

Train.py

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(base) PS D:\LLM projects\MLOPS\LAB4-MLFlow python .\train.py

Loading Iris Dataset

Training samples: 120
Test samples: 30
Features: ['sepal length (cm)', 'sepal width (cm)', 'petal length (cm)', 'petal width (cm)']
Classes: [np.str_('setosa'), np.str_('versicolor'), np.str_('virginica')]

Total Configurations: 12
RandomForest: 4 configs
SVC: 4 configs
LogisticRegression: 4 configs

Training RandomForest with 4 hyperparameter sets

Training RandomForest_config_1...
2025/11/01 15:51:15 WARNING mlflow.models.model: "artifact_path" is deprecated. Please use "name" instead.
Downloading artifacts: 100% |██████████| 7/7 [00:00<00:00, 5965.08it/s]
    ✓ Accuracy: 0.9000 | F1: 0.8997
Training RandomForest_config_2...
2025/11/01 15:51:24 WARNING mlflow.models.model: "artifact_path" is deprecated. Please use "name" instead.
Downloading artifacts: 100% |██████████| 7/7 [00:00<00:00, 4368.42it/s]
    ✓ Accuracy: 0.9667 | F1: 0.9666
Training RandomForest_config_3...
2025/11/01 15:51:29 WARNING mlflow.models.model: "artifact_path" is deprecated. Please use "name" instead.
Downloading artifacts: 100% |██████████| 7/7 [00:00<00:00, 4593.98it/s]
    ✓ Accuracy: 0.9000 | F1: 0.8997
Training RandomForest_config_4...
2025/11/01 15:51:34 WARNING mlflow.models.model: "artifact_path" is deprecated. Please use "name" instead.
Downloading artifacts: 100% |██████████| 7/7 [00:00<00:00, 5620.24it/s]
    ✓ Accuracy: 0.9667 | F1: 0.9666

(base) PS D:\LLM projects\MLOPS\LAB4-MLFlow python .\train.py
2025/11/01 15:51:34 WARNING mlflow.models.model: "artifact_path" is deprecated. Please use "name" instead.
Downloading artifacts: 100% |██████████| 7/7 [00:00<00:00, 5620.24it/s]
    ✓ Accuracy: 0.9667 | F1: 0.9666

Summary for RandomForest:
  Best Config: #2
  Best Accuracy: 0.9667
  Avg Accuracy: 0.9333
  Std Accuracy: 0.0333

Training SVC with 4 hyperparameter sets

Training SVC_config_1...
2025/11/01 15:51:39 WARNING mlflow.models.model: "artifact_path" is deprecated. Please use "name" instead.
Downloading artifacts: 100% |██████████| 7/7 [00:00<00:00, 4749.29it/s]
    ✓ Accuracy: 0.9667 | F1: 0.9666
Training SVC_config_2...
2025/11/01 15:51:43 WARNING mlflow.models.model: "artifact_path" is deprecated. Please use "name" instead.
Downloading artifacts: 100% |██████████| 7/7 [00:00<00:00, 4687.87it/s]
    ✓ Accuracy: 0.9667 | F1: 0.9666
Training SVC_config_3...
2025/11/01 15:51:47 WARNING mlflow.models.model: "artifact_path" is deprecated. Please use "name" instead.
Downloading artifacts: 100% |██████████| 7/7 [00:00<00:00, 6475.55it/s]
    ✓ Accuracy: 1.0000 | F1: 1.0000
Training SVC_config_4...
2025/11/01 15:51:51 WARNING mlflow.models.model: "artifact_path" is deprecated. Please use "name" instead.
Downloading artifacts: 100% |██████████| 7/7 [00:00<00:00, 3952.63it/s]
    ✓ Accuracy: 1.0000 | F1: 1.0000

Summary for SVC:
  Best Config: #3
  Best Accuracy: 1.0000
  Avg Accuracy: 0.9833
  Std Accuracy: 0.0167
```

```
(base) PS D:\LLM projects\MLOPS\LAB4-MLOps> python ./train.py
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Training logisticRegression with 4 hyperparameter sets
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Training LogisticRegression config 1...
2025/11/01 15:51:55 WARNING mlflow.models.model: "artifact_path" is deprecated. Please use "name" instead.
Downloading artifacts: 100% |██████████| 7/7 [00:00<00:00, 4115.52it/s]
    ✓ Accuracy: 0.9667 | F1: 0.9666
Training LogisticRegression config 2...
2025/11/01 15:51:59 WARNING mlflow.models.model: "artifact_path" is deprecated. Please use "name" instead.
Downloading artifacts: 100% |██████████| 7/7 [00:00<00:00, 4088.58it/s]
    ✓ Accuracy: 0.9667 | F1: 0.9666
Training LogisticRegression config 3...
2025/11/01 15:52:03 WARNING mlflow.models.model: "artifact_path" is deprecated. Please use "name" instead.
Downloading artifacts: 100% |██████████| 7/7 [00:00<00:00, 5304.45it/s]
    ✓ Accuracy: 1.0000 | F1: 1.0000
Training LogisticRegression config 4...
D:\miniconda3\lib\site-packages\sklearn\linear_model\sag.py:348: convergenceWarning: the max_iter was reached which means the coef_ did
not converge
    warnings.warn(
2025/11/01 15:52:10 WARNING mlflow.models.model: "artifact_path" is deprecated. Please use "name" instead.
Downloading artifacts: 100% |██████████| 7/7 [00:00<00:00, 5421.00it/s]
    ✓ Accuracy: 1.0000 | F1: 1.0000

Summary for LogisticRegression:
Best Config: #3
Best Accuracy: 1.0000
Avg Accuracy: 0.9833
Std Accuracy: 0.0167
=====

MODEL COMPARISON - BEST FROM EACH TYPE
=====


| Model              | Best Config | Test Accuracy | Test F1 | Precision | Recall | Run ID   |
|--------------------|-------------|---------------|---------|-----------|--------|----------|
| SVC                | #3          | 1.0000        | 1.0000  | 1.0000    | 1.0000 | c1e1c4c5 |
| LogisticRegression | #3          | 1.0000        | 1.0000  | 1.0000    | 1.0000 | 2966aab2 |
| RandomForest       | #2          | 0.9667        | 0.9666  | 0.9697    | 0.9667 | 2627597F |


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(base) PS D:\LLM projects\MLOPS\LAB4-MLOps> python ./train.py
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DETAILED COMPARISON - ALL CONFIGURATIONS
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| Model              | Config | Test Accuracy | Test F1 | Run ID   |
|--------------------|--------|---------------|---------|----------|
| SVC                | #3     | 1.0000        | 1.0000  | c1e1c4c5 |
| SVC                | #4     | 1.0000        | 1.0000  | 88ded6a2 |
| LogisticRegression | #3     | 1.0000        | 1.0000  | 2966aab2 |
| LogisticRegression | #4     | 1.0000        | 1.0000  | 4dbd8654 |
| RandomForest       | #2     | 0.9667        | 0.9666  | 2627597F |
| RandomForest       | #4     | 0.9667        | 0.9666  | 5c6cb210 |
| SVC                | #1     | 0.9667        | 0.9666  | f4716131 |
| SVC                | #2     | 0.9667        | 0.9666  | 939241a2 |
| LogisticRegression | #1     | 0.9667        | 0.9666  | d835375F |
| LogisticRegression | #2     | 0.9667        | 0.9666  | f781ffbf |
| RandomForest       | #1     | 0.9000        | 0.8997  | a2c8533F |
| RandomForest       | #3     | 0.9000        | 0.8997  | 4089fbf8 |


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OVERALL BEST MODEL
=====
Model Type: SVC
Configuration: #3
Test Accuracy: 1.0000
Test F1 Score: 1.0000
Test Precision: 1.0000
Test Recall: 1.0000
Run ID: c1e1c4c5338a49b985facea41b309b5F
=====

Registering Best Model to Model Registry
=====
Successfully registered model 'iris_best_model'.
2025/11/01 15:52:13 WARNING mlflow.tracking._model_registry.fluent: Run with id c1e1c4c5338a49b985facea41b309b5F has no artifacts at artifact path 'model', registering model based on models:/m-def22ff9a5fc4de7a0f71b1e2fa4dfc1 instead
=====
```

```
(base) PS D:\LLM projects\MLOPS\LAB4-MLflow> python .\train.py
Model Type: SVC
Configuration: #3
Registry Name: iris_best_model
Version: 1
Stage: Production
Accuracy: 1.0000
Run ID: c1e1c4c5338a49b985facea41b30e65f

=====
INFERENCE - Loading Production Model
D:\LLM projects\MLOPS\LAB4-MLflow\train.py:606: FutureWarning: ``mlflow.tracking.client.MlflowClient.get_latest_versions`` is deprecated since 2.9.0. Model registry stages will be removed in a future major release. To learn more about the deprecation of model registry stages, see our migration guide here: https://mlflow.org/docs/latest/model-registry.html#migrating-from-stages
    versions = client.get_latest_versions(MODEL_REGISTRY_NAME, stages=[stage])
Model Name: iris_best_model
Version: 1
Stage: Production

Results:
    Accuracy: 1.0000
    F1 Score: 1.0000

Sample Predictions:
✓ Sample 1: True-setosa | Pred=setosa | Conf=0.957
✓ Sample 2: True-virginica | Pred=virginica | Conf=0.637
✓ Sample 3: True-versicolor | Pred=versicolor | Conf=0.885
✓ Sample 4: True-versicolor | Pred=versicolor | Conf=0.995
✓ Sample 5: True-setosa | Pred=setosa | Conf=0.958
✓ Sample 6: True-versicolor | Pred=versicolor | Conf=0.895
✓ Sample 7: True-setosa | Pred=setosa | Conf=0.957
✓ Sample 8: True-setosa | Pred=setosa | Conf=0.949
✓ Sample 9: True-virginica | Pred=virginica | Conf=0.923
✓ Sample 10: True-versicolor | Pred=versicolor | Conf=0.884
```

Inference.py

- (base) PS D:\LLM projects\MLOPS\LAB4-MLflow> **python .\inference.py**
 Loading model: iris_best_model from Production stage...
 ✓ Model loaded successfully

Input:

Sepal Length: 5.1
 Sepal Width: 3.5
 Petal Length: 1.4
 Petal Width: 0.2

Predicted Class: setosa

Class Probabilities:

setosa	: 0.9670 (96.70%)
versicolor	: 0.0172 (1.72%)
virginica	: 0.0158 (1.58%)

- (base) PS D:\LLM projects\MLOPS\LAB4-MLflow>