

Lab MLFlow - Cloud Computing - M311

The screenshot shows the MLflow UI interface. At the top, there's a navigation bar with the MLflow logo, version 3.6.0, and links for GitHub and Docs. Below the navigation is a search bar with the text "scikit_learn_experiment" and a dropdown menu set to "Machine learning". On the left, a sidebar has tabs for "Runs", "Models" (which is selected), and "Traces". The main area displays a table of model runs. The columns are: Model name, Status, Created, Logged from, Source run, Registered models, and Dataset. There are five entries, all labeled "log_reg_model" and marked as "Ready". The "Created" column shows times ranging from "52 seconds ago" to "26 minutes ago". The "Logged from" column shows "ipykernel_launcher.py" for all entries. The "Source run" column shows various run IDs like "resilient-cat-614", "big-asp-908", etc. The "Registered models" and "Dataset" columns both show "-".

This screenshot shows the detailed view of a specific model run within the experiment. The top navigation bar and sidebar are identical to the previous screenshot. The main content area is titled "log_reg_model". It includes tabs for "Overview", "Traces", and "Artifacts" (which is selected). On the left, there's a tree view under "MLmodel" showing files like "conda.yaml", "model.pkl", "python_env.yaml", and "requirements.txt". The right side contains a large text block detailing the "MLmodel" configuration. Key parameters listed include "artifact_path", "flavors", "python_function", "env", "loader_module", "model_path", "predict_fn", "python_version", "sklearn", "mlflow_version", "model_id", "model_size_bytes", and "model_uuid". The "python_version" is specified as "3.12.3". The "mlflow_version" is "3.6.0". The "model_id" is "m-464e0136275943d5b81ff311950eb5d8". The "model_size_bytes" is "520111". The "model_uuid" is "m-464e0136275943d5b81ff311950eb5d8".

Comparing metrics

This screenshot shows the MLflow UI comparing metrics across multiple runs. The top navigation bar and sidebar are consistent with the previous screenshots. The main area features a sidebar with "Runs", "Models" (selected), and "Traces". A search bar at the top right says "Search metric charts". Below it, a section titled "Metrics (3)" is expanded, showing three horizontal bar charts: "eval_acc", "auc_score", and "train_acc". Each chart compares five runs, each labeled "log_reg_model". The "eval_acc" chart has values 1.00, 1.00, 1.00, 1.00, and 1.00. The "auc_score" chart has values 0.84, 0.85, 0.85, 0.84, and 0.85. The "train_acc" chart has values 1.00, 1.00, 1.00, 1.00, and 1.00. At the bottom of each chart, there are legends indicating which color corresponds to which run ID.

Loading a logged model

Loading a logged model

Cliquez sur un run et copiez le run ID en haut et exécutez le code suivant avec l'id de votre RUN

```
[19]    1 loaded_model = mlflow.sklearn.load_model("runs:/426d47f594c445a9ab8709e23c0b9b13/log_reg_model")
[19]    ✓ 0.0s
```

```
[20]    1 loaded_model.score(x_test, y_test)
[20]    ✓ 2.6s
... 0.9987732641687989
```

Hyperparameter tuning

```
fold 5
Anomaly Weight: 15
AUC: 0.8813861631838532
eval_acc: 0.9973711882229233
2025/11/15 12:03:03 WARNING mlflow.models.model: Model logged without a signature and input example. Please set

Averages:
Accuracy: 0.9978970181373118
AUC: 0.9212283479853886
Best:
Accuracy: 0.998422712933754
AUC: 0.9751350672194998
```

Sort by AUC score

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Columns Group by

metrics.rmse < 1 and params.model = "tree"

Time created State: Active Datasets Sort: auc_score

New run

	Run Name	Created	Dataset	Duration	Source	Models	Metrics
	Run Name	Created	Dataset	Duration	Source	Models	auc_score
<input type="checkbox"/>	righteous-hare-4	24 minutes ago	-	2.3s	ipykerne...	anom_weight_5_fold_2	0.975398919...
<input type="checkbox"/>	gaudy-wolf-538	24 minutes ago	-	2.5s	ipykerne...	anom_weight_10_fold_2	0.975310968...
<input type="checkbox"/>	unique-bat-754	24 minutes ago	-	3.0s	ipykerne...	anom_weight_15_fold_2	0.975135067...
<input type="checkbox"/>	rebellious-robin-273	24 minutes ago	-	2.3s	ipykerne...	anom_weight_5_fold_3	0.931466316...
<input type="checkbox"/>	sassy-cod-652	24 minutes ago	-	2.7s	ipykerne...	anom_weight_10_fold_3	0.931378350...
<input type="checkbox"/>	brawny-tern-973	24 minutes ago	-	4.2s	ipykerne...	anom_weight_15_fold_3	0.931290384...
<input type="checkbox"/>	omniscient-stork-139	24 minutes ago	-	2.7s	ipykerne...	anom_weight_10_fold_1	0.924384561...
<input type="checkbox"/>	clumsy-rook-730	24 minutes ago	-	2.7s	ipykerne...	anom_weight_15_fold_1	0.924296641...
<input type="checkbox"/>	burly-auk-81	24 minutes ago	-	2.4s	ipykerne...	anom_weight_10_fold_4	0.894385162...
<input type="checkbox"/>	wise-vole-948	24 minutes ago	-	2.8s	ipykerne...	anom_weight_5_fold_4	0.894385162...
<input type="checkbox"/>	exultant-goose-965	23 minutes ago	-	3.8s	ipykerne...	anom_weight_15_fold_4	0.894033483...

20 matching runs

metrics.auc_score >= 0.9 and params.anomaly_weight = "5"

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Columns Group by

metrics.auc_score >= 0.9 and params.anomaly_weight = "5"

Time created State: Active Datasets Sort: anomaly_weight

New run

	Run Name	Created	Dataset	Duration	Source	Models	Metrics	Parameters
	Run Name	Created	Dataset	Duration	Source	Models	auc_score	anomaly_weight
<input type="checkbox"/>	rebellious-robin-273	50 minutes ago	-	2.3s	ipykerne...	anom_weight_5_fold_3	0.931466316...	5
<input type="checkbox"/>	righteous-hare-4	50 minutes ago	-	2.3s	ipykerne...	anom_weight_5_fold_2	0.975398919...	5

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`metrics.auc_score >= 0.95 and params.anomaly_weight = "5"`

Run Name	Created	Dataset	Duration	Source	Models	Metrics	Parameters
righteous-hare-4	50 minutes ago	-	2.3s	ipykerne...	anom_weight_5_fold_2	auc_score	anomaly_weight 5

`metrics.auc_score >= 0.95 and params.anomaly_weight = "10"`

Run Name	Created	Dataset	Duration	Source	Models	Metrics	Parameters
gaudy-wolf-538	50 minutes ago	-	2.5s	ipykerne...	anom_weight_10_fold_2	auc_score	anomaly_weight 10

`metrics.auc_score >= 0.95 and params.anomaly_weight = "15"`

Run Name	Created	Dataset	Duration	Source	Models	Metrics	Parameters
unique-bat-754	50 minutes ago	-	3.0s	ipykerne...	anom_weight_15_fold_2	auc_score	anomaly_weight 15

Le meilleur interval est de [5, 10]

Run Name	Created	Duration	Source	Models	Metrics	Parameters
suave-snake-606	16 minutes ago	1.8s	ipykerne...	anom_weight_5_fold_2	auc_score	anomaly_weight 5
awesome-goat-152	16 minutes ago	1.9s	ipykerne...	anom_weight_5_fold_3	auc_score	anomaly_weight 5
upset-yak-956	16 minutes ago	1.9s	ipykerne...	anom_weight_3_fold_2	auc_score	anomaly_weight 3
puzzled-bee-12	16 minutes ago	1.9s	ipykerne...	anom_weight_4_fold_2	auc_score	anomaly_weight 4
nosy-gull-609	16 minutes ago	2.0s	ipykerne...	anom_weight_4_fold_3	auc_score	anomaly_weight 4
upset-frog-969	16 minutes ago	1.9s	ipykerne...	anom_weight_2_fold_2	auc_score	anomaly_weight 2
bustling-flea-833	16 minutes ago	1.9s	ipykerne...	anom_weight_2_fold_4	auc_score	anomaly_weight 2
painted-bug-423	16 minutes ago	1.9s	ipykerne...	anom_weight_5_fold_4	auc_score	anomaly_weight 5
salty-sow-810	16 minutes ago	1.9s	ipykerne...	anom_weight_4_fold_4	auc_score	anomaly_weight 4
nimble-goat-762	16 minutes ago	1.9s	ipykerne...	anom_weight_3_fold_4	auc_score	anomaly_weight 3
shivering-fly-867	16 minutes ago	1.9s	ipykerne...	anom_weight_3_fold_3	auc_score	anomaly_weight 3

Même si on essaie avec [1, 2, 3, 4, 5] le meilleur weight reste 5.

2- MLFlow with Tensorflow

The screenshots illustrate the MLFlow interface for managing a Tensorflow experiment named "TF_Keras_MNIST".

Top Screenshot: The "Runs" page shows three active runs: "judicious-perch-363" (1 minute ago), "dapper-snipe-673" (1 day ago), and "zealous-steed-839" (1 day ago). Each run is associated with a "dataset (ed12ba6c)" and a "model" source.

Run Name	Created	Dataset	Duration	Source	Models
judicious-perch-363	1 minute ago	dataset (ed12ba6c) Train	25.2s	ipykerne...	model
dapper-snipe-673	1 day ago	dataset (ed12ba6c) Train	25.4s	ipykerne...	model
zealous-steed-839	1 day ago	dataset (ed12ba6c) Train	27.2s	ipykerne...	model

Middle Screenshot: The "Model metrics" page for the "judicious-perch-363" run displays three charts: "accuracy" (line chart showing accuracy increasing from ~0.7 to ~0.95 over 10 steps), "auc_score" (bar chart showing auc_score at 0.99), and "eval_acc" (bar chart showing eval_acc at 0.98).

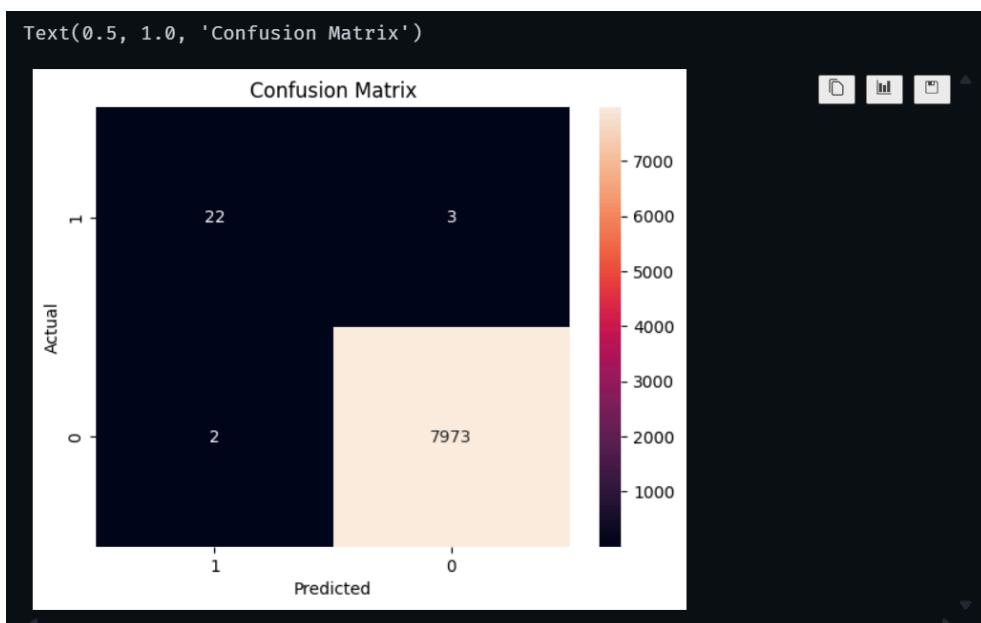
Bottom Screenshot: The "Artifacts" page for the same run shows the "model_summary.txt" file, which contains the following table of model architecture details:

Layer (type)	Output Shape	Param #
conv2d (Conv2D)	(None, 14, 14, 16)	160
conv2d_1 (Conv2D)	(None, 7, 7, 8)	1,160
flatten (Flatten)	(None, 392)	0
dense (Dense)	(None, 30)	11,790
dense_1 (Dense)	(None, 20)	620
dense_2 (Dense)	(None, 10)	210

Total params: 13,940 (54.45 KB)
Trainable params: 13,940 (54.45 KB)
Non-trainable params: 0 (0.00 B)

4- Local model serving - deployment

```
> mlflow models serve --model-uri runs:/426d47f594c445a9ab8709e23c0b9b13/log_reg_model -p 1235
/home/zczak/LAB_CLOUD_COMPUTING_M311/Lab Folder MLOps/venv/lib/python3.12/site-packages/mlflow/tracking/_tracking_servic
e/utils.py:140: FutureWarning: Filesystem tracking backend (e.g., './mlruns') is deprecated. Please switch to a database
backend (e.g., 'sqlite:///mlflow.db'). For feedback, see: https://github.com/mlflow/mlflow/issues/18534
    return FileStore(store_uri, store_uri)
2025/11/16 15:38:24 INFO mlflow.models.flavor_backend_registry: Selected backend for flavor 'python_function'
2025/11/16 15:38:24 INFO mlflow.utils.virtualenv: Environment /home/zczak/.mlflow/envs/mlflow-567b28edbc31fa1f5c709f93f0
266fa290dea436 already exists
2025/11/16 15:38:24 INFO mlflow.utils.environment: === Running command '['['bash', '-c', 'source /home/zczak/.mlflow/envs/
mlflow-567b28edbc31fa1f5c709f93f0266fa290dea436/bin/activate && python -c ""']'
2025/11/16 15:38:24 INFO mlflow.utils.environment: === Running command '['['bash', '-c', 'source /home/zczak/.mlflow/envs/
mlflow-567b28edbc31fa1f5c709f93f0266fa290dea436/bin/activate && exec uvicorn --host 127.0.0.1 --port 1235 --workers 1 ml
flow.pyfunc.scoring_server.app:app']'
/home/zczak/LAB_CLOUD_COMPUTING_M311/Lab Folder MLOps/venv/lib/python3.12/site-packages/mlflow/tracking/_tracking_servic
e/utils.py:140: FutureWarning: Filesystem tracking backend (e.g., './mlruns') is deprecated. Please switch to a database
backend (e.g., 'sqlite:///mlflow.db'). For feedback, see: https://github.com/mlflow/mlflow/issues/18534
    return FileStore(store_uri, store_uri)
INFO:     Started server process [5211]
INFO:     Waiting for application startup.
INFO:     Application startup complete.
INFO:     Uvicorn running on http://127.0.0.1:1235 (Press CTRL+C to quit)
```



5- MLFlow Databricks

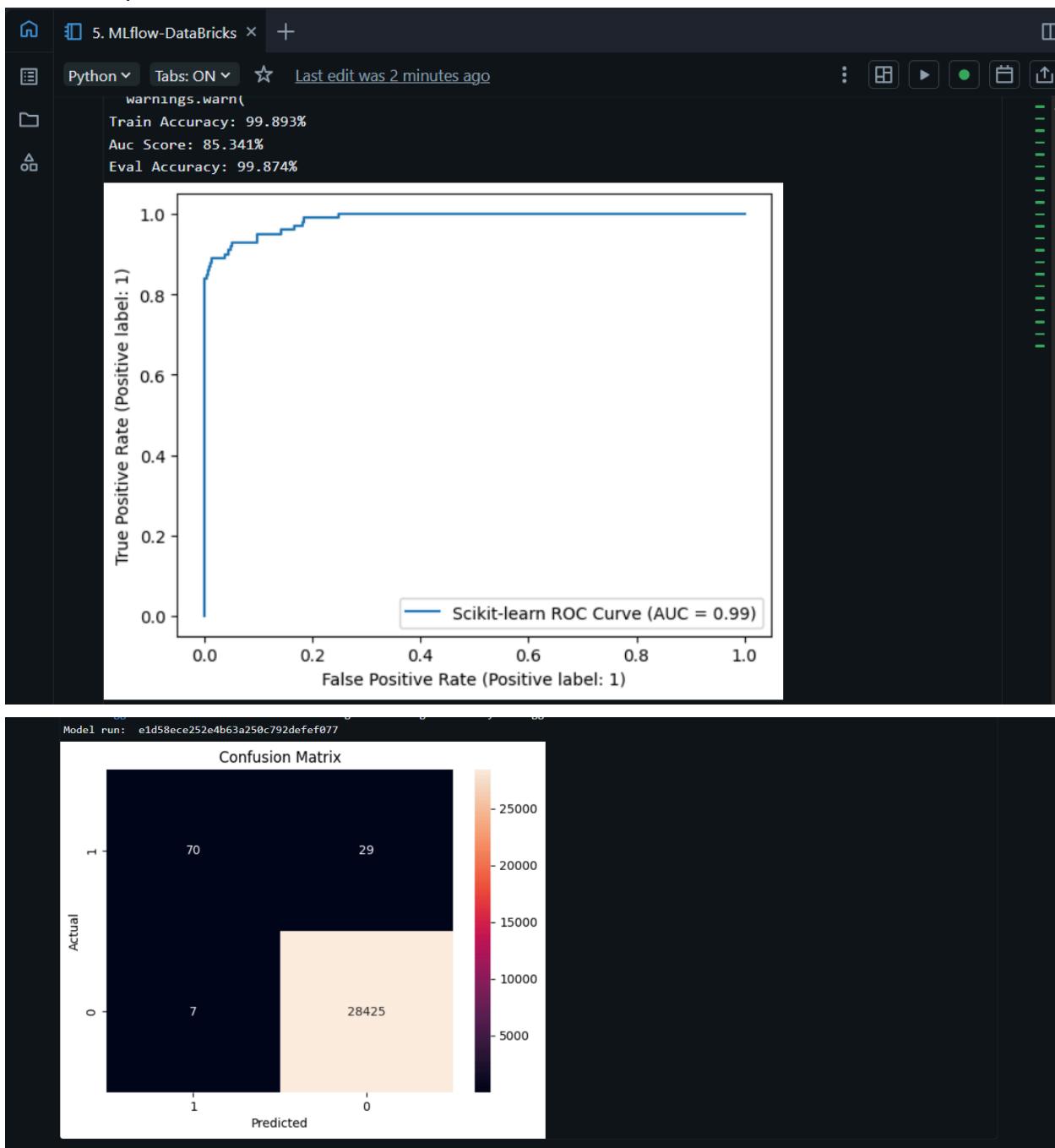
The screenshot shows the Databricks workspace interface. On the left is the sidebar with various notebooks and workspace sections like Recents, Catalog, Jobs & Pipelines, Compute, Marketplace, SQL, Data Engineering, Job Runs, Data Ingestion, and AI/ML. Two notebooks are open in the main area:

- Notebook 1 (Top):** A Python notebook titled "5. MLflow-Databricks". It contains code for importing libraries (numpy, pandas, matplotlib, seaborn, sklearn, mlflow) and setting up MLflow. A warning message is displayed: "/databricks/python/lib/python3.11/site-packages/mlflow/proto/service_pb2.py:11: UserWarning: google.protobuf.service module is deprecated. RPC implementations should provide code generator plugins which generate code specific to the RPC implementation. service.py will be removed in Jan 2025".
- Notebook 2 (Bottom):** Another Python notebook with the same title. It runs a pip command to install mlflow==1.20.2. Then it attempts to drop the "Time" column from a DataFrame named "df" and prints the first few rows of the modified DataFrame.

Je configure databricks cli pour pouvoir lancer

```
> databricks configure --token
Databricks Host (should begin with https://): https://dbc-15fdc886-7696.cloud.databricks.com/
Token:
```

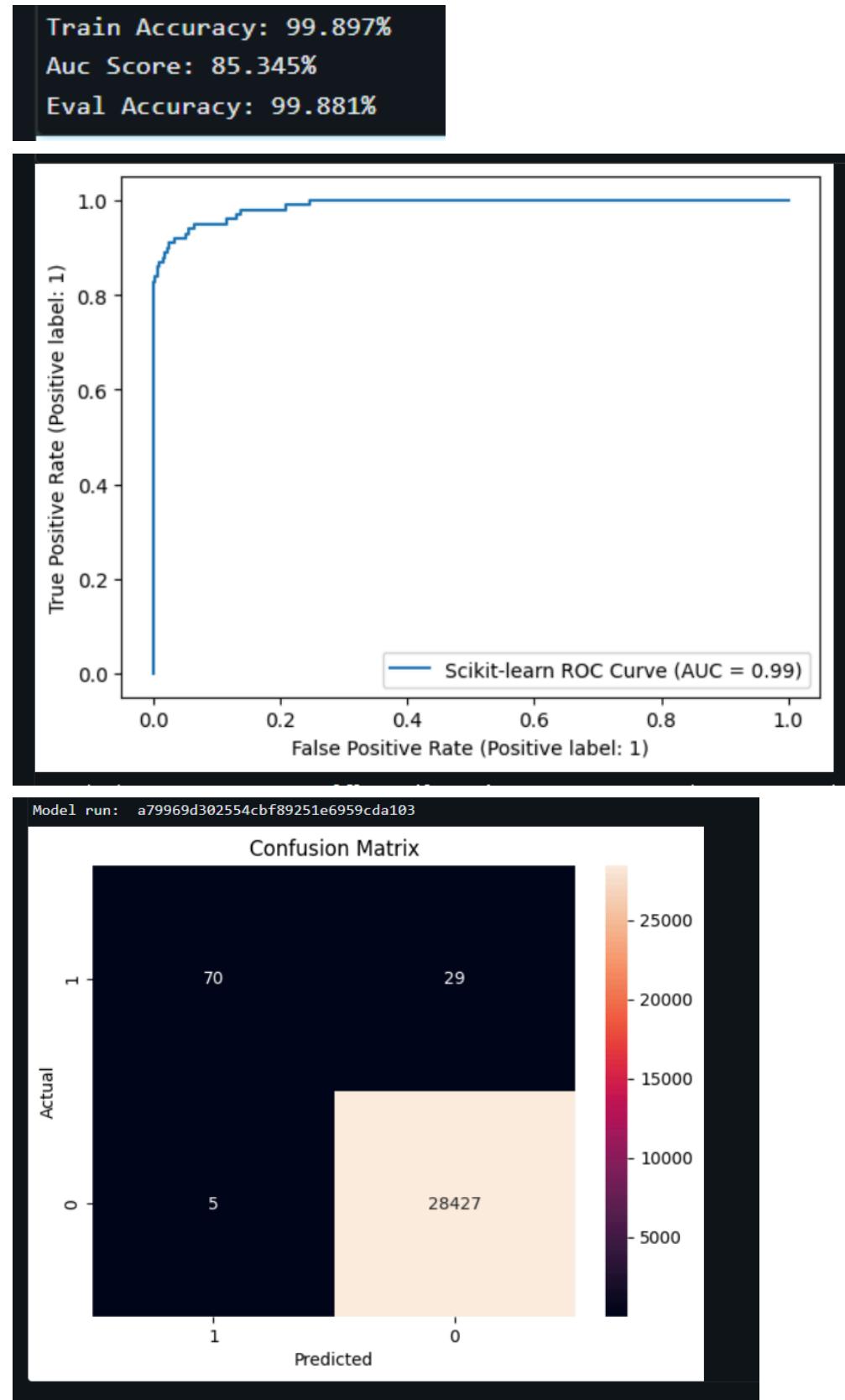
J'ai run l'expérimentation



Now for the last process, it took 44 minutes



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A screenshot of a Jupyter Notebook cell titled "5. MLflow-Databricks". The cell contains Python code to search for runs and display them as a pandas DataFrame. The DataFrame has columns: run_id, experiment_id, status, and artifact_uri. There are three rows of data, all labeled as FINISHED. The code was run 1 minute ago, and the table was refreshed 1 minute ago.

	run_id	experiment_id	status	artifact_uri
1	a79969d302554cbf89251e6959cda103	1834869671727596	FINISHED	dbfs:/databricks/mlflow-tracking/1834869671727596/a79969d302554cbf89251e6959cda103/artifacts
2	e1d58ece252e4b63a250c792defef077	1834869671727596	FINISHED	dbfs:/databricks/mlflow-tracking/1834869671727596/e1d58ece252e4b63a250c792defef077/artifacts
3	10c0b7ba61a6488b866b7d10f67ea225	1834869671727596	FINISHED	dbfs:/databricks/mlflow-tracking/1834869671727596/10c0b7ba61a6488b866b7d10f67ea225/artifacts

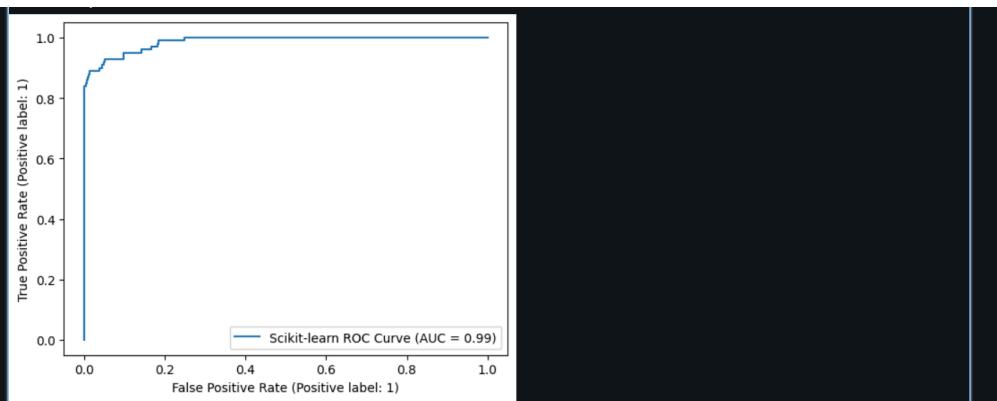
TAF:

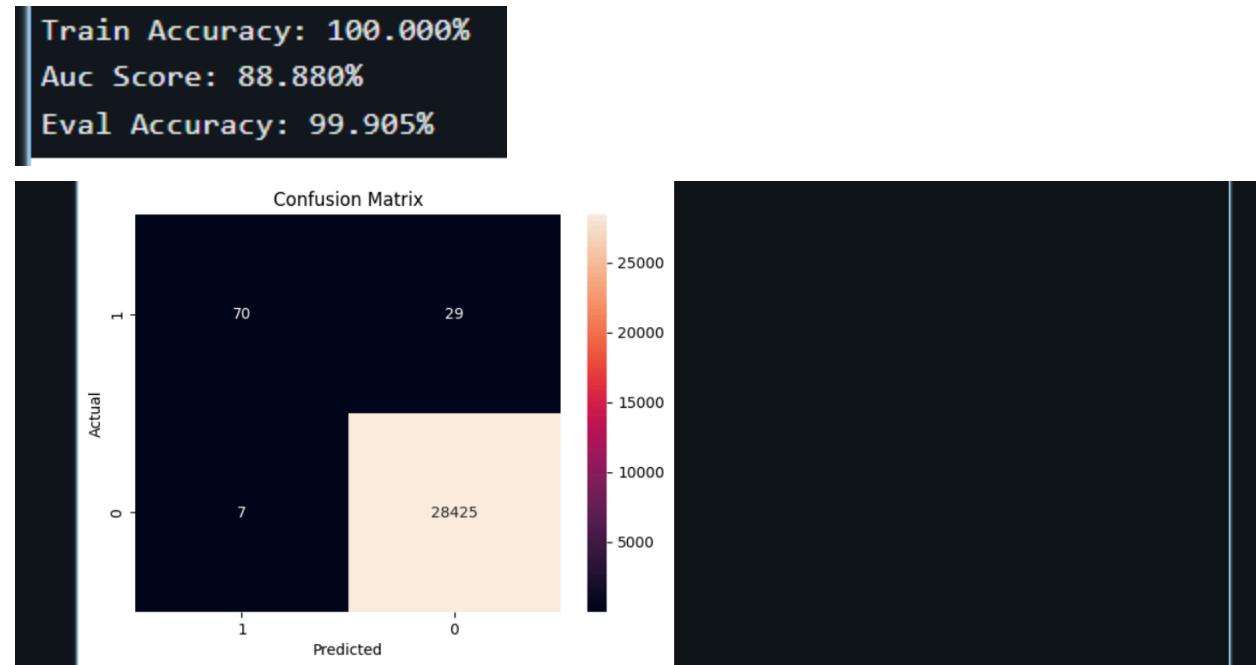
1. réexécutez la cellule 18 en utilisant d'autres modèle ML de SKlear
2. comparez vos résultats en utilisant l'outil de comparaison de MLFlow

```
8 models = [
9     ("LogisticRegression", LogisticRegression(random_state=None, max_iter=10, solver='newton-cg')),
10    ("RandomForest", RandomForestClassifier(n_estimators=100, random_state=2020)),
11    ("SVC", SVC(probability=True, random_state=2020))
12 ]
```

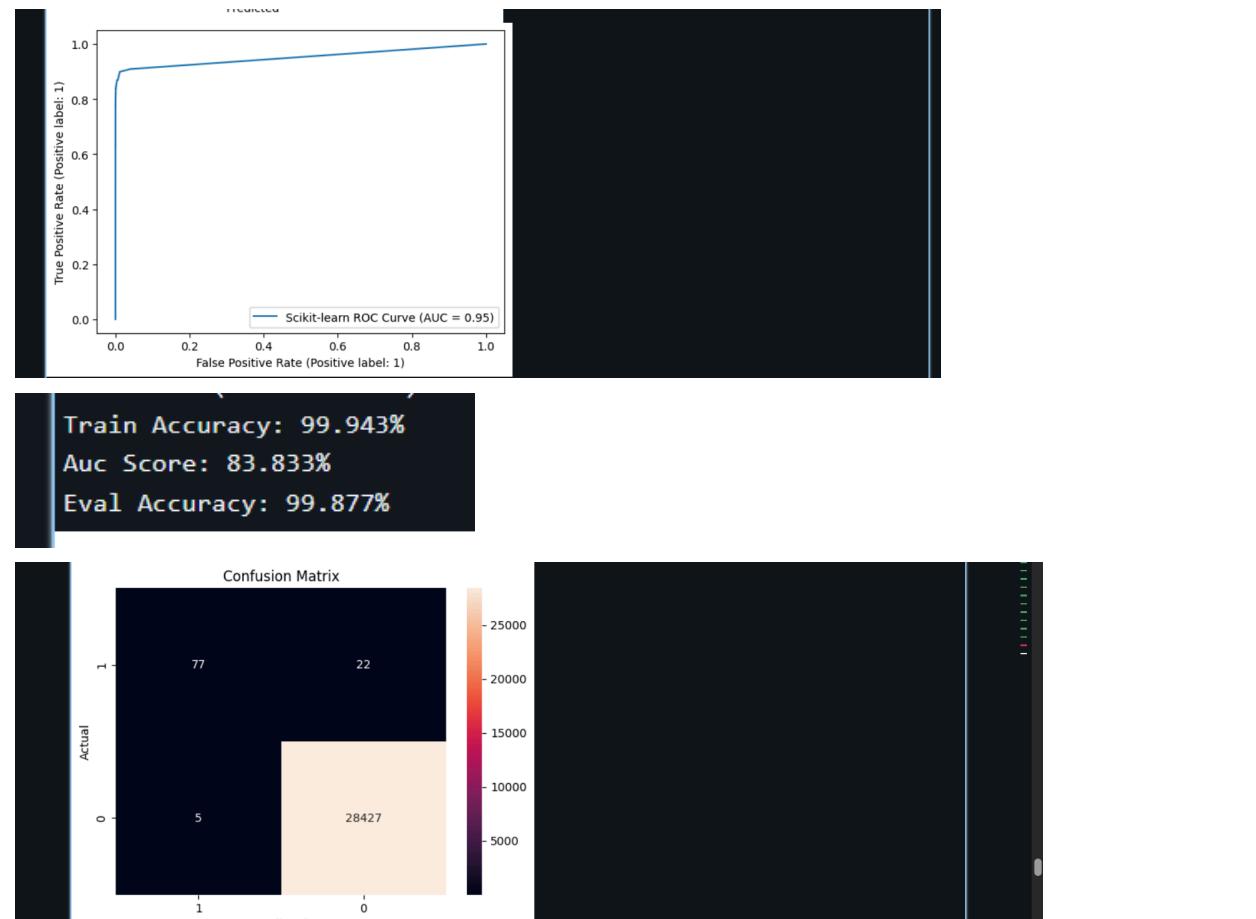
Logistic regression

```
Train Accuracy: 99.893%
Auc Score: 85.341%
Eval Accuracy: 99.874%
```





Random Forest



SVC

