

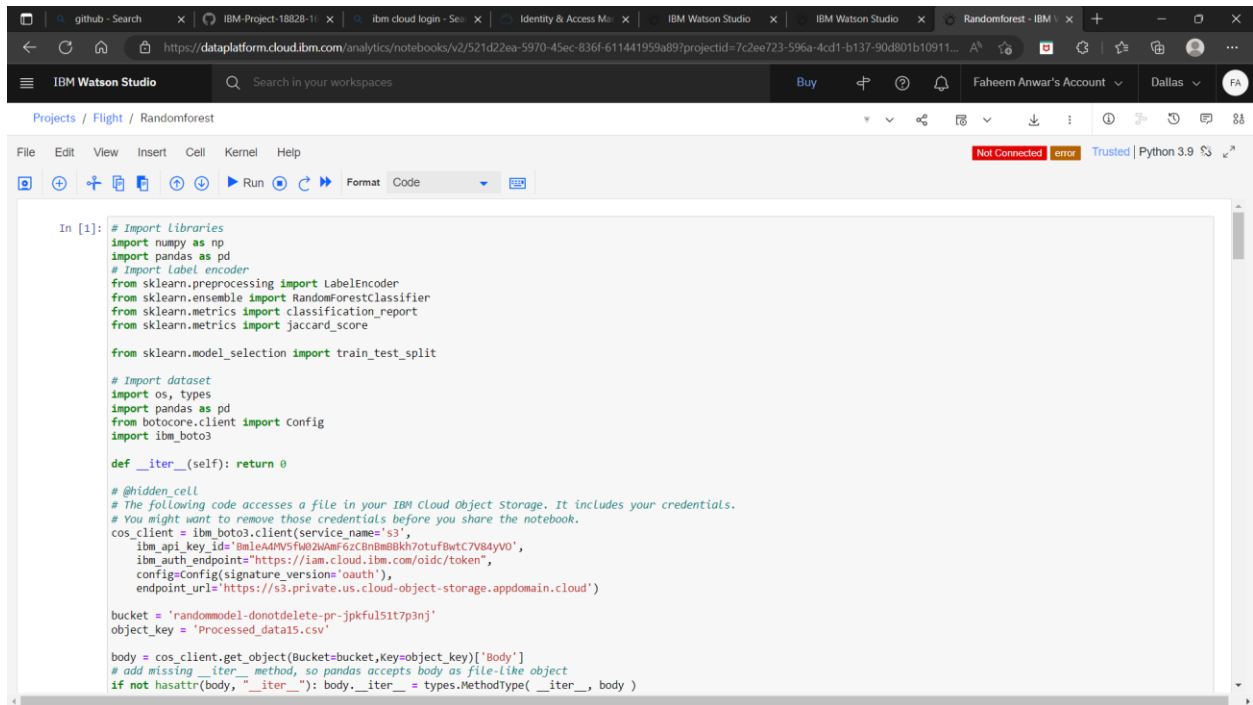
PROJECT DEVELOPMENT PHASE

Sprint 1

Date	18-Nov-22
Team ID	PNTIBM2022TMID52214
Project Name	Developing a Flight Delay Prediction Model Using Machine Learning
Maximum Marks	8 marks

Test cases:

IBM CLOUD DEPLOYMENT:



```
In [1]: # Import libraries
import numpy as np
import pandas as pd
# Import label encoder
from sklearn.preprocessing import LabelEncoder
from sklearn.ensemble import RandomForestClassifier
from sklearn.metrics import classification_report
from sklearn.metrics import jaccard_score

from sklearn.model_selection import train_test_split

# Import dataset
import os, types
import pandas as pd
from botocore.client import Config
import ibm_boto3

def __iter__(self): return 0

#@hidden_cell
# The following code accesses a file in your IBM Cloud object storage. It includes your credentials.
# You might want to remove those credentials before you share the notebook.
cos_client = ibm_boto3.client(service_name='s3',
                              ibm_api_key_id='bm1e4MV5fw02uAmf6zCBnBmBBkh7otufBwTC7V84yV0',
                              ibm_auth_endpoint='https://iam.cloud.ibm.com/oidc/token',
                              config=Config(signature_version='oauth'),
                              endpoint_url='https://s3.private.us.cloud-object-storage.appdomain.cloud')

bucket = 'randommodel-donotdelete-pr-jpkful51t7p3nj'
object_key = 'Processed_data15.csv'

body = cos_client.get_object(Bucket=bucket,Key=object_key)['body']
# add missing __iter__ method, so pandas accepts body as file-like object
if not hasattr(body, "__iter__"): body.__iter__ = types.MethodType( __iter__, body )
```

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```
In [2]: df.head(90)
Out[2]:
```

	year	month	day	carrier	origin	dest	delayed
0	2013	1	1	UA	EWB	IAH	0
1	2013	1	1	UA	LGA	IAH	1
2	2013	1	1	AA	JFK	MIA	1
3	2013	1	1	B6	JFK	BQN	0
4	2013	1	1	DL	LGA	ATL	0
...
85	2013	1	1	UA	EWB	MCO	1
86	2013	1	1	B6	JFK	SYR	0
87	2013	1	1	B6	JFK	SFO	0
88	2013	1	1	AA	LGA	ORD	0
89	2013	1	1	UA	EWB	IAH	1

90 rows x 7 columns

```
In [3]: columns = ['carrier', 'dest', 'origin']
le = LabelEncoder()
for i in columns:
    df[i] = le.fit_transform(df[i])

In [4]: df['carrier'].unique()
Out[4]: array([11, 1, 3, 4, 5, 9, 12, 14, 13, 7, 2, 0, 6, 8, 15, 10])
```

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```
Out[5]: array([0, 2, 1])

In [6]: df['dest'].unique()
Out[6]: array([38, 50, 11, 3, 59, 31, 37, 46, 61, 88, 43, 78, 27, 10, 42, 53, 29,
72, 80, 64, 15, 20, 13, 26, 83, 54, 81, 51, 77, 71, 87, 84, 69,
21, 41, 18, 48, 65, 73, 25, 19, 85, 47, 35, 9, 4, 12, 63, 86, 30,
5, 68, 40, 75, 17, 36, 44, 24, 2, 6, 49, 52, 33, 23, 14, 70, 34,
32, 45, 60, 74, 76, 62, 79, 58, 22, 56, 82, 90, 67, 28, 66, 89, 8,
57, 16, 1, 7, 0, 39, 55])

In [7]: df.head(90)
Out[7]:
```

	year	month	day	carrier	origin	dest	delayed
0	2013	1	1	11	0	38	0
1	2013	1	1	11	2	38	1
2	2013	1	1	1	1	50	1
3	2013	1	1	3	1	11	0
4	2013	1	1	4	2	3	0
...
85	2013	1	1	11	0	46	1
86	2013	1	1	3	1	87	0
87	2013	1	1	3	1	78	0
88	2013	1	1	1	2	59	0
89	2013	1	1	11	0	38	1

90 rows x 7 columns

```
2.11.*->ibm-watson-machine-learning) (1.15.0)
Requirement already satisfied: charset-normalizer<2.0.0 in /opt/conda/envs/python-3.9/lib/python3.9/site-packages (from requests->ibm-watson-machine-learning) (2.0.4)
Requirement already satisfied: idna<4,>=2.5 in /opt/conda/envs/python-3.9/lib/python3.9/site-packages (from requests->ibm-watson-machine-learning) (3.3)
Requirement already satisfied: zipp>=0.5 in /opt/conda/envs/python-3.9/lib/python3.9/site-packages (from importlib-metadata->ibm-watson-machine-learning) (3.6.0)

In [*]: from ibm_watson_machine_learning import APIClient
import json
import numpy as np

In [*]: wml_credentials = { "apikey": "20fmuoh80m4uaxlg06ov9hjbfdzik5-crxjdn6yG876z",
                           "url": "https://us-south.ml.cloud.ibm.com" }

In [*]: wml_client = APIClient(wml_credentials)
wml_client.spaces.list()

In [*]: SPACE_ID = "334068a5-18a7-4e2c-89c9-a6587410477e"

In [*]: wml_client.set.default_space(SPACE_ID)

In [*]: wml_client.software_specifications.list(500)

In [*]: #Save and Deploy the model

In [*]: import sklearn
sklearn.__version__

In [*]: MODEL_NAME = 'Flight'
DEPLOYMENT_NAME = 'model_deploy'
DEMO_MODEL = c1f

In [*]: # Set Python Version
```

```
In [*]: # Setup model meta
model_props = {
    wml_client.repository.ModelMetadata.NAME: MODEL_NAME,
    wml_client.repository.ModelMetadata.TYPE: "scikit-learn_1.0",
    wml_client.repository.ModelMetadata.SOFTWARE_SPEC_UID: software_spec_uid
}

In [30]: #Save model
model_details = wml_client.repository.store_model(
    model=DEMO_MODEL,
    meta_props=model_props,
    training_data=X_train,
    training_targets=y_train
)

In [31]: model_details

Out[31]: {'entity': {'hybrid_pipeline_software_specs': [],
                    'label_column': 'delayed',
                    'schemas': {'input': [{'fields': [{'name': 'f0', 'type': 'int'},
                                                         {'name': 'f1', 'type': 'int'},
                                                         {'name': 'f2', 'type': 'int'},
                                                         {'name': 'f3', 'type': 'int'},
                                                         {'name': 'f4', 'type': 'int'},
                                                         {'name': 'f5', 'type': 'int'}],
                                     'id': '1',
                                     'type': 'struct'}],
                    'output': [],
                    'software_spec': {'id': '12b83a17-24d8-5082-900f-0ab31fbfd3cb',
                                     'name': 'runtime-22.1-py3.9'},
                    'type': 'scikit-learn_1.0'},
                    'metadata': {'created_at': '2022-11-18T07:13:46.214Z',
                                'id': 'cdad071d-5a69-44c4-bb2c-6ef05a1ea7b',
                                'modified_at': '2022-11-18T07:17:19.740Z'}}
```

```

'resource_key': '27060486-e538-4e4a-9446-49df1b4cf4f3',
'space_id': '334068a5-18a7-4e2c-89c9-a6587410477e'},
'system': {'warnings': []}}

In [32]: model_id = wml_client.repository.get_model_id(model_details)

In [33]: model_id
Out[33]: 'cdad471d-5a60-44c4-bb2c-6ef05a81ea7b'

In [34]: # Set meta
deployment_props = {
    wml_client.deployments.ConfigurationMetaNames.NAME: DEPLOYMENT_NAME,
    wml_client.deployments.ConfigurationMetaNames.ONLINE: {}
}

In [35]: # Deploy
deployment = wml_client.deployments.create(
    artifact_uid=model_id,
    meta_props=deployment_props
)

#####

Synchronous deployment creation for uid: 'cdad471d-5a60-44c4-bb2c-6ef05a81ea7b' started

#####

initializing
Note: online_url is deprecated and will be removed in a future release. Use serving_urls instead.
..

```

```

Out[33]: 'cdad471d-5a60-44c4-bb2c-6ef05a81ea7b'

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#####

Synchronous deployment creation for uid: 'cdad471d-5a60-44c4-bb2c-6ef05a81ea7b' started

#####

initializing
Note: online_url is deprecated and will be removed in a future release. Use serving_urls instead.
..
ready

-----
Successfully finished deployment creation, deployment_uid='b6206819-9cf0-4be3-ad76-6949a3a90717'

```

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https://dataplatform.cloud.ibm.com/ml-runtime/deployments/b6206819-9c10-4be3-ad76-6949a3a90717/test?space_id=334068a5-18a7-4e2c-89c9-a658741...

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Deployments / model_deploy / Flight /

Prediction results

Prediction type

Binary classification

Prediction percentage

1

Record

0

Confidence level distribution

1

Table viewJSON view

	Prediction	Confidence
1	0	91%
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		

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