

SCREENSHOT  
Document  
for  
UpGrad's Assignment  
Submission

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## Airflow Main UI Page

This is the main Airflow UI page that contains all the registered DAGs. We can see our 3 DAGs:

- Lead\_Scoring\_Data\_Engineering\_Pipeline
- Lead\_scoring\_training\_pipeline
- Lead\_scoring\_inference\_pipeline

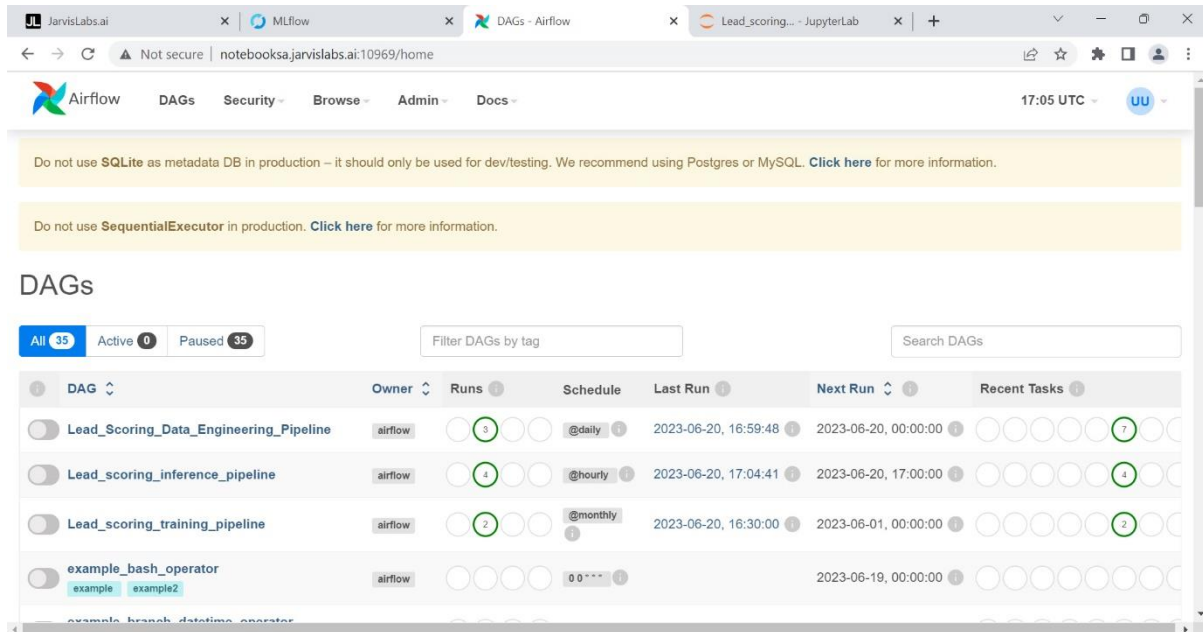


Figure 1: Airflow Main UI Page

## Initial run of Lead\_Scoring\_Data\_Engineering\_Pipeline

We have triggered manual run of Lead\_Scoring\_Data\_Engineering\_Pipeline for data engineering and cleaning data.

Both manual and scheduled runs can be seen in picture. Manual runs have white coloured arrow on top of green bars in Grid view.

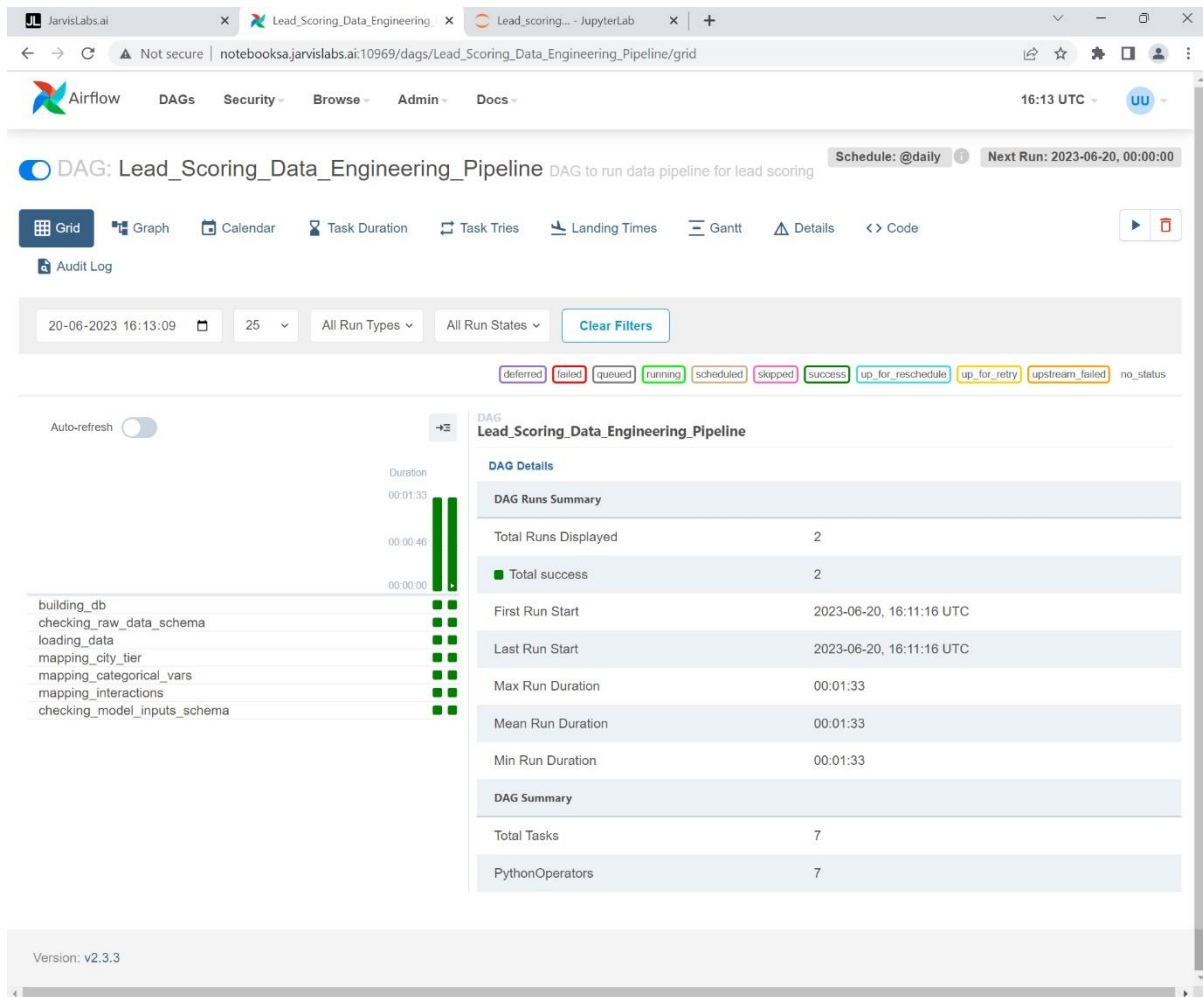


Figure 2: Grid view of Lead\_Scoring\_Data\_Engineering\_Pipeline

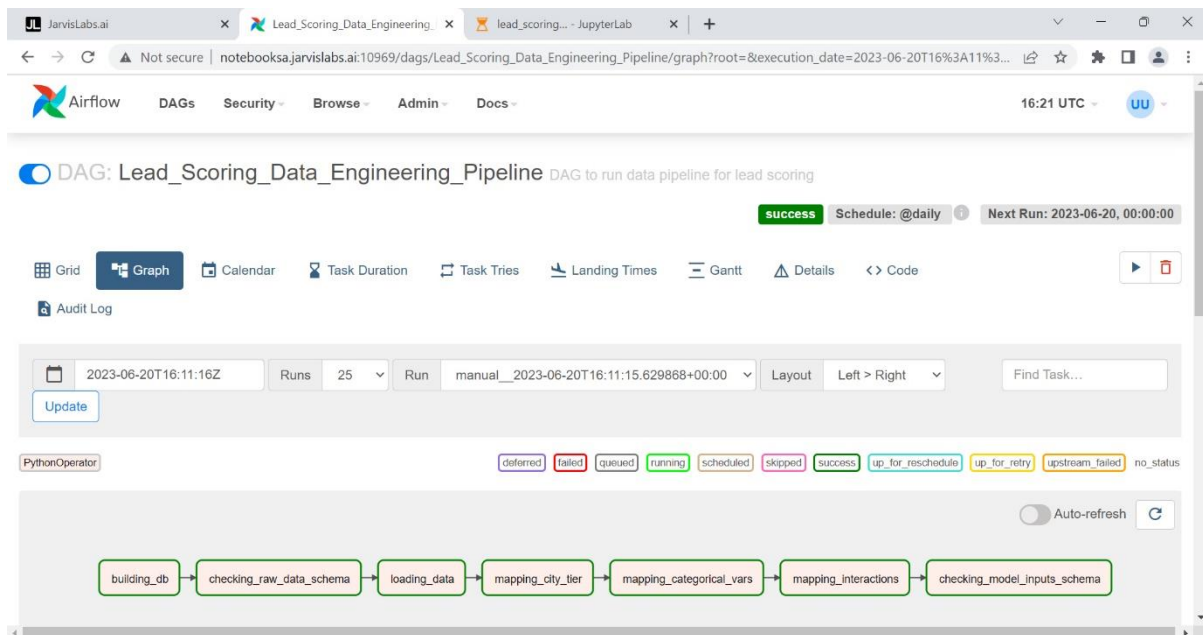


Figure 3: Graph view of Lead\_Scoring\_Data\_Engineering\_Pipeline

## Initial run of Lead\_scoring\_training\_pipeline

We have triggered manual run of Lead\_scoring\_training\_pipeline for training cleaned data.

Both manual and scheduled runs can be seen in picture. Manual runs have white coloured arrow on top of green bars in Grid view.

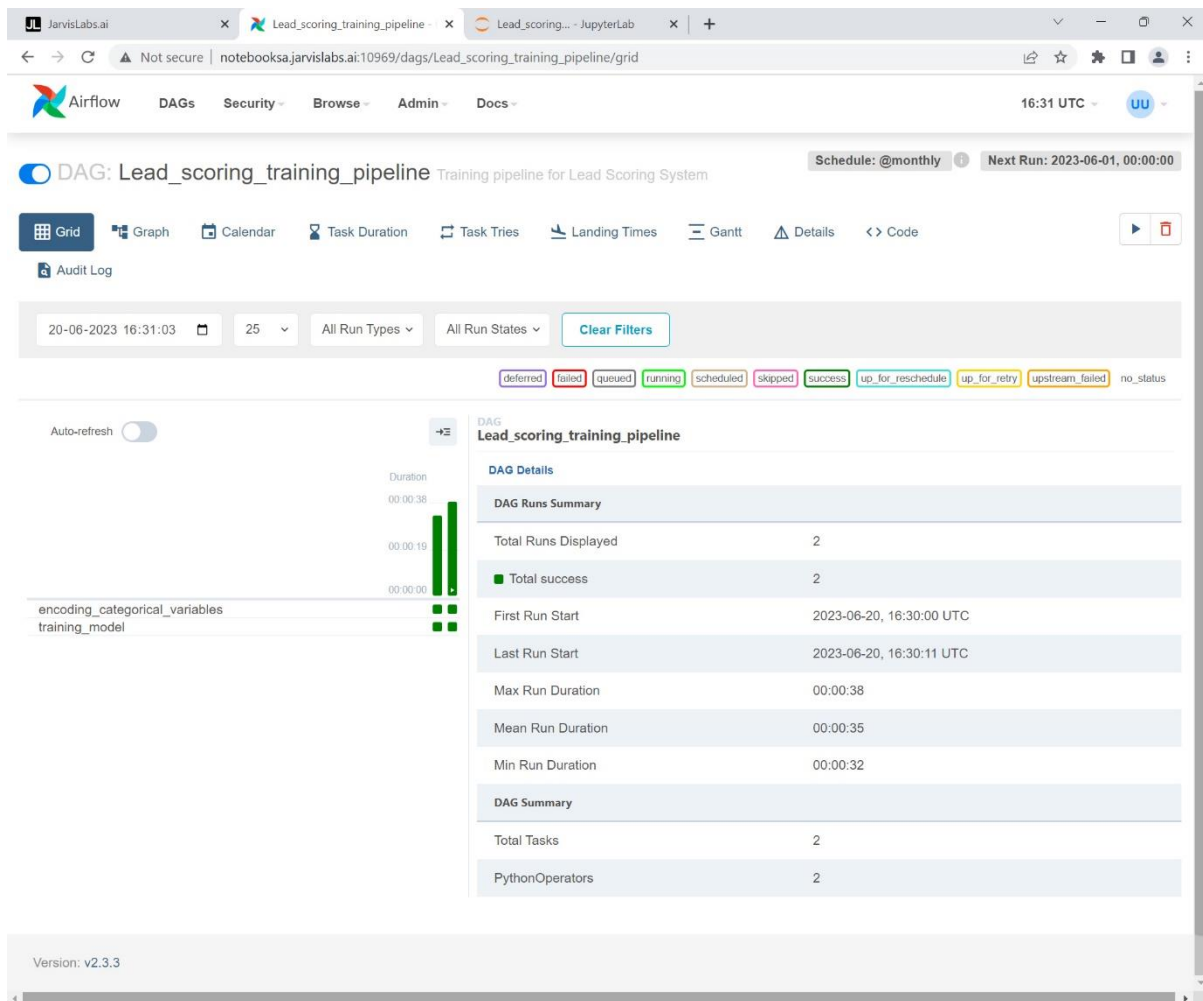


Figure 4: Grid view of Lead\_scoring\_training\_pipeline

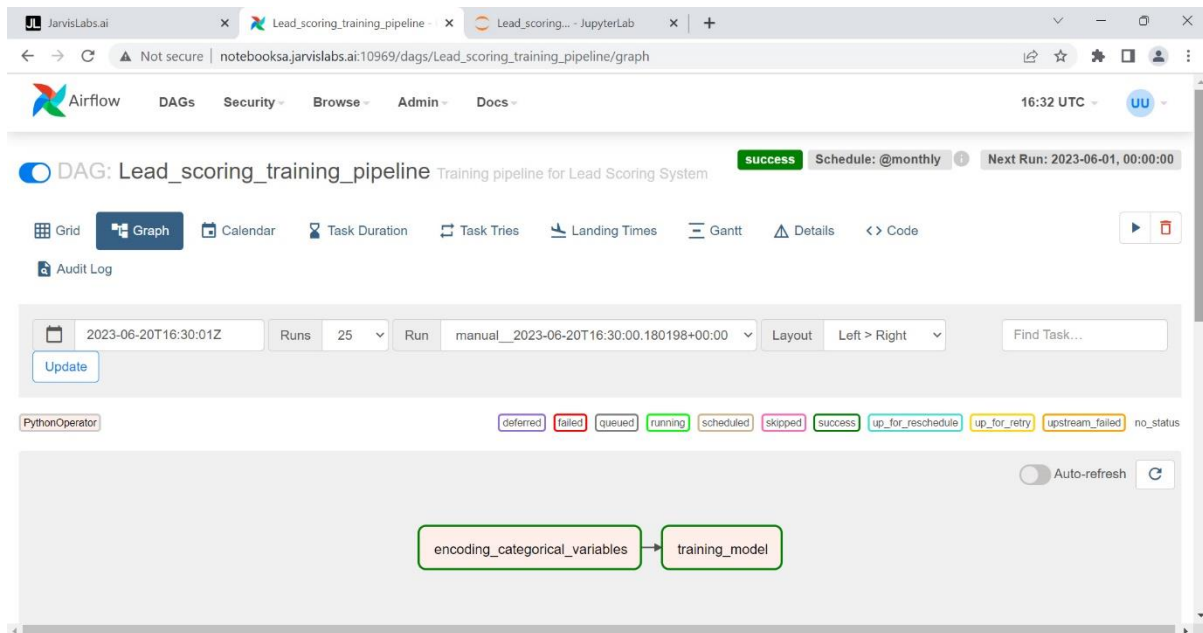


Figure 5: Graph view of Lead\_scoring\_training\_pipeline

## Initial run of Lead\_scoring\_inference\_pipeline

We have triggered manual run of Lead\_scoring\_inference\_pipeline for inferencing incoming data and predict outcome.

Both manual and scheduled runs can be seen in picture. Manual runs have white coloured arrow on top of green bars in Grid view.

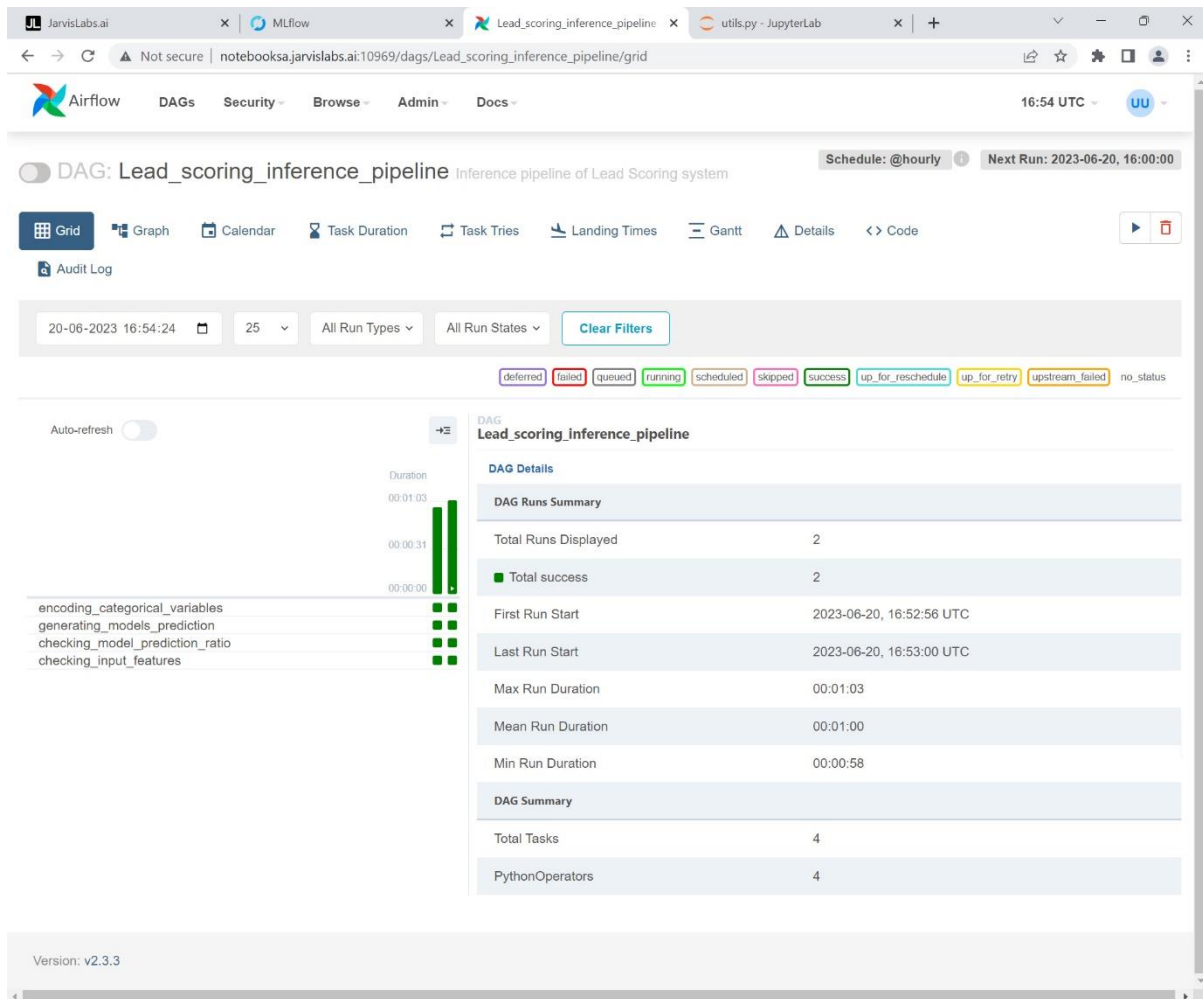


Figure 6: Grid view of Lead\_scoring\_inference\_pipeline

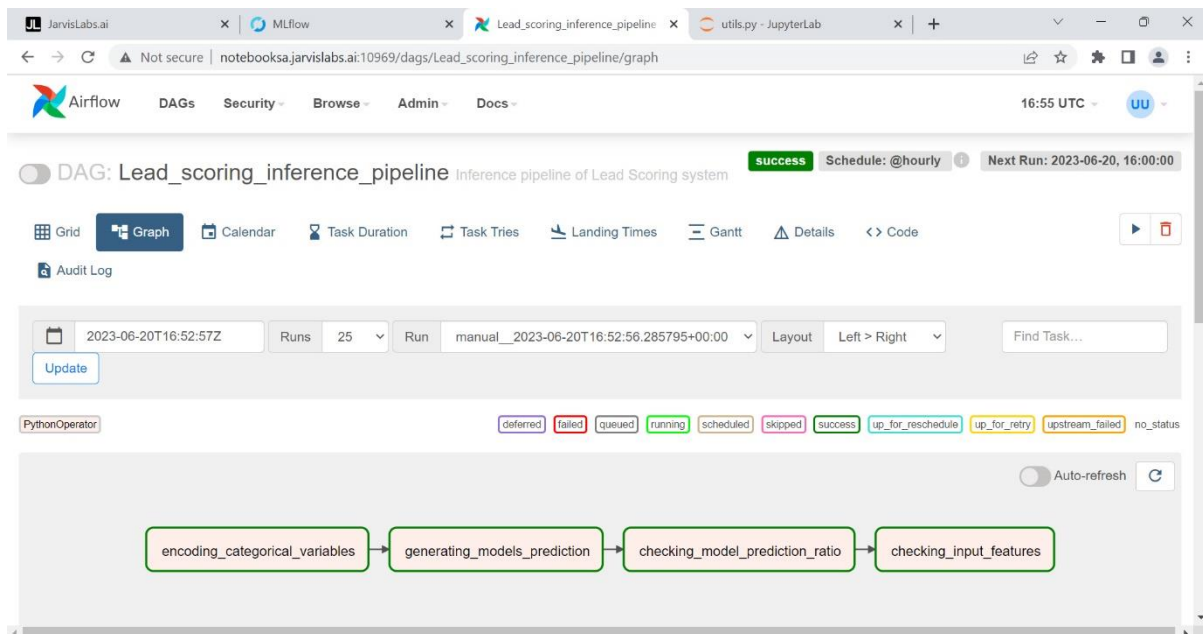


Figure 7: Graph view of Lead\_scoring\_inference\_pipeline



## Next run of Lead\_Scoring\_Data\_Engineering\_Pipeline

We have triggered manual run of Lead\_Scoring\_Data\_Engineering\_Pipeline for cleaning **leadscoring\_inference.csv**.

Both manual and scheduled runs can be seen in picture. Manual runs have white coloured arrow on top of green bars in Grid view.

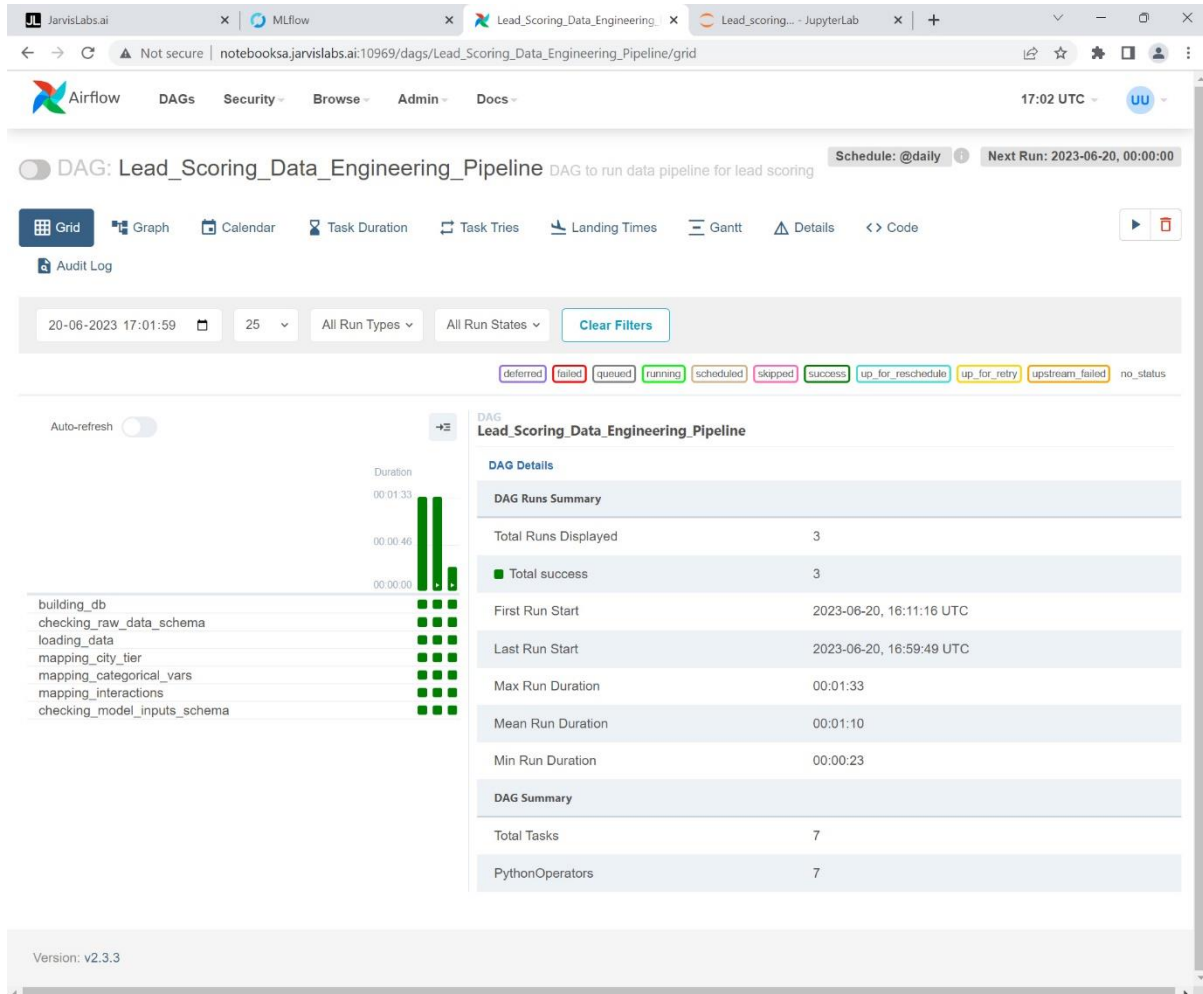


Figure 8: Grid view of Lead\_Scoring\_Data\_Engineering\_Pipeline

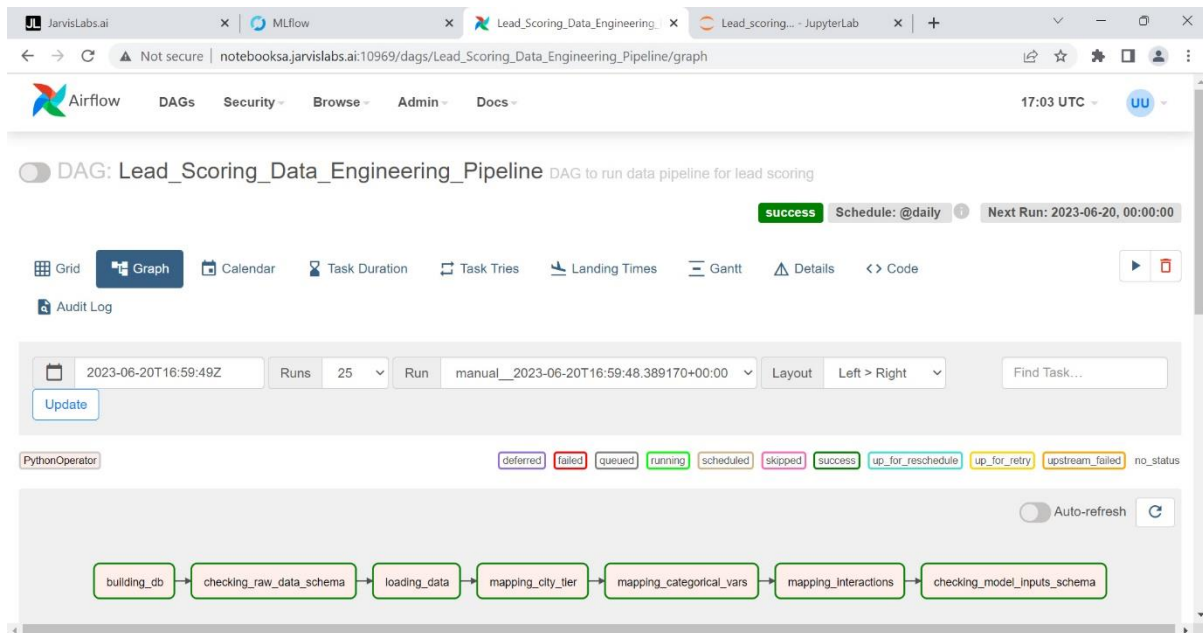


Figure 9: Graph view of Lead\_Scoring\_Data\_Engineering\_Pipeline

## Next run of Lead\_scoring\_inference\_pipeline

We have triggered manual run of Lead\_scoring\_inference\_pipeline for inferencing incoming data and predict outcome.

Both manual and scheduled runs can be seen in picture. Manual runs have white coloured arrow on top of green bars in Grid view.

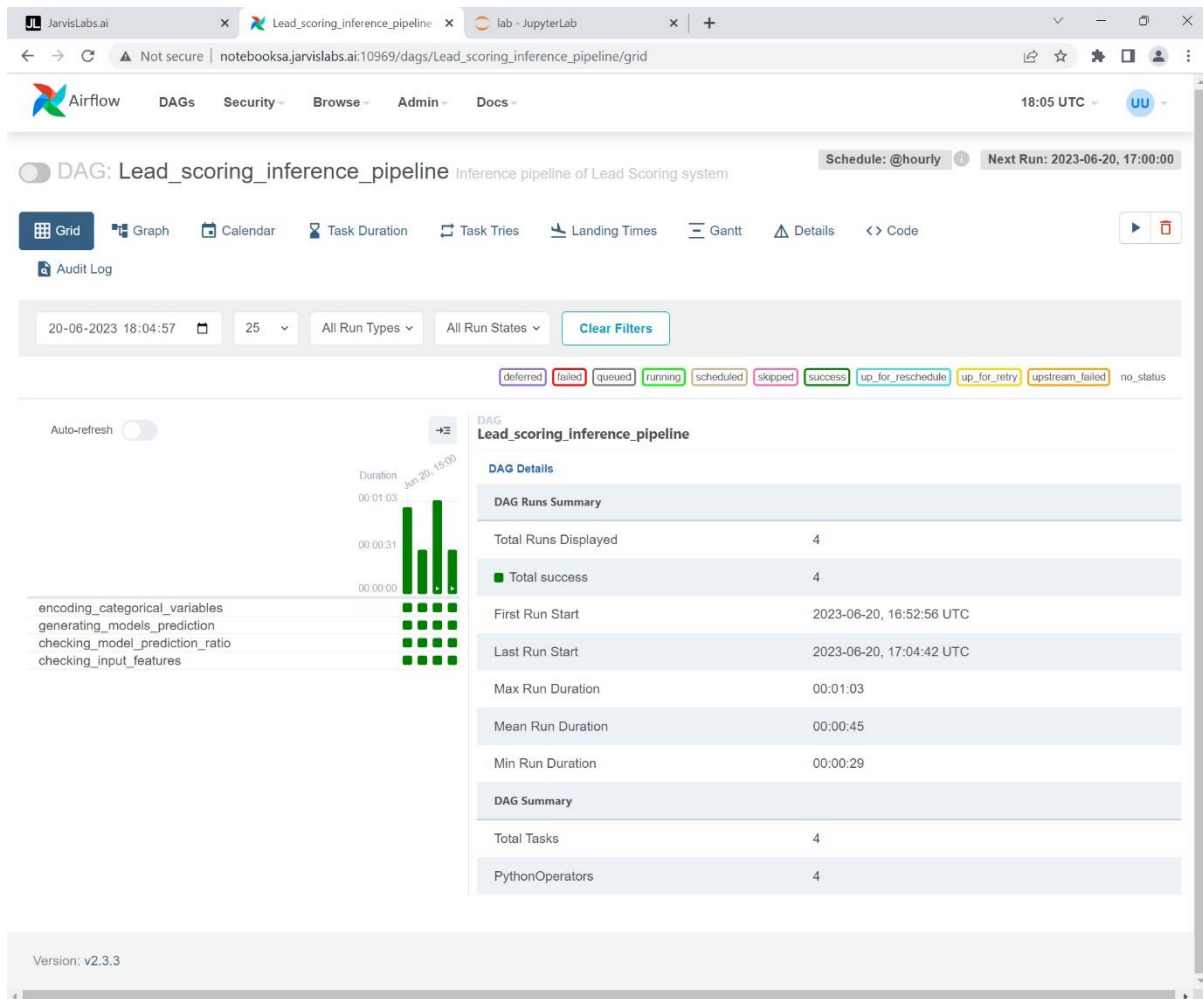


Figure 10: Grid view of `Lead_scoring_inference_pipeline`

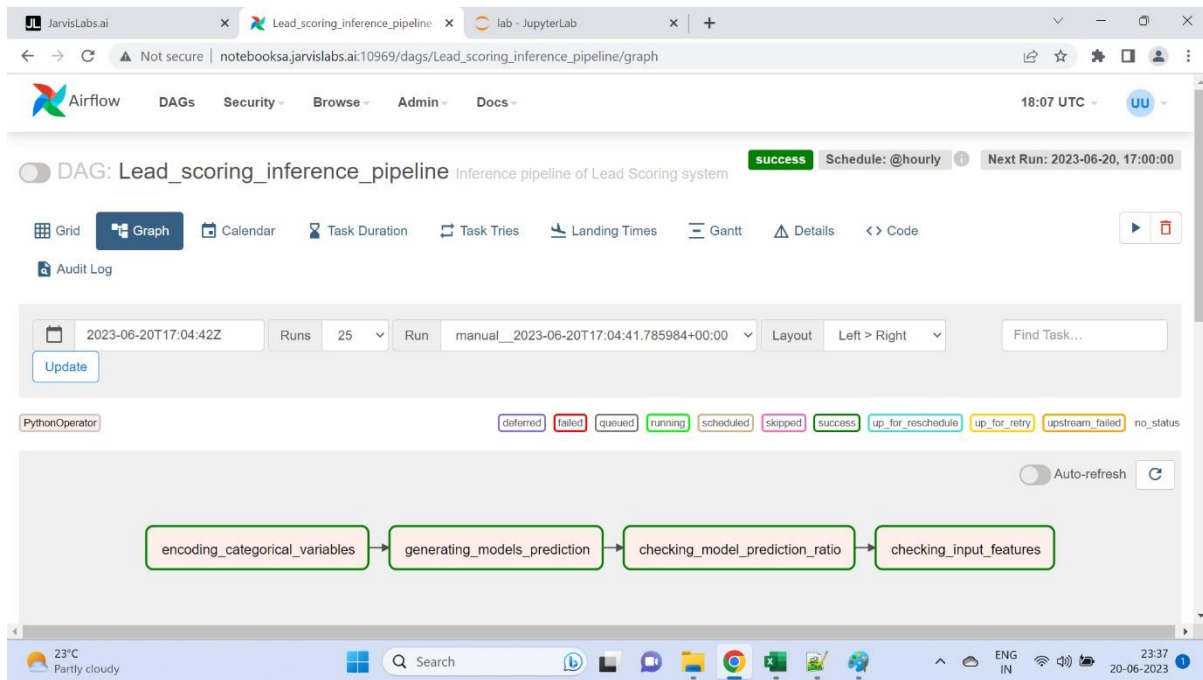


Figure 11: Graph view of Lead\_scoring\_inference\_pipeline

## MLFlow of Baseline\_model\_exp01

Baseline\_model\_exp01 is the initial pycaret setup experiment done for training model.

The screenshot displays the MLFlow web interface for the 'Baseline\_model\_exp01' experiment. The interface includes a top navigation bar with 'mlflow', 'Experiments', and 'Models'. The 'Experiments' tab is selected, showing a list of experiments on the left: 'Default', 'Baseline\_model\_exp01', 'Baseline\_model\_exp02', and 'Lead\_scoring\_mlflow...'. The 'Baseline\_model\_exp01' experiment is selected, showing its details on the right. The experiment ID is '1'. Below the description, there are buttons for 'Refresh', 'Compare', 'Delete', 'Download CSV', and a dropdown for 'Start Time'. A search bar is also present with the query 'metrics.rmse < 1 and params.model = "tree"'. Below the search bar, it says 'Showing 11 matching runs'. A table of runs is displayed with columns: 'Start Time', 'Duration', 'Run Name', 'User', 'Source', 'Version', 'Models', and 'Metrics'. The first run is '14 minutes ago' with a duration of 'Session Initi...' and a user of 'root'. The table is truncated with a '...' at the end.

Start Time	Duration	Run Name	User	Source	Version	Models	Metrics
14 minutes ago	Session Initi...		root	ipykernel...	-	-	-

Figure 12: Main MLFlow UI of Baseline\_model\_exp01

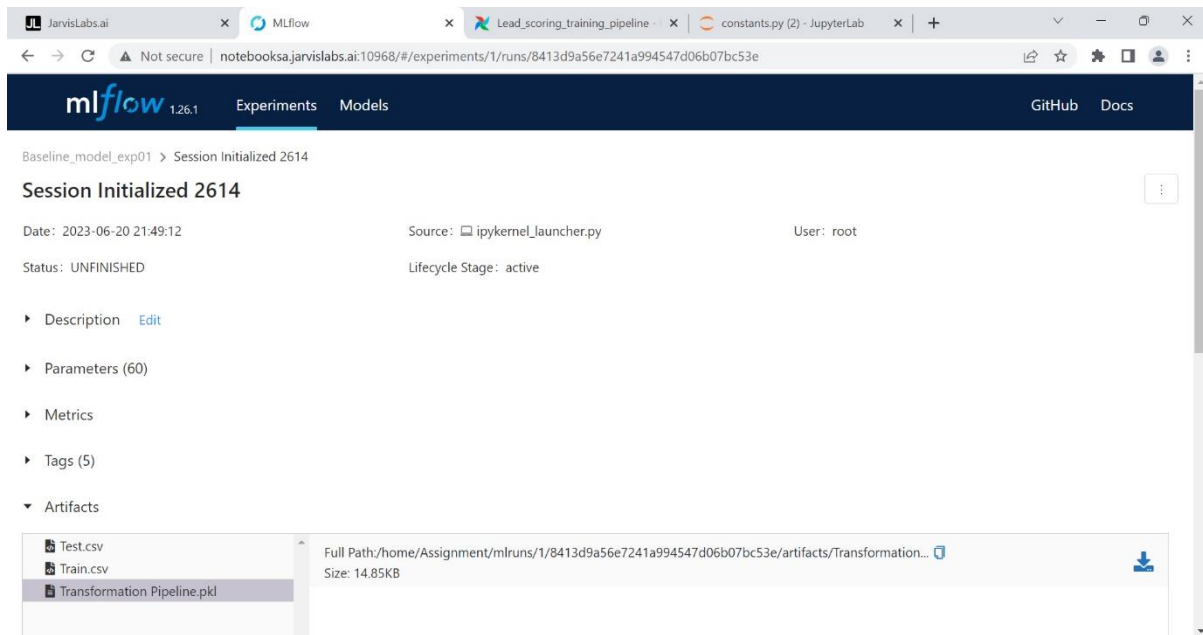


Figure 13: MLFlow Artifacts of Baseline\_model\_exp01

## MLFlow of Baseline\_model\_exp02

Baseline\_model\_exp02 is the pycaret setup experiment done for training model **after removing certain features**.

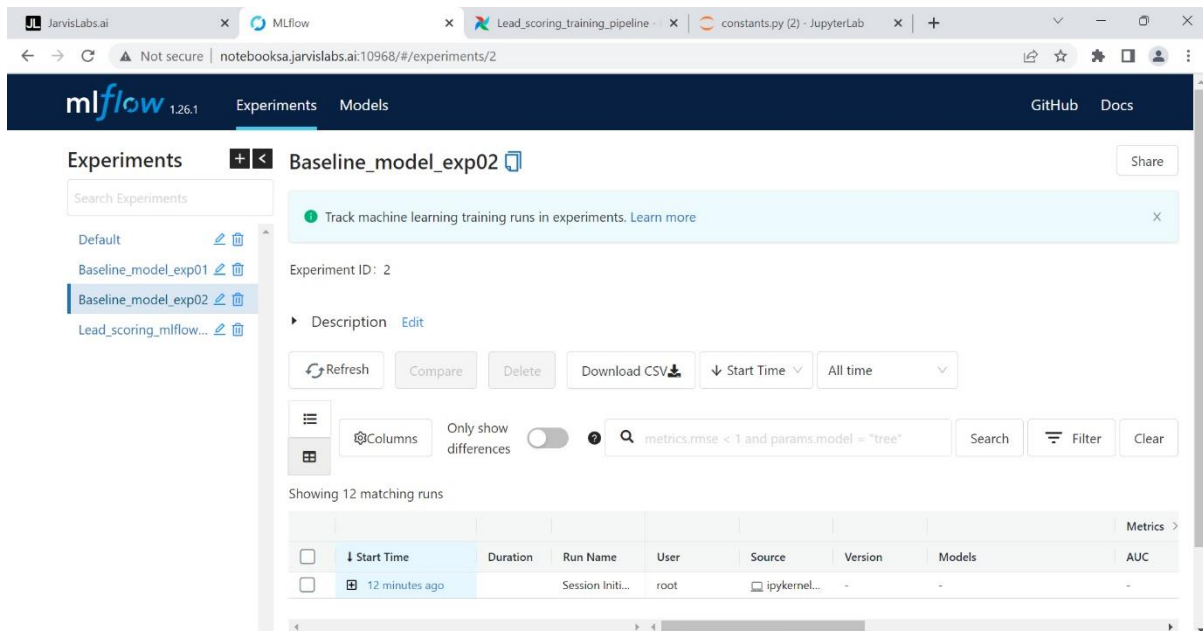


Figure 14: Main MLFlow UI of Baseline\_model\_exp02

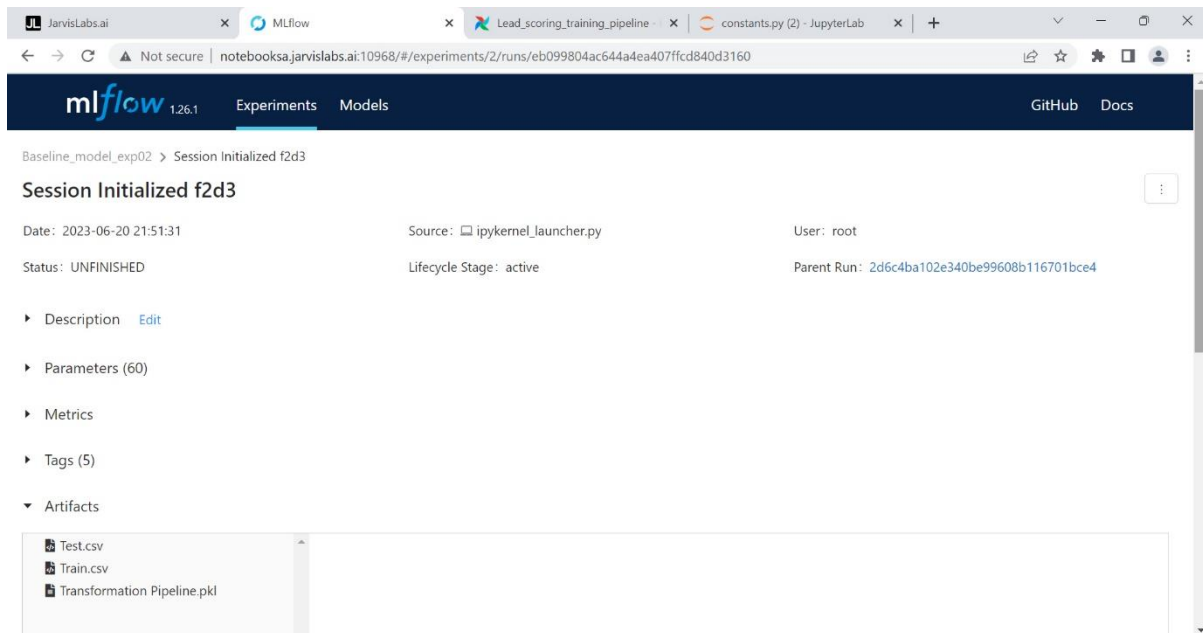


Figure 15: MLFlow Artifacts of Baseline\_model\_exp02

## MLFlow of Lead\_scoring\_mlflow\_production

Lead\_scoring\_mlflow\_production is the final model we have selected. We can see 3 models are generated:

- **Version 1** - One was created when dummy notebook was run to check the working of utils.py functions.
- **Version 2** - One was created during schedule run of airflow (automatic).
- **Version 3** - One was created manually from airflow UI. This is our final model and we have moved this version to **PRODUCTION** stage.

Please check the figure captions to understand the following screenshots.

JarvisLabs.ai MLflow Lead\_scoring\_training\_pipeline constants.py (2) - JupyterLab

Not secure notebooks.jarvislabs.ai:10968/#/experiments/3

mlflow 1.26.1 Experiments Models GitHub Docs

### Experiments

Search Experiments

- Default
- Baseline\_model\_exp01
- Baseline\_model\_exp02
- Lead\_scoring\_mlflow...

## Lead\_scoring\_mlflow\_production

Share

Track machine learning training runs in experiments. [Learn more](#)

Experiment ID: 3

Description Edit

Refresh Compare Delete Download CSV Start Time All time

Columns Only show differences metrics.rmse < 1 and params.model = "tree" Search Filter Clear

Showing 3 matching runs

	Start Time	Duration	Run Name	User	Source	Version	Models	Metrics
<input type="checkbox"/>	4 minutes ago	6.9s	Lead_scoring...	root	airflow	-	LightGBM/3	0.75
<input type="checkbox"/>	4 minutes ago	6.8s	Lead_scoring...	root	airflow	-	LightGBM/2	0.75
<input type="checkbox"/>	5 minutes ago	6.4s	Lead_scoring...	root	ipykernel...	-	LightGBM/1	0.75

Load more

Figure 16: Main MLflow UI of Lead\_scoring\_mlflow\_production

Lead\_scoring\_mlflow\_production > Lead\_scoring\_mlflow\_production\_20\_06\_2023

## Lead\_scoring\_mlflow\_production\_20\_06\_2023

Date: 2023-06-20 21:59:22 Source: `ipykernel_launcher.py` User: root

Duration: 6.4s Status: FINISHED Lifecycle Stage: active

- Description [Edit](#)
- Parameters (20)
- Metrics (9)
- Tags
- Artifacts

**models**

- MLmodel
- conda.yaml
- model.pkl
- python\_env.yaml
- requirements.txt

Full Path: `/home/Assignment/mlruns/3/8b4a64d02c9240019cbc8c116d1a5e6c/artifacts/models` [LightGBM, v1](#)  
Registered on 2023/06/20

### MLflow Model

The code snippets below demonstrate how to make predictions using the logged model. This model is also registered to the [model registry](#).

**Model schema**

Input and output schema for your model. [Learn more](#)

Name	Type
No schema. See <a href="#">MLflow docs</a> for how to include input and output schema with your model.	

**Make Predictions**

Predict on a Spark DataFrame:

```
import mlflow
logged_model = 'runs:/8b4a64d02c9240019cbc8c116d1a5e6c/models'

# Load model as a Spark UDF. Override result_type if the model does not return double values.
loaded_model = mlflow.pyfunc.spark_udf(spark, model_uri=logged_model, result_type='double')

# Predict on a Spark DataFrame.
columns = list(df.columns)
df.withColumn('predictions', loaded_model(*columns)).collect()
```

Predict on a Pandas DataFrame:

```
import mlflow
logged_model = 'runs:/8b4a64d02c9240019cbc8c116d1a5e6c/models'

# Load model as a PyFuncModel.
loaded_model = mlflow.pyfunc.load_model(logged_model)

# Predict on a Pandas DataFrame.
import pandas as pd
loaded_model.predict(pd.DataFrame(data))
```

Figure 17: MLflow Artifacts of Version 1 model



The screenshot displays the MLflow web interface in a browser. The top navigation bar shows 'mlflow 1.26.1' and tabs for 'Experiments' and 'Models'. The breadcrumb trail indicates the path: 'Lead\_scoring\_mlflow\_production > Lead\_scoring\_mlflow\_production\_20\_06\_2023'. The main header for the model is 'Lead\_scoring\_mlflow\_production\_20\_06\_2023'. Below this, metadata is shown: Date: 2023-06-20 22:00:25, Source: airflow, User: root, Duration: 6.8s, Status: FINISHED, and Lifecycle Stage: active. A sidebar on the left lists artifacts under the 'models' folder: MLmodel, conda.yaml, model.pkl, python\_env.yaml, and requirements.txt. The main content area is titled 'MLflow Model' and includes a description: 'The code snippets below demonstrate how to make predictions using the logged model. This model is also registered to the model registry.' It features two sections: 'Model schema' with a table for input and output schema (currently empty with a note to see MLflow docs) and 'Make Predictions' with two code snippets. The first snippet shows how to predict on a Spark DataFrame using a Spark UDF, and the second shows how to predict on a Pandas DataFrame using a PyFuncModel.

Full Path: /home/Assignment/mlruns/3/5adfbe1e52fc41d4a5260c8fe740d88b/artifacts/models

Registered on 2023/06/20

### MLflow Model

The code snippets below demonstrate how to make predictions using the logged model. This model is also registered to the [model registry](#).

#### Model schema

Input and output schema for your model. [Learn more](#)

Name	Type
------	------

No schema. See [MLflow docs](#) for how to include input and output schema with your model.

#### Make Predictions

Predict on a Spark DataFrame:

```
import mlflow
logged_model = 'runs:/5adfbe1e52fc41d4a5260c8fe740d88b/models'

# Load model as a Spark UDF. Override result_type if the model does not return double values.
loaded_model = mlflow.pyfunc.spark_udf(spark, model_uri=logged_model, result_type='double')

# Predict on a Spark DataFrame.
columns = list(df.columns)
df.withColumn('predictions', loaded_model(*columns)).collect()
```

Predict on a Pandas DataFrame:

```
import mlflow
logged_model = 'runs:/5adfbe1e52fc41d4a5260c8fe740d88b/models'

# Load model as a PyFuncModel.
loaded_model = mlflow.pyfunc.load_model(logged_model)

# Predict on a Pandas DataFrame.
import pandas as pd
loaded_model.predict(pd.DataFrame(data))
```

Figure 18: MLFlow Artifacts of Version 2 model

The screenshot displays the MLflow web interface for a production model artifact. The browser tabs include 'jarvislab.ai', 'MLflow', 'DAGs - Airflow', and 'JupyterLab'. The URL is 'notebooks.jarvislab.ai:10968/#/experiments/3/runs/52365e3cf06b40de9ee2d036677c86e1'. The MLflow version is 1.26.1.

The main view is for the experiment 'Lead\_scoring\_mlflow\_production' and the specific run 'Lead\_scoring\_mlflow\_production\_20\_06\_2023'. The run details show a date of '2023-06-20 22:00:42', a source of 'airflow', a user of 'root', a duration of '6.9s', a status of 'FINISHED', and a lifecycle stage of 'active'.

The 'Parameters (20)' section lists the following parameters:

Name	Value
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_split_gain	0.0
n_estimators	100
n_jobs	-1
num_leaves	31
objective	None
random_state	42
reg_alpha	0.0
reg_lambda	0.0
silent	warn
subsample	1.0
subsample_for_bin	200000
subsample_freq	0

The 'Metrics (9)' section shows the following metrics:

Name	Value
AUC	0.75
False Negative	1939
False Positive	8430
Precision	0.74
Recall	0.75
True Negative	15213
True Positive	20211
F1	0.738
test_accuracy	0.741

The 'Tags' and 'Artifacts' sections are also visible. The 'Artifacts' section shows a file tree for the 'models' artifact, including 'MLmodel', 'conda.yaml', 'model.pkl', 'python\_env.yaml', and 'requirements.txt'.

The 'MLflow Model' artifact details are shown in a separate pane. It includes the 'Model schema' (input and output schema) and 'Make Predictions' instructions for both Spark and Pandas DataFrames.

**Model schema**  
Input and output schema for your model. Learn more

Name	Type
------	------

No schema. See [MLflow docs](#) for how to include input and output schema with your model.

**Make Predictions**  
Predict on a Spark DataFrame:

```
import mlflow
logged_model = 'runs:/52365e3cf06b40de9ee2d036677c86e1/models'

# Load model as a Spark UDF. Override result_type if the model does not return double values.
loaded_model = mlflow.pyfunc.spark_udf(spark, model_uri=logged_model, result_type='double')

# Predict on a Spark DataFrame.
columns = list(df.columns)
df.withColumn('predictions', loaded_model(*columns)).collect()
```

Predict on a Pandas DataFrame:

```
import mlflow
logged_model = 'runs:/52365e3cf06b40de9ee2d036677c86e1/models'

# Load model as a PyFuncModel.
loaded_model = mlflow.pyfunc.load_model(logged_model)

# Predict on a Pandas DataFrame.
import pandas as pd
loaded_model.predict(pd.DataFrame(data))
```

Figure 19: MLflow Artifacts of Version 3 model

mlflow 1.26.1 Experiments Models GitHub Docs

Registered Models > LightGBM > Version 3

### Version 3

Registered At: 2023-06-20 22:00:48 Stage: Production Last Modified: 2023-06-20 22:17:34

Source Run: [Lead\\_scoring\\_mlflow\\_production\\_20\\_06\\_2023](#)

► Description [Edit](#)

► Tags

▼ Schema

Name	Type
No schema. See <a href="#">MLflow docs</a> for how to include input and output schema with your model.	

Figure 20: Version 3 model registered as Production Stage