Microsoft

MLOps In a Day

M02 Use Case

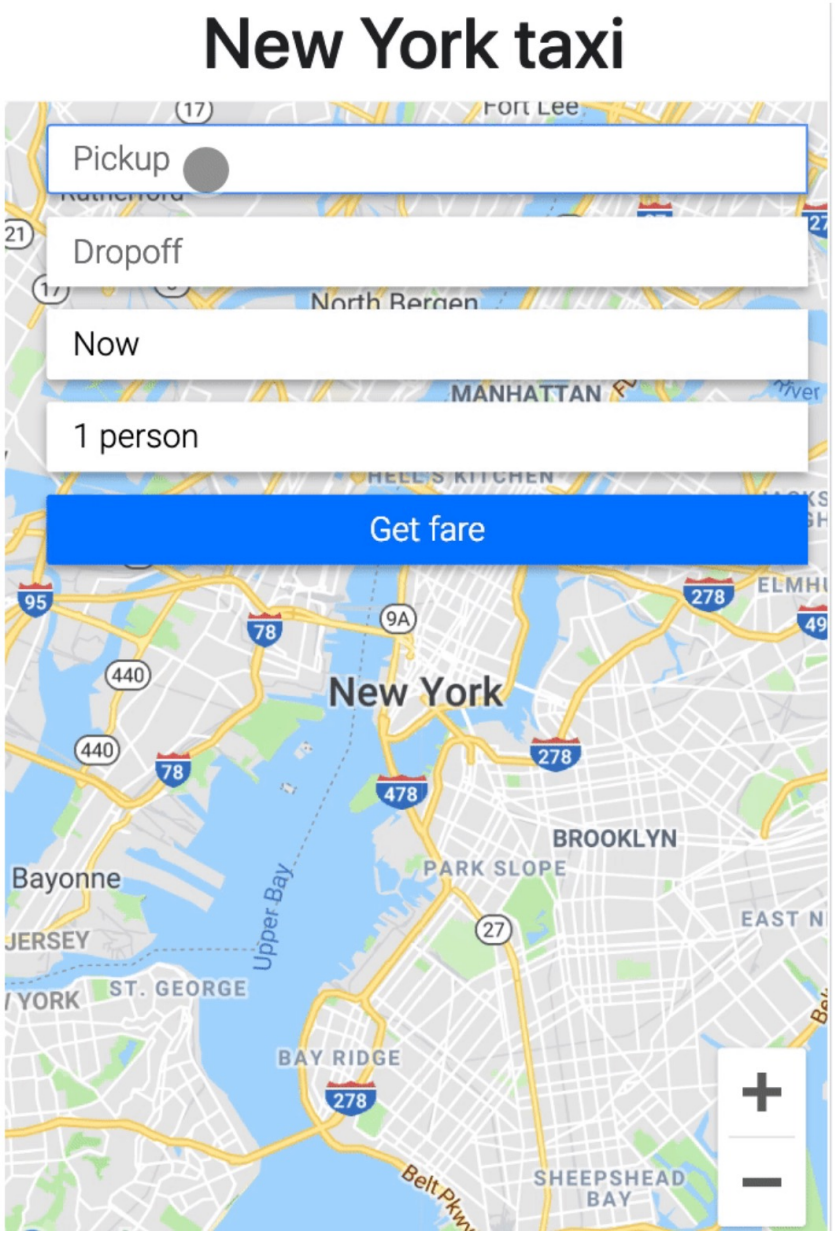
Learning Units covered in this Module

MLOps Use Case

Use Case

Use Case

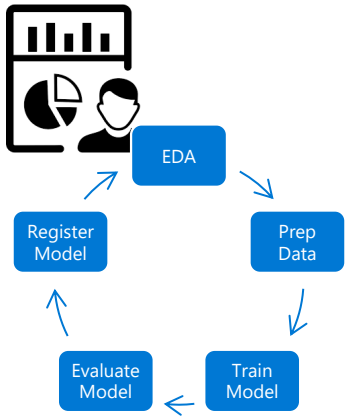
- Predict taxi fare in New York City
- Tabular data
- Regression model
- Random forest scikit-learn model
- Train model using Azure Machine Learning
- Deploy model using Azure Machine Learning Managed Endpoints
- mlflow for tracking & model management
- Azure Devops for infra setup and CI/CD
- Demo Repository:
  - https://github.com/Azure/mlops-v2-workshop

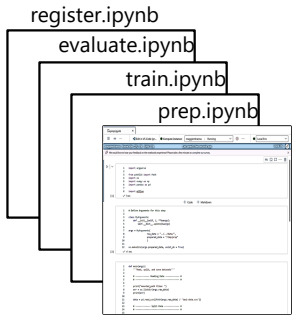


MLOps Journey

Develop | Package | Orchestrate | Deploy & Serve | Monitor | Automate

Experimentation





Azure Machine Learning

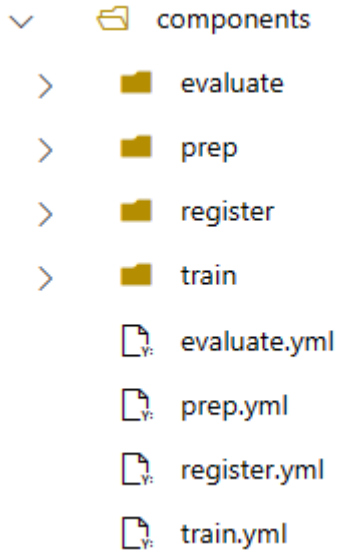
Compute

Notebooks

MLOps Journey

Experimentation

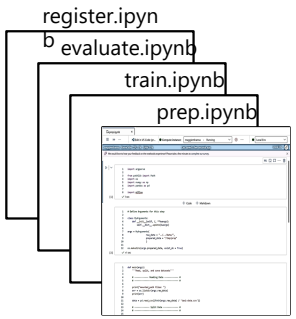
Training Code



MLOps Journey

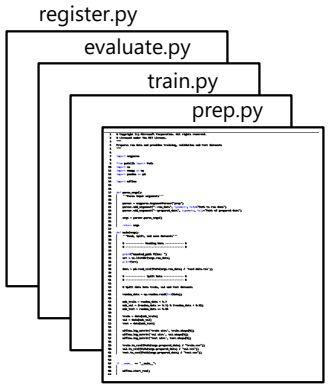
Develop | Package | Orchestrate | Deploy & Serve | Monitor | Automate

Training Code



Training Code

1. Refactor code & package into scripts
   - input & output arguments
2. Prepare required Environment



train-conda.yml

```yaml
channels:
  - defaults
  - anaconda
  - conda-forge
dependencies:
  - python=3.7.5
  - pip
  - pip:
      - azureml-mlflow==1.38.0
      - azureml-sdk==1.38.0
      - scikit-learn==0.24.1
      - pandas==1.2.1
      - joblib==1.0.0
      - matplotlib==3.3.3
```

Azure Machine Learning

Compute

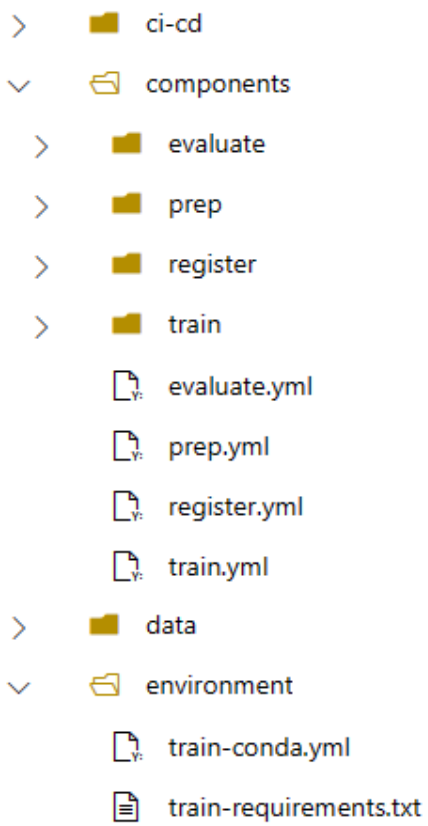
Notebooks

MLOps Journey

Develop | Package | Orchestrate | Deploy & Serve | Monitor | Automate

Training Code

Training Code

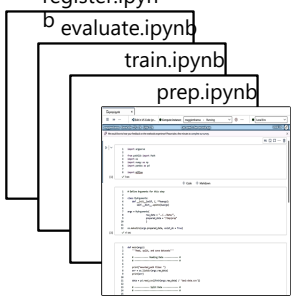


MLOps Journey

Develop | Package | Orchestrate | Deploy & Serve | Monitor | Automate

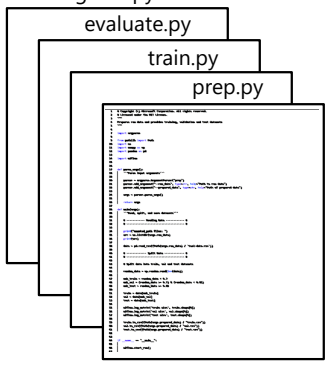
Training Code

register.ipynb
evaluate.ipynb
train.ipynb
prep.ipynb



Training Code

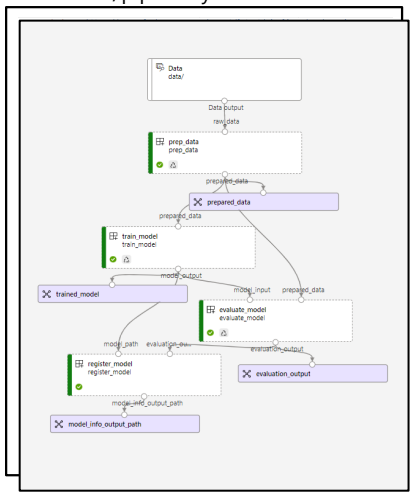
register.py
evaluate.py
train.py
prep.py



Training Code

```
az ml compute create -f compute.yml
az ml environment create -f environment.yml
az ml job create -f pipeline.yml
```

train/pipeline.yml



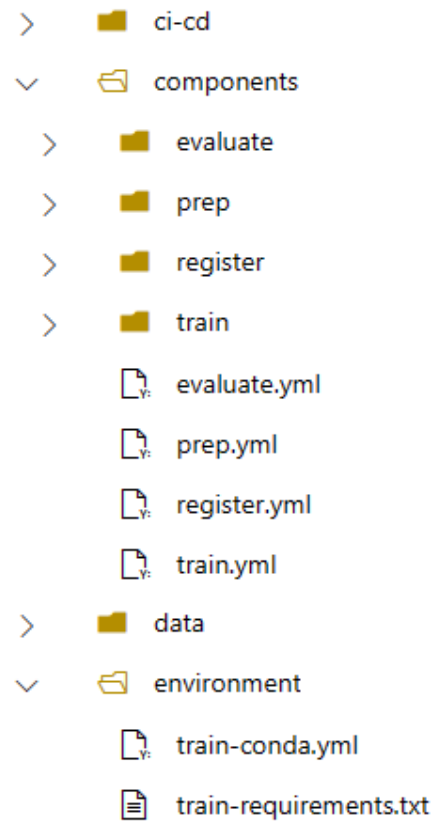
train-conda.yml

```
channels:
  - defaults
  - anaconda
  - conda-forge
dependencies:
  - python=3.7.5
  - pip
  - pip:
      - azureml-mlflow==1.38.0
      - azureml-sdk==1.38.0
      - scikit-learn==0.24.1
      - pandas==1.2.1
      - joblib==1.0.0
      - matplotlib==3.3.3
```

Azure Machine Learning

Data	Jobs
Environments	Pipelines
Compute	Models
Datastores	mlflow

MLOps Journey

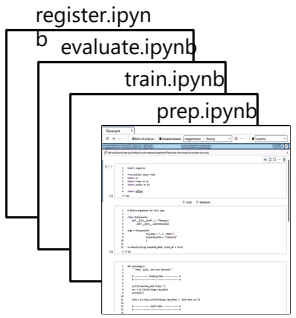


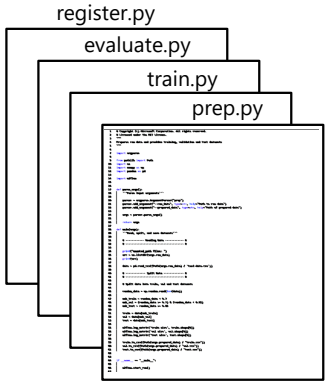
MLOps Journey

Develop | Package | Orchestrate | Deploy & Serve | Monitor | Automate

Training Code | Training Code | Training Code | Model

```
# create batch endpoint & deployment
az ml batch-endpoint create -f batch-endpoint.yml
az ml batch-deployment create -f batch-deployment.yml
```

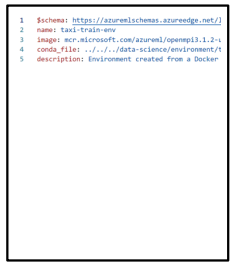




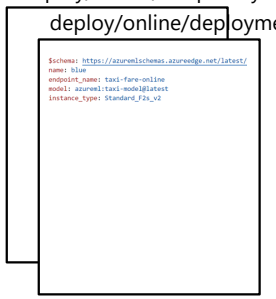
train-conda.yml

train/pipeline.yml

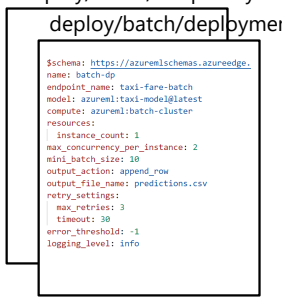
train-env.yml



deploy/online/endpoint.yml
deploy/online/deployment.yml



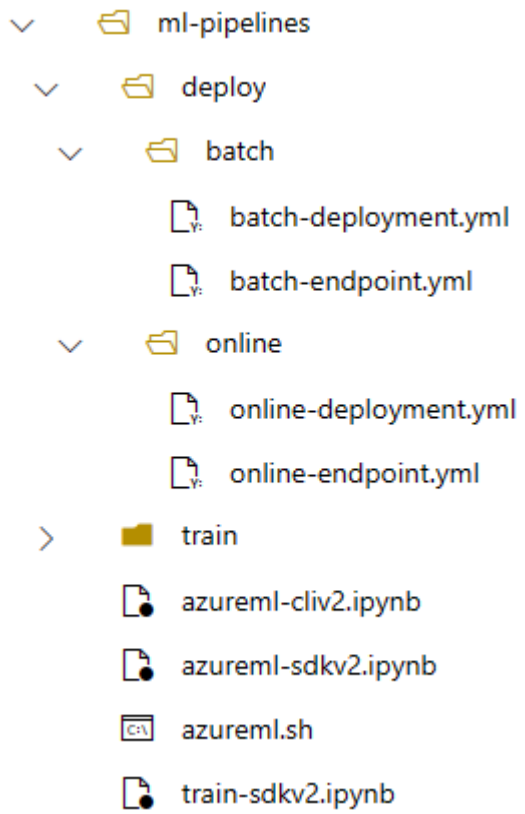
deploy/batch/endpoint.yml
deploy/batch/deployment.yml



Azure Machine Learning

Compute | Models | Endpoints | mlflow

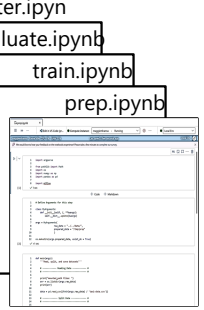
MLOps Journey



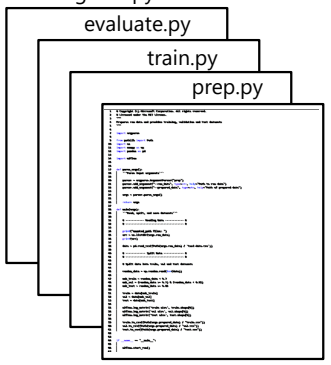
MLOps Journey

Develop	Package	Orchestrate	Deploy & Serve	Monitor	Automate
Training Code	Training Code	Training Code	Model		Training & Deployment

register.ipynb
evaluate.ipynb
train.ipynb
prep.ipynb



register.py
evaluate.py
train.py
prep.py



train-conda.yml

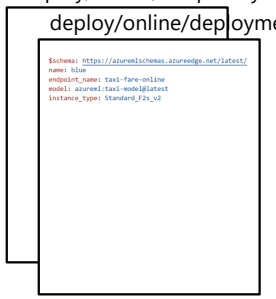
```yaml
channels:
  - defaults
  - anaconda
  - conda-forge
dependencies:
  - python=3.7.5
  - pip
  - pip:
      - azureml-mlflow==1.38.0
      - azureml-sdk==1.38.0
      - scikit-learn==0.24.1
      - pandas==1.2.1
      - joblib==1.0.0
      - matplotlib==3.3.3
```

train/pipeline.yml

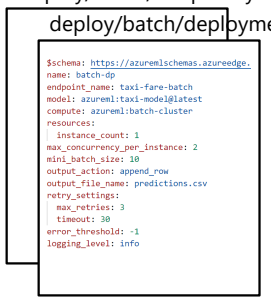
train-env.yml

```
az ml compute create -f compute.yml
az ml environment create -f environment.yml
az ml job create -f pipeline.yml
```

deploy/online/endpoint.yml
deploy/online/deployment.yml



deploy/batch/endpoint.yml
deploy/batch/deployment.yml



```
# create online endpoint & deployment
az ml online-endpoint create -f online-endpoint.yml
az m
# create batch endpoint & deployment
az ml batch-endpoint create -f batch-endpoint.yml
az ml batch-deployment create -f batch-deployment.yml
```

unit-tests.yml
deploy-model-training-pipeline.yml

deploy-batch-endpoint-pipeline.yml
deploy-online-endpoint-pipeline.yml

Azure DevOps

GitHub Actions

MLOps Journey