In [1]:
```
!python -c "import sys; print(sys.executable)"
```

```
/home/usmanzaman/mlops-student/bin/python
```

In [2]:
```
import pandas as pd
```

In [3]:
```
pd.__version__
```

Out[3]:
```
'1.5.2'
```

In [4]:
```
%%bash --bg

mlflow server --host 0.0.0.0 \
    --port 5000 \
    --backend-store-uri sqlite:///mlflow.db \
    --default-artifact-root ./mlruns
```

In [5]:
```
%cat MLproject
```

```
name: basic_mlflow

entry_points:
  main:
    # parameters is a key-value collection.
    parameters:
      max_k:
        type: int
        default: 10
    command: "python train_usman.py {max_k}"
```

In [6]:
```
import sklearn
```

In [7]:
```
sklearn.__version__
```

Out[7]:
```
'1.2.0'
```

In [8]:
```
import mlflow
```

In [9]:
```
%%bash
source mlflow_env_vars.sh
mlflow run .
```

```
2022/12/20 11:40:51 INFO mlflow.utils.conda: Conda environment mlflow-dd0fbdd40ba98798131458f29496394bd1a3fb33 already exists.
2022/12/20 11:40:51 INFO mlflow.projects.utils: === Created directory /tmp/tmpwtr7weit for downloading remote URIs passed to ar
guments of type 'path' ===
2022/12/20 11:40:51 INFO mlflow.projects.backend.local: === Running command 'source /home/usmanzaman/anaconda3/bin/../etc/profi
le.d/conda.sh && conda activate mlflow-dd0fbdd40ba98798131458f29496394bd1a3fb33 1>&2 && python train_usman.py 10' in run with I
D '07695a692a6e4d55bd15b34b00e90de4' ===
/home/usmanzaman/anaconda3/envs/mlflow-dd0fbdd40ba98798131458f29496394bd1a3fb33/lib/python3.10/site-packages/_distutils_hack/__
init__.py:33: UserWarning: Setuptools is replacing distutils.
  warnings.warn("Setuptools is replacing distutils.")
Registered model 'new_knn' already exists. Creating a new version of this model...
2022/12/20 11:40:55 INFO mlflow.tracking._model_registry.client: Waiting up to 300 seconds for model version to finish creatio
n.                    Model name: new_knn, version 19
Created version '19' of model 'new_knn'.
Registered model 'new_knn' already exists. Creating a new version of this model...
2022/12/20 11:40:57 INFO mlflow.tracking._model_registry.client: Waiting up to 300 seconds for model version to finish creatio
n.                    Model name: new_knn, version 20
Created version '20' of model 'new_knn'.
Registered model 'new_knn' already exists. Creating a new version of this model...
2022/12/20 11:40:58 INFO mlflow.tracking._model_registry.client: Waiting up to 300 seconds for model version to finish creatio
n.                    Model name: new_knn, version 21
Created version '21' of model 'new_knn'.
Registered model 'new_knn' already exists. Creating a new version of this model...
2022/12/20 11:41:00 INFO mlflow.tracking._model_registry.client: Waiting up to 300 seconds for model version to finish creatio
n.                    Model name: new_knn, version 22
Created version '22' of model 'new_knn'.
Registered model 'new_knn' already exists. Creating a new version of this model...
2022/12/20 11:41:01 INFO mlflow.tracking._model_registry.client: Waiting up to 300 seconds for model version to finish creatio
n.                    Model name: new_knn, version 23
Created version '23' of model 'new_knn'.
Registered model 'new_knn' already exists. Creating a new version of this model...
2022/12/20 11:41:03 INFO mlflow.tracking._model_registry.client: Waiting up to 300 seconds for model version to finish creatio
n.                    Model name: new_knn, version 24
Created version '24' of model 'new_knn'.
Registered model 'new_knn' already exists. Creating a new version of this model...
2022/12/20 11:41:04 INFO mlflow.tracking._model_registry.client: Waiting up to 300 seconds for model version to finish creatio
n.                    Model name: new_knn, version 25
Created version '25' of model 'new_knn'.
Registered model 'new_knn' already exists. Creating a new version of this model...
2022/12/20 11:41:06 INFO mlflow.tracking._model_registry.client: Waiting up to 300 seconds for model version to finish creatio
n.                    Model name: new_knn, version 26
Created version '26' of model 'new_knn'.
Registered model 'new_knn' already exists. Creating a new version of this model...
2022/12/20 11:41:07 INFO mlflow.tracking._model_registry.client: Waiting up to 300 seconds for model version to finish creatio
n.                    Model name: new_knn, version 27
Created version '27' of model 'new_knn'.
2022/12/20 11:41:07 INFO mlflow.projects: === Run (ID '07695a692a6e4d55bd15b34b00e90de4') succeeded ===
```

Inspecting stored models

The trained models are stored in `mlruns/0`.

These directories contain artifacts and config that is needed to serve them.

In [10]:
```
%%bash
last_model_path=$(ls -tr mlruns/0/ | tail -1)
cat mlruns/0/$last_model_path/artifacts/knn/MLmodel
```

```
artifact_path: knn
flavors:
  python_function:
    env:
      conda: conda.yaml
      virtualenv: python_env.yaml
    loader_module: mlflow.sklearn
    model_path: model.pkl
    predict_fn: predict
    python_version: 3.10.8
  sklearn:
    code: null
    pickled_model: model.pkl
    serialization_format: cloudpickle
    sklearn_version: 1.2.0
mlflow_version: 2.0.1
model_uuid: 0294a3e784464d33a898983ce538315b
run_id: 8f5234b86fba4ab8a667b0a434016ccb
utc_time_created: '2022-12-20 06:41:06.466915'
```

In [11]:
```
import mlflow
```

In [12]:
```
mlflow.__version__
```

Out[12]:
```
'2.0.1'
```

Serving model

Now that we trained our models we can go to *Models* page on MLFLow UI (http://localhost:5000/#/models).

Click *sklearn_knn* on this page, choose a model and move it to *Production* stage.

The following cell will serve the model at localhost on port 5001.

In [13]:
```
%%bash --bg
source mlflow_env_vars.sh
mlflow --version
mlflow models serve -m models:/new_knn/Production -p 5001 --env-manager=conda
```

In [23]:
```
%%bash
data='[[1.423e+01, 1.710e+00, 2.430e+00, 1.560e+01, 1.270e+02, 2.800e+00,3.060e+00, 2.800e-01, 2.290e+00, 5.640e+00, 1.040e+00,
echo $data

curl -d "{\"inputs\": $data}" -H 'Content-Type: application/json' 127.0.0.1:5001/invocations
```

```
[[1.423e+01, 1.710e+00, 2.430e+00, 1.560e+01, 1.270e+02, 2.800e+00,3.060e+00, 2.800e-01, 2.290e+00, 5.640e+00, 1.040e+00, 3.920
e+00,1.065e+03]]
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100   175  100    20  100   155   2935  22750 --:--:-- --:--:-- --:--:-- 29166
{"predictions": [0]}
```

In [15]:
```
from sklearn import datasets
```

In [19]:
```
wine = datasets.load_wine()
wine.data[:1, :]
```

Out[19]:
```
array([[1.423e+01, 1.710e+00, 2.430e+00, 1.560e+01, 1.270e+02, 2.800e+00,
        3.060e+00, 2.800e-01, 2.290e+00, 5.640e+00, 1.040e+00, 3.920e+00,
        1.065e+03]])
```

In [22]:
```
wine.target[:1]
```

Out[22]:
```
array([0])
```