.0: no version information available (required by /usr/sbin/nginx)
/usr/sbin/nginx: /azureml-envs/azureml_ff0063076d2a17abb2b0822f4d9c1249/lib/libssl.so.1.0.0: no version information available (required by /usr/sbin/nginx)
/usr/sbin/nginx: /azureml-envs/azureml_ff0063076d2a17abb2b0822f4d9c1249/lib/libssl.so.1.0.0: no version information available (required by /usr/sbin/nginx)
EdgeHubConnectionString and IOTEDGE_IOTHUBHOSTNAME are not set. Exiting...
2021-03-15T03:14:20,187536200+00:00 - iot-server/finish 1 0
2021-03-15T03:14:20,210483800+00:00 - Exit code 1 is normal. Not restarting iot-server.
Starting gunicorn 19.9.0
Listening at: http://127.0.0.1:31311 (74)
Using worker: sync
worker timeout is set to 300
Booting worker with pid: 100
SPARK_HOME not set. Skipping PySpark Initialization.
Generating new fontManager, this may take some time...
Initializing logger
2021-03-15 03:14:25,859 | root | INFO | Starting up app insights client
2021-03-15 03:14:25,860 | root | INFO | Starting up request id generator
2021-03-15 03:14:25,860 | root | INFO | Starting up app insight hooks
2021-03-15 03:14:25,861 | root | INFO | Invoking user's init function
2021-03-15 03:14:35,590 | root | INFO | Users's init has completed successfully
2021-03-15 03:14:35,643 | root | INFO | Skipping middleware: dbg_model_info as it's not enabled.
2021-03-15 03:14:35,643 | root | INFO | Skipping middleware: dbg_resource_usage as it's not enabled.
2021-03-15 03:14:35,646 | root | INFO | Scoring timeout is found from os.environ: 60000 ms
2021-03-15 03:21:27,124 | root | INFO | 200
127.0.0.1 - - [15/Mar/2021:03:21:27 +0000] "GET /swagger.json HTTP/1.0" 200 3284 "-" "Go-http-client/1.1"
2021-03-15 03:21:28,819 | root | INFO | 200
127.0.0.1 - - [15/Mar/2021:03:21:28 +0000] "GET /swagger.json HTTP/1.0" 200 3284 "-" "Go-http-client/1.1"

azureuser@udacityproject2:~/cloudfiles/code/Users/odl_user_140452/Microsoft-Azure-Machine-Learning-Engineer-Project-2-Udacity-Solution-main$
```

UDACITY NANODEGREE DEMO


quick-starts-ws-140452 - Micros
Notebooks - Microsoft Azure Ma
f5ec9ed6-6c56-4f3d-9eee-def62
QuirkyDataScientist1978/Micros
localhost
ml.azure.com/fileexplorerAzNB?wsid=/subscriptions/f5091c60-1c3c-430f-8d81-d802f6bf2414/resourcegroups/aml-quickstarts-140452/workspaces/quick-starts-ws-140452&tid=660b3398-b80e-49d2-bc5b-ac1dc93b5254&activeFilePath=Terminals/udacityproject2/6
Microsoft Azure Machine Learning
Udacity CloudLabs Sub - 11
quick-starts-ws-140452
Home
Notebooks
Notebooks
Files
Samples
*aml-pipelines-with-
5:udacityproject2
6:udacityproject2
7:udacityproject2
Help
View active sessions (7)
Focus mode
Compute:
udacityproject2 - Running
Users
odl_user_140452
Microsoft-Azure-Machine-Le...
.config
pipeline-project
.amlignore
aml-pipelines-with-automa...
automl_errors.log
bankmarketing_train.csv
benchmark.sh
config.json
endpoint.py
logs.py
swagger.json
/usr/sbin/nginx: /azureml-envs/azureml_ff0063076d2a17abb2b0822f4d9c1249/lib/libcrypto.so.1.0.0: no version information available (required by /usr/sbin/nginx)
/usr/sbin/nginx: /azureml-envs/azureml_ff0063076d2a17abb2b0822f4d9c1249/lib/libssl.so.1.0.0: no version information available (required by /usr/sbin/nginx)
/usr/sbin/nginx: /azureml-envs/azureml_ff0063076d2a17abb2b0822f4d9c1249/lib/libssl.so.1.0.0: no version information available (required by /usr/sbin/nginx)
/usr/sbin/nginx: /azureml-envs/azureml_ff0063076d2a17abb2b0822f4d9c1249/lib/libssl.so.1.0.0: no version information available (required by /usr/sbin/nginx)
EdgeHubConnectionString and IOTEDGE_IOTHUBHOSTNAME are not set. Exiting...
2021-03-15T03:14:20,187536200+00:00 - iot-server/finish 1 0
2021-03-15T03:14:20,210483800+00:00 - Exit code 1 is normal. Not restarting iot-server.
Starting gunicorn 19.9.0
Listening at: http://127.0.0.1:31311 (74)
Using worker: sync
worker timeout is set to 300
Booting worker with pid: 100
SPARK_HOME not set. Skipping PySpark Initialization.
Generating new fontManager, this may take some time...
Initializing logger
2021-03-15 03:14:25,859 | root | INFO | Starting up app insights client
2021-03-15 03:14:25,860 | root | INFO | Starting up request id generator
2021-03-15 03:14:25,860 | root | INFO | Starting up app insight hooks
2021-03-15 03:14:25,861 | root | INFO | Invoking user's init function
2021-03-15 03:14:35,590 | root | INFO | Users's init has completed successfully
2021-03-15 03:14:35,643 | root | INFO | Skipping middleware: dbg_model_info as it's not enabled.
2021-03-15 03:14:35,643 | root | INFO | Skipping middleware: dbg_resource_usage as it's not enabled.
2021-03-15 03:14:35,646 | root | INFO | Scoring timeout is found from os.environ: 60000 ms
2021-03-15 03:21:27,124 | root | INFO | 200
127.0.0.1 - - [15/Mar/2021:03:21:27 +0000] "GET /swagger.json HTTP/1.0" 200 3284 "-" "Go-http-client/1.1"
2021-03-15 03:21:28,819 | root | INFO | 200
127.0.0.1 - - [15/Mar/2021:03:21:28 +0000] "GET /swagger.json HTTP/1.0" 200 3284 "-" "Go-http-client/1.1"
azureuser@udacityproject2:~/cloudfiles/code/Users/odl_user_140452/Microsoft-Azure-Machine-Learning-Engineer-Project-2-Udacity-Solution-main$ ls
aml-pipelines-with-automated-machine-learning-step.ipynb
aml-pipelines-with-automated-machine-learning-step.ipynb.amltmp
automl_errors.log
azureml
bankmarketing_train.csv
benchmark.sh
config.json
endpoint.py
logs.py
pipeline-project
swagger.json
azureuser@udacityproject2:~/cloudfiles/code/Users/odl_user_140452/Microsoft-Azure-Machine-Learning-Engineer-Project-2-Udacity-Solution-main$ vim endpoint.py
azureuser@udacityproject2:~/cloudfiles/code/Users/odl_user_140452/Microsoft-Azure-Machine-Learning-Engineer-Project-2-Udacity-Solution-main$ vim endpoint.py
azureuser@udacityproject2:~/cloudfiles/code/Users/odl_user_140452/Microsoft-Azure-Machine-Learning-Engineer-Project-2-Udacity-Solution-main$ python endpoint.py
{"result": ["no", "no"]}
azureuser@udacityproject2:~/cloudfiles/code/Users/odl_user_140452/Microsoft-Azure-Machine-Learning-Engineer-Project-2-Udacity-Solution-main$
UDACITY NANODEGREE DEMO

Microsoft Azure Machine Learning

Home > Endpoints > bankmarketing-final-deployment

bankmarketing-final-deployment

Details Test Consume Deployment logs

Basic consumption info

REST endpoint

Endpoint URL is not available yet.

Authentication types

(•) Using key ( ) Using token

Primary key

vgTuAa1ryHspz9OPjRCdEjjFLSrvK40S Regenerate

Secondary key

BDe0yO9Gq2ok52EodpD7dmvdxMMRss9W Regenerate

quick-starts-ws-140435 - Micros | datastore - Microsoft Azure Mac | QuirkyDataScientist1978/Micros

ml.azure.com/data/datastore/datastore/edit?wsid=/subscriptions/61c5c3f0-6dc7-4ed9-a7f3-c704b20e3b30/resourcegroups/aml-quickstarts-14

Microsoft Azure Machine Learning

Home > Datastores > datastore

Refresh | Update authentication | Unregister

General

Datastore name
datastore

Datastore type
Azure Blob Storage

Created by
Service Principal

Subscription ID
61c5c3f0-6dc7-4ed9-a7f3-c704b20e3b30

Resource group name
aml-quickstarts-140435

Protocol
https

Endpoint
core.windows.net

Account name
mlstrg140435

Blob container
container140435

Data URL
https://mlstrg140435.blob.core.windows.net/container140435

Authentication

Allowed workspace managed identity access
No

quick-starts-ws-140435 - Micros | Datasets - Microsoft Azure Mach | QuirkyDataScientist1978/Micros

ml.azure.com/data?wsid=/subscriptions/61c5c3f0-6dc7-4ed9-a7f3-c704b20e3b30/resourcegroups/aml-quickstarts-140435/workspaces/quick-starts-ws-140435&tid=660b3398-b80e-49d2-bc5b-ac1dc93b5254

Microsoft Azure Machine Learning

Udacity CloudLabs Sub - 13
quick-starts-ws-140435

Home > Datasets

Datasets

Registered datasets | Dataset monitors (preview)

+ Create dataset | Refresh | Unregister

Search to filter items...

Name	Version	Data source	Created on	Modified on	Properties	Created by	Tags
Bank-marketing	1	URI	Mar 14, 2021 8:06 PM	Mar 14, 2021 8:06 PM	Tabular	ODL_User 140435	

UDACITY NANODEGREE DEMO

quick-starts-ws-140435 - Micros | Bank-marketing - Microsoft Azur | QuirkyDataScientist1978/Micros

ml.azure.com/dataset/Bank-marketing/latest/details?wsid=/subscriptions/61c5c3f0-6dc7-4ed9-a7f3-c704b20e3b30/resourcegroups/aml-quickstarts-140435/workspaces/quick-starts-ws-140435&tid=660b3398-b80e-49d2-bc5b-ac1dc93b5254

Microsoft Azure Machine Learning

Udacity CloudLabs Sub - 13
quick-starts-ws-140435

Home > Datasets > Bank-marketing

Details | Consume | Explore | Models

Refresh | Generate profile | Unregister | New version

Attributes

Properties
Tabular

Description

Created by
ODL_User 140435

Web Url
https://udacitystorage.blob.core.windows.net/udacity/bankmarketing_train.csv

Profile
No profile generated

Files in dataset
1

Total size of files in dataset
3.958 MiB

Current version
1

Latest version
1

Created time
Mar 14, 2021 8:06 PM

Modified time
Mar 14, 2021 8:06 PM

Tags

No data

UDACITY NANODEGREE DEMO

quick-starts-ws-140435 - Micros | Notebooks - Microsoft Azure Ma | QuirkyDataScientist1978/Micros

ml.azure.com/fileexplorerAzNB?wsid=/subscriptions/61c5c3f0-6dc7-4ed9-a7f3-c704b20e3b30/resourcegroups/aml-quickstarts-140435/workspaces/quick-starts-ws-140435&tid=660b3398-b80e-49d2-bc5b-ac1dc93b5254&activeFilePath=Users/odl_user_140435/nd00333_AZMLND_C2-ma...

Microsoft Azure Machine Learning

Udacity CloudLabs Sub - 13
quick-starts-ws-140435

Home > Notebooks

Notebooks

Files | Samples

*aml-pipelines-with-

Editors | Compute: udacity-project2 - Running | Python 3

udacity-project2 · Jupyter kernel idle | Python 3.

- odl_user_140435
  - nd00333_AZMLND_C2-master
    - starter_files
      - .config
      - pipeline-project
      - swagger
      - .amlignore
      - aml-pipelines-with-auto...
      - automl_errors.log
      - benchmark.sh
      - endpoint.py
      - logs.py
      - README.md
    - README.md

```
Submitted PipelineRun 3157c6e1-48b2-483a-9aa6-fba7a6cdc09f
Link to Azure Machine Learning Portal: https://ml.azure.com/experiments/udacity-project-2/runs/3157c6e1-48b2-483a-9aa6-fba7a6cdc09f?wsid=/subscriptions/61c5c3f0-6dc7-4ed9-a7f3-c704b20e3b30/resourcegroups/aml-quickstarts-140435/workspaces/quick-starts-ws-140435
```

[43]

```
from azureml.widgets import RunDetails
RunDetails(pipeline_run).show()
```

✓ 1.2s

Run 51 | Completed | Show log | View run details

```
[2021-03-14 21:50:34Z] Submitting 1 runs, first five are: d42ef295:4d6695a0-663e-49ac-841f-da9de59f6059
[2021-03-14 22:15:11Z] Completing processing run id 4d6695a0-663e-49ac-841f-da9de59f6059.

Run is completed.
```

[44]

```
pipeline_run.wait_for_completion()
```

✓ 1,473.3s

```
PipelineRunId: 3157c6e1-48b2-483a-9aa6-fba7a6cdc09f
Link to Azure Machine Learning Portal: https://ml.azure.com/experiments/udacity-project-2/runs/3157c6e1-48b2-483a-9aa6-fba7a6cdc09f?wsid=/subscriptions/61c5c3f0-6dc7-4ed9-a7f3-c704b20e3b30/resourcegroups/aml-quickstarts-140435/workspaces/quick-starts-ws-140435
PipelineRun Status: Running
```

UDACITY NANODEGREE DEMO

Project Lab

SEND FEEDBACK

quick-starts-ws-140435 - Micros | udacity-project-2 - Microsoft Az | QuirkyDataScientist1978/Microsc

ml.azure.com/experiments/id/d24eca2d-4285-451d-99c4-89120af1fe0f?wsid=/subscriptions/61c5c3f0-6dc7-4ed9-a7f3-c704b20e3b30/resourcegroups/aml-quickstarts-140435/workspaces/quick-starts-ws-140435&tid=660b3398-b80e-49d2-bc5b-ac1dc93b5254

Microsoft Azure Machine Learning

Udacity CloudLabs Sub - 13
quick-starts-ws-140435

Home > Experiments > udacity-project-2

401:

Trace ID : af9ff022-3161-4a49-b57a-986a2437a19f

udacity-project-2

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 0

Completed 2

Failed 0

Canceled 0

Queued 0

Other 0

recall_score_micro

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

precision_score_micro

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 ↓	Duration	Submitted by	Compute target	Run type	Last(recall_sco...	Last(precision...	Tags
Run 51	3157c6e1-48b2-483a-9aa6-fba7a6cdc09f	Completed	Mar 14, 2021 9:50 PM	24m 41s	ODL_User 140435		Pipeline			azureml.pipelineComponent : pipelinerun
Run 1	7490816e-d227-4c17-9ff8-3fb032c57ae6	Completed	Mar 14, 2021 8:46 PM	43m 18s	ODL_User 140435		Pipeline			azureml.pipelineComponent : pipelinerun

UDACITY NANODEGREE DEMO

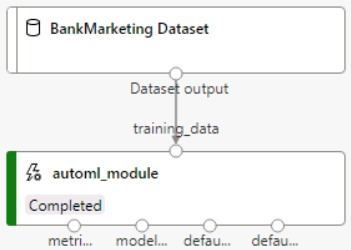
Run 51

Completed

Refresh | Clone | Publish | Resubmit | Cancel

Graph | Steps | Outputs + logs | Metrics | Images | Snapshot | Explanations (preview) | Fairness (preview)

100% | Hide run overview



Navigator

Pipeline run overview

Attributes | Pipeline parameters

Properties

Status
Completed

Submitted by
ODL_User 140435

Total steps
1

Run ID
3157c6e1-48b2-483a-9aa6-fba7a6cdc09f

Run source
SDK

Run type
SDK

Published pipeline
--

Tags

azureml.pipelineComponent : pipelinerun

Description

pipeline_with_automlstep

quick-starts-ws-140435 - Micros | Notebooks - Microsoft Azure Ma | QuirkyDataScientist1978/Micros

ml.azure.com/fileexplorerAzNB?wsid=/subscriptions/61c5c3f0-6dc7-4ed9-a7f3-c704b20e3b30/resourcegroups/aml-quickstarts-140435/workspaces/quick-starts-ws-140435&tid=660b3398-b80e-49d2-bc5b-ac1dc93b5254&activeFilePath=Users/odl_user_140435/nd00333_AZMLND_C2-ma...

Microsoft Azure Machine Learning

Udacity CloudLabs Sub - 13
quick-starts-ws-140435

Home > Notebooks

Notebooks

Files Samples

aml-pipelines-with-a

Editors Compute: udacity-project2 - Running Python 3

udacity-project2 · Jupyter kernel idle Python 3

- Users
  - odl_user_140435
    - nd00333_AZMLND_C2-master
      - starter_files
        - .config
        - azureml
        - pipeline-project
        - swagger
        - .amlignore
        - aml-pipelines-with-auto...
        - automl_errors.log
        - benchmark.sh
        - endpoint.py
        - logs.py

```
                                    y_transformer_name='LabelEncoder')
```

[49]
```
1  best_model.steps
```
✓ 0.2s

```
[('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',
  PreFittedSoftVotingClassifier(classification_labels=None,
                                estimators=[('22',
                                             Pipeline(memory=None,
                                                      steps=[('maxabsscaler',
                                                              MaxAbsScaler(copy=True)),
                                                             ('lightgbmclassifier',
                                                              LightGBMClassifier(boosting_type='goss',
                                                                                 class_weight=None,
                                                                                 colsample_bytree=0.1988888888888889,
                                                                                 importance_type='split',
                                                                                 learning_rate=0.1,
```

Test the Model

Load Test Data

For the test data, it should have the same preparation step as the train data. Otherwise it might get failed at the preprocessing step.

UDACITY NANODEGREE DEMO

https://ml.azure.com/fileexplorerAzNB?wsid=/subscriptions/61c5c3f0-6dc7-4ed9-a7f3-c704b20e3b30/resourcegroups/aml-quickstarts-140435/workspaces/quick-starts-ws-140435&tid=660b3398-b80e-49d2-bc5b-ac1dc93b5254

Project Lab

SEND FEEDBACK

quick-starts-ws-140435 - Micros | Notebooks - Microsoft Azure Ma | QuirkyDataScientist1978/Micros

ml.azure.com/fileexplorerAzNB?wsid=/subscriptions/61c5c3f0-6dc7-4ed9-a7f3-c704b20e3b30/resourcegroups/aml-quickstarts-140435/workspaces/quick-starts-ws-140435&tid=660b3398-b80e-49d2-bc5b-ac1dc93b5254&activeFilePath=Users/odl_user_140435/nd00333_AZMLND_C2-ma...

Microsoft Azure Machine Learning

Udacity CloudLabs Sub - 13
quick-starts-ws-140435

Home > Notebooks

Notebooks

Files | Samples

*aml-pipelines-with-

Editors | Compute: udacity-project2 - Running | Python 3

udacity-project2 · Jupyter kernel idle | Python 3

```
Downloading azureml/4d6695a0-663e-49ac-841f-da9de59f6059/model_data
Downloaded azureml/4d6695a0-663e-49ac-841f-da9de59f6059/model_data, 1 files out of an estimated total of 1
```

[48]

```
import pickle

with open(best_model_output._path_on_datastore, "rb" ) as f:
    best_model = pickle.load(f)
best_model
```

✓ 0.2s

```
PipelineWithYTransformations(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))...
                                                                                      min_samples_split=0.2442105263157895,
                                                                                      min_weight_fraction_leaf=0.0,
                                                                                      n_estimators=10,
                                                                                      n_jobs=1,
```

[49]

```
best_model.steps
```

- Users
  - odl_user_140435
    - nd00333_AZMLND_C2-master
      - starter_files
        - .config
        - azureml
        - pipeline-project
        - swagger
        - .amlignore
        - aml-pipelines-with-auto...
        - automl_errors.log
        - benchmark.sh
        - endpoint.py
        - logs.py

UDACITY NANODEGREE DEMO

https://ml.azure.com/fileexplorerAzNB?wsid=/subscriptions/61c5c3f0-6dc7-4ed9-a7f3-c704b20e3b30/resourcegroups/aml-quickstarts-140435/workspaces/quick-starts-ws-140435&tid=660b3398-b80e-49d2-bc5b-ac1dc93b5254

Pipelines

Pipeline runs | **Pipeline endpoints** | Pipeline drafts

Refresh | Disable | Enable | Include disabled

Search to filter items...

Name ↓	Description	Date updated	Updated by	Last run submit time	Last run status	Status
Bankmarketing_pipeline	Bank Marketing Pipeline for Udacity Project 2 - Aaron Gauthier - Final	March 14, 2021 10:56 PM	ODL_User 140435	--	--	Active
Bankmarketing Train	Training bankmarketing pipeline	March 14, 2021 10:17 PM	ODL_User 140435	March 14, 2021 10:17 PM	Finished	Active

quick-starts-ws-140435 - Micros | Bankmarketing_pipeline - Micros

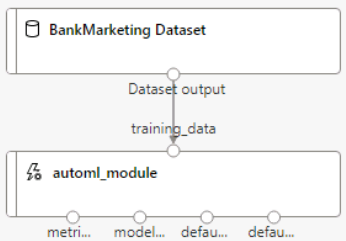
ml.azure.com/endpoint/6305351b-bbd4-4f72-8667-5345c58665a7/Bankmarketing_pipeline/detail?wsid=/subscriptions/61c5c3f0-6dc7-4ed9-a7f3-c704b20e3b30/resourcegroups/aml-quickstarts-140435/workspaces/quick-starts-ws-140435&tid=660b3398-b80e-49d2-bc5b-ac1dc93b5254

Bankmarketing_pipeline

Details | Published pipelines

Refresh | Submit | Clone

100% | Hide overview



Navigator

Pipeline endpoint overview

https://southcentralus.api.azureml.ms/pipelines/v1.0/subscriptions/61c5c3f0-6dc7-4ed9-a7f3-c704b20e3b30/resourceGroups/aml-quickstarts-140435/providers/Microsoft.MachineLearningServices/workspaces/quick-starts-ws-140435/PipelineRuns/PipelineEndpointSubmit/Id/6305351b-bbd4-4f72-8667-5345c58665a7

REST endpoint documentation
https://southcentralus.api.azureml.ms/pipelines/swagger/pipelineendpointsubmit/swagger.json

Published by
ODL_User 140435

Date published
March 14, 2021 10:56 PM

PipelineEndpoint ID
6305351b-bbd4-4f72-8667-5345c58665a7

Default version
0

Default published pipeline
531da3f2-169b-4e6d-bf7f-f3a248438f08

Last run submit time

Description

Bank Marketing Pipeline for Udacity Project 2 - Aaron Gauthier - Final

UDACITY NANODEGREE DEMO

Run 98

Completed

Refresh | Deploy | Download | Explain model | Cancel

Details | **Model** | Explanations (preview) | Metrics | Outputs + logs | Images | Child runs | Snapshot

Model summary

Algorithm name
VotingEnsemble

AUC weighted
0.94607 View all other metrics

Sampling
100.00 %

Registered models
No registration yet

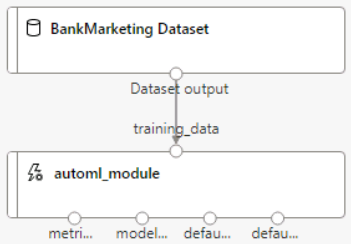
Deploy status
No deployment yet

Bankmarketing Train

Details | Runs

Refresh | Submit | Clone

100% | Hide overview



Navigator

Published pipeline overview

REST endpoints
https://southcentralus.api.azureml.ms/pipelines/v1.0/subscriptions/61c5c3f0-6dc7-4ed9-a7f3-c704b20e3b30/resourceGroups/aml-quickstarts-140435/providers/Microsoft.MachineLearningServices/workspaces/quick-starts-ws-140435/PipelineRuns/PipelineSubmit/468c4d8a-24fe-4e61-95c0-716ee964e32e

Updated by
ODL_User 140435

Updated
March 14, 2021 10:17 PM

Total steps
1

Pipeline ID
468c4d8a-24fe-4e61-95c0-716ee964e32e

Total runs
1

Last run start time
March 14, 2021 10:17 PM

Last run status
Finished

Description
Training bankmarketing pipeline

4d6695a0663e49a41:1

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

Refresh | Deploy | Download

Attributes

Version
1

ID
4d6695a0663e49a41:1

Date registered
3/15/2021, 12:33:31 AM

Framework
AutoML

Framework version
--

Experiment name
udacity-project-2

Run ID
4d6695a0-663e-49ac-841f-da9de59f6059_41

Created by
ODL_User 140435

Description

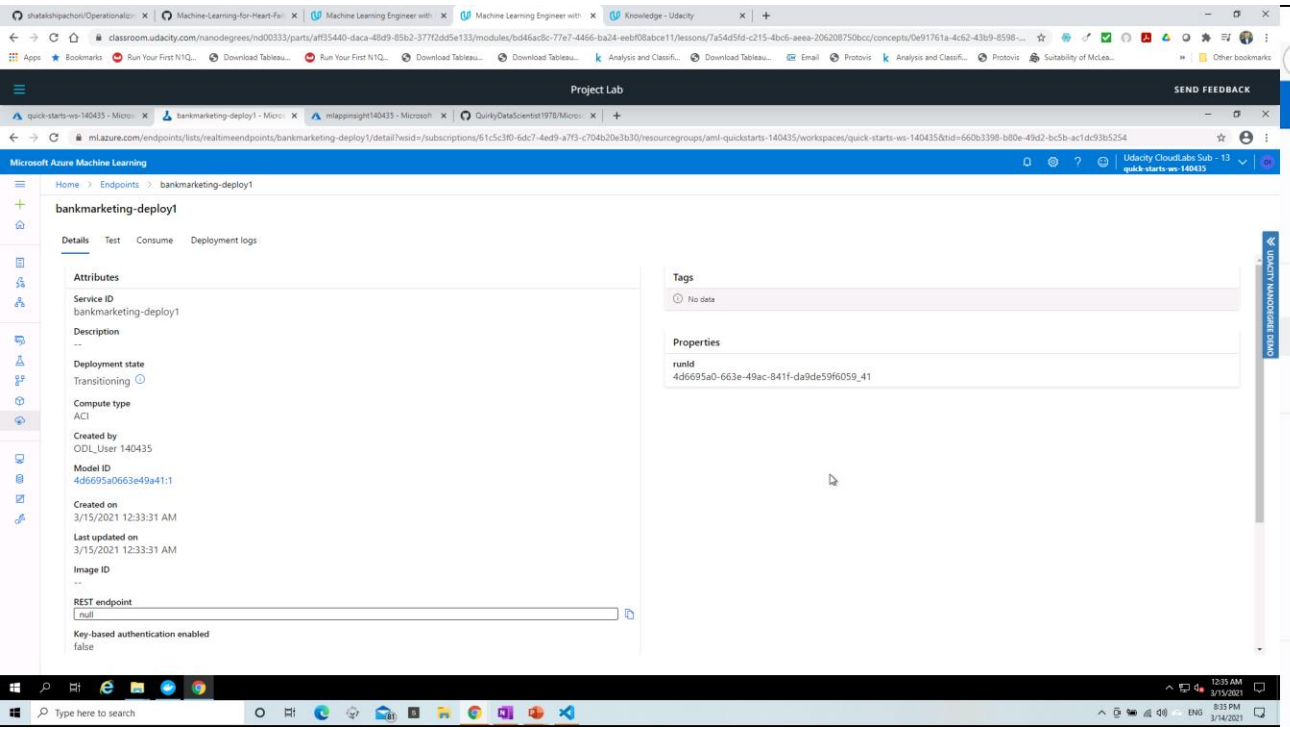
No data

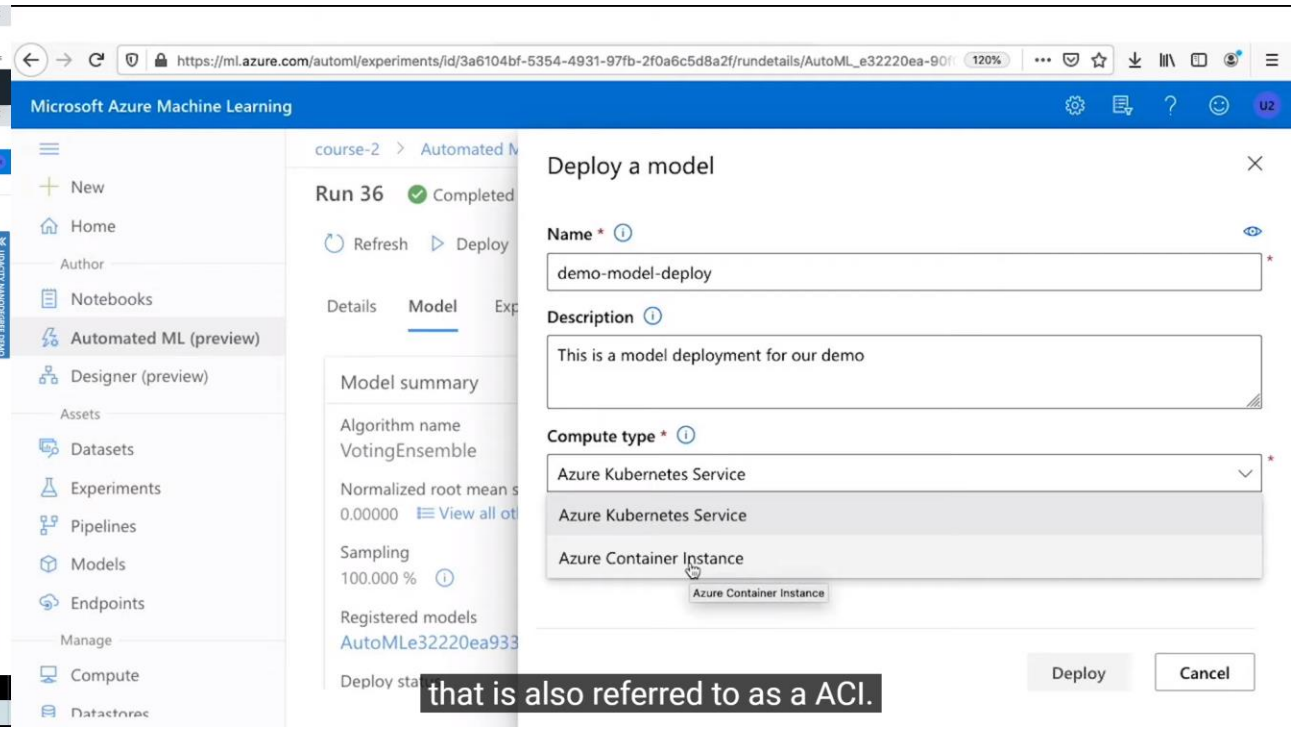
Tags

No tags

Properties

No properties





that is also referred to as a ACI.

Project Lab SEND FEEDBACK

quick-starts-ws-140435 - Micros | bankmarketing-deploy1 - Micros | mlappinsight140435 - Microsoft | QuirkyDataScientist1978/Micros

portal.azure.com/#@udacitylabs.onmicrosoft.com/resource/subscriptions/61c5c3f0-6dc7-4ed9-a7f3-c704b20e3b30/resourcegroups/aml-quickstarts-140435/providers/microsoft.insights/components/mlappinsight140435/overview

Microsoft Azure | Search resources, services, and docs (G+/) | odl_user_140435@udaci... UDACITY

Home >

mlappinsight140435

Application Insights

Search (Ctrl+/)

- Overview
- Activity log
- Access control (IAM)
- Tags
- Diagnose and solve problems

Investigate

- Application map
- Smart Detection
- Live metrics
- Transaction search
- Availability
- Failures
- Performance
- Troubleshooting guides (previ...

Monitoring

- Alerts
- Metrics
- Logs
- Workbooks

Usage

Application Dashboard | Getting started | Search | Logs | Monitor resource group | Feedback | Favorites | Rename | Delete

Essentials JSON View

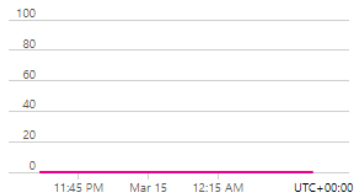
Resource group (change) : aml-quickstarts-140435
Location : South Central US
Subscription (change) : Udacity CloudLabs Sub - 13
Subscription ID : 61c5c3f0-6dc7-4ed9-a7f3-c704b20e3b30
Tags (change) : Click here to add tags

Instrumentation Key : cde2c214-fbf1-49d6-959a-b851565f7d8e
Connection String : InstrumentationKey=cde2c214-fbf1-49d6-959a-b851565f7d8e;IngestionEndpoint=https://southcentralus-0.in.applicati...

UDACITY NANODEGREE DEMO

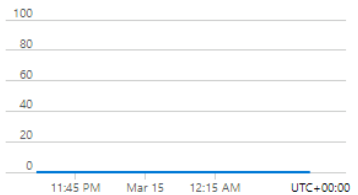
Show data for last: 30 minutes | 1 hour | 6 hours | 12 hours | 1 day | 3 days | 7 days | 30 days

Failed requests

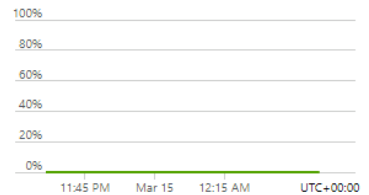


Server response time

Server requests



Availability



```
RunDetails(pipeline_run).show()
```

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

In [44]:
```
pipeline_run.wait_for_completion()
```

```
PipelineRunId: 3157c6e1-48b2-483a-9aa6-fba7a6cdc09f
Link to Azure Machine Learning Portal: https://ml.azure.com/experiments/udacity-project-2/runs/3157c6e1-48b2-483a-9aa6-fba7a6cdc09f?wsid
=/subscriptions/61c5c3f0-6dc7-4ed9-a7f3-c704b20e3b30/resourcegroups/aml-quickstarts-140435/workspaces/quick-starts-ws-140435
PipelineRun Status: Running


StepRunId: 4d6695a0-663e-49ac-841f-da9de59f6059
Link to Azure Machine Learning Portal: https://ml.azure.com/experiments/udacity-project-2/runs/4d6695a0-663e-49ac-841f-da9de59f6059?wsid
=/subscriptions/61c5c3f0-6dc7-4ed9-a7f3-c704b20e3b30/resourcegroups/aml-quickstarts-140435/workspaces/quick-starts-ws-140435
StepRun( automl_module ) Status: Running

StepRun(automl_module) Execution Summary
=========================================
StepRun( automl_module ) Status: Finished
{'runId': '4d6695a0-663e-49ac-841f-da9de59f6059', 'target': 'auto-ml', 'status': 'Completed', 'startTimeUtc': '2021-03-14T21:50:51.571004
Z', 'endTimeUtc': '2021-03-14T22:13:30.811233Z', 'properties': {'ContentSnapshotId': '7f664141-8c9b-4db6-b493-92438062a82c', 'StepType':
'AutoMLStep', 'azureml.moduleid': '04cabeac-0c81-4222-ae51-24da1aacf447', 'azureml.runsource': 'azureml.StepRun', 'azureml.nodeid': 'd42e
f295', 'azureml.pipelinerunid': '3157c6e1-48b2-483a-9aa6-fba7a6cdc09f', 'num_iterations': '1000', 'training_type': 'TrainFull', 'acquisit
ion_function': 'EI', 'metrics': 'accuracy', 'primary_metric': 'AUC_weighted', 'train_split': '0', 'MaxTimeSeconds': None, 'acquisition_pa
rameter': '0', 'num_cross_validation': None, 'target': 'auto-ml', 'RawAMLSettingsString': None, 'AMLSettingsJsonString': '{"path": null,
"name": "placeholder", "subscription_id": "61c5c3f0-6dc7-4ed9-a7f3-c704b20e3b30", "resource_group": "aml-quickstarts-140435", "workspace_
name": "quick-starts-ws-140435", "region": "southcentralus", "compute_target": "auto-ml", "spark_service": null, "azure_service": null,
"many_models": false, "pipeline_fetch_max_batch_size": 1, "iterations": 1000, "primary_metric": "AUC_weighted", "task_type": "classificat
ion", "data_script": null, "validation_size": 0.0, "n_cross_validations": null, "y_min": null, "y_max": null, "num_classes": null, "featu
rization": "auto", "_ignore_package_version_incompatibilities": false, "is_timeseries": false, "max_cores_per_iteration": 1, "max_concurr
ent_iterations": 5, "iteration_timeout_minutes": null, "mem_in_mb": null, "enforce_time_on_windows": false, "experiment_timeout_minutes":
20, "experiment_exit_score": null, "whitelist_models": null, "blacklist_algos": ["XGBoostClassifier"], "supported_models": ["LightGBM",
"LinearSVM", "MultinomialNaiveBayes", "GradientBoosting", "TensorFlowDNN", "KNN", "ExtremeRandomTrees", "DecisionTree", "SVM", "SGD", "Ra
ndomForest", "TensorFlowLinearClassifier", "LogisticRegression", "BernoulliNaiveBayes", "XGBoostClassifier", "AveragedPerceptronClassifie
r"], "private_models": [], "auto_blacklist": true, "blacklist_samples_reached": false, "exclude_nan_labels": true, "verbosity": 20, "_deb
ug_log": "automl_errors.log", "show_warnings": false, "model_explainability": true, "service_url": null, "sdk_url": null, "sdk_packages":
null, "enable_onnx_compatible_models": false, "enable_split_onnx_featurizer_estimator_models": false, "vm_type": "STANDARD_D2_V2", "telem
etry_verbosity": 20, "send_telemetry": true, "enable_dnn": false, "scenario": "SDK-1.13.0", "environment_label": null, "force_text_dnn":
false, "enable_feature_sweeping": true, "enable_early_stopping": true, "early_stopping_n_iters": 10, "metrics": null, "enable_ensemblin
g": true, "enable_stack_ensembling": true, "ensemble_iterations": 15, "enable_tf": false, "enable_subsampling": null, "subsample_seed": n
ull, "enable_nimbusml": false, "enable_streaming": false, "force_streaming": false, "track_child_runs": true, "allowed_private_models":
[], "label_column_name": "y", "weight_column_name": null, "cv_split_column_names": null, "enable_local_managed": false, "_local_managed_r
un_id": null, "cost_mode": 1, "lag_length": 0, "metric_operation": "maximize", "preprocess": true}', 'DataPrepJsonString': '{\\"training_
data\\": {\\"datasetId\\": \\"c76ac69e-c8d9-43f8-865d-37e99d564d70\\"}, \\"datasets\\": 0}', 'EnableSubsampling': 'False', 'runTemplate':
'AutoML', 'Orchestrator': 'automl', 'ClientType': 'Others', '_aml_system_scenario_identification': 'Remote.Parent', 'root_attribution':
'azureml.StepRun', 'snapshotId': '7f664141-8c9b-4db6-b493-92438062a82c', 'SetupRunId': '4d6695a0-663e-49ac-841f-da9de59f6059_setup', 'Set
upRunContainerId': 'dcid.4d6695a0-663e-49ac-841f-da9de59f6059_setup', 'ClientSdkVersion': '1.22.0', 'FeaturizationRunJsonPath': 'featuriz
er_container.json', 'FeaturizationRunId': '4d6695a0-663e-49ac-841f-da9de59f6059_featurize', 'ProblemInfoJsonString': '{"dataset_num_categ
orical": 0, "is_sparse": true, "subsampling": false, "dataset_classes": 2, "dataset_features": 132, "dataset_samples": 29655, "single_fre
quency_class_detected": false}', 'ModelExplainRunId': '4d6695a0-663e-49ac-841f-da9de59f6059_ModelExplain'}, 'inputDatasets': [], 'outputD
atasets': [], 'logFiles': {'logs/azureml/executionlogs.txt': 'https://mlstrg140435.blob.core.windows.net/azureml/ExperimentRun/dcid.4d669
5a0-663e-49ac-841f-da9de59f6059/logs/azureml/executionlogs.txt?sv=2019-02-02&sr=b&sig=DLyoH6l4tT1KepVsUJ0iL%2BfCEH0H7FgNSAt7OeIjSsY%3D&st
=2021-03-14T21%3A40%3A44Z&se=2021-03-15T05%3A50%3A44Z&sp=r', 'logs/azureml/stderrlogs.txt': 'https://mlstrg140435.blob.core.windows.net/a
zureml/ExperimentRun/dcid.4d6695a0-663e-49ac-841f-da9de59f6059/logs/azureml/stderrlogs.txt?sv=2019-02-02&sr=b&sig=9RFOW%2FjtlPru%2FkcE9%2
FgSt92UPZKAAbkUJ0mFMBrGUfQ%3D&st=2021-03-14T21%3A40%3A44Z&se=2021-03-15T05%3A50%3A44Z&sp=r', 'logs/azureml/stdoutlogs.txt': 'https://mlst
rg140435.blob.core.windows.net/azureml/ExperimentRun/dcid.4d6695a0-663e-49ac-841f-da9de59f6059/logs/azureml/stdoutlogs.txt?sv=2019-02-02&
sr=b&sig=9y9cPLspVEVJd0Bx3WBdsiBoqxGVTkZDHerWrTMunls%3D&st=2021-03-14T21%3A40%3A44Z&se=2021-03-15T05%3A50%3A44Z&sp=r'}, 'submittedBy': 'O
DL_User 140435'}
```

```
                                                                0.06666666666666667]))],
                                'verbose': False},
                               y_transformer={},
                               y_transformer_name='LabelEncoder')
```

In [49]:
```
best_model.steps
```

Out[49]:
```
[('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',
  PreFittedSoftVotingClassifier(classification_labels=None,
                                estimators=[('22',
                                             Pipeline(memory=None,
                                                      steps=[('maxabsscaler',
                                                              MaxAbsScaler(copy=True)),
                                                             ('lightgbmclassifier',
                                                              LightGBMClassifier(boosting_type='goss',
                                                                                 class_weight=None,
                                                                                 colsample_bytree=0.1988888888888889,
                                                                                 importance_type='split',
                                                                                 learning_rate=0.1,
                                                                                 max_bin=310,
                                                                                 max_depth=9,
                                                                                 min_child_samples=103,
                                                                                 mi...
                                                                                     min_impurity_split=None,
                                                                                     min_samples_leaf=0.01,
                                                                                     min_samples_split=0.2442105263157895,
                                                                                     min_weight_fraction_leaf=0.0,
                                                                                     n_estimators=10,
                                                                                     n_jobs=1,
                                                                                     oob_score=False,
                                                                                     random_state=None,
                                                                                     verbose=0,
                                                                                     warm_start=False))],
                                                      verbose=False))],
                                flatten_transform=None,
                                weights=[0.3333333333333333, 0.4,
                                         0.06666666666666667, 0.06666666666666667,
                                         0.06666666666666667,
                                         0.06666666666666667]))]
```

Test the Model

Load Test Data

For the test data, it should have the same preparation step as the train data. Otherwise it might get failed at the preprocessing step.

In [50]:
```
dataset_test = Dataset.Tabular.from_delimited_files(path='https://automlsamplenotebookdata.blob.core.windows.net/automl-sample-notebook-data/bankmarketing_train.csv')
df_test = dataset_test.to_pandas_dataframe()
df_test = df_test[pd.notnull(df_test['y'])]

y_test = df_test['y']
```

bankmarketing-deploy1

Details | Test | Consume | Deployment logs

Description
--

Deployment state
Healthy

Compute type
ACI

Created by
ODL_User 140435

Model ID
4d6695a0663e49a41:1

Created on
3/15/2021 12:33:31 AM

Last updated on
3/15/2021 12:33:31 AM

Image ID
--

REST endpoint
http://ed8682d8-2f3c-4dcb-9581-d822ea16e1a2.southcentralus.azurecontainer.io/score

Key-based authentication enabled
false

Swagger URI
http://ed8682d8-2f3c-4dcb-9581-d822ea16e1a2.southcentralus.azurecontainer.io/swagger.json

CPU
1.8

Properties

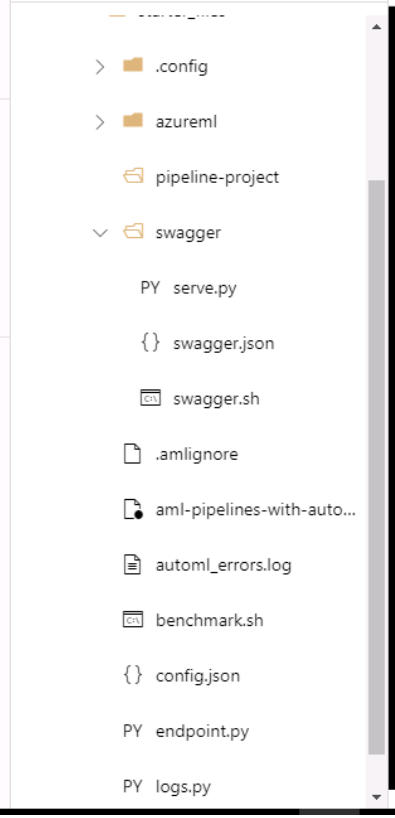
runId
4d6695a0-663e-49ac-841f-da9de59f6059_41

hasInferenceSchema
True

hasHttps
False

Notebooks

Files Samples



aml-pipelines-with-a | config.json | 1:udacity-project2

Help | View active sessions (1) | Focus mode | Compute: udacity-project2 - Running

```
swagger.json                                  100%[=========================================================================================================>]   3.19K  --.-KB/s    in 0s

2021-03-15 00:54:57 (247 MB/s) - 'swagger.json' saved [3266/3266]

azureuser@udacity-project2:~/cloudfiles/code/Users/odl_user_140435/nd00333_AZMLND_C2-master/starter_files/swagger$ ls
serve.py  swagger.json  swagger.sh
azureuser@udacity-project2:~/cloudfiles/code/Users/odl_user_140435/nd00333_AZMLND_C2-master/starter_files/swagger$ cat swagger.sh
# Run the swagger-ui project locally, requires docker to be installed and running
# Will pull the latest swagger-ui docker image and then will try to run it on port 80
#
# Once running, it is accessible at: http://localhost/
#
# If the user doesn't have enough permissions to use port 80, modify the local
# port to something above 8000 that is available.

docker pull swaggerapi/swagger-ui
docker run -p 80:8080 swaggerapi/swagger-ui
azureuser@udacity-project2:~/cloudfiles/code/Users/odl_user_140435/nd00333_AZMLND_C2-master/starter_files/swagger$ bash swagger.sh
Using default tag: latest
latest: Pulling from swaggerapi/swagger-ui
ba3557a56b15: Pull complete
1a18b9f93d41: Pull complete
38ceab6c6432: Pull complete
6104f3bd82cc: Pull complete
750e0e12d70c: Pull complete
d7c38a871210: Pull complete
2bcce1cd78aa: Pull complete
4d83c00333a6: Pull complete
91ea9bc13610: Pull complete
a4b38fff50aa: Pull complete
68d133941ec8: Pull complete
cda91901c34b: Pull complete
Digest: sha256:2200e9981f38608b78ba5bac97dccffde461926162958aa11851c931e6826a06
Status: Downloaded newer image for swaggerapi/swagger-ui:latest
docker.io/swaggerapi/swagger-ui:latest
```

quick-starts-ws-140435 - Micros | Notebooks - Microsoft Azure Ma | ed8682d8-2f3c-4dcb-9581-d822 | QuirkyDataScientist1978/Micros | localhost

localhost

It works!

Notebooks

Files Samples

- .config
- azureml
- pipeline-project
- swagger
  - serve.py
  - swagger.json
  - swagger.sh
- .amlignore
- aml-pipelines-with-auto...
- automl_errors.log
- benchmark.sh
- config.json
- endpoint.py
- logs.py

aml-pipelines-with-a | config.json | 1:udacity-project2 | 2:udacity-project2

Help | View active sessions (2) | Focus mode | Compute: udacity-project2 - Running

```
    $ python3 serve.py 8000

The port number is optional, defaulting to 8000. Once the server is up and
running with a swagger.json file in the same directory, then the url (assuming
port 8000) to be used in swagger-ui would be:

    http://localhost:8000/swagger.json

"""


from http.server import HTTPServer, SimpleHTTPRequestHandler, test
import sys


class CORSRequestHandler(SimpleHTTPRequestHandler):
    """
    Allows a simple HTTP server to have CORS enabled by default
    """

    def end_headers(self):
        self.send_header("Access-Control-Allow-Origin", "*")
        SimpleHTTPRequestHandler.end_headers(self)


if __name__ == "__main__":
    if len(sys.argv) > 1:
        # Allows the port to be passed in as an argument
        port = sys.argv[-1]
    else:
        port = 8000

    test(CORSRequestHandler, HTTPServer, port=port)
azureuser@udacity-project2:~/cloudfiles/code/Users/odl_user_140435/nd00333_AZMLND_C2-master/starter_files/swagger$ python serve.py
Serving HTTP on 0.0.0.0 port 8000 (http://0.0.0.0:8000/) ...
```

```
quick-starts-ws-140452
aml-quickstarts-140452
southcentralus
f5091c60-1c3c-430f-8d81-d802f6bf2414
```

Create an Azure ML experiment

Let's create an experiment named "automlstep-classification" and a folder to hold the training scripts. The script runs will be recorded under the experiment in Azure.

The best practice is to use separate folders for scripts and its dependent files for each step and specify that folder as the `source_directory` for the step. This helps reduce the size of the snapshot created for the step (only the specific folder is snapshotted). Since changes in any files in the `source_directory` would trigger a re-upload of the snapshot, this helps keep the reuse of the step when there are no changes in the `source_directory` of the step.

Udacity Note: There is no need to create an Azure ML experiment, this needs to re-use the experiment that was already created

In [3]:
```
from azureml.core import Workspace
from azureml.core.webservice import Webservice

# Choose a name for the run history container in the workspace.
# NOTE: update these to match your existing experiment name
experiment_name = 'udacity-project-2'
project_folder = './pipeline-project'

experiment = Experiment(ws, experiment_name)
experiment
```

Out[3]:

Name	Workspace	Report Page	Docs Page
udacity-project-2	quick-starts-ws-140452	Link to Azure Machine Learning studio	Link to Documentation

Create or Attach an AmlCompute cluster

You will need to create a compute target for your AutoML run. In this tutorial, you get the default `AmlCompute` as your training compute resource.

Udacity Note There is no need to create a new compute target, it can re-use the previous cluster

In [4]:
```
from azureml.core.compute import AmlCompute
from azureml.core.compute import ComputeTarget
from azureml.core.compute_target import ComputeTargetException

# NOTE: update the cluster name to match the existing cluster
# Choose a name for your CPU cluster
amlcompute_cluster_name = "auto-ml"

# Verify that cluster does not exist already
```

```
key = "BankMarketing Dataset"
description_text = "Bank Marketing DataSet for Udacity Course 2"

if key in ws.datasets.keys():
        found = True
        dataset = ws.datasets[key]

if not found:
        # Create AML Dataset and register it into Workspace
        example_data = 'https://automlsamplenotebookdata.blob.core.windows.net/automl-sample-notebook-data/bankmarketing_train.csv'
        dataset = Dataset.Tabular.from_delimited_files(example_data)
        #Register Dataset in Workspace
        dataset = dataset.register(workspace=ws,
                                   name=key,
                                   description=description_text)


df = dataset.to_pandas_dataframe()
df.describe()
```

Out[5]:

	age	duration	campaign	pdays	previous	emp.var.rate	cons.price.idx	cons.conf.idx	euribor3m	nr.employed
count	32950.000000	32950.000000	32950.000000	32950.000000	32950.000000	32950.000000	32950.000000	32950.000000	32950.000000	32950.000000
mean	40.040212	257.335205	2.561730	962.174780	0.174780	0.076228	93.574243	-40.518680	3.615654	5166.859608
std	10.432313	257.331700	2.763646	187.646785	0.496503	1.572242	0.578636	4.623004	1.735748	72.208448
min	17.000000	0.000000	1.000000	0.000000	0.000000	-3.400000	92.201000	-50.800000	0.634000	4963.600000
25%	32.000000	102.000000	1.000000	999.000000	0.000000	-1.800000	93.075000	-42.700000	1.344000	5099.100000
50%	38.000000	179.000000	2.000000	999.000000	0.000000	1.100000	93.749000	-41.800000	4.857000	5191.000000
75%	47.000000	318.000000	3.000000	999.000000	0.000000	1.400000	93.994000	-36.400000	4.961000	5228.100000
max	98.000000	4918.000000	56.000000	999.000000	7.000000	1.400000	94.767000	-26.900000	5.045000	5228.100000

Review the Dataset Result

You can peek the result of a TabularDataset at any range using `skip(i)` and `take(j).to_pandas_dataframe()`. Doing so evaluates only `j` records for all the steps in the TabularDataset, which makes it fast even against large datasets.

`TabularDataset` objects are composed of a list of transformation steps (optional).

In [6]:
```
dataset.take(5).to_pandas_dataframe()
```

Out[6]:

	age	job	marital	education	default	housing	loan	contact	month	day_of_week	...	campaign	pdays	previous	poutcome	emp.var.rate	co

```
    allow_reuse=True)
```

In [10]:
```
from azureml.pipeline.core import Pipeline
pipeline = Pipeline(
    description="pipeline_with_automlstep",
    workspace=ws,
    steps=[automl_step])
```

In [11]:
```
pipeline_run = experiment.submit(pipeline)
```

```
Created step automl_module [9c14d65a][d144d13a-01c5-4723-b37f-ca4a0edd3bfd], (This step will run and generate new outputs)
Submitted PipelineRun ebb39760-d0f9-44c4-b648-d3d75da722df
Link to Azure Machine Learning Portal: https://ml.azure.com/experiments/udacity-project-2/runs/ebb39760-d0f9-44c4-b648-d3d75da722df?wsid
=/subscriptions/f5091c60-1c3c-430f-8d81-d802f6bf2414/resourcegroups/aml-quickstarts-140452/workspaces/quick-starts-ws-140452
```

In [12]:
```
from azureml.widgets import RunDetails
RunDetails(pipeline_run).show()
```

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

In [13]:
```
pipeline_run.wait_for_completion()
```

```
PipelineRunId: ebb39760-d0f9-44c4-b648-d3d75da722df
Link to Azure Machine Learning Portal: https://ml.azure.com/experiments/udacity-project-2/runs/ebb39760-d0f9-44c4-b648-d3d75da722df?wsid
=/subscriptions/f5091c60-1c3c-430f-8d81-d802f6bf2414/resourcegroups/aml-quickstarts-140452/workspaces/quick-starts-ws-140452
PipelineRun Status: Running


StepRunId: 3e4e91a7-df71-4301-99b7-2d38c2fac599
Link to Azure Machine Learning Portal: https://ml.azure.com/experiments/udacity-project-2/runs/3e4e91a7-df71-4301-99b7-2d38c2fac599?wsid
=/subscriptions/f5091c60-1c3c-430f-8d81-d802f6bf2414/resourcegroups/aml-quickstarts-140452/workspaces/quick-starts-ws-140452
StepRun( automl_module ) Status: Running

StepRun(automl_module) Execution Summary
========================================
StepRun( automl_module ) Status: Finished
{'runId': '3e4e91a7-df71-4301-99b7-2d38c2fac599', 'target': 'auto-ml', 'status': 'Completed', 'startTimeUtc': '2021-03-15T02:03:52.173735
Z', 'endTimeUtc': '2021-03-15T02:41:52.464863Z', 'properties': {'ContentSnapshotId': '00000000-0000-0000-0000-000000000000', 'StepType':
'AutoMLStep', 'azureml.moduleid': 'd144d13a-01c5-4723-b37f-ca4a0edd3bfd', 'azureml.runsource': 'azureml.StepRun', 'azureml.nodeid': '9c14
d65a', 'azureml.pipelinerunid': 'ebb39760-d0f9-44c4-b648-d3d75da722df', 'num_iterations': '1000', 'training_type': 'TrainFull', 'acquisit
ion_function': 'EI', 'metrics': 'accuracy', 'primary_metric': 'AUC_weighted', 'train_split': '0', 'MaxTimeSeconds': None, 'acquisition_pa
rameter': '0', 'num_cross_validation': None, 'target': 'auto-ml', 'RawAMLSettingsString': None, 'AMLSettingsJsonString': '{"path": null,
"name": "placeholder", "subscription_id": "f5091c60-1c3c-430f-8d81-d802f6bf2414", "resource_group": "aml-quickstarts-140452", "workspace_
name": "quick-starts-ws-140452", "region": "southcentralus", "compute_target": "auto-ml", "spark_service": null, "azure_service": null,
"many_models": false, "pipeline_fetch_max_batch_size": 1, "iterations": 1000, "primary_metric": "AUC_weighted", "task_type": "classificat
ion", "data_script": null, "validation_size": 0.0, "n_cross_validations": null, "y_min": null, "y_max": null, "num_classes": null, "featu
rization": "auto", "_ignore_package_version_incompatibilities": false, "is_timeseries": false, "max_cores_per_iteration": 1, "max_concurr
ent_iterations": 5, "iteration_timeout_minutes": null, "mem_in_mb": null, "enforce_time_on_windows": false, "experiment_timeout_minutes":
20, "experiment_exit_score": null, "whitelist_models": null, "blacklist_algos": ["XGBoostClassifier"], "supported_models": ["XGBoostClass
ifier", "KNN", "MultinomialNaiveBayes", "DecisionTree", "ExtremeRandomTrees", "GradientBoosting", "TensorFlowDNN", "LightGBM", "TensorFlo
```

StepRun(automl_module) Status: Finished

{'runId': '3e4e91a7-df71-4301-99b7-2d38c2fac599', 'target': 'auto-ml', 'status': 'Completed', 'startTimeUtc': '2021-03-15T02:03:52.173735Z', 'endTimeUtc': '2021-03-15T02:41:52.464863Z', 'properties': {'ContentSnapshotId': '00000000-0000-0000-0000-000000000000', 'StepType': 'AutoMLStep', 'azureml.moduleid': 'd144d13a-01c5-4723-b37f-ca4a0edd3bfd', 'azureml.runsource': 'azureml.StepRun', 'azureml.nodeid': '9c14d65a', 'azureml.pipelinerunid': 'ebb39760-d0f9-44c4-b648-d3d75da722df', 'num_iterations': '1000', 'training_type': 'TrainFull', 'acquisition_function': 'EI', 'metrics': 'accuracy', 'primary_metric': 'AUC_weighted', 'train_split': '0', 'MaxTimeSeconds': None, 'acquisition_parameter': '0', 'num_cross_validation': None, 'target': 'auto-ml', 'RawAMLSettingsString': None, 'AMLSettingsJsonString': '{"path": null, "name": "placeholder", "subscription_id": "f5091c60-1c3c-430f-8d81-d802f6bf2414", "resource_group": "aml-quickstarts-140452", "workspace_name": "quick-starts-ws-140452", "region": "southcentralus", "compute_target": "auto-ml", "spark_service": null, "azure_service": null, "many_models": false, "pipeline_fetch_max_batch_size": 1, "iterations": 1000, "primary_metric": "AUC_weighted", "task_type": "classification", "data_script": null, "validation_size": 0.0, "n_cross_validations": null, "y_min": null, "y_max": null, "num_classes": null, "featurization": "auto", "_ignore_package_version_incompatibilities": false, "is_timeseries": false, "max_cores_per_iteration": 1, "max_concurrent_iterations": 5, "iteration_timeout_minutes": null, "mem_in_mb": null, "enforce_time_on_windows": false, "experiment_timeout_minutes": 20, "experiment_exit_score": null, "whitelist_models": null, "blacklist_algos": ["XGBoostClassifier"], "supported_models": ["XGBoostClassifier", "KNN", "MultinomialNaiveBayes", "DecisionTree", "ExtremeRandomTrees", "GradientBoosting", "TensorFlowDNN", "LightGBM", "TensorFlowLinearClassifier", "LogisticRegression", "LinearSVM", "RandomForest", "SGD", "BernoulliNaiveBayes", "AveragedPerceptronClassifier", "SVM"], "private_models": [], "auto_blacklist": true, "blacklist_samples_reached": false, "exclude_nan_labels": true, "verbosity": 20, "_debug_log": "automl_errors.log", "show_warnings": false, "model_explainability": true, "service_url": null, "sdk_url": null, "sdk_packages": null, "enable_onnx_compatible_models": false, "enable_split_onnx_featurizer_estimator_models": false, "vm_type": "STANDARD_DS12_V2", "telemetry_verbosity": 20, "send_telemetry": true, "enable_dnn": false, "scenario": "SDK-1.13.0", "environment_label": null, "force_text_dnn": false, "enable_feature_sweeping": true, "enable_early_stopping": true, "early_stopping_n_iters": 10, "metrics": null, "enable_ensembling": true, "enable_stack_ensembling": true, "ensemble_iterations": 15, "enable_tf": false, "enable_subsampling": null, "subsample_seed": null, "enable_nimbusml": false, "enable_streaming": false, "force_streaming": false, "track_child_runs": true, "allowed_private_models": [], "label_column_name": "y", "weight_column_name": null, "cv_split_column_names": null, "enable_local_managed": false, "_local_managed_run_id": null, "cost_mode": 1, "lag_length": 0, "metric_operation": "maximize", "preprocess": true}', 'DataPrepJsonString': '{\\"training_data\\": {\\"datasetId\\": \\"47da540d-aae6-4555-8a07-b5e298699ce7\\"}, \\"datasets\\": 0}', 'EnableSubsampling': 'False', 'runTemplate': 'AutoML', 'Orchestrator': 'automl', 'ClientType': 'Others', '_aml_system_scenario_identification': 'Remote.Parent', 'root_attribution': 'azureml.StepRun', 'snapshotId': '00000000-0000-0000-0000-000000000000', 'SetupRunId': '3e4e91a7-df71-4301-99b7-2d38c2fac599_setup', 'SetupRunContainerId': 'dcid.3e4e91a7-df71-4301-99b7-2d38c2fac599_setup', 'ClientSdkVersion': '1.22.0', 'FeaturizationRunJsonPath': 'featurizer_container.json', 'FeaturizationRunId': '3e4e91a7-df71-4301-99b7-2d38c2fac599_featurize', 'ProblemInfoJsonString': '{"dataset_num_categorical": 0, "is_sparse": true, "subsampling": false, "dataset_classes": 2, "dataset_features": 132, "dataset_samples": 29655, "single_frequency_class_detected": false}', 'ModelExplainRunId': '3e4e91a7-df71-4301-99b7-2d38c2fac599_ModelExplain'}, 'inputDatasets': [], 'outputDatasets': [], 'logFiles': {'logs/azureml/executionlogs.txt': 'https://mlstrg140452.blob.core.windows.net/azureml/ExperimentRun/dcid.3e4e91a7-df71-4301-99b7-2d38c2fac599/logs/azureml/executionlogs.txt?sv=2019-02-02&sr=b&sig=ER1dsN7NbE0RBDWP5pZdnB6TPfCFM183dDrZnNdPn%2Fg%3D&st=2021-03-15T02%3A09%3A35Z&se=2021-03-15T10%3A19%3A35Z&sp=r', 'logs/azureml/stderrlogs.txt': 'https://mlstrg140452.blob.core.windows.net/azureml/ExperimentRun/dcid.3e4e91a7-df71-4301-99b7-2d38c2fac599/logs/azureml/stderrlogs.txt?sv=2019-02-02&sr=b&sig=2EZFa9mWKP%2Ffajc3ijptgnM6SM%2F2LUX7PqYhNQu85uo%3D&st=2021-03-15T02%3A09%3A38Z&se=2021-03-15T10%3A19%3A38Z&sp=r', 'logs/azureml/stdoutlogs.txt': 'https://mlstrg140452.blob.core.windows.net/azureml/ExperimentRun/dcid.3e4e91a7-df71-4301-99b7-2d38c2fac599/logs/azureml/stdoutlogs.txt?sv=2019-02-02&sr=b&sig=jDdEh6p5uaXy9tUwCs3aHF5W8G1KmlrxUo5d2uHIszs%3D&st=2021-03-15T02%3A09%3A38Z&se=2021-03-15T10%3A19%3A38Z&sp=r'}, 'submittedBy': 'ODL_User 140452'}

PipelineRun Execution Summary
==========
PipelineRun Status: Finished

{'runId': 'ebb39760-d0f9-44c4-b648-d3d75da722df', 'status': 'Completed', 'startTimeUtc': '2021-03-15T02:03:31.556111Z', 'endTimeUtc': '2021-03-15T02:42:56.127813Z', 'properties': {'azureml.runsource': 'azureml.PipelineRun', 'runSource': 'SDK', 'runType': 'SDK', 'azureml.parameters': '{}'}, 'inputDatasets': [], 'outputDatasets': [], 'logFiles': {'logs/azureml/executionlogs.txt': 'https://mlstrg140452.blob.core.windows.net/azureml/ExperimentRun/dcid.ebb39760-d0f9-44c4-b648-d3d75da722df/logs/azureml/executionlogs.txt?sv=2019-02-02&sr=b&sig=nFFg

```
PipelineRun Execution Summary
==============================
PipelineRun Status: Finished
{'runId': 'ebb39760-d0f9-44c4-b648-d3d75da722df', 'status': 'Completed', 'startTimeUtc': '2021-03-15T02:03:31.556111Z', 'endTimeUtc': '20
21-03-15T02:42:56.127813Z', 'properties': {'azureml.runsource': 'azureml.PipelineRun', 'runSource': 'SDK', 'runType': 'SDK', 'azureml.par
ameters': '{}'}, 'inputDatasets': [], 'outputDatasets': [], 'logFiles': {'logs/azureml/executionlogs.txt': 'https://mlstrg140452.blob.cor
e.windows.net/azureml/ExperimentRun/dcid.ebb39760-d0f9-44c4-b648-d3d75da722df/logs/azureml/executionlogs.txt?sv=2019-02-02&sr=b&sig=nFFg
L%2BbA5J1ylWt4FYPvDOBymmPqi6X0xXjh1PqR%2FpU%3D&st=2021-03-15T01%3A53%3A35Z&se=2021-03-15T10%3A03%3A35Z&sp=r', 'logs/azureml/stderrlogs.tx
t': 'https://mlstrg140452.blob.core.windows.net/azureml/ExperimentRun/dcid.ebb39760-d0f9-44c4-b648-d3d75da722df/logs/azureml/stderrlogs.t
xt?sv=2019-02-02&sr=b&sig=k0DxM%2BYgk8IzLoMtMWW7uXlUDM0%2Be0DBgo%2B%2FhPK08hw%3D&st=2021-03-15T01%3A53%3A35Z&se=2021-03-15T10%3A03%3A35Z&
sp=r', 'logs/azureml/stdoutlogs.txt': 'https://mlstrg140452.blob.core.windows.net/azureml/ExperimentRun/dcid.ebb39760-d0f9-44c4-b648-d3d7
5da722df/logs/azureml/stdoutlogs.txt?sv=2019-02-02&sr=b&sig=3D7tHSWKbo3x%2BhLu3BXhBuipvYGuBLtT6trU76FKqM0%3D&st=2021-03-15T01%3A53%3A35Z&
se=2021-03-15T10%3A03%3A35Z&sp=r'}, 'submittedBy': 'ODL_User 140452'}
```

Out[13]: 'Finished'

Examine Results

Retrieve the metrics of all child runs

Outputs of above run can be used as inputs of other steps in pipeline. In this tutorial, we will examine the outputs by retrieve output data and running some tests.

In [14]:
```
metrics_output = pipeline_run.get_pipeline_output(metrics_output_name)
num_file_downloaded = metrics_output.download('.', show_progress=True)
```

```
Downloading azureml/3e4e91a7-df71-4301-99b7-2d38c2fac599/metrics_data
Downloaded azureml/3e4e91a7-df71-4301-99b7-2d38c2fac599/metrics_data, 1 files out of an estimated total of 1
```

In [15]:
```
import json
with open(metrics_output._path_on_datastore) as f:
    metrics_output_result = f.read()

deserialized_metrics_output = json.loads(metrics_output_result)
df = pd.DataFrame(deserialized_metrics_output)
df
```

Out[15]:

	3e4e91a7-df71-4301-99b7-2d38c2fac599_4	3e4e91a7-df71-4301-99b7-2d38c2fac599_8	3e4e91a7-df71-4301-99b7-2d38c2fac599_15	3e4e91a7-df71-4301-99b7-2d38c2fac599_14	3e4e91a7-df71-4301-99b7-2d38c2fac599_6	3
average_precision_score_micro	[0.9672619961996088]	[0.7898895396540168]	[0.7868207390502362]	[0.8175225409477944]	[0.9526710764188303]	[
norm_macro_recall	[0.16624062002752638]	[0.46335072715047043]	[0.4700850426139258]	[0.46979607184998695]	[0.0]	[
f1_score_micro	[0.8989377845220029]	[0.7253414264036417]	[0.7523520485584219]	[0.7268588770864947]	[0.8877086494688923]	[
f1_score_weighted	[0.8711927106115441]	[0.7737695427062569]	[0.7928309818850775]	[0.7750017866134096]	[0.8251882663491893]	[

```
with open(best_model_output._path_on_datastore, "rb" ) as f:
    best_model = pickle.load(f)
best_model
```

Out[17]:
```
PipelineWithYTransformations(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))...
                                                                                                                                    n_es
timators=25,
                                                                                                                                    n_jo
bs=1,
                                                                                                                                    oob_
score=False,
                                                                                                                                    rand
om_state=None,
                                                                                                                                    verb
ose=0,
                                                                                                                                    warm
_start=False))],
                                                                                                        verbose=False))],
                                                                                  flatten_transform=None,
                                                                                  weights=[0.38461538461538464,
                                                                                           0.23076923076923078,
                                                                                           0.07692307692307693,
                                                                                           0.07692307692307693,
                                                                                           0.07692307692307693,
                                                                                           0.07692307692307693,
                                                                                           0.07692307692307693]))],
                                       'verbose': False},
                                y_transformer={},
                                y_transformer_name='LabelEncoder')
```

In [18]:
```
best_model.steps
```

Out[18]:
```
[('datatransformer',
  DataTransformer(enable_dnn=None, enable_feature_sweeping=None,
                  feature_sweeping_config=None, feature_sweeping_timeout=None,
                  featurization_config=None, force_text_dnn=None,
```

```
                                y_transformer={},
                                y_transformer_name='LabelEncoder')
```

In [18]:
```
best_model.steps
```

Out[18]:
```
[('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',
  PreFittedSoftVotingClassifier(classification_labels=None,
                                estimators=[('0',
                                             Pipeline(memory=None,
                                                      steps=[('maxabsscaler',
                                                              MaxAbsScaler(copy=True)),
                                                             ('lightgbmclassifier',
                                                              LightGBMClassifier(boosting_type='gbdt',
                                                                                 class_weight=None,
                                                                                 colsample_bytree=1.0,
                                                                                 importance_type='split',
                                                                                 learning_rate=0.1,
                                                                                 max_depth=-1,
                                                                                 min_child_samples=20,
                                                                                 min_child_weight=0.001,
                                                                                 min_spl...
                                                                                     min_samples_leaf=0.1131578947368421,
                                                                                     min_samples_split=0.2442105263157895,
                                                                                     min_weight_fraction_leaf=0.0,
                                                                                     n_estimators=25,
                                                                                     n_jobs=1,
                                                                                     oob_score=False,
                                                                                     random_state=None,
                                                                                     verbose=0,
                                                                                     warm_start=False))],
                                                      verbose=False))],
                                flatten_transform=None,
                                weights=[0.38461538461538464, 0.23076923076923078,
                                         0.07692307692307693, 0.07692307692307693,
                                         0.07692307692307693, 0.07692307692307693,
                                         0.07692307692307693]))]
```

Test the Model

Load Test Data

For the test data, it should have the same preparation step as the train data. Otherwise it might get failed at the preprocessing step.

Publish and run from REST endpoint

Run the following code to publish the pipeline to your workspace. In your workspace in the portal, you can see metadata for the pipeline including run history and durations. You can also run the pipeline manually from the portal.

Additionally, publishing the pipeline enables a REST endpoint to rerun the pipeline from any HTTP library on any platform.

In [22]:
```
published_pipeline = pipeline_run.publish_pipeline(
    name="Bankmarketing Train", description="Training bankmarketing pipeline", version="1.0")

published_pipeline
```

Out[22]:

Name	Id	Status	Endpoint
Bankmarketing Train	d01b6485-78b6-4063-92f3-be7921794e63	Active	REST Endpoint

Authenticate once again, to retrieve the `auth_header` so that the endpoint can be used

In [23]:
```
from azureml.core.authentication import InteractiveLoginAuthentication

interactive_auth = InteractiveLoginAuthentication()
auth_header = interactive_auth.get_authentication_header()
```

Get the REST url from the endpoint property of the published pipeline object. You can also find the REST url in your workspace in the portal. Build an HTTP POST request to the endpoint, specifying your authentication header. Additionally, add a JSON payload object with the experiment name and the batch size parameter. As a reminder, the process_count_per_node is passed through to ParallelRunStep because you defined it is defined as a PipelineParameter object in the step configuration.

Make the request to trigger the run. Access the Id key from the response dict to get the value of the run id.

In [24]:
```
import requests

rest_endpoint = published_pipeline.endpoint
response = requests.post(rest_endpoint,
                         headers=auth_header,
                         json={"ExperimentName": "pipeline-rest-endpoint"}
                        )
```

In [25]:
```
try:
    response.raise_for_status()
except Exception:
    raise Exception("Received bad response from the endpoint: {}\n"
                    "Response Code: {}\n"
                    "Headers: {}\n"
                    "Content: {}".format(rest_endpoint, response.status_code, response.headers, response.content))
```

Get the REST url from the endpoint property of the published pipeline object. You can also find the REST url in your workspace in the portal. Build an HTTP POST request to the endpoint, specifying your authentication header. Additionally, add a JSON payload object with the experiment name and the batch size parameter. As a reminder, the process_count_per_node is passed through to ParallelRunStep because you defined it is defined as a PipelineParameter object in the step configuration.

Make the request to trigger the run. Access the Id key from the response dict to get the value of the run id.

In [24]:
```
import requests

rest_endpoint = published_pipeline.endpoint
response = requests.post(rest_endpoint,
                         headers=auth_header,
                         json={"ExperimentName": "pipeline-rest-endpoint"}
                        )
```

In [25]:
```
try:
    response.raise_for_status()
except Exception:
    raise Exception("Received bad response from the endpoint: {}\n"
                    "Response Code: {}\n"
                    "Headers: {}\n"
                    "Content: {}".format(rest_endpoint, response.status_code, response.headers, response.content))

run_id = response.json().get('Id')
print('Submitted pipeline run: ', run_id)
```

```
Submitted pipeline run:  44217aa0-72f4-452a-8dd1-58a1760fbae0
```

Use the run id to monitor the status of the new run. This will take another 10-15 min to run and will look similar to the previous pipeline run, so if you don't need to see another pipeline run, you can skip watching the full output.

In [26]:
```
from azureml.pipeline.core.run import PipelineRun
from azureml.widgets import RunDetails

published_pipeline_run = PipelineRun(ws.experiments["pipeline-rest-endpoint"], run_id)
RunDetails(published_pipeline_run).show()
```

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