

Kailash Parshad

➤ TensorFlow and MLflow Demo

GitHub: - <https://github.com/at0m-b0mb/>

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- **Create Conda Environment: -**

```
(base) C:\Users\at0m>conda create -n kailash python=3.10.5 ipykernel
Collecting package metadata (current_repodata.json): failed

CondaError: KeyboardInterrupt

Terminate batch job (Y/N)? C:\ProgramData\Microsoft\Windows\Start Menu\Programs\Ana
conda3 (64-bit)n
Terminate batch job (Y/N)?
Terminate batch job (Y/N)? mn
Terminate batch job (Y/N)? n

(base) C:\Users\at0m>conda create -n kailash python=3.10 ipykernel
Collecting package metadata (current_repodata.json): done
Solving environment: done

==> WARNING: A newer version of conda exists. <==
  current version: 23.7.4
  latest version: 23.9.0
```

- **Activate the environment and add a newly created environment to the notebook as kernel: -**

```
(base) C:\Users\at0m\Desktop>conda activate kailash

(kailash) C:\Users\at0m\Desktop>python -m ipykernel install --user --name=kailash
Installed kernelspec kailash in C:\Users\at0m\AppData\Roaming\jupyter\kernels\kaila
sh
```

- **Now installing notebook: -**

```
(kailash) C:\Users\at0m\Desktop>pip install notebook
Collecting notebook
  Obtaining dependency information for notebook from https://files.pythonhosted.org/packages/29/e0/50b48473fcb99651dd21302da50ae2c49113ccf3dfb901fc6aaa3117e7ed/notebook-7.0.4-py3-none-any.whl.metadata
  Downloading notebook-7.0.4-py3-none-any.whl.metadata (10 kB)
Collecting jupyter-server<3,>=2.4.0 (from notebook)
  Obtaining dependency information for jupyter-server<3,>=2.4.0 from https://files.pythonhosted.org/packages/96/a2/b432812537beaf22a9dbc0d50cb62471e57ef90df42738675760fb3dce98/jupyter_server-2.7.3-py3-none-any.whl.metadata
  Downloading jupyter_server-2.7.3-py3-none-any.whl.metadata (8.6 kB)
Collecting jupyterlab-server<3,>=2.22.1 (from notebook)
  Obtaining dependency information for jupyterlab-server<3,>=2.22.1 from https://files.pythonhosted.org/packages/96/cd/cdabe44549d60e0967904f0bdd9e3756b521112317612a3997eb2fda9181/jupyterlab_server-2.25.0-py3-none-any.whl.metadata
  Downloading jupyterlab_server-2.25.0-py3-none-any.whl.metadata (5.9 kB)
```

- Now installing all the dependencies: -

```
pip install pandas
pip install numpy
pip install scikit-learn
pip install imblearn
pip install matplotlib
pip install mlflow
```

We are using -U so that pip update or downgrade accordingly: -

- MLflow Auto log compatible version 2.3.0 – 2.12.0

```
(base) C:\Users\at0m>pip install -U tensorflow==2.12.0
Defaulting to user installation because normal site-packages is not writeable
Collecting tensorflow==2.12.0
  Downloading tensorflow-2.12.0-cp311-cp311-win_amd64.whl (1.9 kB)
Collecting tensorflow-intel==2.12.0 (from tensorflow==2.12.0)
  Downloading tensorflow_intel-2.12.0-cp311-cp311-win_amd64.whl (272.9 MB)
  18.5/272.9 MB 206.0 kB/s eta 0:20:35
```

- Now I will open the Jupiter notebook: -

Notebook Link: - <https://github.com/at0m-b0mb/MLflow-Tensorflow-Demo/blob/main/MLFlow%20Tensorflow%20Model%20Kailash.ipynb>

```
(kailash) C:\Users\at0m\Desktop\mlflow-main>jupyter notebook
[I 2023-10-07 16:03:01.383 ServerApp] Package notebook took 0.0000s to import
[I 2023-10-07 16:03:01.483 ServerApp] Package jupyter_lsp took 0.1114s to import
[W 2023-10-07 16:03:01.483 ServerApp] A '_jupyter_server_extension_points' function was not found in jupyter_lsp. Instead, a '_jupyter_server_extension_paths' function was found and will be used for now. This function name will be deprecated in future releases of Jupyter Server.
[I 2023-10-07 16:03:03.791 ServerApp] Package jupyter_server_terminals took 2.3049s to import
[I 2023-10-07 16:03:03.791 ServerApp] Package jupyterlab took 0.0000s to import
[I 2023-10-07 16:03:04.038 ServerApp] Package notebook_shim took 0.0000s to import
[W 2023-10-07 16:03:04.038 ServerApp] A '_jupyter_server_extension_points' function was not found in notebook_shim. Instead, a '_jupyter_server_extension_paths' function was found and will be used for now. This function name will be deprecated in future releases of Jupyter Server.
[I 2023-10-07 16:03:04.038 ServerApp] jupyter_lsp | extension was successfully linked.
[I 2023-10-07 16:03:04.058 ServerApp] jupyter_server_terminals | extension was successfully linked.
[I 2023-10-07 16:03:04.070 ServerApp] jupyterlab | extension was successfully linked.
[I 2023-10-07 16:03:04.081 ServerApp] notebook | extension was successfully linked.
[I 2023-10-07 16:03:04.086 ServerApp] Writing Jupyter server cookie secret to C:\Users\at0m\AppData\Roaming\jupyter\runtime\jupyter_cookie_secret
[I 2023-10-07 16:03:04.641 ServerApp] notebook_shim | extension was successfully linked.
[I 2023-10-07 16:03:04.689 ServerApp] notebook_shim | extension was successfully loaded.
[I 2023-10-07 16:03:04.689 ServerApp] jupyter_lsp | extension was successfully loaded.
[I 2023-10-07 16:03:04.689 ServerApp] jupyter_server_terminals | extension was successfully loaded.
```

- *Now run all the functions in the notebook: -*

```
import tensorflow as tf
import mlflow
import numpy as np
import matplotlib.pyplot as plt

[1] ✓ 14.0s Python

import sys
sys.executable

[2] ✓ 0.0s Python
... 'c:\Users\at0m\.conda\envs\kailash\python.exe'

!python --version

[3] ✓ 0.0s Python
... Python 3.10.13

print(tf.__version__)

[4] ✓ 0.0s Python
... 2.12.0

print(mlflow.__version__)

[5] ✓ 0.0s Python
... 2.7.1
```

```
def load_data():
    fashion_mnist = tf.keras.datasets.fashion_mnist
    (train_images, train_labels), (test_images, test_labels) = fashion_mnist.load_data()

    class_names = ['T-shirt/top', 'Trouser', 'Pullover', 'Dress', 'Coat',
                   'Sandal', 'Shirt', 'Sneaker', 'Bag', 'Ankle boot']

    return train_images, train_labels, test_images, test_labels, class_names
```

[6] ✓ 0.0s

Python

```
train_images, train_labels, test_images, test_labels, class_names= load_data()
```

[7] ✓ 1m 22.3s

Python

```
... Downloading data from https://storage.googleapis.com/tensorflow/tf-keras-datasets/train-labels-idx1-ubyte.gz
29515/29515 [=====] - 0s 2us/step
Downloading data from https://storage.googleapis.com/tensorflow/tf-keras-datasets/train-images-idx3-ubyte.gz
26421880/26421880 [=====] - 66s 2us/step
Downloading data from https://storage.googleapis.com/tensorflow/tf-keras-datasets/t10k-labels-idx1-ubyte.gz
5148/5148 [=====] - 0s 0s/step
Downloading data from https://storage.googleapis.com/tensorflow/tf-keras-datasets/t10k-images-idx3-ubyte.gz
4422102/4422102 [=====] - 12s 3us/step
```

```
print(train_images.shape)
#Each Label is between 0-9train_labels
print(test_images.shape)
```

[8] ✓ 0.0s

Python

```
... (60000, 28, 28)
(10000, 28, 28)
```

```
def get_val_data(test_images, test_labels):  
    test_images_sub_arr = np.array_split(test_images, 2)  
    val_images = test_images_sub_arr[0]  
    test_images = test_images_sub_arr[1]  
  
    test_labels_sub_arr = np.array_split(test_labels, 2)  
    val_labels = test_labels_sub_arr[0]  
    test_labels = test_labels_sub_arr[1]  
  
    return val_images, val_labels, test_images, test_labels
```

[9] ✓ 0.0s

Python

```
val_images, val_labels, test_images, test_labels = get_val_data(test_images, test_labels)
```

[10] ✓ 0.0s

Python

```
print(val_images.shape)  
print(test_images.shape)  
  
print(val_labels.shape)  
print(test_labels.shape)
```

[11] ✓ 0.0s

Python

```
... (5000, 28, 28)  
    (5000, 28, 28)  
    (5000,)  
    (5000,)
```

```
def check_image_pixel_values(single_image):  
    plt.figure()  
    plt.imshow(single_image)  
    plt.colorbar()  
    plt.grid(False)  
    plt.show()
```

[12] ✓ 0.0s

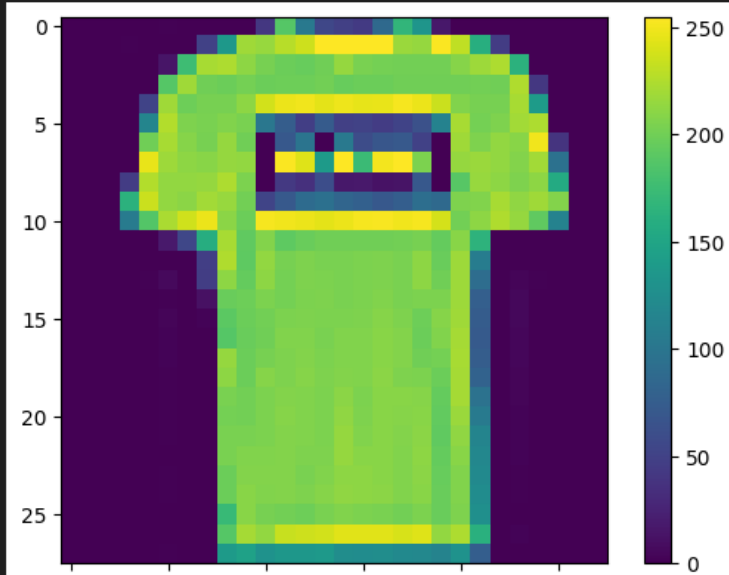
Python

```
check_image_pixel_values(train_images[1])
```

[13] ✓ 1.2s

Python

...



... Activate Windows ...

```
def image_scaling(img_arr):  
    scaled_img = img_arr / 255.0  
    return scaled_img
```

[14] ✓ 0.0s

Python

```
scaled_train_images = image_scaling(train_images)  
scaled_val_images = image_scaling(val_images)  
scaled_test_images = image_scaling(test_images)
```

[15] ✓ 0.3s

Python

```
def verify_data_format(img_arr, img_labels, class_names):  
    plt.figure(figsize=(10,10))  
    for i in range(25):  
        plt.subplot(5,5,i+1)  
        plt.xticks([])  
        plt.yticks([])  
        plt.grid(False)  
        plt.imshow(img_arr[i], cmap=plt.cm.binary)  
        plt.xlabel(class_names[img_labels[i]])  
    plt.show()
```

[16] ✓ 0.0s

Python

```
verify_data_format(scaled_train_images, train_labels, class_names)
```

[17]

✓ 1.0s

Python

...



Ankle boot



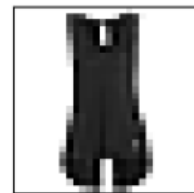
T-shirt/top



T-shirt/top



Dress



T-shirt/top



Pullover



Sneaker



Pullover



Sandal



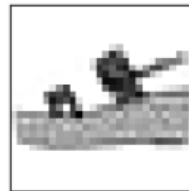
Sandal



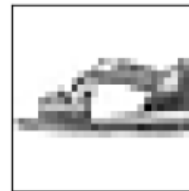
T-shirt/top



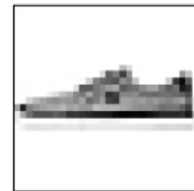
Ankle boot



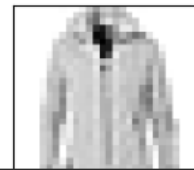
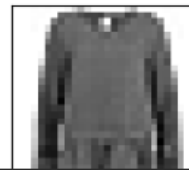
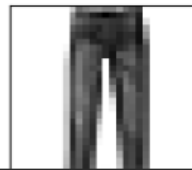
Sandal



Sandal



Sneaker




```
verify_data_format(scaled_val_images, val_labels, class_names)
```

[18]

✓ 0.9s

Python

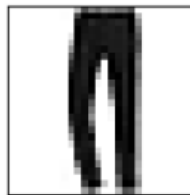
...



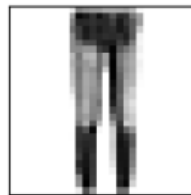
Ankle boot



Pullover



Trousers



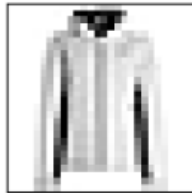
Trousers



Shirt



Trousers



Coat



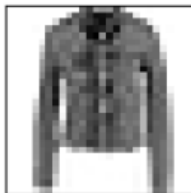
Shirt



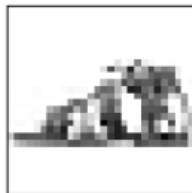
Sandal



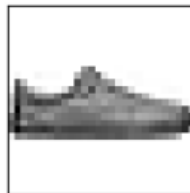
Sneaker



Coat



Sandal



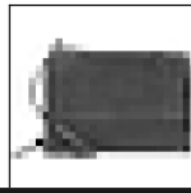
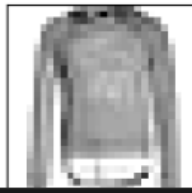
Sneaker

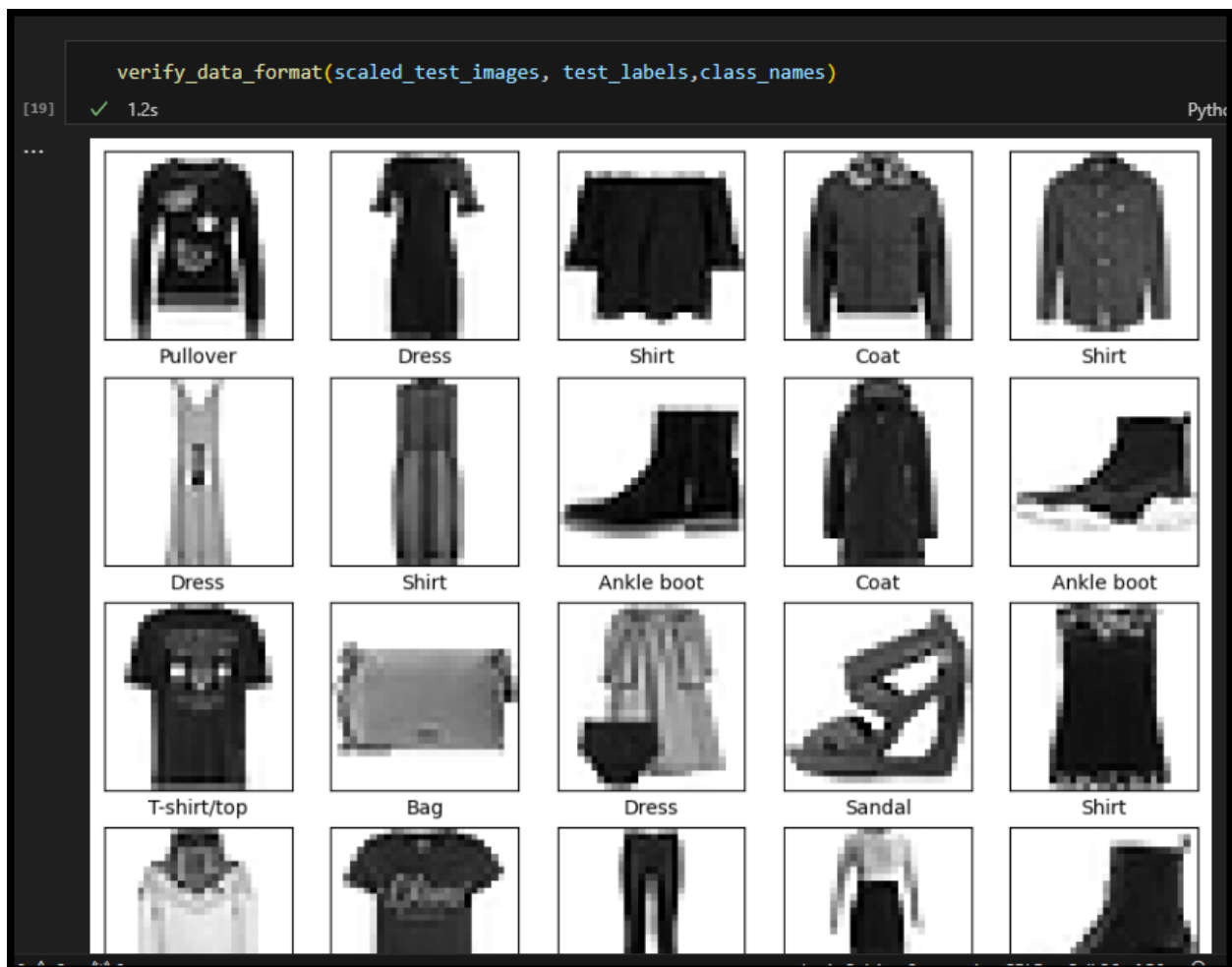


Dress

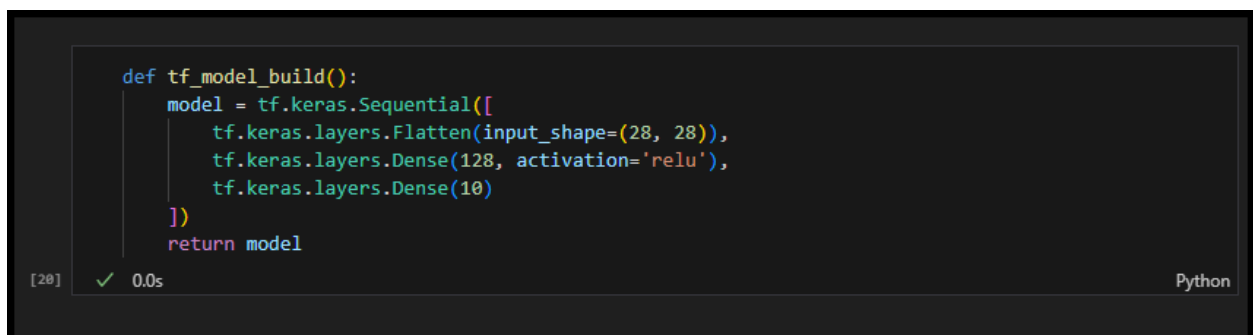


Coat





- **Build the Model: -**



- **Compile the Model: -**

```
def tf_compile_model(model):  
    model.compile(optimizer='adam',  
                  loss=tf.keras.losses.SparseCategoricalCrossentropy(from_logits=True),  
                  metrics=['accuracy'])  
    return model
```

[21]

✓ 0.0s

Python

- **Training the Model: -**

```
import mlflow  
mlflow.tensorflow.autolog(every_n_iter=2)
```

[22]

✓ 0.0s

Python

```
def tf_train_model(scaled_train_images, train_labels, epochs, batch_size, scaled_val_images, val_la  
    model.fit(scaled_train_images,  
              train_labels,  
              epochs=epochs,  
              batch_size=batch_size,  
              validation_data=(scaled_val_images, val_labels)  
    )  
    return model
```

[23]

✓ 0.0s

Python

```
model = tf_model_build()
model = tf_compile_model(model)

epochs = 10
batch_size = 32
model = tf_train_model(scaled_train_images, train_labels, epochs, batch_size, scaled_val_images, va

[37] ✓ 1m 5.8s Python

... 2023/10/07 19:26:25 INFO mlflow.utils.autologging_utils: Created MLflow autologging run with ID 'e70777t
Epoch 1/10
1875/1875 [=====] - 7s 3ms/step - loss: 0.5034 - accuracy: 0.8237 - val_loss:
Epoch 2/10
1875/1875 [=====] - 5s 3ms/step - loss: 0.3757 - accuracy: 0.8643 - val_loss:
Epoch 3/10
1875/1875 [=====] - 5s 3ms/step - loss: 0.3360 - accuracy: 0.8782 - val_loss:
Epoch 4/10
1875/1875 [=====] - 5s 3ms/step - loss: 0.3137 - accuracy: 0.8845 - val_loss:
Epoch 5/10
1875/1875 [=====] - 5s 3ms/step - loss: 0.2947 - accuracy: 0.8910 - val_loss:
Epoch 6/10
1875/1875 [=====] - 5s 3ms/step - loss: 0.2827 - accuracy: 0.8959 - val_loss:
Epoch 7/10
1875/1875 [=====] - 6s 3ms/step - loss: 0.2667 - accuracy: 0.9020 - val_loss:
Epoch 8/10
1875/1875 [=====] - 6s 3ms/step - loss: 0.2572 - accuracy: 0.9042 - val_loss:
Epoch 9/10
1875/1875 [=====] - 6s 3ms/step - loss: 0.2460 - accuracy: 0.9083 - val_loss:
Epoch 10/10
1875/1875 [=====] - 5s 3ms/step - loss: 0.2396 - accuracy: 0.9100 - val_loss:
1/1 [=====] - 0s 41ms/step
WARNING:absl:Found untraced functions such as _update_step_xla while saving (showing 1 of 1). These fur
INFO:tensorflow:Assets written to: C:\Users\at0m\AppData\Local\Temp\tmp_5qieg9\model\data\model\assets
```

- Starting and Looking the data in MLflow: -\

```
(base) C:\Users\at0m>conda activate kailash
(kailash) C:\Users\at0m>mlflow ui
Traceback (most recent call last):
  File "C:\Users\at0m\.conda\envs\kailash\lib\runpy.py", line 196, in _run_module_as_main
    return _run_code(code, main_globals, None,
  File "C:\Users\at0m\.conda\envs\kailash\lib\runpy.py", line 86, in _run_code
    exec(code, run_globals)
  File "C:\Users\at0m\.conda\envs\kailash\Scripts\mlflow.exe\__main__.py", line 4, in <module>
    from mlflow.cli import cli
  File "C:\Users\at0m\.conda\envs\kailash\lib\site-packages\mlflow\__init__.py", line 44, in <module>
    from mlflow import (
  File "C:\Users\at0m\.conda\envs\kailash\lib\site-packages\mlflow\data\__init__.py", line 4, in <modul
e>
```

MLflow

127.0.0.1:5000/#/experiments/0?searchFilter=&orderByKey=t...

mlflow 2.7.1

Experiments

Models

GitHub

Docs

Experiments

Search Experiments

☒

Default

☐

live_mnist_exp_20231007

Default

Provide Feedback

Share

Experiment ID: 0

Artifact Location: file:///c:/Users/at0m/Desktop/mlflow-main/Main/mlruns/0

> Description Edit

metrics.rmse < 1 and params.model = "tree"

Time created: Last year

State: Active

Sort: Run Name

Columns

Expand rows

New run

Table

Chart

Evaluation

Experimental

		Run Name	Created	Data
<input type="checkbox"/>	<input type="radio"/>	agreeable-shrimp-118	18 minutes ago	
<input type="checkbox"/>	<input type="radio"/>	carefree-fawn-812	1 hour ago	
<input type="checkbox"/>	<input type="radio"/>	chill-fawn-160	10 minutes ago	
<input type="checkbox"/>	<input type="radio"/>	orderly-toad-85	20 minutes ago	

6 matching runs

Table

Chart

Evaluation

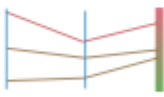
Experimental

	Run Name
<input type="radio"/>	agreeable-shrimp-118
<input type="radio"/>	carefree-fawn-812
<input type="radio"/>	chill-fawn-160
<input type="radio"/>	orderly-toad-85
<input type="radio"/>	salty-shad-831

6 matching runs

+ Add chart

Parallel Coordin...



Compare parameter

MLflow

127.0.0.1:5000/#/experiments/0/runs/fe9c0f13476341c68a56...

mlflow2.7.1

Experiments

Models

Default >

agreeable-shrimp-118

Run ID: fe9c0f13476341c68a565f7c09f56af5

Date: 2023-10-07 19:10:49

Source: c:\Users\at0m\conda\envs\kailash\lib\site-packages\ipykernel_launcher.py

User: at0m

Duration: 1.2min

Status: FINISHED

Lifecycle Stage: active

> Description

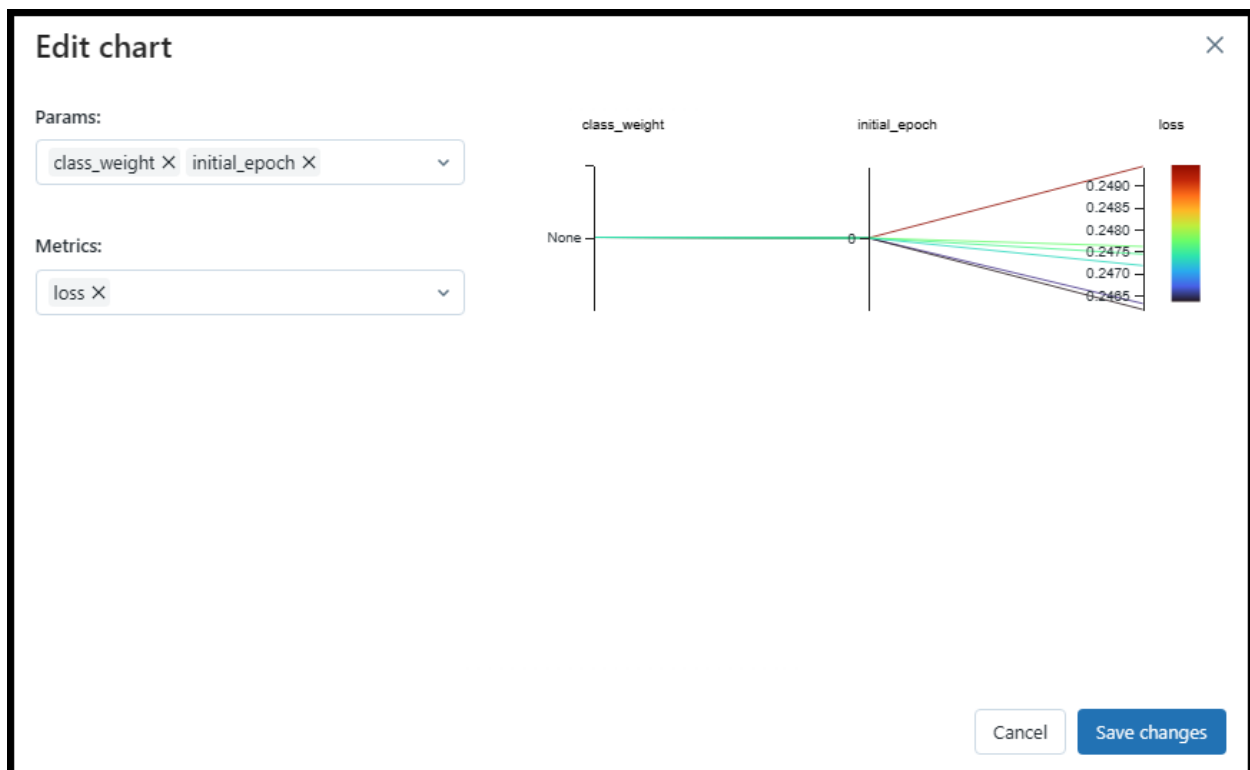
Edit

> Datasets (2)

Parameters (29)

Parameters (29)

Name	Value
batch_size	32
class_weight	None
epochs	10
initial_epoch	0
max_queue_size	10
opt_amsgrad	False
opt_beta_1	0.9
opt_beta_2	0.999
opt_clipnorm	None
opt_clipvalue	None
opt_ema_momentum	0.99



Artifacts

- model
 - data
 - model
 - assets
 - variables
 - fingerprint.pb
 - keras_metadata.pb
 - saved_model.pb
 - keras_module.txt
 - save_format.txt
 - MLModel**
 - conda.yaml
 - python_env.yaml
 - requirements.txt
 - tensorboard_logs
 - model_summary.txt

Full Path: file:///c:/Users/at0m/Desktop/mlflow-main/Main/mlruns/0/7a91...
Size: 705B

```
artifact_path: model
flavors:
  python_function:
    data: data
    env:
      conda: conda.yaml
      virtualenv: python_env.yaml
    loader_module: mlflow.tensorflow
    python_version: 3.10.13
  tensorflow:
    code: null
    data: data
    keras_version: 2.12.0
    model_type: keras
    save_format: tf
mlflow_version: 2.7.1
model_uuid: 0501661e377c4d6595f6b4dbe6c18720
run_id: 7a91dca279dc45f38ad1f0afc8a9c5af
signature:
  inputs: '[{"type": "tensor", "tensor-spec": {"dtype": "float64", "shape": [-1, 28, 28]}}]'
  outputs: '[{"type": "tensor", "tensor-spec": {"dtype": "float32", "shape": [-1, 10]}}]'
  params: null
```

Activate Windows
Go to Settings to activate Windows

Table		Chart	Evaluation	Experimental	
<input type="checkbox"/>	<input type="radio"/>	Run Name	Created	Dataset	Duration
<input type="checkbox"/>	<input type="radio"/>	monumental-wasp-214	33 seconds ago	dataset (998a5036) Train, data ... +1	
<input type="checkbox"/>	<input type="radio"/>	salty-shad-831	19 minutes ago	dataset (26d73293) Eval, data ... +1	
<input type="checkbox"/>	<input type="radio"/>	chill-fawn-160	21 minutes ago	dataset (998a5036) Train, data ... +1	
<input type="checkbox"/>	<input type="radio"/>	agreeable-shrimp-118	29 minutes ago	dataset (26d73293) Eval, data ... +1	
<input type="checkbox"/>	<input type="radio"/>	orderly-toad-85	31 minutes ago	dataset (998a5036) Train, data ... +1	
<input type="checkbox"/>	<input type="radio"/>	dataset (998a5036) ...	

- **Evaluate Model in the test Images: -**

```
[25] train_loss, train_acc = model.evaluate(scaled_train_images, train_labels, verbose=2)
print('\ntrain accuracy:', train_acc)

... 1875/1875 - 3s - loss: 0.2314 - accuracy: 0.9134 - 3s/epoch - 1ms/step

train accuracy: 0.9133999943733215

[26] val_loss, val_acc = model.evaluate(scaled_val_images, val_labels, verbose=2)
print('\nval accuracy:', val_acc)

... 157/157 - 0s - loss: 0.3414 - accuracy: 0.8760 - 248ms/epoch - 2ms/step

val accuracy: 0.8759999871253967

[27] test_loss, test_acc = model.evaluate(test_images, test_labels, verbose=2)
print('\nTest accuracy:', test_acc)

... 157/157 - 0s - loss: 74.6896 - accuracy: 0.8432 - 311ms/epoch - 2ms/step

Test accuracy: 0.8432000279426575
```

```
[28] predictions = model.predict(test_images)
      predictions[0]
Python

... 1/157 [.....] - ETA: 7s
      157/157 [=====] - 0s 1ms/step

... array([ -623.4931 , -1499.3573 ,  945.1065 , -2064.4617 ,
            41.167755, -3514.1626 ,  511.58093 , -4882.0435 ,
            -2092.7468 , -3331.1501 ], dtype=float32)

[29] import numpy as np
      np.argmax(predictions[0])
      #Model is most confident that it's an ankle boot. Let's see if it's correct
Python

... 2

[30] test_labels[0]
Python

... 2

[31] class_names[0]
Python

... 'T-shirt/top'
```

- *Experiment Tracking for TensorFlow-based Models: -*

```
def tf_experiment_tracking(exp_name, run_name, batch_size, epochs, train_loss, train_acc,
                           val_loss, val_acc, test_loss, test_acc, model_signature):
    mlflow.set_experiment(exp_name)
    with mlflow.start_run(run_name=run_name):
        mlflow.log_param("batch_size", batch_size)
        #mlflow.log_param("learning_rate", learning_rate)
        mlflow.log_param("epochs", epochs)
        mlflow.log_metric("train_loss", train_loss)
        mlflow.log_metric("train_accuracy", train_acc)
        mlflow.log_metric("val_loss", val_loss)
        mlflow.log_metric("val_accuracy", val_acc)
        mlflow.log_metric("test_loss", test_loss)
        mlflow.log_metric("test_accuracy", test_acc)
        mlflow.tensorflow.log_model(model, "mnist", signature=model_signature)
    mlflow.end_run()
```

[32] Python

```
from mlflow.models.signature import infer_signature
model_signature = infer_signature(scaled_test_images, model.predict(scaled_test_images))
```

[33] Python

... 157/157 [=====] - 0s 1ms/step

```
from datetime import datetime
exp_timestamp = datetime.now().strftime("%Y%m%d")
exp_name = "live_mnist_exp_" + exp_timestamp
print(exp_name)

run_timestamp = datetime.now().strftime("%Y%m%d--%H%M%S")
run_name = "live_mnist_exp_run_" + run_timestamp
print(run_name)
```

[34] Python

... live_mnist_exp_20231007
live_mnist_exp_run_20231007--192214

```
tf_experiment_tracking(exp_name, run_name, batch_size, epochs, train_loss, train_acc,
                       val_loss, val_acc, test_loss, test_acc, model_signature)
```

[35] Python

... WARNING:absl:Found untraced functions such as _update_step_xla while saving (showing 1 of 1). These functions will not be traced.
INFO:tensorflow:Assets written to: C:\Users\at0m\AppData\Local\Temp\tmpd1_fj0h9\model\data\model\assets
INFO:tensorflow:Assets written to: C:\Users\at0m\AppData\Local\Temp\tmpd1_fj0h9\model\data\model\assets

mlflow2.7.1

Experiments

Models

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☒ live_mnist_exp_20231007

live_mnist_exp_20231007

Experiment ID: 624049329627277009

Artifact Location: file:///C:/Users/at0m/Desktop/mlflow-main/Main/mlruns/624049329627277009

Provide Feedback

Share

metrics.rmse < 1 and params.model = "tree"

Time created

State: Active

Sort: Created

New run

Table

Chart

Evaluation

Experimental

Run Name

live_mnist_exp_run_20231007--194...

unequaled-grouse-98

live_mnist_exp_run_20231007--192...

live_mnist_exp_run_20231007--191...

+ Add chart

test_accuracy

Comparing first 4 runs

Your device is at risk of being out of date. It will need to restart to install updates.

Table					
Chart					
Evaluation					
Experimental					
<input type="checkbox"/>	<input type="radio"/>	Run Name	Created	↕	Data
<input type="checkbox"/>	<input type="radio"/>	live_mnist_exp_run_20231007--194...	9 minutes ago	✓	-
<input type="checkbox"/>	<input type="radio"/>	unequaled-grouse-98	24 minutes ago	✓	📊
<input type="checkbox"/>	<input type="radio"/>	live_mnist_exp_run_20231007--192...	28 minutes ago	✓	-
<input type="checkbox"/>	<input type="radio"/>	live_mnist_exp_run_20231007--191...	31 minutes ago	✓	-

The screenshot shows the MLflow Artifacts interface. On the left, a file explorer shows the hierarchy: `mnist` > `data` > `model` > `MLmodel`. The main panel displays the metadata for the selected artifact:

```
Full Path: file:///C:/Users/at0m/Desktop/mlflow-main/Main/mlruns/62404...
Size: 705B

artifact_path: mnist
flavors:
  python_function:
    data: data
    env:
      conda: conda.yaml
      virtualenv: python_env.yaml
    loader_module: mlflow.tensorflow
    python_version: 3.10.13
  tensorflow:
    code: null
    data: data
    keras_version: 2.12.0
    model_type: keras
    save_format: tf
mlflow_version: 2.7.1
model_uuid: 6a66ba9a918b49aeac222ae0645671c0
run_id: bb579ab24c9b4ea78a5e03f9b7d15f14
signature:
  inputs: '[{"type": "tensor", "tensor-spec": {"dtype": "float64", "shape": [-1, 28, 28]}}]'
  outputs: '[{"type": "tensor", "tensor-spec": {"dtype": "float32", "shape": [-1, 10]}}]'
  params: null
creation_time: 1699340973.4431297
last_update_time: 1699340973.4431297
```

- **Load the model from MLflow Run and making Predictions: -**

```
import mlflow
logged_model = 'runs:/dfd48942778440ba80521c9bd4c521c9/mnist'

# Load model as a PyFuncModel.
loaded_model = mlflow.pyfunc.load_model(logged_model)
#test_images1 = scaled_test_images.astype('float64')
predictions = loaded_model.predict(scaled_test_images)
predictions[0]
```

The code is written in a Python environment, as indicated by the 'Python' label in the bottom right corner of the editor window.

