AWS INNOVATE

ONLINE CONFERENCE 2019

MACHINE LEARNING & AI EDITION

Opensource ML Frameworks on Amazon SageMaker Featuring TensorFlow, PyTorch, MXnet, Keras and Gluon (Level 300)

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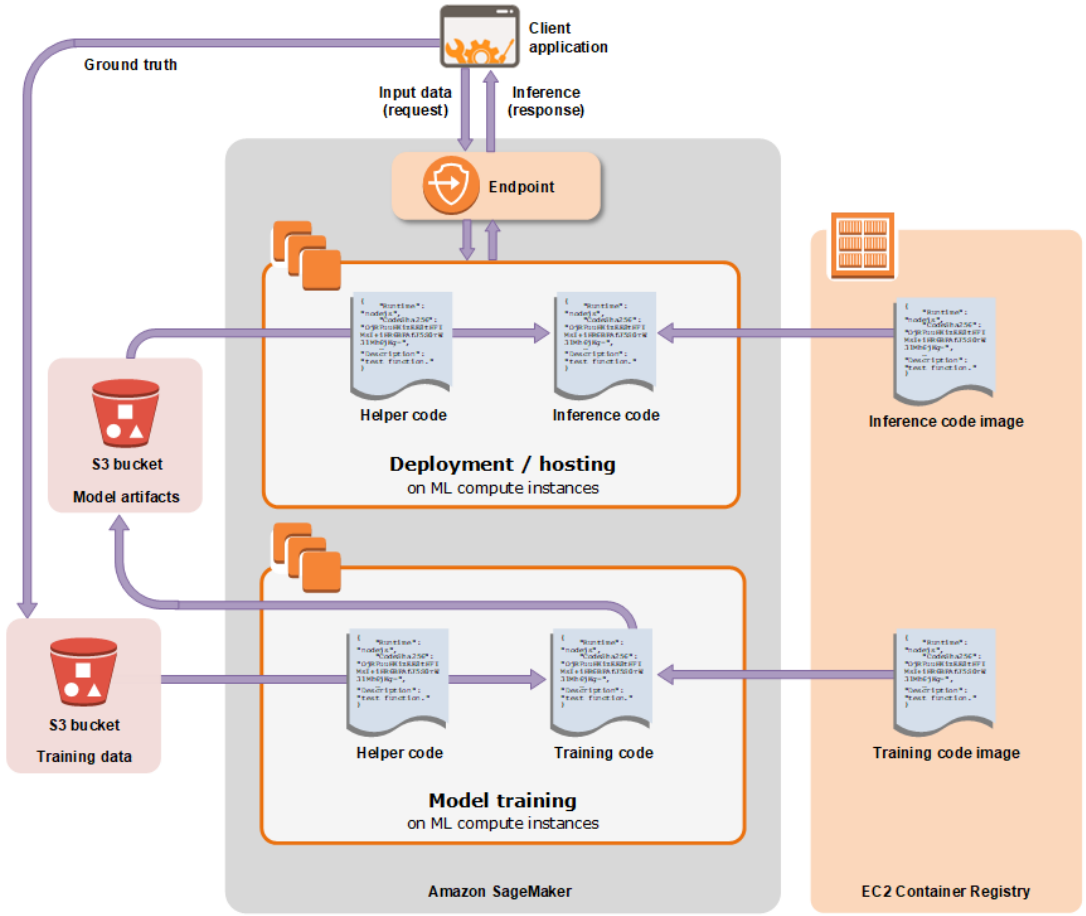
aws

Deep Learning on Amazon SageMaker

- Built-in support for TensorFlow, PyTorch, Chainer, MXNet
- Fully customizable Bring Your Own (BYO) container option
- Distributed GPU training
- Code Portability
- Experiment Tracking
- One-click training and One-click deployment

Amazon SageMaker – Training phase



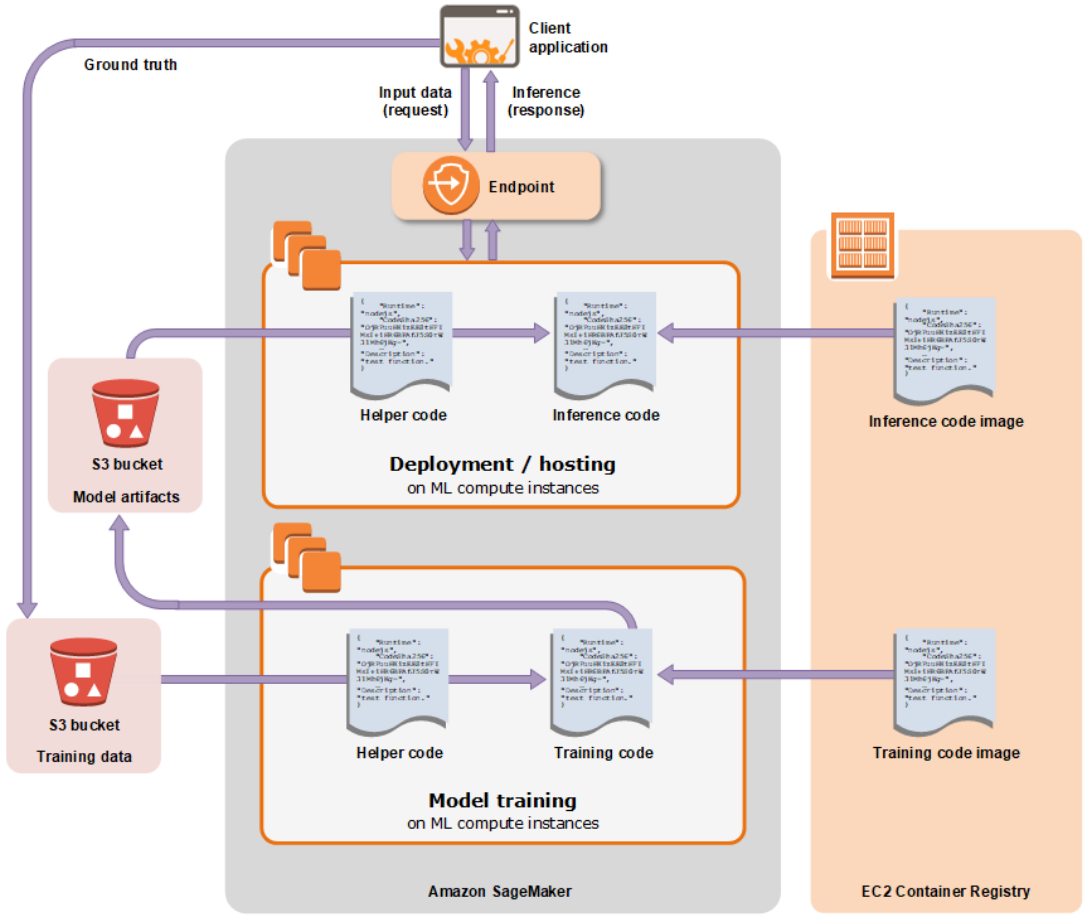
You provide

1. Your source code in S3 or local file system
2. Your data usually in S3
3. A base docker image, SageMaker Built-in or BYO
4. The EC2 instance type and count

Amazon SageMaker

- ✓ Automatically provisions and tears down Amazon EC2 instances for your training job
- ✓ Launches docker image in the EC2 instance type required for training & inference
- ✓ Downloads code & data from S3 to container host
- ✓ Executes training job
- ✓ Copies model from container host to S3
- ✓ Copies results from container host to S3
- ✓ Logs / print results captured in Amazon CloudWatch
- ✓ Captures training infrastructure & performance metrics in CloudWatch

Amazon SageMaker – Inference phase



You provide

1. The trained model
2. The docker Image
3. The EC2 instance type and initial count

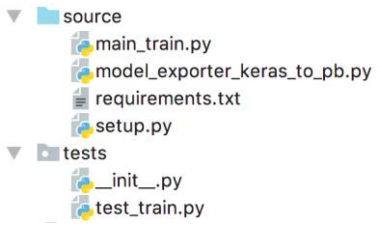
SageMaker

- ✓ Launches docker image in the EC2 instance type
- ✓ Downloads model from S3 to container host
- ✓ Auto scales instances based on scaling policy
- ✓ Automatically captures metrics such as latency, #invocations
- ✓ Logs / print results captured in CloudWatch

Hyperparameters and Environment Variables

```python
# Train dir files
parser.add_argument("--traindata", help="The input file wrt to the training directory", required=True)
# The environment variable SM_CHANNEL_TRAIN is defined
parser.add_argument('--traindata-dir',
                    help='The directory containing training artifacts such as training data',
                    default=os.environ.get('SM_CHANNEL_TRAIN', "."))
# val dir files
parser.add_argument("--validationdata", help="The validation input file wrt to the val directory", required=True)
parser.add_argument('--validationdata-dir',
                    help='The directory containing validation artifacts such as validation data',
                    default=os.environ.get('SM_CHANNEL_VALIDATION', "."))

# output dir to save any files such as predictions, logs, etc
parser.add_argument("--outputdir", help="The output dir to save results",
                    default=os.environ.get('SM_OUTPUT_DATA_DIR', "result_data")
                    )

parser.add_argument("--model_dir", help="Do not use this.. required by SageMaker", default=None)

# This is where the model needs to be saved to
parser.add_argument("--snapshot_dir", help="The directory to save the snapshot to..",
                    default=os.environ.get('SM_MODEL_DIR', None))

# Additional parameters for your code
parser.add_argument("--epochs", help="The number of epochs", default=10, type=int)
parser.add_argument("--batch-size", help="The mini batch size", default=30, type=int)
```

main_train.py



Hyperparameters and Environment Variables

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# Additional parameters for your code
parser.add_argument("--epochs", help="The number of epochs", default=1
parser.add_argument("--batch-size", help="The mini batch size", defau
```

main_train.py

Submit your training job

```
from sagemaker.tensorflow import TensorFlow
from time import gmtime, strftime

s3_model_path = "s3://{}/models".format(sagemaker_session.default_bucket())

abalone_estimator = TensorFlow(entry_point='main_train.py',
                    source_dir="./source",
                    role=role,
                    py_version="py3",
                    framework_version = "1.11.0",
                    hyperparameters={'traindata' : 'abalone_train.csv',
                            'validationdata' : 'abalone_test.csv',
                            'epochs': 10,
                            'batch-size': 32},
                    model_dir = s3_model_path,
                    metric_definitions = [{"Name": "mean_squared_error",
                                 "Regex": "## validation_metric_mse ##: (\d*[.]?\d*)"}
                                ,{"Name": "mean_absolute_error",
                                 "Regex": "## validation_metric_mae ##: (\d*[.]?\d*)"}
                                ,{"Name": "mean_absolute_percentage_error",
                                 "Regex": "## validation_metric_mape ##: (\d*[.]?\d*)"}
                                ],
                    train_instance_count=1,
                    train_instance_type='ml.c4.xlarge')

abalone_estimator.fit( {'train': s3_input_prefix,
                        'validation':s3_input_prefix},
                       job_name="ablone-age-py3-{}".format(strftime("%Y-%m-%d-%H-%M-%S", gmtime())))
```

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                                         "Regex": "## validation_metric_mape ##: (\d*[.]?\d*)"}
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abalone_estimator.fit( {'train': s3_input_prefix,
                        'validation':s3_input_prefix},
                      job_name="ablone-age-py3-{}".format(strftime("%Y-%m-%d-%H-%M-%S", gmtime())))
```

1) Specify source code
The entry point file and source code dir

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Hyperparameters and Environment Variables

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# output dir to save any files such as predictions, logs, etc
parser.add_argument("--outputdir", help="The output dir to save result
                    default=os.environ.get('SM_OUTPUT_DATA_DIR', "res
                    )

parser.add_argument("--model_dir", help="Do not use this.. required by

# This is where the model needs to be saved to
parser.add_argument("--snapshot_dir", help="The directory to save the
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# Additional parameters for your code
parser.add_argument("--epochs", help="The number of epochs", default=1
parser.add_argument("--batch-size", help="The mini batch size", defau
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main_train.py

Submit your training job

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s3_model_path = "s3://{}/models".format(sagemaker_session.default_bucket())

abalone_estimator = TensorFlow(entry_point='main_train.py',
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                               py_version="py3",
                               framework_version = "1.11.0",
                               hyperparameters={'traindata' : 'abalone_train.csv',
                                        'validationdata' : 'abalone_test.csv',
                                        'epochs': 10,
                                        'batch-size': 32},
                               model_dir = s3_model_path
                               metric_definitions = [{"Nam
                                        "Regex": "## val
                                       ,{"Name": "mean
                                        "Regex": "## val
                                       ,{"Name": "mean
                                        "Regex": "## val
                                       ],
                               train_instance_count=1,
                               train_instance_type='ml.c4.x

abalone_estimator.fit( {'train': s3_input_prefix,
                        'validation':s3_input_prefix},
                       job_name="abalone-age-py3-{}".format(strftime("%Y-%m-%d-%H-%M-%S", gmtime())))
```

2) **Map S3 prefix to local download directory**

The key name e.g. 'train' matches environment variable SM_CHANNEL_**TRAIN** suffix **TRAIN** , for train data directory

Hyperparameters and Environment Variables

```
# Train dir files
parser.add_argument("--traindata", help="The input file wrt to the tra
# The environment variable SM_CHANNEL_TRAIN is defined
parser.add_argument('--traindata-dir',
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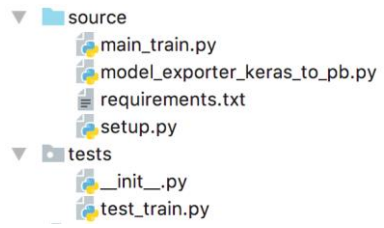
                    default=os.environ.get('SM_OUTPUT_DATA_DIR', "resu
                    )

parser.add_argument("--model_dir", help="Do not use this.. required by

# This is where the model needs to be saved to
parser.add_argument("--snapshot_dir", help="The directory to save the
                    default=os.environ.get('SM_MODEL_DIR', None))

# Additional parameters for your code
parser.add_argument("--epochs", help="The number of epochs", default=1
parser.add_argument("--batch-size", help="The mini batch size", defaul
```

main_train.py



Submit your training job

```
from sagemaker.tensorflow import Te
from time import gmtime, strftime

s3_model_path = "s3://{}/models".for

abalone_estimator = TensorFlow(entry
                source_dir="./source",
                role=role,
                py_version="py3",
                framework_version = "1.11.0",
                hyperparameters={'traindata' : 'abalone_train.csv',
                        'validationdata' : 'abalone_test.csv',
                        'epochs': 10,
                        'batch-size': 32},
                model_dir='s3_model_path',
                metric_definitions = [{"Name": "mean_squared_error",
                                "Regex": "## validation_metric_mse ##: (\d*[.]?\d*)"}
                               ,{"Name": "mean_absolute_error",
                                "Regex": "## validation_metric_mae ##: (\d*[.]?\d*)"}
                               ,{"Name": "mean_absolute_percentage_error",
                                "Regex": "## validation_metric_mape ##: (\d*[.]?\d*)"}
                               ],
                train_instance_count=1,
                train_instance_type='ml.c4.xlarge')

abalone_estimator.fit( {'train': s3_input_prefix,
                        'validation':s3_input_prefix},
                       job_name="ablone-age-py3-{}".format(strftime("%Y-%m-%d-%H-%M-%S", gmtime())))
```

3) Pass hyper parameters
The hyperparameter dict key name e.g. “traindata”, “epochs” matches the argument name “--traindata” , “--epochs”

aws

Hyperparameters and Environment Variables

```
# Train dir files
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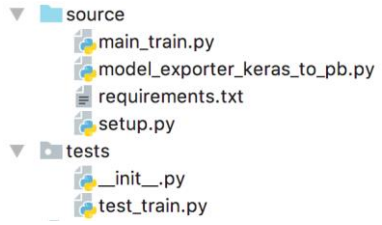
# output dir to save any files such as predictions, logs, etc
parser.add_argument("--outputdir", help="The output dir to save resul
                    default=os.environ.get('SM_OUTPUT_DATA_DIR', "res
                    )

parser.add_argument("--model_dir", help="Do not use this., required by

# This is where the model needs to be saved to
parser.add_argument("--snapshot_dir", help="The directory to save the
                    default=os.environ.get('SM_MODEL_DIR', None))

# Additional parameters for your code
parser.add_argument("--epochs", help="The number of epochs", default=1
parser.add_argument("--batch-size", help="The mini batch size", defau
```

main_train.py



Submit your training job

```
from sagemaker.tensorflow import TensorFlow
from time import gmtime, strftime

s3_model_pa

abalone_est
```

4) Save artifacts to output
Save model to output to dir pointed by environment variable SM_MODEL_DIR. Artifacts placed here are automatically uploaded to S3 and available during inference

```
                validationdata': 'abalone_test.csv',
                'epochs': 10,
                batch-size': 32},
model_dir = s3_model_path,
metric_definitions = [{"Name": "mean_squared_error",
                       "Regex": "## validation_metric_mse ##: (\d*[.]?\d*)"}
                      ,{"Name": "mean_absolute_error",
                       "Regex": "## validation_metric_mae ##: (\d*[.]?\d*)"}
                      ,{"Name": "mean_absolute_percentage_error",
                       "Regex": "## validation_metric_mape ##: (\d*[.]?\d*)"}
                      ],
train_instance_count=1,
train_instance_type='ml.c4.xlarge')

abalone_estimator.fit( {'train': s3_input_prefix,
                        'validation':s3_input_prefix},
                       job_name="ablone-age-py3-{}".format(strftime("%Y-%m-%d-%H-%M-%S", gmtime())))
```


aws

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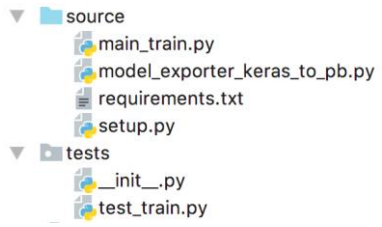
main_train.py



Submit your training job

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                    framework_version = "1.11.0",
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                            'validationdata' : 'abal
                            'epochs': 10,
                            'batch-size': 32},
                    model_dir = s3_model_path,
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                                "Regex": "## validation_metric_mse ##: (\d*[.]?\d*)"}
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                               ],
                    train_instance_count=1,
                    train_instance_type='ml.c4.xlarge')

abalone_estimator.fit( {'train': s3_input_prefix,
                        'validation':s3_input_prefix},
                       job_name="ablone-age-py3-{}".format(strftime("%Y-%m-%d-%H-%M-%S", gmtime())))
```

5) Specify the instance type for your training. Increase the instance count if your code supports distributed training

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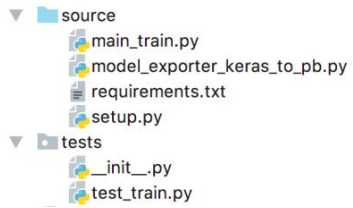
Model metrics & Framework Versions

```
# For a mean squared error regression problem
# Using RMSProp optimiser with mean squared error
metrics = ['mse', 'mae', 'mape']
model.compile(optimizer='rmsprop',
              loss='mse', metrics=metrics)

# load train & test data
train_x, train_y = input_transformer_load(os.path.join(training_dir, training_filename))
val_x, val_y = input_transformer_load(os.path.join(val_dir, val_filename))
# Start training
model.fit(train_x, train_y, epochs=epochs, batch_size=batch_size, validation_data=(val_x, val_y))
# model evaluate
scores = model.evaluate(val_x, val_y)
# model save in keras default format
model_keras_path = os.path.join(model_snapshotdir, "abalone_age_predictor.h5")
model.save(model_keras_path)

# Step 2: Log your metrics in a special format so that it can be extracted using a regular express
# This allows SageMaker to report this metrics and allows hyper parameter tuning
# Note: Use a special marker for SageMaker to extract the metrics, say ## Metric ##
for i, m in enumerate(metrics):
    print("## validation_metric_{} ##: {}".format(m, scores[1+i]))
```



main_train.py

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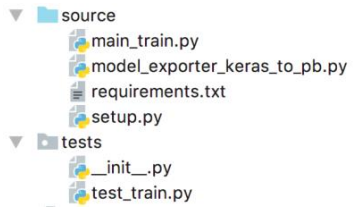

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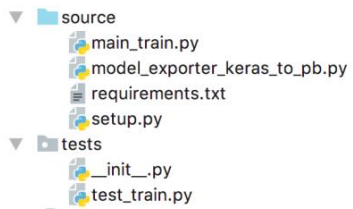
```
# load train & test data
train_x, train_y = input_transformer_load(os.path.join(tra
val_x, val_y = input_transformer_load(os.path.join(val_di
# Start training
model.fit(train_x, train_y, epochs=epochs, batch_size=bat
# model evaluate
scores = model.evaluate(val_x, val_y)
# model save in keras default format
model_keras_path = os.path.join(model_snapshotdir, "abalo
model.save(model_keras_path)
```

```
# Step 2: Log your metrics in a special format so that it
# This allows SageMaker to report this metrics and allows
# Note: Use a special marker for SageMaker to extract the
for i, m in enumerate(metrics):
    print("## validation_metric_{} ##: {}".format(m, score
```



main_train.py

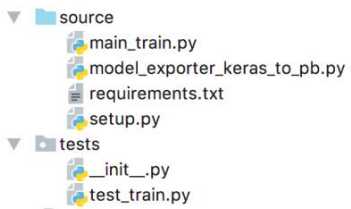
Submit your training job

```
from sagemaker.tensorflow import TensorFlow
from time import gmtime, strftime
s3_model_path = "s3://{}/models".format(sagemaker_session.default_bucket())
abalone_estimator = TensorFlow(entry_point
                source_dir="./source",
                role=role,
                py_version="py3",
                framework_version = "1.1
                hyperparameters={'traind
                        'validationdata' :
                        'epochs': 10,
                        'batch-size': 32},
                model_dir = s3_model_path
                metric_definitions = [{"Name": "mean_squared_error",
                                       "Regex": "## validation_metric_mse ##: (\d*[.]?\d*)"}
                                      ,{"Name": "mean_absolute_error",
                                       "Regex": "## validation_metric_mae ##: (\d*[.]?\d*)"}
                                      ,{"Name": "mean_absolute_percentage_error",
                                       "Regex": "## validation_metric_mape ##: (\d*[.]?\d*)"}
                                      ],
                train_instance_count=1,
                train_instance_type='ml.c4.xlarge')

abalone_estimator.fit( {'train': s3_input_prefix,
                        'validation':s3_input_prefix},
                      job_name="ablone-age-py3-{}".format(strftime("%Y-%m-%d-%H-%M-%S", gmtime())))
```

6) Model metrics regex to trace and visualize your model performance

Model metrics & Framework Versions

```
# For a mean squared error regression problem
# Using RMSProp optimiser with mean squared error
metrics = ['mse', 'mae', 'mape']
model.compile(optimizer='rmsprop',
              loss='mse', metrics=metrics)

# load train & test data
train_x, train_y = input_transformer_load(os.path.join(tra
val_x, val_y = input_transformer_load(os.path.join(val_di
# Start training
model.fit(train_x, train_y, epochs=epochs, batch_size=batc
# model evaluate
scores = model.evaluate(val_x, val_y)
# model save in keras default format
model_keras_path = os.path.join(model_snapshotdir, "abalon
model.save(model_keras_path)

# Step 2: Log your metrics in a special format so that it
# This allows SageMaker to report this metrics and allows
# Note: Use a special marker for SageMaker to extract the
for i, m in enumerate(metrics):
    print("## validation_metric_{} ##: {}".format(m, score
```



main_train.py

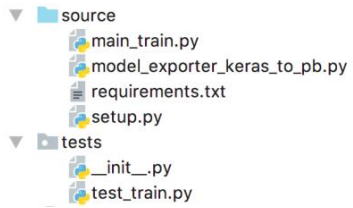
Submit your training job

```
from sagemaker.tensorflow import Ten
from time import gmtime, strftime
s3_model_path = "s3://{}/models".forn
abalone_estimator = TensorFlow(entry
                source_dir="./source"
                role=role,
                py_version="py3",
                framework_version = "1.11.0",
                hyperparameters={'traindata' : 'abalone_train.csv',
                                 'validationdata' : 'abalone_test.csv',
                                 'epochs': 10,
                                 'batch-size': 32},
                model_dir = s3_model_path,
                metric_definitions = [{"Name": "mean_squared_error",
                                       "Regex": "## validation_metric_mse ##: (\d*[.]?\d*)"}
                                      ,{"Name": "mean_absolute_error",
                                       "Regex": "## validation_metric_mae ##: (\d*[.]?\d*)"}
                                      ,{"Name": "mean_absolute_percentage_error",
                                       "Regex": "## validation_metric_mape ##: (\d*[.]?\d*)"}
                                      ],
                train_instance_count=1,
                train_instance_type='ml.c4.xlarge')

abalone_estimator.fit( {'train': s3_input_prefix,
                        'validation':s3_input_prefix},
                       job_name="ablone-age-py3-{}".format(strftime("%Y-%m-%d-%H-%M-%S", gmtime())))
```

7) Specify python version (py3)
TensorFlow framework version
(1.11.0)

Model metrics & Framework Versions

```
# For a mean squared error regression problem
# Using RMSProp optimiser with mean squared error
metrics = ['mse', 'mae', 'mape']
model.compile(optimizer='rmsprop',
              loss='mse', metrics=metrics)

# load train & test data
train_x, train_y = input_transformer_load(os.path.join(training_dir, training_filename))
val_x, val_y = input_transformer_load(os.path.join(val_dir, val_filename))
# Start training
model.fit(train_x, train_y, epochs=epochs, batch_size=batch_size, validation_data=(val_x, val_y))
# model evaluate
scores = model.evaluate(val_x, val_y)
# model save in keras default format
model_keras_path = os.path.join(model_snapshotdir, "abalone_age_predictor.h5")
model.save(model_keras_path)

# Step 2: Log your metrics in a special format so that it can be extracted using a regular express
# This allows SageMaker to report this metrics and allows hyper parameter tuning
# Note: Use a special marker for SageMaker to extract the metrics, say ## Metric ##
for i, m in enumerate(metrics):
    print("## validation_metric_{} ##: {}".format(m, scores[1+i]))
```

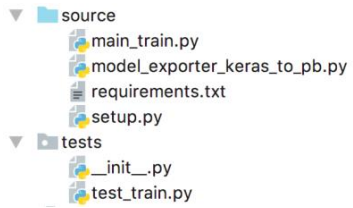


main_train.py

aws

Model metrics & Framework Versions

```
# For a mean squared error regression problem
# Using RMSProp optimiser with mean squared error
metrics = ['mse', 'mae', 'mape']
model.compile(optimizer='rmsprop',
              loss='mse', metrics=metrics)

# load train & test data
train_x, train_y = input_transformer_load(os.path.join(tra
val_x, val_y = input_transformer_load(os.path.join(val_di
# Start training
model.fit(train_x, train_y, epochs=epochs, batch_size=bat
# model evaluate
scores = model.evaluate(val_x, val_y)
# model save in keras default format
model_keras_path = os.path.join(model_snapshotdir, "abalo
model.save(model_keras_path)

# Step 2: Log your metrics in a special format so that it
# This allows SageMaker to report this metrics and allows
# Note: Use a special marker for SageMaker to extract the
for i, m in enumerate(metrics):
    print("## validation_metric_{} ##: {}".format(m, score
```



main_train.py

Submit your training job

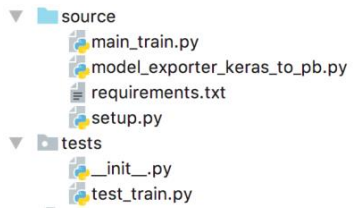
```
from sagemaker.tensorflow import TensorFlow
from time import gmtime, strftime
s3_model_path = "s3://{}/models".format(sagemaker_session.default_bucket())
abalone_estimator = TensorFlow(entry_point='main_train.py',
                    source_dir="./source",
                    role=role,
                    py_version="py3",
                    framework_version = "1.11.0",
                    hyperparameters={'traindata' : 'abalone_train.csv',
                              'validationdata' : 'abalone_test.csv',
                              'epochs': 10,
                              'batch-size': 32},
                    model_dir = s3_model_path,
                    metric_definitions = [{"Name": "mean_squared_error",
                                 "Regex": "## validation_metric_mse ##: (\d*[.]?\d*)"}
                                ,{"Name": "mean_absolute_error",
                                 "Regex": "## validation_metric_mae ##: (\d*[.]?\d*)"}
                                ,{"Name": "mean_absolute_percentage_error",
                                 "Regex": "## validation_metric_mape ##: (\d*[.]?\d*)"}
                                ],
                    train_instance_count=1,
                    train_instance_type='ml.c4.xlarge')

abalone_estimator.fit( {'train': s3_input_prefix,
                        'validation':s3_input_prefix},
                       job_name="ablone-age-py3-{}".format(strftime("%Y-%m-%d-%H-%M-%S", gmtime())))
```

Model metrics & Framework Versions

```
# For a mean squared error regression problem
# Using RMSProp optimiser with mean squared error
metrics = ['mse', 'mae', 'mape']
model.compile(optimizer='rmsprop',
              loss='mse', metrics=metrics)
```

```
# load train & test data
train_x, train_y = input_transformer_load(os.path.join(tra
val_x, val_y = input_transformer_load(os.path.join(val_di
# Start training
model.fit(train_x, train_y, epochs=epochs, batch_size=bat
# model evaluate
scores = model.evaluate(val_x, val_y)
# model save in keras default format
model_keras_path = os.path.join(model_snapshotdir, "abalo
model.save(model_keras_path)
```

```
# Step 2: Log your metrics in a special format so that it
# This allows SageMaker to report this metrics and allows
# Note: Use a special marker for SageMaker to extract the
for i, m in enumerate(metrics):
    print("## validation_metric_{} ##: {}".format(m, score
```



main_train.py

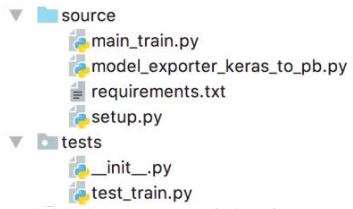
Submit your training job

```
from sagemaker.tensorflow import TensorFlow
from time import gmtime, strftime
s3_model_path = "s3://{}/models".format(sagemaker_session.default_bucket())
abalone_estimator = TensorFlow(entry_point
                source_dir="./source",
                role=role,
                py_version="py3",
                framework_version = "1.1
                hyperparameters={'traind
                        'validationdata' :
                        'epochs': 10,
                        'batch-size': 32},
                model_dir = s3_model_path
                metric_definitions = [{"Name": "mean_squared_error",
                                       "Regex": "## validation_metric_mse ##: (\d*[.]?\d*)"}
                                      ,{"Name": "mean_absolute_error",
                                       "Regex": "## validation_metric_mae ##: (\d*[.]?\d*)"}
                                      ,{"Name": "mean_absolute_percentage_error",
                                       "Regex": "## validation_metric_mape ##: (\d*[.]?\d*)"}
                                      ],
                train_instance_count=1,
                train_instance_type='ml.c4.xlarge')

abalone_estimator.fit( {'train': s3_input_prefix,
                        'validation':s3_input_prefix},
                       job_name="ablone-age-py3-{}".format(strftime("%Y-%m-%d-%H-%M-%S", gmtime())))
```

6) Model metrics regex to trace and visualize your model performance

Model metrics & Framework Versions

```
# For a mean squared error regression problem
# Using RMSProp optimiser with mean squared error
metrics = ['mse', 'mae', 'mape']
model.compile(optimizer='rmsprop',
              loss='mse', metrics=metrics)

# load train & test data
train_x, train_y = input_transformer_load(os.path.join(tra
val_x, val_y = input_transformer_load(os.path.join(val_di
# Start training
model.fit(train_x, train_y, epochs=epochs, batch_size=bat
# model evaluate
scores = model.evaluate(val_x, val_y)
# model save in keras default format
model_keras_path = os.path.join(model_snapshotdir, "abalo
model.save(model_keras_path)

# Step 2: Log your metrics in a special format so that it
# This allows SageMaker to report this metrics and allows
# Note: Use a special marker for SageMaker to extract the
for i, m in enumerate(metrics):
    print("## validation_metric_{} ##: {}".format(m, score
```



main_train.py

Submit your training job

```
from sagemaker.tensorflow import Ten
from time import gmtime, strftime
s3_model_path = "s3://{}/models".forr
abalone_estimator = TensorFlow(entry
                source_dir="./source"
                role=role,
                py_version="py3",
                framework_version = "1.11.0",
                hyperparameters={'traindata' : 'abalone_train.csv',
                                 'validationdata' : 'abalone_test.csv',
                                 'epochs': 10,
                                 'batch-size': 32},
                model_dir = s3_model_path,
                metric_definitions = [{"Name": "mean_squared_error",
                                       "Regex": "## validation_metric_mse ##: (\d*[.]?\d*)"}
                                      ,{"Name": "mean_absolute_error",
                                       "Regex": "## validation_metric_mae ##: (\d*[.]?\d*)"}
                                      ,{"Name": "mean_absolute_percentage_error",
                                       "Regex": "## validation_metric_mape ##: (\d*[.]?\d*)"}
                                      ],
                train_instance_count=1,
                train_instance_type='ml.c4.xlarge')

abalone_estimator.fit( {'train': s3_input_prefix,
                        'validation':s3_input_prefix},
                       job_name="ablone-age-py3-{}".format(strftime("%Y-%m-%d-%H-%M-%S", gmtime())))
```

7) Specify python version (py3)
TensorFlow framework version
(1.11.0)

Demo – Abalone age prediction

SageMaker with TensorFlow, Keras in Python 3

PyTorch on SageMaker

PyTorch training with SageMaker

```
# Train dir files
parser.add_argument("--traindata", help="The input file wrt to the training directory", required=True)
# The environment variable SM_CHANNEL_TRAIN is defined
parser.add_argument('--traindata-dir',
                    help='The directory containing training artifacts such as training data',
                    default=os.environ.get('SM_CHANNEL_TRAIN', "."))
# val dir files
parser.add_argument("--validationdata", help="The validation input file wrt to the val directory", required=True)
parser.add_argument('--validationdata-dir',
                    help='The directory containing validation artifacts such as validation data',
                    default=os.environ.get('SM_CHANNEL_VALIDATION', "."))

# output dir to save any files such as predictions, logs, etc
parser.add_argument("--outputdir", help="The output dir to save results",
                    default=os.environ.get('SM_OUTPUT_DATA_DIR', "result_data")
                    )

parser.add_argument("--model_dir", help="Do not use this.. required by SageMaker", default=None)

# This is where the model needs to be saved to
parser.add_argument("--snapshot_dir", help="The directory to save the snapshot to..",
                    default=os.environ.get('SM_MODEL_DIR', None))

# Additional parameters for your code
parser.add_argument("--epochs", help="The number of epochs", default=10, type=int)
parser.add_argument("--batch-size", help="The mini batch size", default=30, type=int)
```

PyTorch training with SageMaker

```
# Train dir files
parser.add_argument("--traindata", help="The input file wrt to the
# The environment variable SM_CHANNEL_TRAIN is defined
parser.add_argument('--traindata-dir',
                    help='The directory containing training artifa
                    default=os.environ.get('SM_CHANNEL_TRAIN', "."
# val dir files
parser.add_argument("--validationdata", help="The validation input
parser.add_argument('--validationdata-dir',
                    help='The directory containing validation arti
                    default=os.environ.get('SM_CHANNEL_VALIDATION'

# output dir to save any files such as predictions, logs, etc
parser.add_argument("--outputdir", help="The output dir to save re
                    default=os.environ.get('SM_OUTPUT_DATA_DIR', "
                    )

parser.add_argument("--model_dir", help="Do not use this.. require

# This is where the model needs to be saved to
parser.add_argument("--snapshot_dir", help="The directory to save
                    default=os.environ.get('SM_MODEL_DIR', None))

# Additional parameters for your code
parser.add_argument("--epochs", help="The number of epochs", defau
parser.add_argument("--batch-size", help="The mini batch size", de
```

Submit your training job

```
from sagemaker.pytorch import PyTorch
from time import gmtime, strftime
s3_model_path = "s3://{}/models".format(sagemaker_session.default_bucket())
abalone_estimator = PyTorch(entry_point='main_train.py',
                    source_dir="./source",
                    role=role,
                    py_version="py3",
                    framework_version = "1.0.0",
                    hyperparameters={'traindata' : 'abalone_train.csv',
                              'validationdata' : 'abalone_test.csv',
                              'epochs': 10,
                              'batch-size': 32},
                    model_dir = s3_model_path,
                    metric_definitions = [{"Name": "mean_squared_error",
                                  "Regex": "## validation_metric_mse ##: (\d*[.]?\d*)"}
                                 ,{"Name": "mean_absolute_error",
                                  "Regex": "## validation_metric_mae ##: (\d*[.]?\d*)"}
                                 ,{"Name": "mean_absolute_percentage_error",
                                  "Regex": "## validation_metric_mape ##: (\d*[.]?\d*)"}
                                 ],
                    train_instance_count=1,
                    train_instance_type='ml.c4.xlarge')

abalone_estimator.fit( {'train': s3_input_prefix,
                        'validation':s3_input_prefix},
                       job_name="ablone-age-py3-{}".format(strftime("%Y-%m-%d-%H-%M-%S", gmtime())))
```

PyTorch training with SageMaker

1) Specify source code
The entry point file and source code dir

```
# Train dir files
parser.add_argument("--traindata", help="The input file wrt to the
# The environment variable SM_CHANNEL_TRAIN is defined
parser.add_argument('--traindata-dir',
                    help='The directory containing training artifa
                    default=os.environ.get('SM_CHANNEL_TRAIN', "."
# val dir files
parser.add_argument("--validationdata", help="The validation input
parser.add_argument('--validationdata-dir',
                    help='The directory containing validation arti
                    default=os.environ.get('SM_CHANNEL_VALIDATION'

# output dir to save any files such as predictions, logs, etc
parser.add_argument("--outputdir", help="The output dir to save re
                    default=os.environ.get('SM_OUTPUT_DATA_DIR', "
                    )

parser.add_argument("--model_dir", help="Do not use this.. require

# This is where the model needs to be saved to
parser.add_argument("--snapshot_dir", help="The directory to save
                    default=os.environ.get('SM_MODEL_DIR', None))

# Additional parameters for your code
parser.add_argument("--epochs", help="The number of epochs", defau
parser.add_argument("--batch-size", help="The mini batch size", de
```

Submit your training job

```
from sagemaker.pytorch import PyTorch
from time import gmtime, strftime
s3_model_path = "s3://{}/models".format(sagemaker_session.default_bucket())
abalone_estimator = PyTorch(entry_point='main_train.py',
                            source_dir="./source",
                            role=role,
                            py_version="py3",
                            framework_version = "1.0.0",
                            hyperparameters={'traindata' : 'abalone_train.csv',
                                             'validationdata' : 'abalone_test.csv',
                                             'epochs': 10,
                                             'batch-size': 32},
                            model_dir = s3_model_path,
                            metric_definitions = [{"Name": "mean_squared_error",
                                                   "Regex": "## validation_metric_mse ##: (\d*[.]?\d*)"}
                                                  ,{"Name": "mean_absolute_error",
                                                   "Regex": "## validation_metric_mae ##: (\d*[.]?\d*)"}
                                                  ,{"Name": "mean_absolute_percentage_error",
                                                   "Regex": "## validation_metric_mape ##: (\d*[.]?\d*)"}
                                                  ],
                            train_instance_count=1,
                            train_instance_type='ml.c4.xlarge')

abalone_estimator.fit( {'train': s3_input_prefix,
                        'validation':s3_input_prefix},
                       job_name="ablone-age-py3-{}".format(strftime("%Y-%m-%d-%H-%M-%S", gmtime())))
```

PyTorch training with SageMaker

```
# Train dir files
parser.add_argument("--traindata", help="The input file wrt to the
# The environment variable SM_CHANNEL_TRAIN is defined
parser.add_argument('--traindata-dir',
                    help='The directory containing training artifa
                    default=os.environ.get('SM_CHANNEL_TRAIN', "."
# val dir files
parser.add_argument("--validationdata", help="The validation input
parser.add_argument('--validationdata-dir',
                    help='The directory containing validation arti
                    default=os.environ.get('SM_CHANNEL_VALIDATION'

# output dir to save any files such as predictions, logs, etc
parser.add_argument("--outputdir", help="The output dir to save re
                    default=os.environ.get('SM_OUTPUT_DATA_DIR', "
                    )

parser.add_argument("--model_dir", help="Do not use this.. require

# This is where the model needs to be saved to
parser.add_argument("--snapshot_dir", help="The directory to save
                    default=os.environ.get('SM_MODEL_DIR', None))

# Additional parameters for your code
parser.add_argument("--epochs", help="The number of epochs", defau
parser.add_argument("--batch-size", help="The mini batch size", de
```

Submit your training job

```
from sagemaker.pytorch import PyTorch
from time import gmtime, strftime
s3_model_path = "s3://{}/models".format(sagemaker_session.default_bucket())
abalone_estimator = PyTorch(entry_point='main_train.py',
                            source_dir="./source",
                            role=role,
                            py_version="py3",
                            framework_version = "1.0.0",
                            hyperparameters={'traindata' : 'abalone_train.csv',
                                             'validationdata' : 'abalone_test.csv',
                                             'epochs': 10,
                                             'batch-size': 32},
                            model_dir = s3_model_path
                            metric_definitions = [{
                                              "Regex": "#
                                             ,{"Name": "
                                              "Regex": "#
                                             ,{"Name": "
                                              "Regex": "#
                                             ],
                            train_instance_count=
                            train_instance_type='n

abalone_estimator.fit( {'train': s3_input_prefix,
                        'validation':s3_input_prefix},
                       job_name="abalone-age-py3-{}".format(strftime("%Y-%m-%d-%H-%M-%S", gmtime())))
```

2) **Map S3 prefix to local download directory**

The key name e.g. ‘train’ matches environment variable SM_CHANNEL_**TRAIN** suffix **TRAIN** , for train data directory

PyTorch training with SageMaker

```
# Train dir files
parser.add_argument("--traindata", help="The input file wrt to the
# The environment variable SM_CHANNEL_TRAIN is defined
parser.add_argument('--traindata-dir',
                    help='The directory containing training artifa
                    default=os.environ.get('SM_CHANNEL_TRAIN', "."
# val dir files
parser.add_argument("--validationdata", help="The validation input
parser.add_argument('--validationdata-dir',
                    help='The directory containing validation arti
                    default=os.environ.get('SM_CHANNEL_VALIDATION'

# output dir to save any files such as predictions, logs, etc
parser.add_argument("--outputdir", help="The output dir to save re
                    default=os.environ.get('SM_OUTPUT_DATA_DIR', "
                    )

parser.add_argument("--model_dir", help="Do not use this.. require

# This is where the model needs to be saved to
parser.add_argument("--snapshot_dir", help="The directory to save
                    default=os.environ.get('SM_MODEL_DIR', None))

# Additional parameters for your code
parser.add_argument("--epochs", help="The number of epochs", defau
parser.add_argument("--batch-size", help="The mini batch size", de
```

3) Pass hyper parameters
The hyperparameter dict key name e.g. “traindata”, “epochs” matches the argument name “--traindata” , “--epochs”

Submit your training job

```
from sagemaker.pytorch import PyTorch
from time import gmtime, strftime
s3_model_path = "s3://{}/models".format(sage
abalone_estimator = PyTorch(entry_point='main_train.py',
                    source_dir="./source",
                    role=role,
                    py_version="py3",
                    framework_version = "1.0.0",
                    hyperparameters={'traindata' : 'abalone_train.csv',
                                'validationdata' : 'abalone_test.csv',
                                'epochs': 10,
                                'batch-size': 32},
                    model_dir = s3_model_path,
                    metric_definitions = [{"Name": "mean_squared_error",
                                 "Regex": "## validation_metric_mse ##: (\d*[.]?\d*)"}
                                ,{"Name": "mean_absolute_error",
                                 "Regex": "## validation_metric_mae ##: (\d*[.]?\d*)"}
                                ,{"Name": "mean_absolute_percentage_error",
                                 "Regex": "## validation_metric_mape ##: (\d*[.]?\d*)"}
                                ],
                    train_instance_count=1,
                    train_instance_type='ml.c4.xlarge')

abalone_estimator.fit( {'train': s3_input_prefix,
                        'validation':s3_input_prefix},
                       job_name="ablone-age-py3-{}".format(strftime("%Y-%m-%d-%H-%M-%S", gmtime())))
```

PyTorch training with SageMaker

```
# Train dir files
parser.add_argument("--traindata", help="The input file wrt to the
# The environment variable SM_CHANNEL_TRAIN is defined
parser.add_argument('--traindata-dir',
                    help='The directory containing training artifa
                    default=os.environ.get('SM_CHANNEL_TRAIN', "."
# val dir files
parser.add_argument("--validationdata", help="The validation input
parser.add_argument('--validationdata-dir',
                    help='The directory containing validation arti
                    default=os.environ.get('SM_CHANNEL_VALIDATION'

# output dir to save any files such as predictions, logs, etc
parser.add_argument("--outputdir", help="The output dir to save re
                    default=os.environ.get('SM_OUTPUT_DATA_DIR', "
                    )

parser.add_argument("--model_dir", help="Do not use this.. require

# This is where the model needs to be saved to
parser.add_argument("--snapshot_dir", help="The directory to save
                    default=os.environ.get('SM_MODEL_DIR', None))

# Additional parameters for your code
parser.add_argument("--epochs", help="The number of epochs", defau
parser.add_argument("--batch-size", help="The mini batch size", de
```

Submit your training job

```
from sagemaker.pytorch import PyTorch
from time import gmtime, strftime
s3_model_path = "s3:
abalone_estimator =
                    sou
                    role
                    py_
                    fram
                    hyp
                                    batch-size : 32},
                    model_dir = s3_model_path,
                    metric_definitions = [{"Name": "mean_squared_error",
                                           "Regex": "## validation_metric_mse ##: (\d*[.]?\d*)"}
                                          ,{"Name": "mean_absolute_error",
                                           "Regex": "## validation_metric_mae ##: (\d*[.]?\d*)"}
                                          ,{"Name": "mean_absolute_percentage_error",
                                           "Regex": "## validation_metric_mape ##: (\d*[.]?\d*)"}
                                          ],
                    train_instance_count=1,
                    train_instance_type='ml.c4.xlarge')

abalone_estimator.fit( {'train': s3_input_prefix,
                        'validation':s3_input_prefix},
                       job_name="ablone-age-py3-{}".format(strftime("%Y-%m-%d-%H-%M-%S", gmtime())))
```

4) Save artifacts to output
Save model to output to dir pointed by environment variable SM_MODEL_DIR. Artifacts placed here are automatically uploaded to S3 and available during inference

PyTorch training with SageMaker

```
# Train dir files
parser.add_argument("--traindata", help="The input file wrt to the
# The environment variable SM_CHANNEL_TRAIN is defined
parser.add_argument('--traindata-dir',
                    help='The directory containing training artifa
                    default=os.environ.get('SM_CHANNEL_TRAIN', "."
# val dir files
parser.add_argument("--validationdata", help="The validation input
parser.add_argument('--validationdata-dir',
                    help='The directory containing validation arti
                    default=os.environ.get('SM_CHANNEL_VALIDATION'

# output dir to save any files such as predictions, logs, etc
parser.add_argument("--outputdir", help="The output dir to save re
                    default=os.environ.get('SM_OUTPUT_DATA_DIR', "
                    )

parser.add_argument("--model_dir", help="Do not use this.. require

# This is where the model needs to be saved to
parser.add_argument("--snapshot_dir", help="The directory to save
                    default=os.environ.get('SM_MODEL_DIR', None))

# Additional parameters for your code
parser.add_argument("--epochs", help="The number of epochs", defau
parser.add_argument("--batch-size", help="The mini batch size", de
```

Submit your training job

```
from sagemaker.pytorch import PyTorch
from time import gmtime, strftime
s3_model_path = "s3://{}/models".format(sagemaker_session.default_bucket())
abalone_estimator = PyTorch(entry_point='main_train.py',
                            source_dir="./source",
                            role=role,
                            py_version="py3",
                            framework_version = "1.0.0",
                            hyperparameters={'traindata'
                                             'validationdata' : 'aba
                                             'epochs': 10,
                                             'batch-size': 32},
                            model_dir = s3_model_path,
                            metric_definitions = [{"Name":
                                                   "Regex": "## validation_metric_mse ##: (\d*[.]?\d*)"}
                                                  ,{"Name": "mean_absolute_error",
                                                   "Regex": "## validation_metric_mae ##: (\d*[.]?\d*)"}
                                                  ,{"Name": "mean_absolute_percentage_error",
                                                   "Regex": "## validation_metric_mape ##: (\d*[.]?\d*)"}
                                                  ],
                            train_instance_count=1,
                            train_instance_type='ml.c4.xlarge')

abalone_estimator.fit( {'train': s3_input_prefix,
                        'validation':s3_input_prefix},
                       job_name="ablone-age-py3-{}".format(strftime("%Y-%m-%d-%H-%M-%S", gmtime())))
```

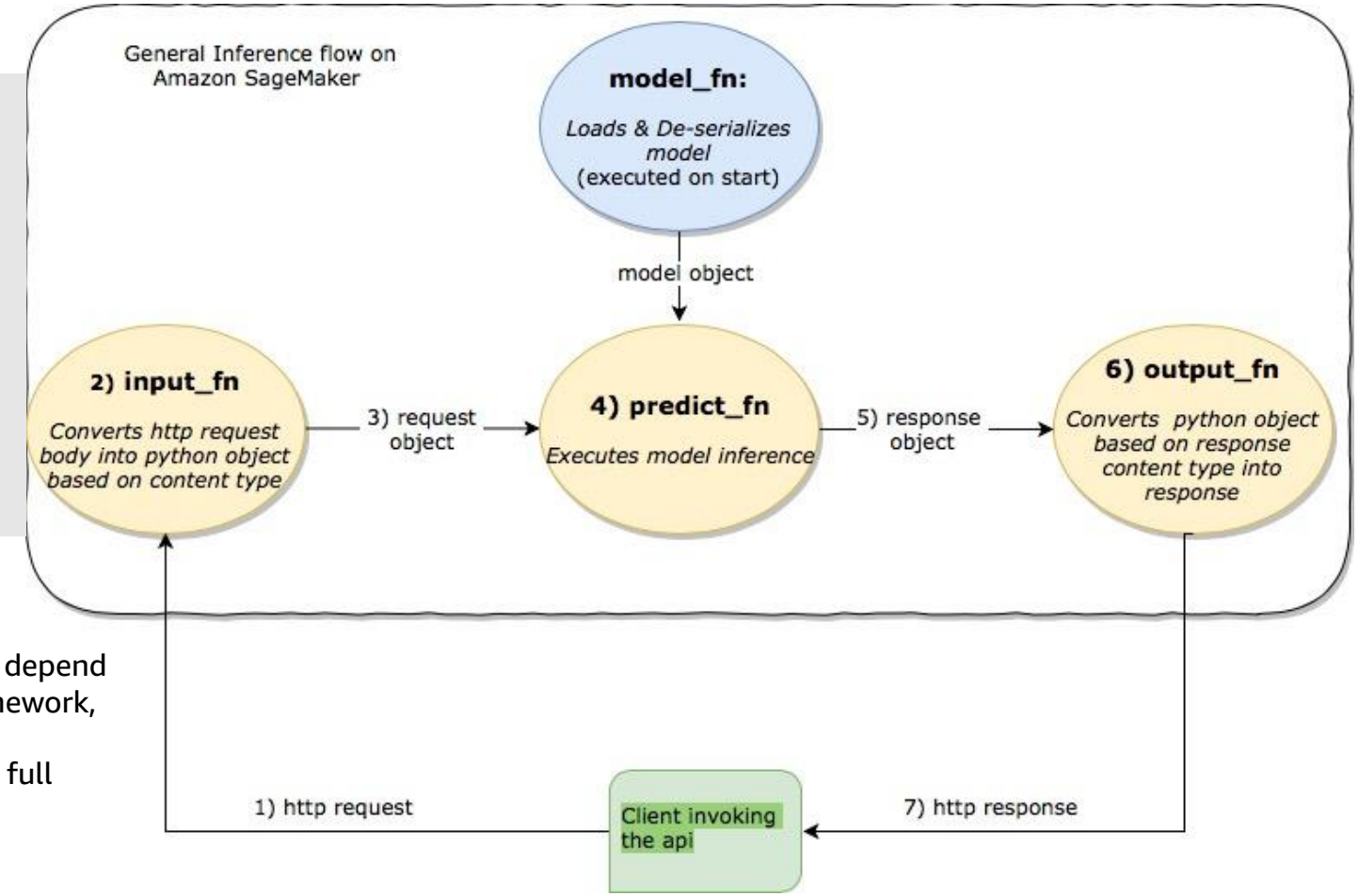
5) Specify the instance type for your training. Increase the instance count if your code supports distributed training

General SageMaker Inference Flow

Sample http request

POST /endpoints/abalone.. HTTP/1.1
Host: *runtime.sagemaker* ..
..
Authorization: AWS4-HMAC-SHA256 Credential ***
Content-Type: application/json
Accept: application/json

[[.34,5.6],[4,56]...]



Note: This is a general flow only. The exact function signatures depend on the SageMaker container for the specific deep learning framework, including its version! Please check the SageMaker samples on https://github.com/awslabs/amazon-sagemaker-examples for full details

PyTorch inference with SageMaker – Load model

```
def model_fn(model_dir):
    device = torch.device("cuda" if torch.cuda.is_available() else "cpu")
    model = torch.nn.DataParallel(Net())
    with open(os.path.join(model_dir, 'model.pth'), 'rb') as f:
        model.load_state_dict(torch.load(f))
    return model.to(device)
```

Note: Your model can be deployed on CPU or GPU instance type you choose when you deploy the endpoint. This code supports both.

Deploy my estimator to a SageMaker Endpoint and get a Predictor predictor = # E.g. m4.xlarge is a CPU instance type or if you use ml.p3.2xlarge then it is a GPU instance type

abalone_estimator.deploy(
instance_type='ml.m4.xlarge',
initial_instance_count=1)

MXNet on SageMaker

MXNet training with SageMaker

```
# Train dir files
parser.add_argument("--traindata", help="The input file wrt to the training directory", required=True)
# The environment variable SM_CHANNEL_TRAIN is defined
parser.add_argument('--traindata-dir',
                    help='The directory containing training artifacts such as training data',
                    default=os.environ.get('SM_CHANNEL_TRAIN', "."))
# val dir files
parser.add_argument("--validationdata", help="The validation input file wrt to the val directory", required=True)
parser.add_argument('--validationdata-dir',
                    help='The directory containing validation artifacts such as validation data',
                    default=os.environ.get('SM_CHANNEL_VALIDATION', "."))

# output dir to save any files such as predictions, logs, etc
parser.add_argument("--outputdir", help="The output dir to save results",
                    default=os.environ.get('SM_OUTPUT_DATA_DIR', "result_data")
                    )

parser.add_argument("--model_dir", help="Do not use this.. required by SageMaker", default=None)

# This is where the model needs to be saved to
parser.add_argument("--snapshot_dir", help="The directory to save the snapshot to..",
                    default=os.environ.get('SM_MODEL_DIR', None))

# Additional parameters for your code
parser.add_argument("--epochs", help="The number of epochs", default=10, type=int)
parser.add_argument("--batch-size", help="The mini batch size", default=30, type=int)
```

MXNet training with SageMaker

```
# Train dir files
parser.add_argument("--traindata", help="The input file wrt to the
# The environment variable SM_CHANNEL_TRAIN is defined
parser.add_argument('--traindata-dir',
                    help='The directory containing training artifa
                    default=os.environ.get('SM_CHANNEL_TRAIN', "."
# val dir files
parser.add_argument("--validationdata", help="The validation input
parser.add_argument('--validationdata-dir',
                    help='The directory containing validation arti
                    default=os.environ.get('SM_CHANNEL_VALIDATION'

# output dir to save any files such as predictions, logs, etc
parser.add_argument("--outputdir", help="The output dir to save re
                    default=os.environ.get('SM_OUTPUT_DATA_DIR', "
                    )

parser.add_argument("--model_dir", help="Do not use this.. require

# This is where the model needs to be saved to
parser.add_argument("--snapshot_dir", help="The directory to save
                    default=os.environ.get('SM_MODEL_DIR', None))

# Additional parameters for your code
parser.add_argument("--epochs", help="The number of epochs", defau
parser.add_argument("--batch-size", help="The mini batch size", de
```

Submit your training job

```
from sagemaker.mxnet import MXNet
from time import gmtime, strftime
s3_model_path = "s3://{}/models".format(sagemaker_session.default_bucket())
abalone_estimator = MXNet(entry_point='main_train.py',
                          source_dir="./source",
                          role=role,
                          py_version="py3",
                          framework_version = "1.3.0"
                          hyperparameters={'traindata' : 'abalone_train.csv',
                                   'validationdata' : 'abalone_test.csv',
                                   'epochs': 10,
                                   'batch-size': 32},
                          model_dir = s3_model_path,
                          metric_definitions = [{"Name": "mean_squared_error",
                                    "Regex": "## validation_metric_mse ##: (\d*[.]?\d*)"}
                                   ,{"Name": "mean_absolute_error",
                                    "Regex": "## validation_metric_mae ##: (\d*[.]?\d*)"}
                                   ,{"Name": "mean_absolute_percentage_error",
                                    "Regex": "## validation_metric_mape ##: (\d*[.]?\d*)"}
                                   ],
                          train_instance_count=1,
                          train_instance_type='ml.c4.xlarge')

abalone_estimator.fit( {'train': s3_input_prefix,
                        'validation':s3_input_prefix},
                       job_name="ablone-age-py3-{}".format(strftime("%Y-%m-%d-%H-%M-%S", gmtime())))
```

MXNet training with SageMaker

1) Specify source code
The entry point file and source code dir

```
# Train dir files
parser.add_argument("--traindata", help="The input file wrt to the
# The environment variable SM_CHANNEL_TRAIN is defined
parser.add_argument('--traindata-dir',
                    help='The directory containing training artifa
                    default=os.environ.get('SM_CHANNEL_TRAIN', "."
# val dir files
parser.add_argument("--validationdata", help="The validation input
parser.add_argument('--validationdata-dir',
                    help='The directory containing validation arti
                    default=os.environ.get('SM_CHANNEL_VALIDATION'

# output dir to save any files such as predictions, logs, etc
parser.add_argument("--outputdir", help="The output dir to save re
                    default=os.environ.get('SM_OUTPUT_DATA_DIR', "
                    )

parser.add_argument("--model_dir", help="Do not use this.. require

# This is where the model needs to be saved to
parser.add_argument("--snapshot_dir", help="The directory to save
                    default=os.environ.get('SM_MODEL_DIR', None))

# Additional parameters for your code
parser.add_argument("--epochs", help="The number of epochs", defau
parser.add_argument("--batch-size", help="The mini batch size", de
```

Submit your training job

```
from sagemaker.mxnet import MXNet
from time import gmtime, strftime
s3_model_path = "s3://{}/models".format(sagemaker_session.default_bucket())
abalone_estimator = MXNet(entry_point='main_train.py',
                          source_dir="./source",
                          role=role,
                          py_version="py3",
                          framework_version = "1.3.0"
                          hyperparameters={'traindata' : 'abalone_train.csv',
                                           'validationdata' : 'abalone_test.csv',
                                           'epochs': 10,
                                           'batch-size': 32},
                          model_dir = s3_model_path,
                          metric_definitions = [{"Name": "mean_squared_error",
                                                 "Regex": "## validation_metric_mse ##: (\d*[.]?\d*)"}
                                                ,{"Name": "mean_absolute_error",
                                                 "Regex": "## validation_metric_mae ##: (\d*[.]?\d*)"}
                                                ,{"Name": "mean_absolute_percentage_error",
                                                 "Regex": "## validation_metric_mape ##: (\d*[.]?\d*)"}
                                                ],
                          train_instance_count=1,
                          train_instance_type='ml.c4.xlarge')

abalone_estimator.fit( {'train': s3_input_prefix,
                        'validation':s3_input_prefix},
                       job_name="ablone-age-py3-{}".format(strftime("%Y-%m-%d-%H-%M-%S", gmtime())))
```

MXNet training with SageMaker

```
# Train dir files
parser.add_argument("--traindata", help="The input file wrt to the
# The environment variable SM_CHANNEL_TRAIN is defined
parser.add_argument('--traindata-dir',
                    help='The directory containing training artifa
                    default=os.environ.get('SM_CHANNEL_TRAIN', "."
# val dir files
parser.add_argument("--validationdata", help="The validation input
parser.add_argument('--validationdata-dir',
                    help='The directory containing validation arti
                    default=os.environ.get('SM_CHANNEL_VALIDATION'

# output dir to save any files such as predictions, logs, etc
parser.add_argument("--outputdir", help="The output dir to save re
                    default=os.environ.get('SM_OUTPUT_DATA_DIR', "
                    )

parser.add_argument("--model_dir", help="Do not use this.. require

# This is where the model needs to be saved to
parser.add_argument("--snapshot_dir", help="The directory to save
                    default=os.environ.get('SM_MODEL_DIR', None))

# Additional parameters for your code
parser.add_argument("--epochs", help="The number of epochs", defau
parser.add_argument("--batch-size", help="The mini batch size", de
```

Submit your training job

```
from sagemaker.mxnet import MXNet
from time import gmtime, strftime
s3_model_path = "s3://{}/models".format(sagemaker_session.default_bucket())
abalone_estimator = MXNet(entry_point='main_train.py',
                          source_dir="./source",
                          role=role,
                          py_version="py3",
                          framework_version = "1.3.0"
                          hyperparameters={'traindata' : 'abalone_train.csv',
                                   'validationdata' : 'abalone_test.csv',
                                   'epochs': 10,
                                   'batch-size': 32},
                          model_dir = s3_model_path,
                          metric_definitions = [{"Name": "mean_squared_error",
                                    "Regex": "## validation_metric_mse ##: (\d*[.]?\d*)"}
                                   ,{"Name": "mean_absolute_error",
                                    "Regex": "## validation_metric_mae ##: (\d*[.]?\d*)"}
                                   ,{"Name": "mean_absolute_percentage_error",
                                    "Regex": "## validation_metric_mape ##: (\d*[.]?\d*)"}
                                   ],
                          train_instance_count=1,
                          train_instance_type='ml.c4.xlarge')

abalone_estimator.fit( {'train': s3_input_prefix,
                        'validation':s3_input_prefix},
                       job_name="ablone-age-py3-{}".format(strftime("%Y-%m-%d-%H-%M-%S", gmtime())))
```

MXNet inference with SageMaker

```
def model_fn(model_dir):
    """
    Load the gluon model. Called once when hosting service starts.
    :param: model_dir The directory where model files are stored.
    :return: a model (in this case a Gluon network)
    """
    net = gluon.SymbolBlock.imports(
        '%s/model-symbol.json' % model_dir,
        ['data'],
        '%s/model-0000.params' % model_dir,
    )
    return net
```

```
# Deploy your MXNet estimator to a SageMaker Endpoint

abalone_estimator.deploy(
instance_type='ml.m4.xlarge',
initial_instance_count=1)
```

1. No code required if using default SageMaker MXNet Model Server.
2. Works well if the model is a single artifact of type MXNet nn.module
3. Else write custom code, e.g load Gluon model..

MXNet inference with SageMaker – Custom Dataformats

```python
def input_fn(request_body, request_content_type, model):
    """An input_fn that loads a pickled numpy array"""
    if request_content_type == "application/python-pickle":
        array = np.load(StringIO(request_body))
        array.reshape(model.data_shpaes[0])
        return mx.io.NDArrayIter(mx.ndarray(array))
    else:
        # Handle other content-types here or raise an Exception
        # if the content type is not supported.
        pass
```

Note: This sample is for SageMaker with MXNet 1.3.0

# Deserialize the Invoke request body into an object we can perform prediction on
input_object = input_fn(request_body, request_content_type, model)

# Perform prediction on the deserialized object, with the loaded model
prediction = predict_fn(input_object, model)

# Serialize the prediction result into the desired response content type
ouput = output_fn(prediction, response_content_type)

Summary – Amazon SageMaker

- Built-in support for opensource ML Frameworks TensorFlow, PyTorch, Chainer, MXNet and Scikit-learn
- Simplifies porting existing code to use AWS Platform, making your code fully portable
- Simplifies model endpoint inference creation – One Click Deployment
- Automatic monitoring and tracking logs, infrstraucture and model performance
- Automatic experiment tracking including data, code, hyperparameters & logs

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