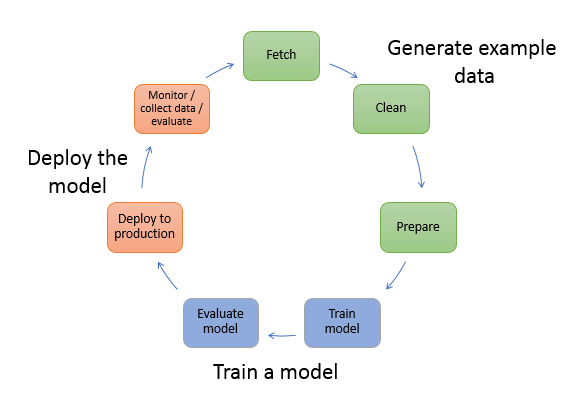
# Develop ML model with Amazon SageMaker

## Workflow of ML model development



### Generate example data

1. Fetch the data that are publicly/privately available.
2. Preprocess the data—perform additional data transformations to improve performance.

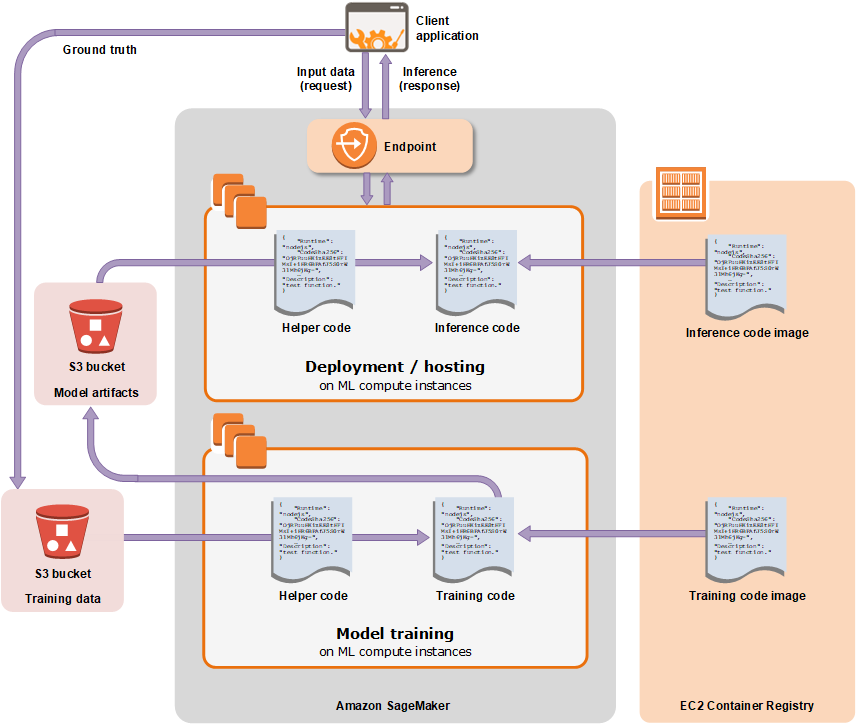
### Train a model

1. Training the model— select an algorithm and use computing resources ranging from a single, small general-purpose instance to a distributed cluster of GPU instances.
2. Evaluate the model to determine its accuracy.

### Deploy the model

Integrate the model into the application to generate inferences in real time and at scale.

## Amazon SageMaker workflow



### Generate data

1. Jupyter notebook to preprocess the data

### Crate a training job and train the model

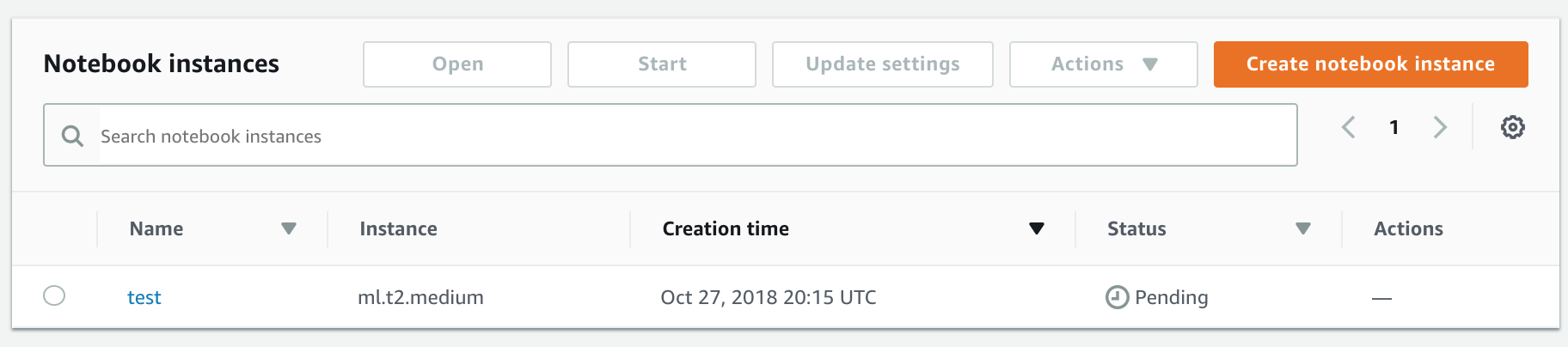
* 1. S3 bucket stores the training data;
  2. The computing resources needed,
  3. S3 bucket stores the output of the job
  4. Docker registry path where the training code is stored.

### Deploying a Model

1. The S3 path where the model artifacts are stored
2. Docker registry path where the inference code is stored.
3. Create an HTTPS endpoint

## Example

### Step 1: Create a Jupyter Notebook and Initialize Variables



### Step 2: Download, Explore, and Transform the Training Data

1. Download the MNIST dataset to your Amazon SageMaker notebook instance

%%time  
import pickle, gzip, numpy, urllib.request, json  
  
*# Load the dataset*  
urllib.request.urlretrieve("http://deeplearning.net/data/mnist/mnist.pkl.gz", "mnist.pkl.gz")  
with gzip.open('mnist.pkl.gz', 'rb') as f:  
 train\_set, valid\_set, test\_set = pickle.load(f, encoding='latin1')

1. Transform the Training Dataset and Upload It to S3

%%time  
from sagemaker.amazon.common import write\_numpy\_to\_dense\_tensor  
import io  
import boto3  
  
bucket = '*sagemaker365*'  
data\_key = 'kmeans\_lowlevel\_example/data'  
data\_location = 's3://{}/{}'.format(bucket, data\_key)  
print('training data will be uploaded to: {}'.format(data\_location))  
  
*# Convert the training data into the format required by the SageMaker KMeans algorithm*  
buf = io.BytesIO()  
write\_numpy\_to\_dense\_tensor(buf, train\_set[0], train\_set[1])  
buf.seek(0)  
  
boto3.resource('s3').Bucket(bucket).Object(data\_key).upload\_fileobj(buf)

### Step 3: Train a Model

1. Choose the Training Algorithm

Specify the registry path of the Docker image that contains the training code.

Specify algorithm-specific parameters.

The input and output S3 bucket.

1. Create a Training Job

Option1: Use the high-level Python library provided by Amazon SageMaker

from sagemaker import KMeans  
  
data\_location = 's3://{}/kmeans\_highlevel\_example/data'.format(bucket)  
output\_location = 's3://{}/kmeans\_highlevel\_example/output'.format(bucket)  
  
print('training data will be uploaded to: {}'.format(data\_location))  
print('training artifacts will be uploaded to: {}'.format(output\_location))  
  
kmeans = KMeans(role=role,  
 train\_instance\_count=2,  
 train\_instance\_type='ml.c4.8xlarge',  
 output\_path=output\_location,  
 k=10,  
 data\_location=data\_location)

%%time  
  
kmeans.fit(kmeans.record\_set(train\_set[0]))

Option2: Use the SDK for Python

### Step 4: Deploy the Model to Amazon SageMaker

Option1: Deploy the Model to Amazon SageMaker Hosting Services

Option2: Deploy the Model to Amazon SageMaker Batch Transform

### Step 5: Validate the Model

Option1: Use the high-level Python library provided by Amazon SageMaker.

Option2: Use the SDK for Python.