UDACITY

DISCUSS ON STUDENT HUB

Operationalizing Machine Learning

REVIEW
CODE REVIEW
HISTORY

Meets Specifications

Awesome 👏🏻 👏🏻
Congratulations on passing this project. 🏆 🏆

This project was not easy but you have done it gracefully. This is all because of your hard work and continuous evaluation. But still don't relax, keep exploring and learning from the other references. These projects are just a starting phase of learning these things but there are many more complex topics and concepts out there. So start exploring and keep learning. 💪🏻 💪🏻

Useful Resources

- Benchmark the Endpoint using Apache Benchmark
- Apache Benchmark Documentation
- Swagger Documentation Lesson
- Swagger REST API Documentation homepage

You can also share your project on LinkedIn and ask the audience for a necessary feedback or open the project for anyone to collaborate. This way you will find many interesting connections and engagement with others.

I wish you good luck. Looking forward to your success.
For any queries, you can ask on Knowledge Portal as well.

Stay 🛡 ! Stay Safe

DON'T FORGET TO RATE MY WORK AS PROJECT REVIEWER! YOUR FEEDBACK IS VERY HELPFUL AND APPRECIATED.

Machine Learning Ops Principles

A README file is included in the project root and has:

- An overview of the project
- An Architectural Diagram
- A short description of how to improve the project in the future
- Screenshots required with a short description to demonstrate key steps
- A link to the screencast video on YouTube (or a similar alternative streaming service)
- In case you are unable to provide an audio file, you can include a written description of your script instead of audio, if you prefer. Please include it in your README file.

🔁 An overview of the project

Further Improvement

Overview

- This project is a part Machine Learning Engineer with Microsoft Azure Nanodegree program.
- In this project we implemented end-to-end machine learning project cycle in Azure ML studio. We used Azure ML to create and train the model with AutoML functionality and deploy it.
- We also created a pipeline to create the model, deploy the model and consumed the model.
- Also the end-point URL of the deployed model is exposed to end-user which they can consume it with sample data.

> You have discussed the actual problem that you are solving through this. (Hint: Bank Marketing)

Architectural Diagram

✅ An Architectural Diagram

✅ A short description of how to improve the project in the future

Link to the Demo.

Future Improvement

- We can try to increase the dataset to improve the model.
- We can export this model to ONNX for faster inference.
- We can include deep learning model in order get good model accuracy.

> The data is also imbalanced so you can try manually balancing the data using algorithmic programs.

✅ Screenshots required with a short description to demonstrate key steps

You have provided the screenshots but try to improve the structure.

You can make this section even better by providing h3 headers before each screenhost stating what each screenshot is about. You can also highlight the parts. For example:
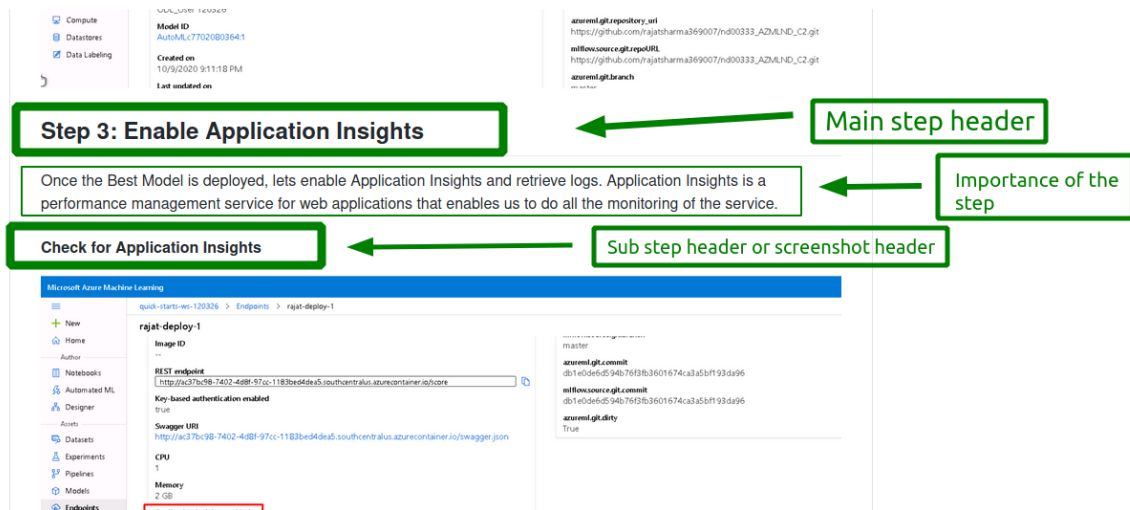
✅ A link to the screencast video on YouTube (or a similar alternative streaming service)

Useful References:

- [Resource for understanding project overview link 1](#)
- [Resource for understanding project overview link 2](#)
- [Azure Automated Machine Learning Concepts](#)

The screencast should meet the following criteria:

- **Screencast is 1-5 minutes in length**
- **Audio is clear and understandable**
- **Video is 1080P or higher with 16:9 aspect ratio**
- **text is readable**

The screencast shows the entire process of the working ML application, including a demonstration of:

- **Working deployed ML model endpoint.**
- **Deployed Pipeline**
- **Available AutoML Model**
- **Successful API requests to the endpoint with a JSON payload**

Screencast is very audible, readable, and informative. Good work!

✅ Screencast is 1-5 minutes in length

✅ Audio is clear and understandable

✅ Video is 1080P or higher with 16:9 aspect ratio

✅ text is readable

✅ Working deployed ML model endpoint.

Available at 3:44

✅ Deployed Pipeline

Available at 3:01

✅ Available AutoML Model

Available at 0:43

✅ Successful API requests to the endpoint with a JSON payload

Available at 3:44

Deploy model in Azure ML Studio

The submission includes screenshots of:

- "Registered Datasets" in ML Studio shows "Bankmarketing" dataset available
- The experiment is shown as completed.

✅ "Registered Datasets" in ML Studio shows "Bankmarketing" dataset available

Home > Datasets

Datasets

Registered datasets   Dataset monitors (preview)

+ Create dataset ∨   ⟳ Refresh   ☆ Unregister

Name	Version	Data source		Created on	Modified on
BankMarketing	1	workspaceblobstore	✔	Apr 13, 2021 12:24 PM	Apr 13, 2021 12:24 PM

✅ The experiment is shown as completed.

Run 3 ✓ Completed

↻ Refresh   ⊗ Cancel

Details   Data guardrails   Models   Outputs + logs   Child runs   Snapshot

Properties	Best model summary
Status ✓ Completed	**Algorithm name** VotingEnsemble
Created Apr 14, 2021 4:00 AM	**Accuracy** 0.91866 ≡ View all o
Started Apr 14, 2021 4:01 AM	**Sampling** 100.00 % ⓘ
Duration 21m 31.50s	**Registered models** No registration yet
Compute target cluster-demo	**Deploy status** No deployment yet

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The submission includes screenshots of:

- Endpoints section in Azure ML Studio, showing that "Application Insights enabled" says "true".
- Logging is enabled by running the provided `logs.py` script
- Swagger runs on localhost showing the HTTP API methods and responses for the model
- `endpoint.py` script runs against the API producing JSON output from the model.
- Apache Benchmark (ab) runs against the HTTP API using authentication keys to retrieve performance results. (optional)

✅ Endpoints section in Azure ML Studio, showing that "Application Insights enabled" says "true".

Key-based authentication enabled
true

Swagger URI
http://3b8c8dd1-a3da-46e0-941e-e2a11c81d804.eastus2.azurecontainer.io/swagger.json

CPU
1.8

Memory
4 GB

Application Insights enabled
true

✅ Logging is enabled by running the provided `logs.py` script

✅ ~~Logging is enabled by running the provided `logs.py` script~~

```
/usr/sbin/nginx: /azureml-envs/azureml_8e5a5a51349877e7d47c6a2872e0ebfd/lib/libcrypto.so.1.0.0: no version information available (requi
 /usr/sbin/nginx)
/usr/sbin/nginx: /azureml-envs/azureml_8e5a5a51349877e7d47c6a2872e0ebfd/lib/libcrypto.so.1.0.0: no version information available (requi
 /usr/sbin/nginx)
/usr/sbin/nginx: /azureml-envs/azureml_8e5a5a51349877e7d47c6a2872e0ebfd/lib/libssl.so.1.0.0: no version information available (required
sr/sbin/nginx)
/usr/sbin/nginx: /azureml-envs/azureml_8e5a5a51349877e7d47c6a2872e0ebfd/lib/libssl.so.1.0.0: no version information available (required
sr/sbin/nginx)
/usr/sbin/nginx: /azureml-envs/azureml_8e5a5a51349877e7d47c6a2872e0ebfd/lib/libssl.so.1.0.0: no version information available (required
sr/sbin/nginx)
EdgeHubConnectionString and IOTEDGE_IOTHUBHOSTNAME are not set. Exiting...
2021-04-13T23:04:12,947946400+00:00 - iot-server/finish 1 0
2021-04-13T23:04:12,952494100+00:00 - Exit code 1 is normal. Not restarting iot-server.
Starting gunicorn 19.9.0
Listening at: http://127.0.0.1:31311 (72)
Using worker: sync
worker timeout is set to 300
Booting worker with pid: 101
SPARK_HOME not set. Skipping PySpark Initialization.
Generating new fontManager, this may take some time...        No traceback
Initializing logger
2021-04-13 23:04:14,447 | root | INFO | Starting up app insights client
2021-04-13 23:04:14,448 | root | INFO | Starting up request id generator
2021-04-13 23:04:14,448 | root | INFO | Starting up app insight hooks
2021-04-13 23:04:14,448 | root | INFO | Invoking user's init function
2021-04-13 23:04:17,818 | azureml.core | WARNING | Failure while loading azureml_run_type_providers. Failed to load entrypoint automl =
ml.train.automl.run:AutoMLRun._from_run_dto with exception cannot import name 'RunType'.
Failure while loading azureml_run_type_providers. Failed to load entrypoint automl = azureml.train.automl.run:AutoMLRun._from_run_dto w
ception cannot import name 'RunType'.
2021-04-13 23:04:18,231 | root | INFO | Users's init has completed successfully
2021-04-13 23:04:18,236 | root | INFO | Skipping middleware: dbg_model_info as it's not enabled.
2021-04-13 23:04:18,236 | root | INFO | Skipping middleware: dbg_resource_usage as it's not enabled.
```

✅ Swagger runs on localhost showing the HTTP API methods and responses for the model

✅ `endpoint.py` script runs against the API producing JSON output from the model.

> 1. We will modify the endpoint url and key in endpoint.py and run it to check the output.

```
(base) →  starter_files git:(master) ✗ python endpoint.py
{"result": ["no", "no"]}
(base) →  starter_files git:(master) ✗ ▉
```

✅ Apache Benchmark (ab) runs against the HTTP API using authentication keys to retrieve performance results. (optional)

```
HTML transferred:       320 bytes
Requests per second:    1.28 [#/sec] (mean)
Time per request:       783.314 [ms] (mean)
Time per request:       783.314 [ms] (mean, across all concurrent requests)
Transfer rate:          0.32 [Kbytes/sec] received
                        1.32 kb/s sent
                        1.64 kb/s total

Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:      201  300  253.1    207   1013
Processing:   466  483   15.3    487    516
Waiting:      465  482   14.3    484    511
Total:        668  783  264.6    695   1529

Percentage of the requests served within a certain time (ms)
  50%    695
  66%    696
  75%    731
  80%    793
  90%   1529
  95%   1529
```

Excellent work! You have also completed the optional part of benchmarking the deployed endpoint.
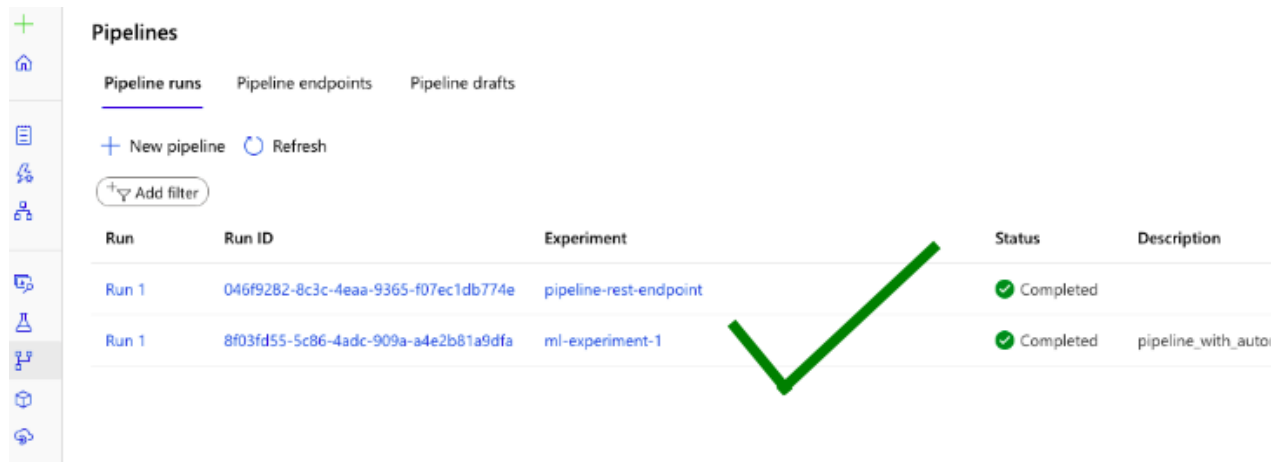
Useful Resources

- Benchmark the Endpoint using Apache Benchmark
- Apache Benchmark Documentation
- Swagger Documentation Lesson
- Swagger REST API Documentation homepage

Publish an ML Pipeline

The submission includes screenshots of:

- The pipeline section of Azure ML studio, showing that the pipeline has been created
- The Bankmarketing dataset with the AutoML module
- The "Published Pipeline overview", showing a REST endpoint and a status of ACTIVE

✅ The pipeline section of Azure ML studio, showing that the pipeline has been created
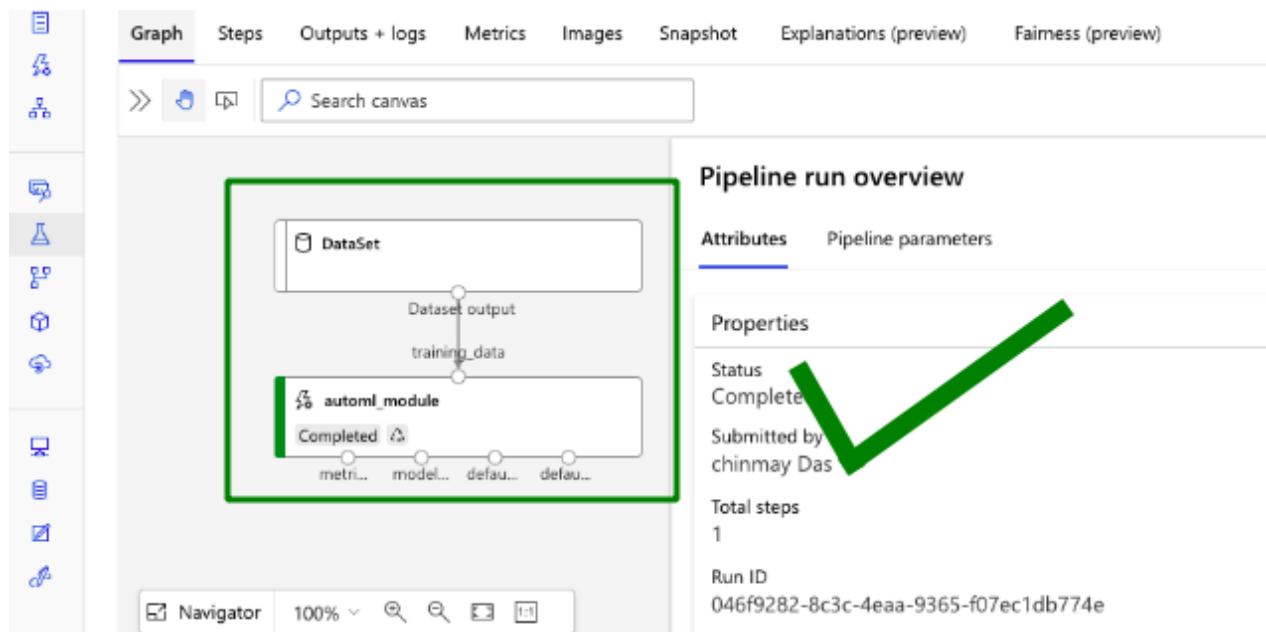
Pipelines

Pipeline runs   Pipeline endpoints   Pipeline drafts

+ New pipeline   ⟳ Refresh

Add filter

Run	Run ID	Experiment	Status	Description
Run 1	046f9282-8c3c-4eaa-9365-f07ec1db774e	pipeline-rest-endpoint	✓ Completed	
Run 1	8f03fd55-5c86-4adc-909a-a4e2b81a9dfa	ml-experiment-1	✓ Completed	pipeline_with_auto

✅ The Bankmarketing dataset with the AutoML module

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

» ✋ ⬚   🔍 Search canvas

DataSet

Dataset output

training_data

automl_module

Completed ♻

metri...   model...   defau...   defau...

Navigator   100% ⌄   ⊕ ⊖ ⊡ 1:1

Pipeline run overview

Attributes   Pipeline parameters

Properties
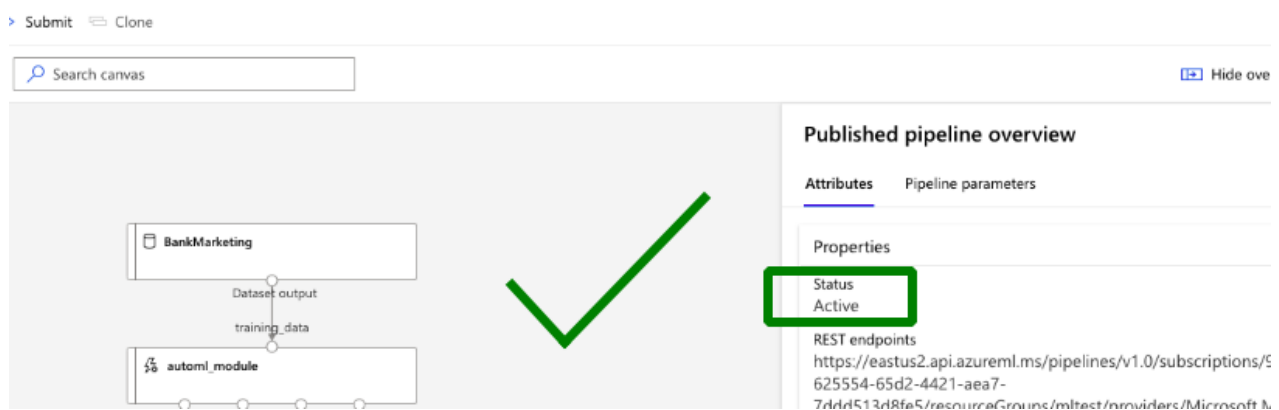
Status
Complete

Submitted by
chinmay Das

Total steps
1

Run ID
046f9282-8c3c-4eaa-9365-f07ec1db774e

✅ The "Published Pipeline overview", showing a REST endpoint and a status of ACTIVE

> Submit   ⊖ Clone

🔍 Search canvas   ⊞ Hide ove

BankMarketing

Dataset output

training_data

automl_module

Published pipeline overview

Attributes   Pipeline parameters

Properties

Status
Active

REST endpoints
https://eastus2.api.azureml.ms/pipelines/v1.0/subscriptions/9
625554-65d2-4421-aea7-
7ddd513d8fe5/resourceGroups/mltest/providers/Microsoft.N

chineLearningServices/workspaces/mltest/PipelineRuns/Pipel
eSubmit/ae0c5fe3-88e6-4aff-a13f-6b1703d076ea

Updated by
chinmav Das

- A screenshot of the Jupyter Notebook is included in the submission showing the "Use RunDetails Widget" with the step runs

✅ A screenshot of the Jupyter Notebook is included in the submission showing the "Use RunDetails Widget" with the step runs

The submission includes screenshots of:

- ML studio showing the pipeline endpoint as Active
- ML studio showing the scheduled run

✅ ML studio showing the pipeline endpoint as Active

⬇ DOWNLOAD PROJECT

RETURN TO PATH