



DESPLIEGUE DE MODELO DE ML EN AZURE

ESPECIALIZACIÓN EN ANALÍTICA – UDEA
DATA STREAMING Y SERVICIOS EN LA NUBE

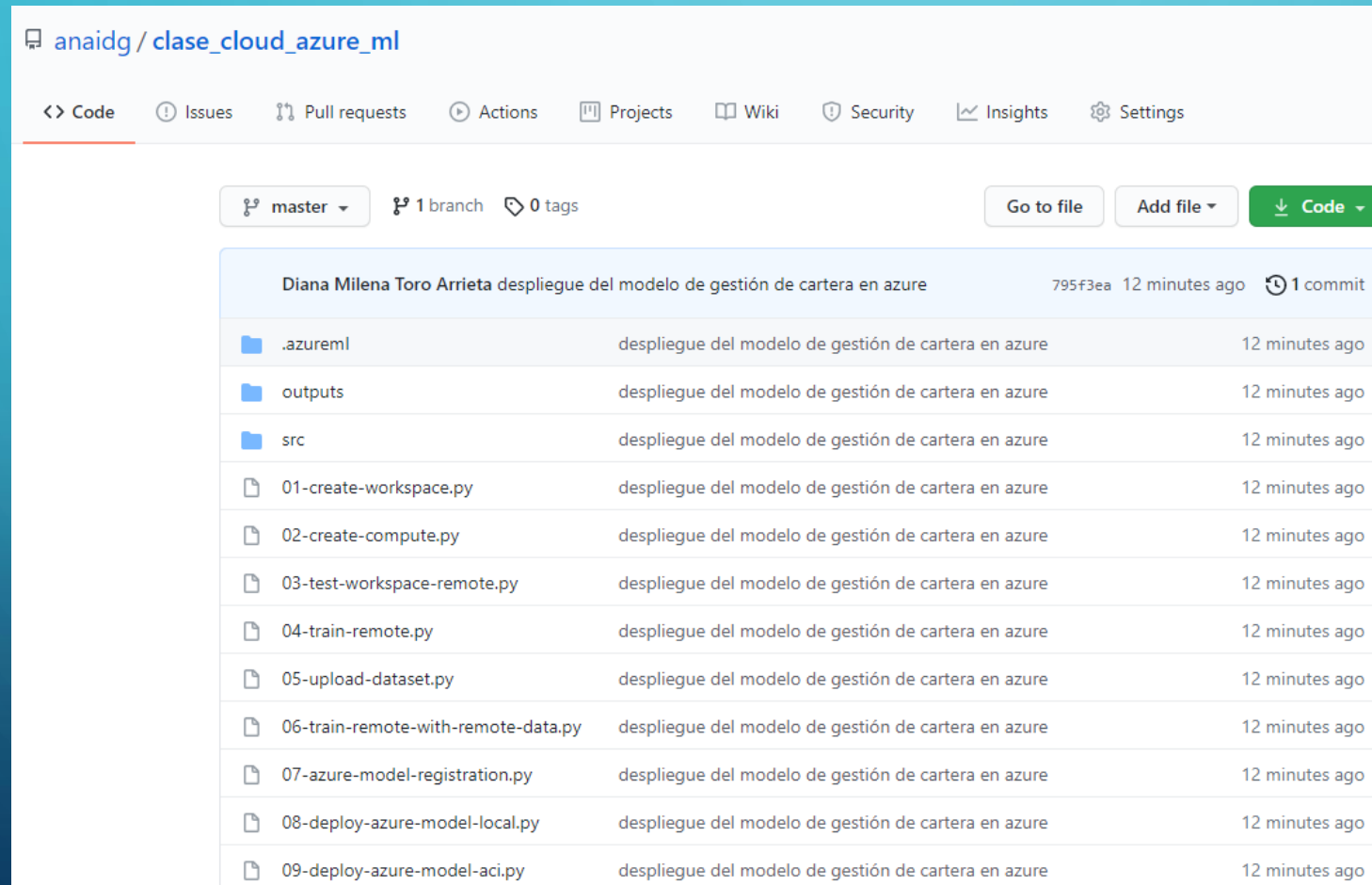
POR :

IVONNE ORTEGA ECHEVERRY
DIANA MILENA TORO ARRIETA

MODELO

- Se hace entrenamiento de uno de los modelos usados para el proyecto de grado de la especialización en Analítica y ciencia de datos de la universidad de Antioquia. El cual consiste en predecir la probabilidad de que una empresa entre en mora el siguiente mes ejecutada la consulta.

- El repositorio del código se encuentra en:
https://github.com/anaidg/clase_cloud_azure_ml.git



The screenshot shows the GitHub interface for the repository 'anaidg/clase_cloud_azure_ml'. The top navigation bar includes links for Code, Issues, Pull requests, Actions, Projects, Wiki, Security, Insights, and Settings. Below the navigation bar, the repository name is displayed, followed by a dropdown for the 'master' branch, indicating 1 branch and 0 tags. There are buttons for 'Go to file', 'Add file', and a green 'Code' button with a download icon. The main content area shows a list of commits. The most recent commit is by 'Diana Milena Toro Arrieta' with the message 'despliegue del modelo de gestión de cartera en azure', commit hash '795f3ea', and timestamp '12 minutes ago'. Below this, a table lists the files included in the commit.

File	Commit Message	Time
.azureml	despliegue del modelo de gestión de cartera en azure	12 minutes ago
outputs	despliegue del modelo de gestión de cartera en azure	12 minutes ago
src	despliegue del modelo de gestión de cartera en azure	12 minutes ago
01-create-workspace.py	despliegue del modelo de gestión de cartera en azure	12 minutes ago
02-create-compute.py	despliegue del modelo de gestión de cartera en azure	12 minutes ago
03-test-workspace-remote.py	despliegue del modelo de gestión de cartera en azure	12 minutes ago
04-train-remote.py	despliegue del modelo de gestión de cartera en azure	12 minutes ago
05-upload-dataset.py	despliegue del modelo de gestión de cartera en azure	12 minutes ago
06-train-remote-with-remote-data.py	despliegue del modelo de gestión de cartera en azure	12 minutes ago
07-azure-model-registration.py	despliegue del modelo de gestión de cartera en azure	12 minutes ago
08-deploy-azure-model-local.py	despliegue del modelo de gestión de cartera en azure	12 minutes ago
09-deploy-azure-model-aci.py	despliegue del modelo de gestión de cartera en azure	12 minutes ago

CREACIÓN DEL AMBIENTE DE TRABAJO EN ANACONDA DESDE UN ARCHIVO YAMEL

```
EXPLORER
...
! sklearn-env-amlproject.yml X 01-create-workspace.py 2

OPEN EDITORS
X ! sklearn-env-amlproject.yml .az...
01-create-workspace.py 2

AZURE-WORKSPACE
.azureml
condaenv.ucs8b9zn.requirements....
! sklearn-env-amlproject.yml
data
dataset_esp.txt
outputs

.azureml > ! sklearn-env-amlproject.yml
1 name: sklearn-env-amlproject
2 dependencies:
3 - python=3.8
4 - scikit-learn
5 - numpy
6 - pip
7
8 - pip:
9 | | | - azureml-defaults
```

```
d:\azure-workspace\.azureml> conda env create -f sklearn-env-amlproject.yml
Collecting package metadata (repodata.json): done
Solving environment: done

Downloading and Extracting Packages
numpy-base-1.20.2 | 4.2 MB | ##### 100%
python-3.8.10 | 15.9 MB | ##### 100%
scikit-learn-0.24.2 | 4.8 MB | ##### 100%
pip-21.1.1 | 1.8 MB | ##### 100%
numpy-1.20.2 | 23 KB | ##### 100%
Preparing transaction: done
Verifying transaction: done
Executing transaction: \
```

Windows 64-bit packages of scikit-learn can be accelerated using scikit-learn-intelex.
More details are available here: <https://intel.github.io/scikit-learn-intelex>

For example:

```
$ conda install scikit-learn-intelex
$ python -m sklearn my_application.py
```

```
done
Installing pip dependencies: -
```

```
d:\azure-workspace\.azureml> conda env list
# conda environments:
#
base * D:\Usuarios\diantoar\Anaconda3
project D:\Usuarios\diantoar\Anaconda3\envs\project
pytorch-local-env D:\Usuarios\diantoar\Anaconda3\envs\pytorch-local-env
sklearn-env-amlproject D:\Usuarios\diantoar\Anaconda3\envs\sklearn-env-amlproject
sklearn-local-env D:\Usuarios\diantoar\Anaconda3\envs\sklearn-local-env
```

CREACIÓN DEL ESPACIO DE TRABAJO EN AZURE

```
cloud\azure-workspace> az login
The default web browser has been opened at https://login.microsoftonline.com/common/oauth2/authorize. Please continue the login in the web browser. If no web browser is available or if the web browser fails to open, use device code flow with 'az login --use-device-code'.
You have logged in. Now let us find all the subscriptions to which you have access...
[
  {
    "cloudName": "AzureCloud",
    "homeTenantId": "99e1e721-7184-498e-8aff-b2ad4e53c1c2",
    "id": "cb1eac41-cfa3-4fb0-b998-d0860b693244",
    "isDefault": true,
    "managedByTenants": [],
    "name": "Azure subscription 1",
    "state": "Enabled",
    "tenantId": "99e1e721-7184-498e-8aff-b2ad4e53c1c2",
    "user": {
      "name": "diana.toro@udea.edu.co",
      "type": "user"
    }
  }
]
```

```
01-create-workspace.py > ...
1 # tutorial/01-create-workspace.py
2 from azureml.core.authentication import InteractiveLoginAuthentication
3 from azureml.core import Workspace
4
5 interactive_auth = InteractiveLoginAuthentication(tenant_id="99e1e721-7184-498e-8aff-b2ad4e53c1c2")
6 ws = Workspace.create(name='azure-ml-project',
7                       subscription_id='cb1eac41-cfa3-4fb0-b998-d0860b693244',
8                       resource_group='rg_machine_learning',
9                       create_resource_group=False,
10                      location='eastus2',
11                      auth=interactive_auth
12                      )
13
14 # write out the workspace details to a configuration file: .azureml/config.json
15 ws.write_config(path='.azureml')
```

Microsoft Azure | Search resources, services, and docs (G+)

Home > rg_machine_learning Resource group

Search (Ctrl+/) << + Add Edit columns Delete resource group Refresh Export to CSV Open query Assign tags Move Delete

Overview

Activity log

Access control (IAM)

Tags

Events

Settings

Deployments

Security

Policies

Properties

Essentials

Subscription (change): Azure subscription 1

Subscription ID: cb1eac41-cfa3-4fb0-b998-d0860b693244

Location: East US 2

Tags (change): createTime: 1621215231.9033513 creationSource: azureml-sdk

Filter for any field... Type == all Location == all Add filter

Showing 1 to 13 of 13 records. Show hidden types

Name	Type	Location
azure-ml	Machine learning	East US 2
azure-ml-project	Machine learning	East US 2

GRUPO DE RECURSOS CREADOS EN LA CUENTA DE AZURE

The screenshot shows the Microsoft Azure portal interface. The top navigation bar includes the Microsoft Azure logo, an Upgrade button, a search bar, and user information for diana.toro@udea.edu.co. The left sidebar shows the 'Resource groups' section with a list of groups, including 'rg_machine_learning'. The main content area displays the details for the 'rg_machine_learning' resource group. The 'Essentials' section shows the subscription 'Azure subscription 1' with ID 'cb1eac41-cfa3-4fb0-b998-d0860b693244' and location 'East US 2'. Below this, a table lists the resources within the group:

Name	Type	Location
azure-ml	Machine learning	East US 2
azuremlinsightsfb47ccd67	Application Insights	East US 2
azuremlkeyvaultd59d570b7	Key vault	East US 2
azuremlstorage6861911742	Storage account	East US 2
b48acc54bd4242658a50428ec05adff1	Container registry	East US 2

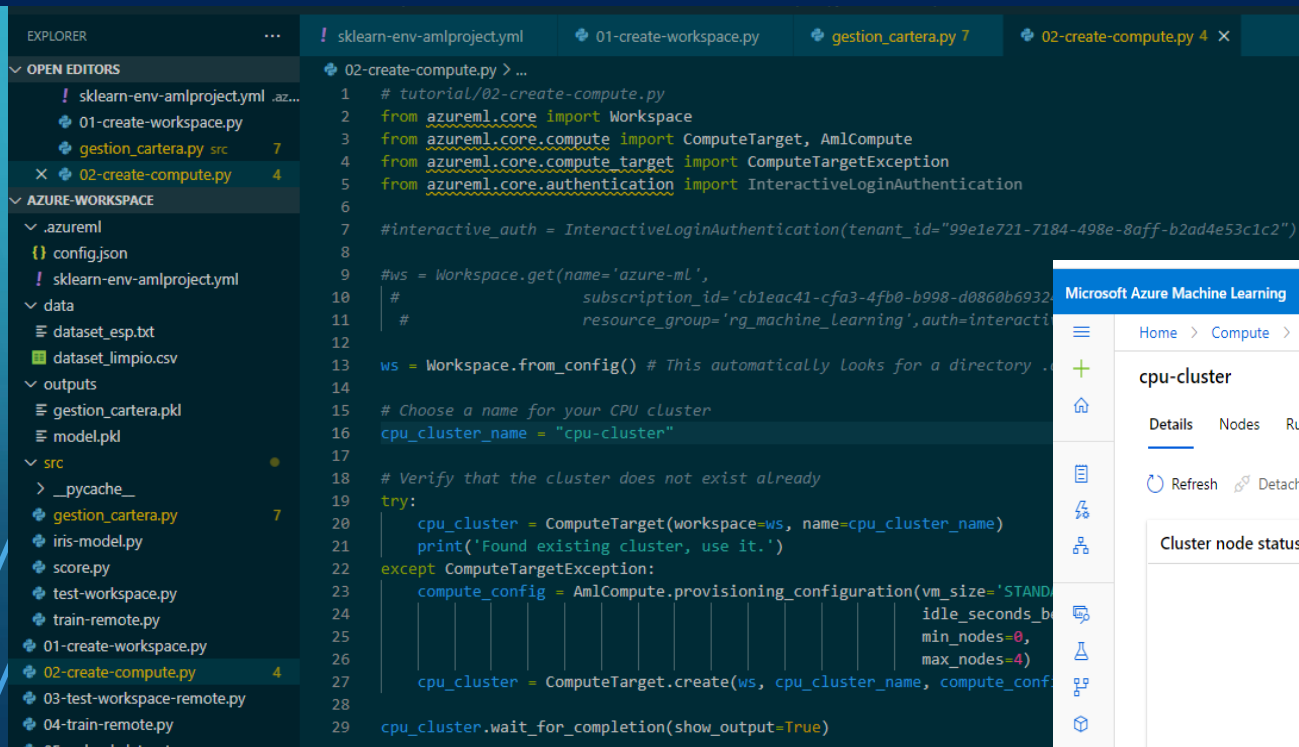
ENTRENAMIENTO DEL MODELO Y GENERACIÓN DEL ARCHIVO .PKL QUE CONTIENE EL MODELO ENTRENADO

[illegible]

CREAMOS EL CLUSTER O MAQUINA PARA QUE CORRA EL MODELO

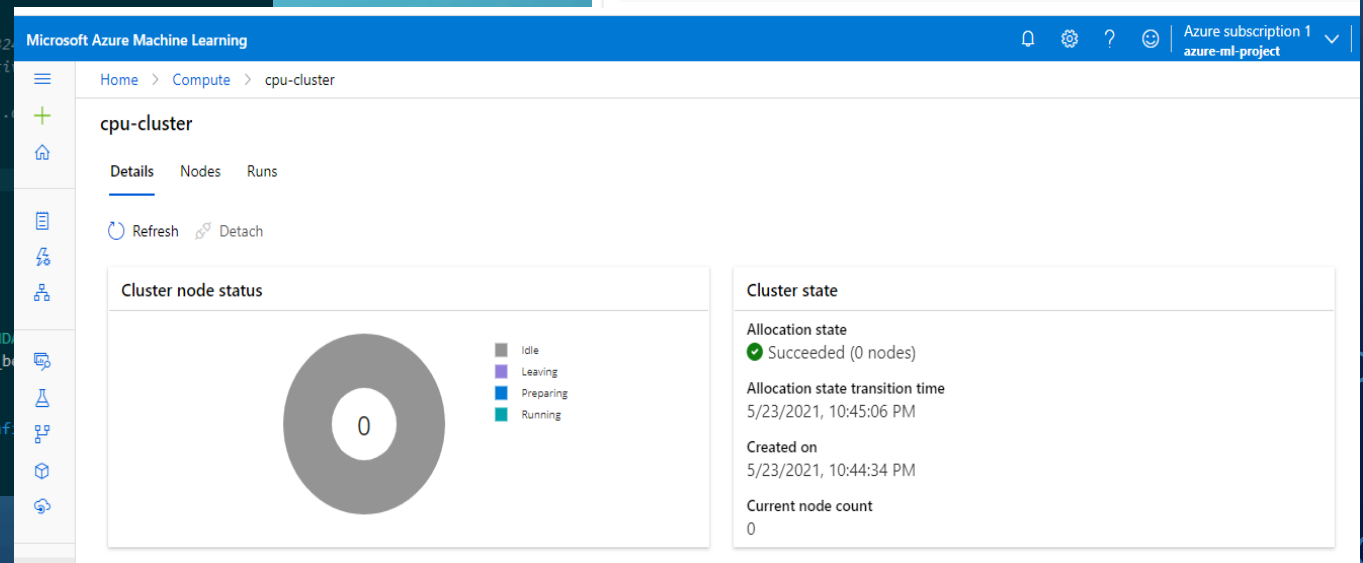
```
(sklearn-env-amlproject) PS D:\Usuarios\diantoar\OneDrive - Seguros Suramericana, S.A\Desktop\dtoro\especializacion Analisis de datos\cloud\azure-workspace> python 02-create-compute.py
Warning: Falling back to use azure cli login credentials.
If you run your code in unattended mode, i.e., where you can't give a user input, then we recommend to use ServicePrincipalAuthentication or MsiAuthentication.
Please refer to aka.ms/aml-notebook-auth for different authentication mechanisms in azureml-sdk.
Creating.....
SucceededProvisioning operation finished, operation "Succeeded"
Succeeded
AmlCompute wait for completion finished

Minimum number of nodes requested have been provisioned
(sklearn-env-amlproject) PS D:\Usuarios\diantoar\OneDrive - Seguros Suramericana, S.A\Desktop\dtoro\especializacion Analisis de datos\cloud\azure-workspace>
```



```
1 # tutorial/02-create-compute.py
2 from azureml.core import Workspace
3 from azureml.core.compute import ComputeTarget, AmlCompute
4 from azureml.core.compute_target import ComputeTargetException
5 from azureml.core.authentication import InteractiveLoginAuthentication
6
7 #interactive_auth = InteractiveLoginAuthentication(tenant_id="99e1e721-7184-498e-8aff-b2ad4e53c1c2")
8
9 #ws = Workspace.get(name='azure-ml',
10 #                  subscription_id='cb1eac41-cfa3-4fb0-b998-d0860b69324',
11 #                  #
12 #                  resource_group='rg_machine_learning',auth=interacti
13
14 ws = Workspace.from_config() # This automatically looks for a directory .
15
16 # Choose a name for your CPU cluster
17 cpu_cluster_name = "cpu-cluster"
18
19 # Verify that the cluster does not exist already
20 try:
21     cpu_cluster = ComputeTarget(workspace=ws, name=cpu_cluster_name)
22     print('Found existing cluster, use it.')
23 except ComputeTargetException:
24     compute_config = AmlCompute.provisioning_configuration(vm_size='STANDARD_DS1_V2',
25                                                         idle_seconds_before_timeout=120,
26                                                         min_nodes=0,
27                                                         max_nodes=4)
28     cpu_cluster = ComputeTarget.create(ws, cpu_cluster_name, compute_conf
29
30 cpu_cluster.wait_for_completion(show_output=True)
```

Compute			
Name	Type	Provisioning state	Created on
cpu-cluster	Machine Learning com...	✔ Succeeded (0 nodes)	May 23, 2021 10:44 PM



Microsoft Azure Machine Learning

Home > Compute > cpu-cluster

cpu-cluster

Details Nodes Runs

Refresh Detach

Cluster node status

0

Legend: Idle, Leaving, Preparing, Running

Cluster state

Allocation state
✔ Succeeded (0 nodes)

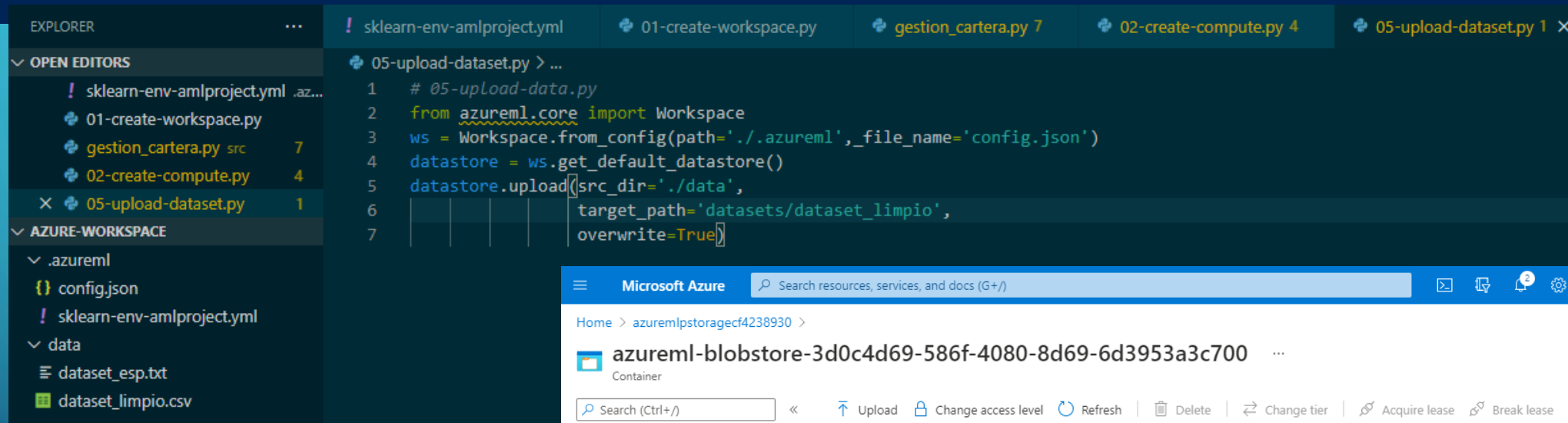
Allocation state transition time
5/23/2021, 10:45:06 PM

Created on
5/23/2021, 10:44:34 PM

Current node count
0

CARGA DEL DATA SET EN AZURE

```
(sklearn-env-amlproject) PS D:\Usuarios\diantoar\OneDrive - Seguros Suramericana, S.A\Desktop\dtoro\especializacion Analisis de datos\cloud\azure-workspace> python 05-upload-dataset.py
Warning: Falling back to use azure cli login credentials.
If you run your code in unattended mode, i.e., where you can't give a user input, then we recommend to use ServicePrincipalAuthentication or MsiAuthentication.
Please refer to aka.ms/aml-notebook-auth for different authentication mechanisms in azureml-sdk.
Uploading an estimated of 2 files
Uploading ./data/dataset_limpio.csv
Uploading ./data/dataset_limpio.csv, 1 files out of an estimated total of 2
Uploading ./data/dataset_esp.txt
Uploading ./data/dataset_esp.txt, 2 files out of an estimated total of 2
Uploaded 2 files
(sklearn-env-amlproject) PS D:\Usuarios\diantoar\OneDrive - Seguros Suramericana, S.A\Desktop\dtoro\especializacion Analisis de datos\cloud\azure-workspace>
```



EXPLORER

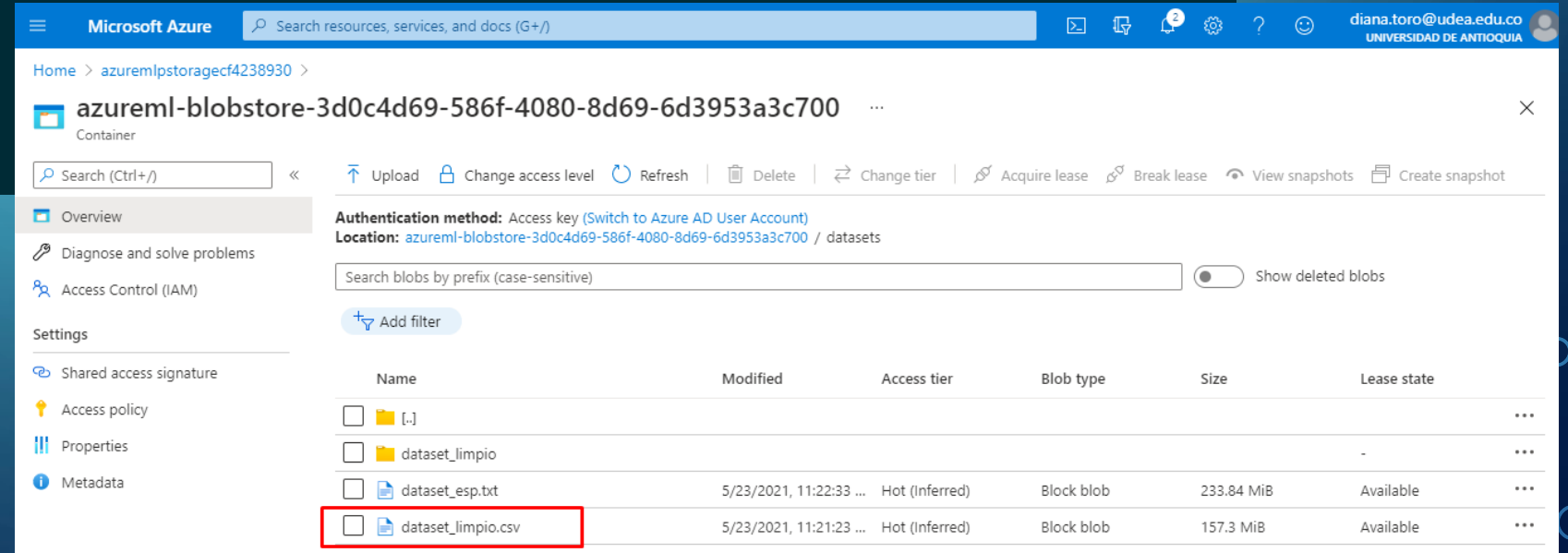
OPEN EDITORS

- ! sklearn-env-amlproject.yml .az...
- 01-create-workspace.py
- gestion_cartera.py src 7
- 02-create-compute.py 4
- X 05-upload-dataset.py 1

AZURE-WORKSPACE

- .azureml
 - config.json
 - ! sklearn-env-amlproject.yml
- data
 - dataset_esp.txt
 - dataset_limpio.csv

```
1 # 05-upload-data.py
2 from azureml.core import Workspace
3 ws = Workspace.from_config(path='./.azureml', _file_name='config.json')
4 datastore = ws.get_default_datastore()
5 datastore.upload(src_dir='./data',
6                 target_path='datasets/dataset_limpio',
7                 overwrite=True)
```



Microsoft Azure

Search resources, services, and docs (G+)

Home > azuremlstorageecf4238930 >

azureml-blobstore-3d0c4d69-586f-4080-8d69-6d3953a3c700

Container

Search (Ctrl+/)

Upload Change access level Refresh Delete Change tier Acquire lease Break lease View snapshots Create snapshot

Authentication method: Access key (Switch to Azure AD User Account)

Location: azureml-blobstore-3d0c4d69-586f-4080-8d69-6d3953a3c700 / datasets

Search blobs by prefix (case-sensitive)

Show deleted blobs

Add filter

Name	Modified	Access tier	Blob type	Size	Lease state
[.]					...
dataset_limpio					...
dataset_esp.txt	5/23/2021, 11:22:33 ...	Hot (Inferred)	Block blob	233.84 MiB	Available
dataset_limpio.csv	5/23/2021, 11:21:23 ...	Hot (Inferred)	Block blob	157.3 MiB	Available

REGISTRO DEL MODELO EN AZURE

```
(sklearn-env-amlproject) PS D:\Usuarios\diantoar\OneDrive - Seguros Suramericana, S.A\Desktop\dtoro\especialización Analisis de datos\cloud\azure-workspace> python .\07-azure-model-registration.py
Warning: Falling back to use azure cli login credentials.
If you run your code in unattended mode, i.e., where you can't give a user input, then we recommend to use ServicePrincipalAuthentication or MsiAuthentication.
Please refer to aka.ms/aml-notebook-auth for different authentication mechanisms in azureml-sdk.
Registering model gestion_cartera_model
gestion_cartera_model gestion_cartera_model:1 1
(sklearn-env-amlproject) PS D:\Usuarios\diantoar\OneDrive - Seguros Suramericana, S.A\Desktop\dtoro\especialización Analisis de datos\cloud\azure-workspace>
```

```
! sklearn-env-amlproject.yml .az...
01-create-workspace.py
gestion_cartera.py src 7
02-create-compute.py 4
05-upload-dataset.py 1
07-azure-model-registrati... 2

AZURE-WORKSPACE
.azureml
config.json
sklearn-env-amlproject.yml
data
dataset_esp.txt
dataset_limpio.csv
outputs
gestion_cartera.pkl
model.pkl
src
__pycache__
gestion_cartera.py 7
score.py
01-create-workspace.py
02-create-compute.py 4
03-test-workspace-remote.py
04-train-remote.py
05-upload-dataset.py 1
06-train-remote-with-remote-data...
07-azure-model-registration.py 2
```

```
07-azure-model-registration.py > ...
1 # 07-model-registration-azure.py
2 from azureml.core import Workspace
3 from azureml.core import Model
4
5 if __name__ == "__main__":
6     ws = Workspace.from_config(path='./.azureml', _file_name='config.json')
7
8     model = Model.register(model_name='gestion_cartera_model',
9                           tags={'area': 'udea_training'},
10                          model_path='outputs/gestion_cartera.pkl',
11                          workspace = ws)
12     print(model.name, model.id, model.version, sep='\t')
```

Microsoft Azure Machine Learning

Home > Models

Model List

+ Register model Delete Deploy Refresh Edit columns Reset view

Search

Created on Created by All filters Clear all

Showing 1-1 of 1 models

Page size: 25

Name	Version	Experiment	Run ID	Created on	Tags	Properties
gestion_cartera_model	1			May 23, 2021 11:10 PM	area : udea_training	...

ENTRENAMIENTO DEL MODELO EN AZURE

day1-experiment-train-data-remote

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

0

Queued

0

0

Other

0

Duration (s)

741

740.5

740

Add a new chart



Show only selected rows (1 selected)

Run Run ID

Run 1... day1-experiment-train-data-remote_1

Microsoft Azure Machine Learning

Home > Experiments > day1-experiment-train-data-remote > Run 1622436252

Run 1622436252 Completed

Refresh Connect to compute Resubmit Cancel Download all Enable log streaming Word wrap

Details Metrics Images Child runs Outputs + logs Snapshot Explanations (preview) Fairness (preview) Monitoring (preview)



azureml-logs

55_azureml-execution-tvmps_1e1fe8a5e945a12...

65_job_prep-tvmps_1e1fe8a5e945a12bc09c228...

70_driver_log.txt

75_job_post-tvmps_1e1fe8a5e945a12bc09c228...

process_info.json

process_status.json

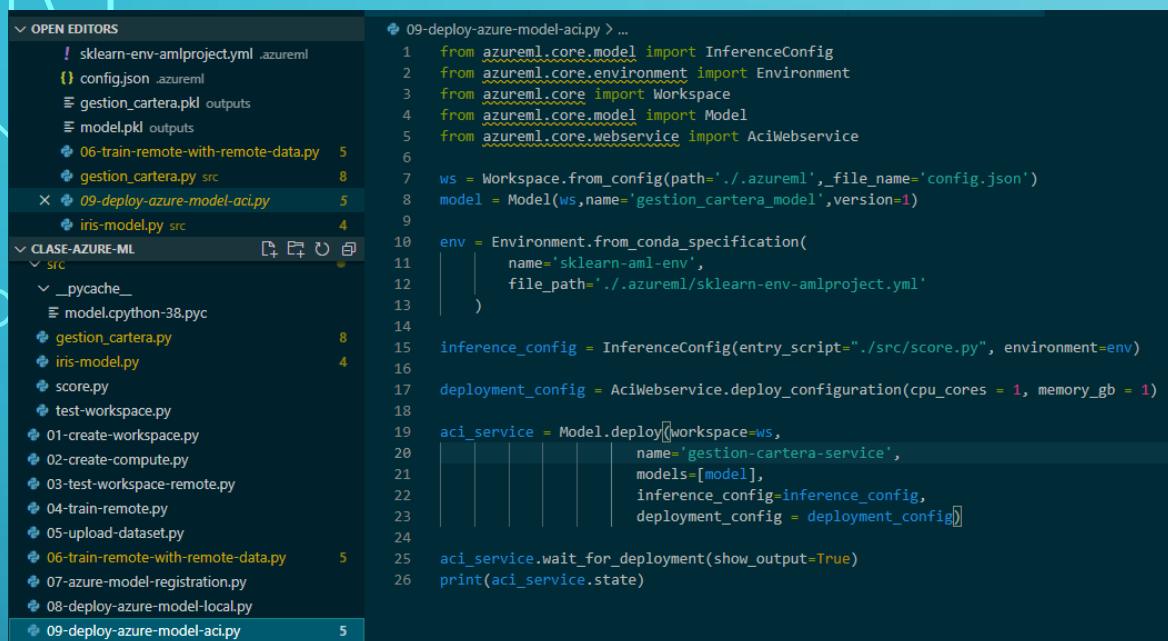
logs

70_driver_log.txt

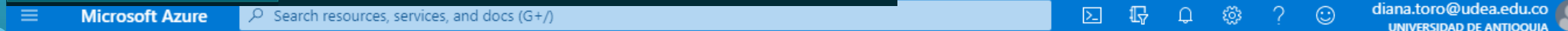
```
194 [CV] END Classifier__max_depth=6, Classifier__max_features=16, Classifier__n_estimators=10; total time:
195 [CV] END Classifier__max_depth=6, Classifier__max_features=16, Classifier__n_estimators=10; total time:
196 [CV] END Classifier__max_depth=6, Classifier__max_features=16, Classifier__n_estimators=10; total time:
197 Mejor score: 0.7029511782056244
198
199
200 [2021-05-31T04:56:41.652070] The experiment completed successfully. Finalizing run...
201 Cleaning up all outstanding Run operations, waiting 900.0 seconds
202 1 items cleaning up...
203 Cleanup took 0.06475138664245605 seconds
204 [2021-05-31T04:56:41.971350] Finished context manager injector.
205 2021/05/31 04:56:43 Attempt 1 of http call to http://10.0.0.4:16384/sendlogstoartifacts/status
206 2021/05/31 04:56:43 Not exporting to RunHistory as the exporter is either stopped or there is no data.
207 Stopped: false
208 OriginalData: 2
209 FilteredData: 0.
210 2021/05/31 04:56:43 Process Exiting with Code: 0
211 2021/05/31 04:56:43 All App Insights Logs was send successfully
212
```

CREACIÓN DEL SERVICIO Y DESPLIEGUE EN AZURE

En este paso se crea el container y se crea el servicio



```
09-deploy-azure-model-aci.py > ...
1  from azureml.core.model import InferenceConfig
2  from azureml.core.environment import Environment
3  from azureml.core import Workspace
4  from azureml.core.model import Model
5  from azureml.core.webservice import AciWebservice
6
7  ws = Workspace.from_config(path='./azureml', _file_name='config.json')
8  model = Model(ws, name='gestion_cartera_model', version=1)
9
10 env = Environment.from_conda_specification(
11     name='sklearn-aml-env',
12     file_path='./azureml/sklearn-env-amlproject.yml'
13 )
14
15 inference_config = InferenceConfig(entry_script="./src/score.py", environment=env)
16
17 deployment_config = AciWebservice.deploy_configuration(cpu_cores = 1, memory_gb = 1)
18
19 aci_service = Model.deploy(workspace=ws,
20                             name='gestion-cartera-service',
21                             models=[model],
22                             inference_config=inference_config,
23                             deployment_config = deployment_config)
24
25 aci_service.wait_for_deployment(show_output=True)
26 print(aci_service.state)
```



Home > rg_machine_learning >

gestion-cartera-service-aU0MPW9YgECNaW05U6PHAA ⚙️ ...
Container instances

Search (Ctrl+/) ⏪ ⏩ Start ⏻ Restart ⏹ Stop 🗑 Delete ↻ Refresh

Overview

Activity log

Access control (IAM)

Tags

Settings

Containers

Identity

Essentials

Resource group (change) : rg_machine_learning

Status : Running

Location : East US 2

Subscription (change) : Azure subscription 1

Subscription ID : cb1eac41-cfa3-4fb0-b998-d0860b693244

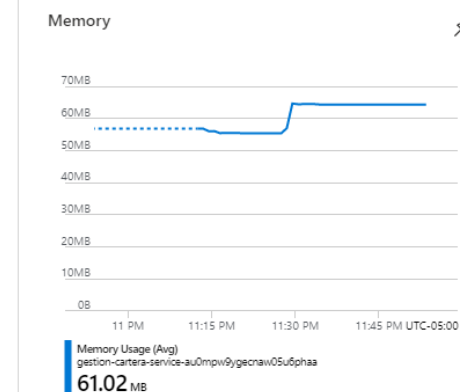
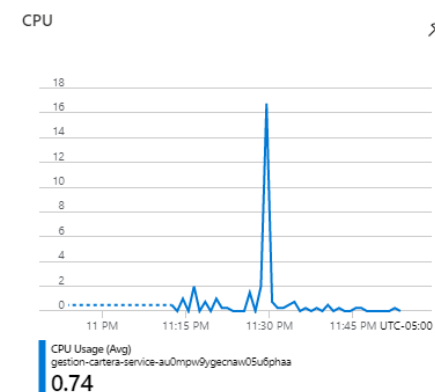
Tags (change) : EmittingService : Machine Learning service

OS type

IP address (Public)

FQDN

Container count



SERVICIO DESPLEGADO EN AZURE COMO SERVICIO

Endpoints

Real-time endpoints

Pipeline endpoints

+ Create (preview) Delete Refresh Edit columns Reset view

Showing 1-1 endpoints

Name	Description	Created on	Created by	Updated on ↓	Compute type
gestion-cartera-service		May 30, 2021 11:03 PM	diana toro	May 30, 2021 11:03 PM	Container instar

gestion-cartera-service

Details Test Consume Deployment logs

Attributes

Service ID
gestion-cartera-service

Description
--

Deployment state
Unhealthy ⓘ

Compute type
Container instance

Created by
diana toro

Model ID
[gestion_cartera_model:1](#)

Created on
5/30/2021 11:03:27 PM

Last updated on
5/30/2021 11:03:27 PM

Image ID
--

REST endpoint

<http://a036d2d2-d790-4c36-9506-41dbcce103a1.eastus2.azurecontainer.io/score>

PRUEBA DEL SERVICIO CON POSTMAN

http://a036d2d2-d790-4c36-9506-41dbcce103a1.eastus2.azurecontainer.io/score

POST http://a036d2d2-d790-4c36-9506-41dbcce103a1.eastus2.azurecontainer.io/score

Params Authorization Headers (8) Body Pre-request Script Tests Settings Cookies Beautify

none form-data x-www-form-urlencoded raw binary GraphQL JSON

```
21 .....4600.0,  
22 .....877803.0,  
23 .....877803.0,  
24 .....0.0,  
25 .....0.522,  
26 .....0.522  
27 .....]  
28 }
```

Body Cookies Headers (7) Test Results Status: 200 OK Time: 109 ms Size: 319 B Save Response

Pretty Raw Preview Visualize JSON

```
1 {"prediction": "NO MORA", "probability": 0.668389525338331}
```