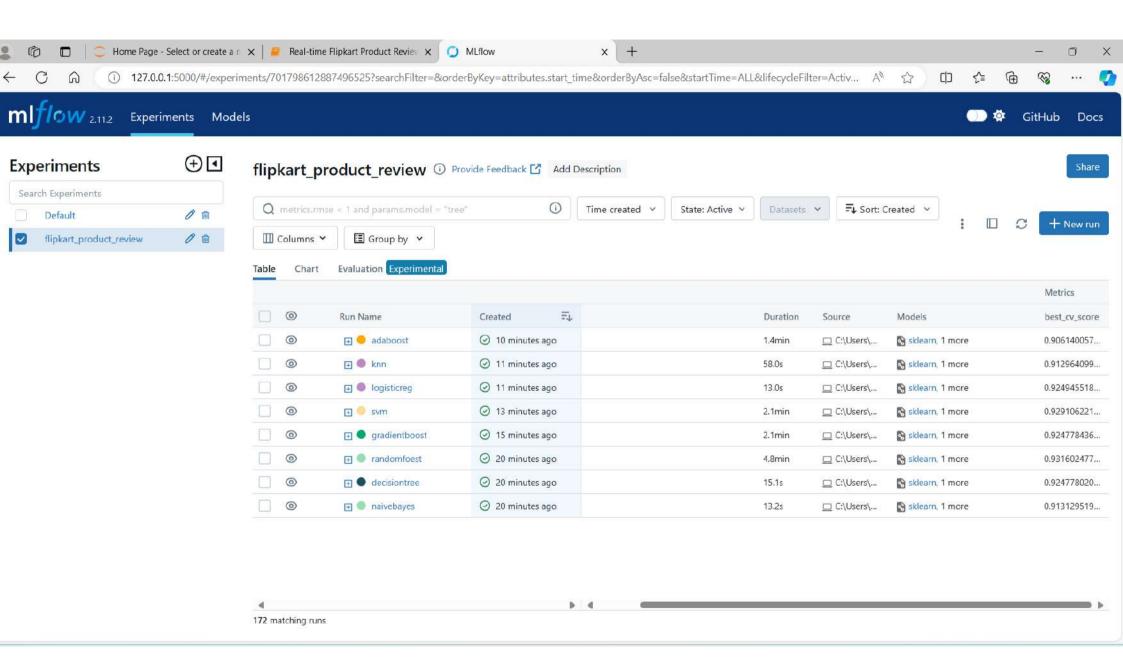# Using MLflow for Experiment Tracking and Model Management
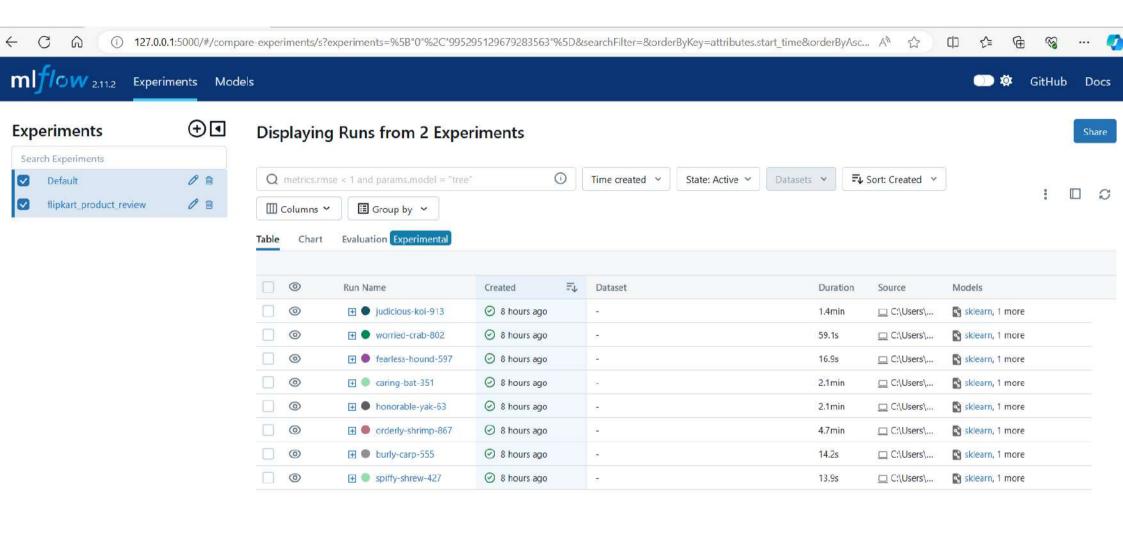
Objective

The objective of this task is to introduce you to MLflow for experiment tracking, model management, and reproducibility in machine learning projects for the Sentiment Analysis Project.
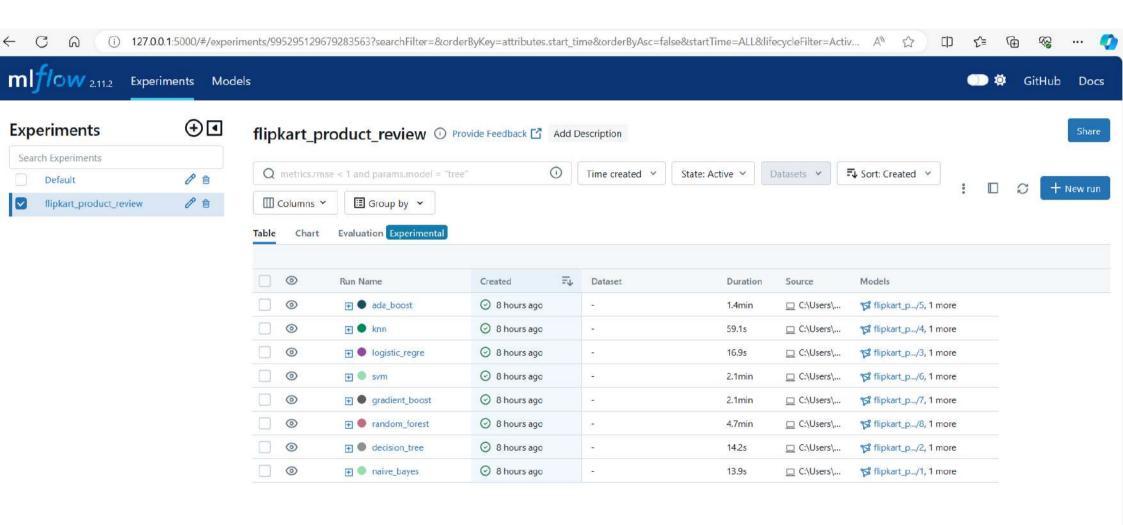
Task

1. Integrate MLflow into your existing machine learning projects.
2. Train machine learning models while logging relevant information with MLflow.
3. Demonstrate how to log parameters, metrics, and artifacts using MLflow tracking APIs.
4. Customizing MLflow UI with run names.
5 Demonstrate metric plots.
6. Demonstrate hyperparameter plots.
7. Demonstrate how to register models and manage by tagging them.
8. (BONUS) Build a Prefect Workflow and Auto Schedule it. Show the Prefect Dashboard with relevant outputs.

127.0.0.1:5000/#/experiments/701798612887496525?searchFilter=&orderByKey=attributes.start_time&orderByAsc=false&startTime=ALL&lifecycleFilter=Activ...

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🔍 metrics.rmse < 1 and params.model = "tree"   ⓘ | Time created ▾ | State: Active ▾ | Datasets ▾ | ⇅ Sort: Created ▾ | ⋮ ▫ ⟳ | + New run

▥ Columns ▾   ▦ Group by ▾

Table   Chart   Evaluation   Experimental

									Metrics
☐	👁	Run Name	Created ⇅		Duration	Source	Models		best_cv_score
☐	👁	⊞ 🟠 adaboost	✓ 10 minutes ago		1.4min	🖥 C:\Users\...	📄 sklearn, 1 more		0.906140057...
☐	👁	⊞ 🟣 knn	✓ 11 minutes ago		58.0s	🖥 C:\Users\...	📄 sklearn, 1 more		0.912964099...
☐	👁	⊞ 🟣 logisticreg	✓ 11 minutes ago		13.0s	🖥 C:\Users\...	📄 sklearn, 1 more		0.924945518...
☐	👁	⊞ 🟡 svm	✓ 13 minutes ago		2.1min	🖥 C:\Users\...	📄 sklearn, 1 more		0.929106221...
☐	👁	⊞ 🟢 gradientboost	✓ 15 minutes ago		2.1min	🖥 C:\Users\...	📄 sklearn, 1 more		0.924778436...
☐	👁	⊞ 🟢 randomfoest	✓ 20 minutes ago		4.8min	🖥 C:\Users\...	📄 sklearn, 1 more		0.931602477...
☐	👁	⊞ ⚫ decisiontree	✓ 20 minutes ago		15.1s	🖥 C:\Users\...	📄 sklearn, 1 more		0.924778020...
☐	👁	⊞ 🟢 naivebayes	✓ 20 minutes ago		13.2s	🖥 C:\Users\...	📄 sklearn, 1 more		0.913129519...

172 matching runs

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Displaying Runs from 2 Experiments   Share

🔍 metrics.rmse < 1 and params.model = "tree"   ⓘ | Time created ⌄ | State: Active ⌄ | Datasets ⌄ | ⇅ Sort: Created ⌄

▥ Columns ⌄   ⊞ Group by ⌄   ⋮ ▢ ↻

Table   Chart   Evaluation   **Experimental**

☐	👁	Run Name	Created ⇅	Dataset	Duration	Source	Models
☐	👁	⊞ ● judicious-koi-913	⊘ 8 hours ago	-	1.4min	🖥 C:\Users\...	📄 sklearn, 1 more
☐	👁	⊞ ● worried-crab-802	⊘ 8 hours ago	-	59.1s	🖥 C:\Users\...	📄 sklearn, 1 more
☐	👁	⊞ ● fearless-hound-597	⊘ 8 hours ago	-	16.9s	🖥 C:\Users\...	📄 sklearn, 1 more
☐	👁	⊞ ● caring-bat-351	⊘ 8 hours ago	-	2.1min	🖥 C:\Users\...	📄 sklearn, 1 more
☐	👁	⊞ ● honorable-yak-63	⊘ 8 hours ago	-	2.1min	🖥 C:\Users\...	📄 sklearn, 1 more
☐	👁	⊞ ● orderly-shrimp-867	⊘ 8 hours ago	-	4.7min	🖥 C:\Users\...	📄 sklearn, 1 more
☐	👁	⊞ ● burly-carp-555	⊘ 8 hours ago	-	14.2s	🖥 C:\Users\...	📄 sklearn, 1 more
☐	👁	⊞ ● spiffy-shrew-427	⊘ 8 hours ago	-	13.9s	🖥 C:\Users\...	📄 sklearn, 1 more

172 matching runs

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| 🔍 metrics.rmse < 1 and params.model = "tree" ⓘ | Time created ⌄ | State: Active ⌄ | Datasets ⌄ | ⇵ Sort: Created ⌄ |

☷ Columns ⌄   ⊞ Group by ⌄

⋮ ▱ ⟳ + New run

Table   Chart   Evaluation   Experimental

	👁	Run Name	Created ⇵	Dataset	Duration	Source	Models
☐	👁	⊞ ● ada_boost	✓ 8 hours ago	-	1.4min	🖥 C:\Users\...	🐿 flipkart_p.../5, 1 more
☐	👁	⊞ ● knn	✓ 8 hours ago	-	59.1s	🖥 C:\Users\...	🐿 flipkart_p.../4, 1 more
☐	👁	⊞ ● logistic_regre	✓ 8 hours ago	-	16.9s	🖥 C:\Users\...	🐿 flipkart_p.../3, 1 more
☐	👁	⊞ ● svm	✓ 8 hours ago	-	2.1min	🖥 C:\Users\...	🐿 flipkart_p.../6, 1 more
☐	👁	⊞ ● gradient_boost	✓ 8 hours ago	-	2.1min	🖥 C:\Users\...	🐿 flipkart_p.../7, 1 more
☐	👁	⊞ ● random_forest	✓ 8 hours ago	-	4.7min	🖥 C:\Users\...	🐿 flipkart_p.../8, 1 more
☐	👁	⊞ ● decision_tree	✓ 8 hours ago	-	14.2s	🖥 C:\Users\...	🐿 flipkart_p.../2, 1 more
☐	👁	⊞ ● naive_bayes	✓ 8 hours ago	-	13.9s	🖥 C:\Users\...	🐿 flipkart_p.../1, 1 more

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Registered Models

Create Model

Filter registered models by name or tags   ⓘ   🔍

Name ⇅	Latest version	Aliased versions	Created by	Last modified	Tags
flipkart_product_review_model	Version 8			2024-03-26 20:03:54	—

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Registered Models ›

flipkart_product_review_model

Created Time: 2024-03-26 19:55:30   Last Modified: 2024-03-26 20:03:54

> Description   Edit

> Tags

∨ Versions   Compare

New model registry UI 🔘

	Version	Registered at ⇊	Created by	Tags	Aliases	Description
⊘	Version 8	2024-03-26 20:03:54		Add	Add	
⊘	Version 7	2024-03-26 20:02:20		Add	Add	
⊘	Version 6	2024-03-26 20:01:46		Add	Add	
⊘	Version 5	2024-03-26 20:01:15		Add	Add	
⊘	Version 4	2024-03-26 20:00:44		Add	Add	
⊘	Version 3	2024-03-26 19:59:53		Add	Add	
⊘	Version 2	2024-03-26 19:58:38		Add	Add	
⊘	Version 1	2024-03-26 19:55:30		Add	Add	

1

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metrics.rmse < 1 and params.model = "tree"   ⓘ | Time created ⌄ | State: Active ⌄ | Datasets ⌄ | ⇟ Sort: Created ⌄

New run

⊞ Group by ⌄

Table   **Chart**   Evaluation   **Experimental**

	Run Name
👁	
👁	⊞ ● ada_boost
👁	⊞ ● knn
👁	⊞ ● logistic_regre
👁	⊞ ● svm
👁	⊞ ● gradient_boost
👁	⊞ ● random_forest
👁	⊞ ● decision_tree
👁	⊞ ● naive_bayes

best_cv_score

Comparing first 8 runs

```
                                    0.91
                                    0.93
                                    0.93
                                    0.93
                                    0.93
                                 0.92
                                    0.91
                                    0.91
0        0.2      0.4      0.6      0.8
```

— ada_boost — knn — logistic_regre — svm
— gradient_boost — random_forest — decision_tree

GridSearchCV_score_X_test

Comparing first 8 runs

```
                                    0.90
                                    0.92
                                    0.93
                                    0.93
                                    0.92
                                 0.91
                                    0.91
                                    0.90
0        0.2      0.4      0.6      0.8
```

— ada_boost — knn — logistic_regre — svm
— gradient_boost — random_forest — decision_tree

mean_fit_time

Comparing first 8 runs

mean_score_time

Comparing first 8 runs

172 matching runs

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Experiments ⊕ ◧

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🔍 metrics.rmse < 1 and params.model = "tree"   ⓘ   **Time created** ⌄   **State: Active** ⌄   Datasets ⌄   ⇅ Sort: Created ⌄

⊞ Group by ⌄   ⋮   ↻   **+ New run**

Table **Chart** Evaluation **Experimental**

☐	👁	Run Name

⌄   svm_hypermeter (1) ✏   ⠿   ⋮ **+ Add chart**

☐	👁	⊞ 🔵 ada_boost
☐	👁	⊞ 🟢 knn
☐	👁	⊞ 🟣 logistic_regre
☐	👁	⊟ 🟢 svm
☐	👁	🔴 flawless-shrew-2...
☐	👁	🟠 gregarious-jay-2...
☐	👁	🔵 grandiose-mole-..
☐	👁	🟠 stylish-squirrel-71
☐	👁	🔵 smiling-eel-833
☐	👁	🟣 enchanting-loon...
☐	👁	🟠 able-yak-842
☐	👁	⚫ magnificent-dov...
☐	👁	🟢 monumental-ro...

⠿ **Parallel Coordinates**   ⛶ ⋮

Comparing 24 runs ⓘ

vector...atures   classifier__C   classifier__kernel   mean_train_score   mean_test_score

172 matching runs   **+ Add section**

Parallel Coordinates

Comparing 24 runs

172 matching runs

+ Add section

Parallel Coordinates

Comparing 24 runs

×

| vectorization__max_features | classifier__C | classifier__kernel | mean_train_score | mean_test_score |

enchanting-loon-327

vectorization__max_features: 5000.000000
classifier__C: 1.000000
classifier__kernel: linear
...
mean_test_score: 0.929106

👁

5,000 ··· 10 ··· rbf

4,000 ··· 8

3,000 ··· 6 ··· 0.92

0.54 ··· 0.91

2,000 ··· 4 ··· 0.92 ··· 0.90

0.90 ··· 0.89

1,000 ··· 2 ··· linear ··· 0.88 ··· 0.88

+ Add section

Parallel Coordinates

Comparing 24 runs

vectorization__max_features	classifier__C	classifier__kernel	mean_train_score	mean_test_score

● bustling-duck-488

vectorization__max_features: 1000.000000
classifier__C: 0.100000
classifier__kernel: rbf
...
mean_test_score: 0.879181

Parallel Coordinates

Comparing 24 runs

×

E

s

classifier__n_estimators	classifier__learning_rate	vectorization__max_features	mean_train_score	mean_test_score

● nebulous-penguin-294

classifier__n_estimators: 200.000000
classifier__learning_rate: 0.100000
vectorization__max_features: 1000.000000
...
mean_test_score: 0.925278

👁

classifier__n_estimators axis: 200, 180, 160, 140, 120, 100, 80, 60

classifier__learning_rate axis: 0.10, 0.08, 0.06, 0.04, 0.02

vectorization__max_features axis: 5.000, 4.000, 3.000, 2.000, 1.000

mean_train_score axis: 0.92, 0.92, 0.90, 0.90, 0.88

mean_test_score axis: 0.92, 0.91, 0.90, 0.89, 0.88

172 matching runs

svm_hypermeter (1)

+ Add chart