ML model deployment in Docker:

1. Creating Virtual Environment (venv)

```
E:\MSC 4\MLOps\Iris-docker-assignment>python -m venv venv

E:\MSC 4\MLOps\Iris-docker-assignment>venv\Scripts\activate
```

2. Installing all the dependencies in requirement.txt

```
(venv) E:\MSC 4\MLOps\Iris-docker-assignment>pip install -r requirements.txt
Collecting fastapi (from -r requirements.txt (line 1))
  Downloading fastapi-0.129.0-py3-none-any.whl.metadata (30 kB)
Collecting uvicorn (from -r requirements.txt (line 2))
  Downloading uvicorn-0.40.0-py3-none-any.whl.metadata (6.7 kB)
Collecting scikit-learn (from -r requirements.txt (line 3))
  Using cached scikit_learn-1.8.0-cp312-cp312-win_amd64.whl.metadata (11 kB)
Collecting pandas (from -r requirements.txt (line 4))
  Using cached pandas-3.0.0-cp312-cp312-win_amd64.whl.metadata (19 kB)
Collecting numpy (from -r requirements.txt (line 5))
  Using cached numpy-2.4.2-cp312-cp312-win_amd64.whl.metadata (6.6 kB)
Collecting joblib (from -r requirements.txt (line 6))
  Using cached joblib-1.5.3-py3-none-any.whl.metadata (5.5 kB)
Collecting starlette<1.0.0,>=0.40.0 (from fastapi->-r requirements.txt (line 1))
  Downloading starlette-0.52.1-py3-none-any.whl.metadata (6.3 kB)
Collecting pydantic>=2.7.0 (from fastapi->-r requirements.txt (line 1))
  Downloading pydantic-2.12.5-py3-none-any.whl.metadata (90 kB)
Collecting typing-extensions>=4.8.0 (from fastapi->-r requirements.txt (line 1))
  Using cached typing_extensions-4.15.0-py3-none-any.whl.metadata (3.3 kB)
Collecting typing-inspection>=0.4.2 (from fastapi->-r requirements.txt (line 1))
  Downloading typing_inspection-0.4.2-py3-none-any.whl.metadata (2.6 kB)
Collecting annotated-doc>=0.0.2 (from fastapi->-r requirements.txt (line 1))
  Downloading annotated_doc-0.0.4-py3-none-any.whl.metadata (6.6 kB)
Collecting click>=7.0 (from uvicorn->-r requirements.txt (line 2))
  Downloading click-8.3.1-py3-none-any.whl.metadata (2.6 kB)
Collecting h11>=0.8 (from uvicorn->-r requirements.txt (line 2))
  Using cached h11-0.16.0-py3-none-any.whl.metadata (8.3 kB)
Collecting scipy>=1.10.0 (from scikit-learn->-r requirements.txt (line 3))
  Using cached scipy-1.17.0-cp312-cp312-win_amd64.whl.metadata (60 kB)
Collecting threadpoolctl>=3.2.0 (from scikit-learn->-r requirements.txt (line 3))
  Using cached threadpoolctl-3.6.0-py3-none-any.whl.metadata (13 kB)
Collecting python-dateutil>=2.8.2 (from pandas->-r requirements.txt (line 4))
  Using cached python_dateutil-2.9.0.post0-py2.py3-none-any.whl.metadata (8.4 kB)
Collecting tzdata (from pandas->-r requirements.txt (line 4))
```

3. creating **train.py** from terminal and writing the code for the model to be trained on iris - data set.

```
(venv) E:\MSC 4\MLOps\Iris-docker-assignment>cd app

(venv) E:\MSC 4\MLOps\Iris-docker-assignment\app>type nul > train.py

(venv) E:\MSC 4\MLOps\Iris-docker-assignment\app>code train.py
```

4. Running train.py , saving the model and printing model's accuracy.

```
(venv) PS E:\MSC 4\MLOps\Iris-docker-assignment\app> py train.py
Model trained successfully!
Accuracy: 1.0000
```

5. commanding docker build , which creats image from docker file and a “build context”

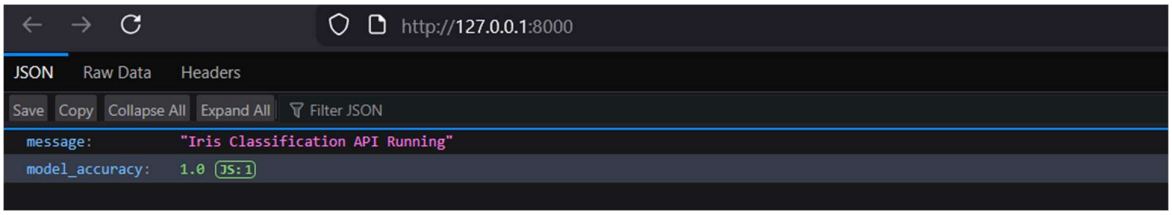
```
(venv) E:\MSC 4\MLOps\Iris-docker-assignment>docker build -t iris-docker-assignment .
[+] Building 7.9s (11/11) FINISHED                                                  docker:desktop-linux
 => [internal] load build definition from dockerfile                                                0.1s
 => => transferring dockerfile: 388B                                                                0.0s
 => [internal] load metadata for docker.io/library/python:3.10-slim                                 2.7s
 => [auth] library/python:pull token for registry-1.docker.io                                       0.0s
 => [internal] load .dockerignore                                                                   0.0s
 => => transferring context: 2B                                                                     0.0s
 => [1/5] FROM docker.io/library/python:3.10-slim@sha256:e508a34e5491225a76fbb9e0f43ebde1f691c6a689  0.0s
 => => resolve docker.io/library/python:3.10-slim@sha256:e508a34e5491225a76fbb9e0f43ebde1f691c6a689  0.0s
 => [internal] load build context                                                                   0.1s
 => => transferring context: 407B                                                                   0.0s
 => CACHED [2/5] WORKDIR /code                                                                      0.0s
 => CACHED [3/5] COPY requirements.txt .                                                            0.0s
 => CACHED [4/5] RUN pip install --no-cache-dir -r requirements.txt                                 0.0s
 => [5/5] COPY ./app ./app                                                                          0.1s
 => exporting to image                                                                              4.8s
 => => exporting layers                                                                             0.1s
 => => exporting manifest sha256:a25aaacc1c43ef768313af3de980e25e02accde0b7fa668c00b3bcef8591608f   0.0s
 => => exporting config sha256:7727d7f37bb8c55ec906128620702d9de31cdc512e860a579e574d91097d01db     0.0s
 => => exporting attestation manifest sha256:b667cf75159be9e9968769913ced5af66aa54d2f1d7d32e1a9048  0.0s
 => => exporting manifest list sha256:b4d0fba1c5b51614bef8e10737369eaa041443eba1ba5693a9efc0f0a491f  0.0s
 => => naming to docker.io/library/iris-docker-assignment:latest                                    0.0s
 => => unpacking to docker.io/library/iris-docker-assignment:latest                                 4.6s

View build details: docker-desktop://dashboard/build/desktop-linux/desktop-linux/p7wzslqc6k0buprbbp0f5klq6
```

6. Docker file view in Docker

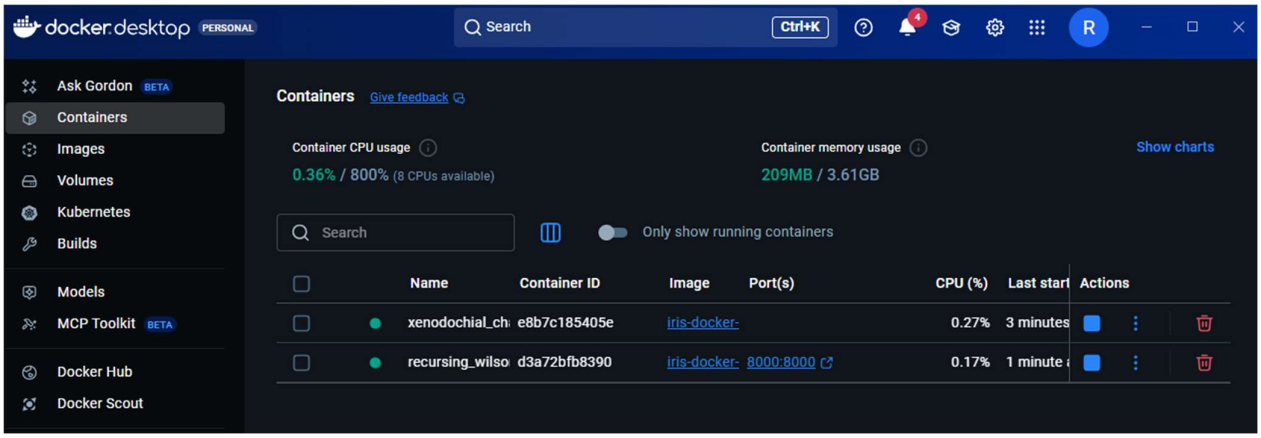
7. Commanding docker run: to create and start new container from a Docker Image

```
PS E:\MSC 4\MLOps\Iris-docker-assignment> docker run -p 8000:8000 iris-docker-assignment
/usr/local/lib/python3.10/site-packages/sklearn/base.py:442: InconsistentVersionWarning: Trying to unpickle estimator DecisionTreeClassifier from ver
sion 1.8.0 when using version 1.7.2. This might lead to breaking code or invalid results. Use at your own risk. For more info please refer to:
https://scikit-learn.org/stable/model_persistence.html#security-maintainability-limitations
  warnings.warn(
/usr/local/lib/python3.10/site-packages/sklearn/base.py:442: InconsistentVersionWarning: Trying to unpickle estimator RandomForestClassifier from ver
sion 1.8.0 when using version 1.7.2. This might lead to breaking code or invalid results. Use at your own risk. For more info please refer to:
https://scikit-learn.org/stable/model_persistence.html#security-maintainability-limitations
  warnings.warn(
INFO:     Started server process [1]
INFO:     Waiting for application startup.
INFO:     Application startup complete.
INFO:     Uvicorn running on http://0.0.0.0:8000 (Press CTRL+C to quit)
INFO:     172.17.0.1:33054 - "GET / HTTP/1.1" 200 OK
INFO:     172.17.0.1:33064 - "GET /favicon.ico HTTP/1.1" 404 Not Found
INFO:     172.17.0.1:42632 - "GET /docd HTTP/1.1" 404 Not Found
INFO:     172.17.0.1:48724 - "GET /favicon.ico HTTP/1.1" 404 Not Found
INFO:     172.17.0.1:48738 - "GET /docs HTTP/1.1" 200 OK
INFO:     172.17.0.1:48738 - "GET /openapi.json HTTP/1.1" 200 OK
INFO:     172.17.0.1:46192 - "POST /predict?sepal_length=2.3&sepal_width=1.3&petal_length=4.6&petal_width=0.2 HTTP/1.1" 200 OK
INFO:     172.17.0.1:47334 - "GET / HTTP/1.1" 200 OK
INFO:     172.17.0.1:47334 - "GET / HTTP/1.1" 200 OK
```

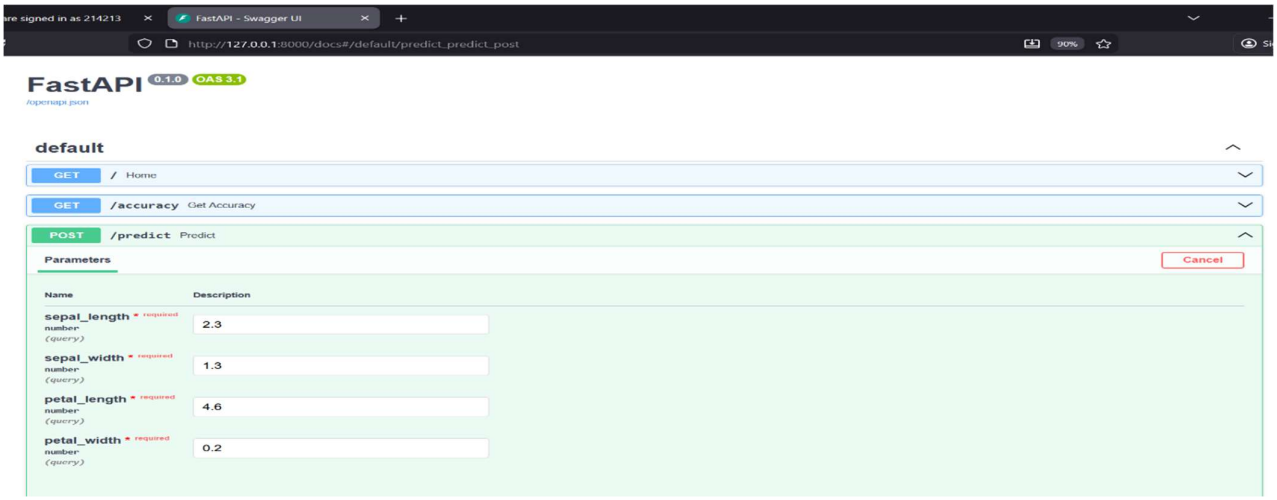
8. Browser view of the deployed Docker Image at port:8000



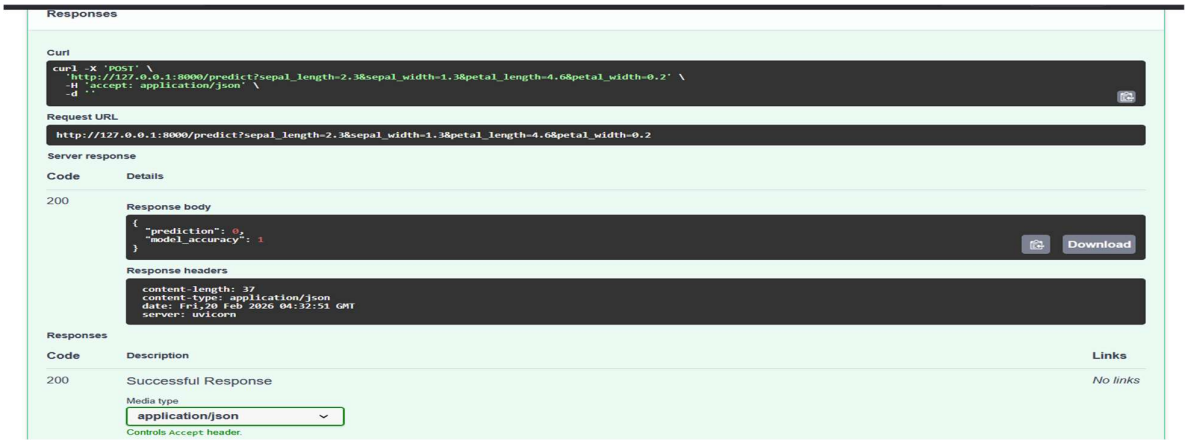
9. Containers in the Docker desktop, current running docker container

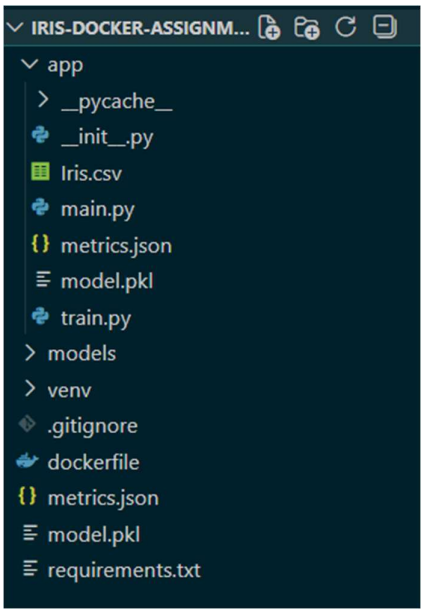


10. Accessing https://192.168.34.1:8090/httpclient.html , the default browser view, to get the prediction from the trained model, while providing the parameters.



11. Response results:





App files:

1. Train.py
2. Main.py
3. Dockerfile