

```
!pip install transformers "datasets[s3]==2.18.0" "sagemaker>=2.190.0"
"huggingface_hub[cli]" --upgrade
```

```
Requirement already satisfied: transformers in
/usr/local/lib/python3.10/dist-packages (4.38.2)
```

```
Collecting transformers
```

```
  Downloading transformers-4.39.1-py3-none-any.whl (8.8 MB)
```

```
----- 8.8/8.8 MB 18.6 MB/s eta
0:00:00
```

```
----- 510.5/510.5 kB 31.3 MB/s eta
```

```
0:00:00
```

```
aker>=2.190.0
```

```
  Downloading sagemaker-2.214.1-py3-none-any.whl (1.4 MB)
```

```
----- 1.4/1.4 MB 36.1 MB/s eta
```

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0:00:00
```

```
Requirement already satisfied: huggingface_hub[cli] in
/usr/local/lib/python3.10/dist-packages (0.20.3)
```

```
Collecting huggingface_hub[cli]
```

```
  Downloading huggingface_hub-0.22.1-py3-none-any.whl (388 kB)
```

```
----- 388.6/388.6 kB 28.4 MB/s eta
```

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0:00:00
```

```
Requirement already satisfied: filelock in /usr/local/lib/python3.10/dist-
packages (from datasets[s3]==2.18.0) (3.13.3)
```

```
Requirement already satisfied: numpy>=1.17 in
```

```
/usr/local/lib/python3.10/dist-packages (from datasets[s3]==2.18.0)
(1.25.2)
```

```
Requirement already satisfied: pyarrow>=12.0.0 in
```

```
/usr/local/lib/python3.10/dist-packages (from datasets[s3]==2.18.0)
(14.0.2)
```

```
Requirement already satisfied: pyarrow-hotfix in
```

```
/usr/local/lib/python3.10/dist-packages (from datasets[s3]==2.18.0)
(0.6)
```

```
Collecting dill<0.3.9,>=0.3.0 (from datasets[s3]==2.18.0)
```

```
  Downloading dill-0.3.8-py3-none-any.whl (116 kB)
```

```
----- 116.3/116.3 kB 12.3 MB/s eta
```

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0:00:00
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```
Requirement already satisfied: pandas in /usr/local/lib/python3.10/dist-
packages (from datasets[s3]==2.18.0) (1.5.3)
```

```
Requirement already satisfied: requests>=2.19.0 in
```

```
/usr/local/lib/python3.10/dist-packages (from datasets[s3]==2.18.0)
(2.31.0)
```

```
Requirement already satisfied: tqdm>=4.62.1 in
```

```
/usr/local/lib/python3.10/dist-packages (from datasets[s3]==2.18.0)
(4.66.2)
```

```
Collecting xxhash (from datasets[s3]==2.18.0)
```

```
  Downloading xxhash-3.4.1-cp310-cp310-
```

```
manylinux_2_17_x86_64.manylinux2014_x86_64.whl (194 kB)
```

```
----- 194.1/194.1 kB 11.4 MB/s eta
```

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0:00:00
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```
ultraprocess (from datasets[s3]==2.18.0)
```

Downloading multiprocess-0.70.16-py310-none-any.whl (134 kB)

134.8/134.8 kB 11.6 MB/s eta

0:00:00

Requirement already satisfied: fsspec[http]<=2024.2.0,>=2023.1.0 in  
/usr/local/lib/python3.10/dist-packages (from datasets[s3]==2.18.0)  
(2023.6.0)

Requirement already satisfied: aiohttp in  
/usr/local/lib/python3.10/dist-packages (from datasets[s3]==2.18.0)  
(3.9.3)

Requirement already satisfied: packaging in  
/usr/local/lib/python3.10/dist-packages (from datasets[s3]==2.18.0)  
(24.0)

Requirement already satisfied: pyyaml>=5.1 in  
/usr/local/lib/python3.10/dist-packages (from datasets[s3]==2.18.0)  
(6.0.1)

Collecting s3fs (from datasets[s3]==2.18.0)

Downloading s3fs-2024.3.1-py3-none-any.whl (29 kB)

Requirement already satisfied: regex!=2019.12.17 in  
/usr/local/lib/python3.10/dist-packages (from transformers)  
(2023.12.25)

Requirement already satisfied: tokenizers<0.19,>=0.14 in  
/usr/local/lib/python3.10/dist-packages (from transformers) (0.15.2)

Requirement already satisfied: safetensors>=0.4.1 in  
/usr/local/lib/python3.10/dist-packages (from transformers) (0.4.2)

Requirement already satisfied: attrs<24,>=23.1.0 in  
/usr/local/lib/python3.10/dist-packages (from sagemaker>=2.190.0)  
(23.2.0)

Collecting boto3<2.0,>=1.33.3 (from sagemaker>=2.190.0)

Downloading boto3-1.34.72-py3-none-any.whl (139 kB)

139.3/139.3 kB 3.0 MB/s eta

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Requirement already satisfied: cloudpickle==2.2.1 in  
/usr/local/lib/python3.10/dist-packages (from sagemaker>=2.190.0)  
(2.2.1)

Requirement already satisfied: google-pasta in  
/usr/local/lib/python3.10/dist-packages (from sagemaker>=2.190.0)  
(0.2.0)

Requirement already satisfied: protobuf<5.0,>=3.12 in  
/usr/local/lib/python3.10/dist-packages (from sagemaker>=2.190.0)  
(3.20.3)

Collecting smdebug-rulesconfig==1.0.1 (from sagemaker>=2.190.0)

Downloading smdebug\_rulesconfig-1.0.1-py2.py3-none-any.whl (20 kB)

Collecting importlib-metadata<7.0,>=1.4.0 (from sagemaker>=2.190.0)

Downloading importlib\_metadata-6.11.0-py3-none-any.whl (23 kB)

Collecting pathos (from sagemaker>=2.190.0)

Downloading pathos-0.3.2-py3-none-any.whl (82 kB)

82.1/82.1 kB 6.2 MB/s eta

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a (from sagemaker>=2.190.0)

Downloading schema-0.7.5-py2.py3-none-any.whl (17 kB)  
Requirement already satisfied: jsonschema in  
/usr/local/lib/python3.10/dist-packages (from sagemaker>=2.190.0)  
(4.19.2)  
Requirement already satisfied: platformdirs in  
/usr/local/lib/python3.10/dist-packages (from sagemaker>=2.190.0)  
(4.2.0)  
Requirement already satisfied: tblib<4,>=1.7.0 in  
/usr/local/lib/python3.10/dist-packages (from sagemaker>=2.190.0)  
(3.0.0)  
Requirement already satisfied: urllib3<3.0.0,>=1.26.8 in  
/usr/local/lib/python3.10/dist-packages (from sagemaker>=2.190.0)  
(2.0.7)  
Collecting docker (from sagemaker>=2.190.0)  
Downloading docker-7.0.0-py3-none-any.whl (147 kB)  
----- 147.6/147.6 kB 14.3 MB/s eta

0:00:00  
Requirement already satisfied: psutil in /usr/local/lib/python3.10/dist-  
packages (from sagemaker>=2.190.0) (5.9.5)  
Requirement already satisfied: typing-extensions>=3.7.4.3 in  
/usr/local/lib/python3.10/dist-packages (from huggingface\_hub[cli])  
(4.10.0)  
Collecting InquirerPy==0.3.4 (from huggingface\_hub[cli])  
Downloading InquirerPy-0.3.4-py3-none-any.whl (67 kB)  
----- 67.7/67.7 kB 5.3 MB/s eta

0:00:00  
InquirerPy==0.3.4->huggingface\_hub[cli])  
Downloading pfzy-0.3.4-py3-none-any.whl (8.5 kB)  
Requirement already satisfied: prompt-toolkit<4.0.0,>=3.0.1 in  
/usr/local/lib/python3.10/dist-packages (from InquirerPy==0.3.4-  
>huggingface\_hub[cli]) (3.0.43)  
Collecting boto3<2.0,>=1.34.72 (from boto3<2.0,>=1.33.3-  
>sagemaker>=2.190.0)  
Downloading boto3-1.34.72-py3-none-any.whl (12.0 MB)  
----- 12.0/12.0 MB 40.7 MB/s eta

0:00:00  
espath<2.0.0,>=0.7.1 (from boto3<2.0,>=1.33.3->sagemaker>=2.190.0)  
Downloading jmespath-1.0.1-py3-none-any.whl (20 kB)  
Collecting s3transfer<0.11.0,>=0.10.0 (from boto3<2.0,>=1.33.3-  
>sagemaker>=2.190.0)  
Downloading s3transfer-0.10.1-py3-none-any.whl (82 kB)  
----- 82.2/82.2 kB 6.2 MB/s eta

0:00:00  
Requirement already satisfied: aiosignal>=1.1.2 in  
/usr/local/lib/python3.10/dist-packages (from aiohttp-  
>datasets[s3]==2.18.0) (1.3.1)  
Requirement already satisfied: frozenlist>=1.1.1 in  
/usr/local/lib/python3.10/dist-packages (from aiohttp-  
>datasets[s3]==2.18.0) (1.4.1)

```

Requirement already satisfied: multidict<7.0,>=4.5 in
/usr/local/lib/python3.10/dist-packages (from aiohttp-
>datasets[s3]==2.18.0) (6.0.5)
Requirement already satisfied: yarl<2.0,>=1.0 in
/usr/local/lib/python3.10/dist-packages (from aiohttp-
>datasets[s3]==2.18.0) (1.9.4)
Requirement already satisfied: async-timeout<5.0,>=4.0 in
/usr/local/lib/python3.10/dist-packages (from aiohttp-
>datasets[s3]==2.18.0) (4.0.3)
Requirement already satisfied: zipp>=0.5 in
/usr/local/lib/python3.10/dist-packages (from importlib-
metadata<7.0,>=1.4.0->sagemaker>=2.190.0) (3.18.1)
Requirement already satisfied: charset-normalizer<4,>=2 in
/usr/local/lib/python3.10/dist-packages (from requests>=2.19.0-
>datasets[s3]==2.18.0) (3.3.2)
Requirement already satisfied: idna<4,>=2.5 in
/usr/local/lib/python3.10/dist-packages (from requests>=2.19.0-
>datasets[s3]==2.18.0) (3.6)
Requirement already satisfied: certifi>=2017.4.17 in
/usr/local/lib/python3.10/dist-packages (from requests>=2.19.0-
>datasets[s3]==2.18.0) (2024.2.2)
Requirement already satisfied: six in /usr/local/lib/python3.10/dist-
packages (from google-pasta->sagemaker>=2.190.0) (1.16.0)
Requirement already satisfied: jsonschema-specifications>=2023.03.6 in
/usr/local/lib/python3.10/dist-packages (from jsonschema-
>sagemaker>=2.190.0) (2023.12.1)
Requirement already satisfied: referencing>=0.28.4 in
/usr/local/lib/python3.10/dist-packages (from jsonschema-
>sagemaker>=2.190.0) (0.34.0)
Requirement already satisfied: rpds-py>=0.7.1 in
/usr/local/lib/python3.10/dist-packages (from jsonschema-
>sagemaker>=2.190.0) (0.18.0)
Requirement already satisfied: python-dateutil>=2.8.1 in
/usr/local/lib/python3.10/dist-packages (from pandas-
>datasets[s3]==2.18.0) (2.8.2)
Requirement already satisfied: pytz>=2020.1 in
/usr/local/lib/python3.10/dist-packages (from pandas-
>datasets[s3]==2.18.0) (2023.4)
Collecting ppft>=1.7.6.8 (from pathos->sagemaker>=2.190.0)
  Downloading ppft-1.7.6.8-py3-none-any.whl (56 kB)
----- 56.8/56.8 kB 4.3 MB/s eta
0:00:00
pathos->sagemaker>=2.190.0)
  Downloading pox-0.3.4-py3-none-any.whl (29 kB)
Collecting aiobotocore<3.0.0,>=2.5.4 (from s3fs->datasets[s3]==2.18.0)
  Downloading aiobotocore-2.12.1-py3-none-any.whl (76 kB)
----- 76.3/76.3 kB 5.0 MB/s eta
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multiple versions of s3fs to determine which version is compatible with

```

```

other requirements. This could take a while.
Collecting s3fs (from datasets[s3]==2.18.0)
  Downloading s3fs-2024.3.0-py3-none-any.whl (29 kB)
  Downloading s3fs-2024.2.0-py3-none-any.whl (28 kB)
  Downloading s3fs-2023.12.2-py3-none-any.whl (28 kB)
  Downloading s3fs-2023.12.1-py3-none-any.whl (28 kB)
  Downloading s3fs-2023.10.0-py3-none-any.whl (28 kB)
Collecting aiobotocore~=2.7.0 (from s3fs->datasets[s3]==2.18.0)
  Downloading aiobotocore-2.7.0-py3-none-any.whl (73 kB)
----- 73.5/73.5 kB 4.0 MB/s eta
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datasets[s3]==2.18.0)
  Downloading s3fs-2023.9.2-py3-none-any.whl (28 kB)
Collecting aiobotocore~=2.5.4 (from s3fs->datasets[s3]==2.18.0)
  Downloading aiobotocore-2.5.4-py3-none-any.whl (73 kB)
----- 73.4/73.4 kB 3.3 MB/s eta
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datasets[s3]==2.18.0)
  Downloading s3fs-2023.9.1-py3-none-any.whl (28 kB)
INFO: pip is looking at multiple versions of s3fs to determine which
version is compatible with other requirements. This could take a
while.
  Downloading s3fs-2023.9.0-py3-none-any.whl (28 kB)
  Downloading s3fs-2023.6.0-py3-none-any.whl (28 kB)
Requirement already satisfied: contextlib2>=0.5.5 in
/usr/local/lib/python3.10/dist-packages (from schema-
>sagemaker>=2.190.0) (21.6.0)
INFO: pip is looking at multiple versions of aiobotocore to determine
which version is compatible with other requirements. This could take a
while.
Collecting aiobotocore~=2.5.0 (from s3fs->datasets[s3]==2.18.0)
  Downloading aiobotocore-2.5.3-py3-none-any.whl (73 kB)
----- 73.3/73.3 kB 4.7 MB/s eta
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----- 72.9/72.9 kB 6.7 MB/s eta
0:00:00
----- 72.8/72.8 kB 5.2 MB/s eta
0:00:00
----- 72.7/72.7 kB 8.2 MB/s eta
0:00:00
ight need to provide the dependency resolver with stricter constraints
to reduce runtime. See https://pip.pypa.io/warnings/backtracking for
guidance. If you want to abort this run, press Ctrl + C.
Collecting s3fs (from datasets[s3]==2.18.0)
  Downloading s3fs-2023.5.0-py3-none-any.whl (28 kB)
  Downloading s3fs-2023.4.0-py3-none-any.whl (28 kB)
  Downloading s3fs-2023.3.0-py3-none-any.whl (27 kB)
Collecting aiobotocore~=2.4.2 (from s3fs->datasets[s3]==2.18.0)
  Downloading aiobotocore-2.4.2-py3-none-any.whl (66 kB)

```

66.8/66.8 kB 5.7 MB/s eta

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`datasets[s3]==2.18.0`

Downloading `s3fs-2023.1.0-py3-none-any.whl` (27 kB)

Downloading `s3fs-2022.11.0-py3-none-any.whl` (27 kB)

Downloading `s3fs-2022.10.0-py3-none-any.whl` (27 kB)

Downloading `s3fs-2022.8.2-py3-none-any.whl` (27 kB)

Downloading `s3fs-2022.8.1-py3-none-any.whl` (27 kB)

Downloading `s3fs-2022.8.0-py3-none-any.whl` (27 kB)

Downloading `s3fs-2022.7.1-py3-none-any.whl` (27 kB)

Collecting `aiobotocore~2.3.4` (from `s3fs->datasets[s3]==2.18.0`)

Downloading `aiobotocore-2.3.4-py3-none-any.whl` (64 kB)

64.7/64.7 kB 8.1 MB/s eta

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`datasets[s3]==2.18.0`

Downloading `s3fs-2022.7.0-py3-none-any.whl` (27 kB)

Downloading `s3fs-2022.5.0-py3-none-any.whl` (27 kB)

Downloading `s3fs-2022.3.0-py3-none-any.whl` (26 kB)

Collecting `aiobotocore~2.2.0` (from `s3fs->datasets[s3]==2.18.0`)

Downloading `aiobotocore-2.2.0.tar.gz` (59 kB)

59.7/59.7 kB 7.8 MB/s eta

0:00:00

`etaddata (setup.py) ... datasets[s3]==2.18.0`

Downloading `s3fs-2022.2.0-py3-none-any.whl` (26 kB)

Collecting `aiobotocore~2.1.0` (from `s3fs->datasets[s3]==2.18.0`)

Downloading `aiobotocore-2.1.2-py3-none-any.whl` (55 kB)

56.0/56.0 kB 7.2 MB/s eta

0:00:00

`datasets[s3]==2.18.0`

Downloading `s3fs-2022.1.0-py3-none-any.whl` (25 kB)

Downloading `s3fs-2021.11.1-py3-none-any.whl` (25 kB)

Collecting `aiobotocore~2.0.1` (from `s3fs->datasets[s3]==2.18.0`)

Downloading `aiobotocore-2.0.1.tar.gz` (54 kB)

54.5/54.5 kB 7.2 MB/s eta

0:00:00

`etaddata (setup.py) ... datasets[s3]==2.18.0`

Downloading `s3fs-2021.11.0-py3-none-any.whl` (25 kB)

Collecting `aiobotocore~1.4.1` (from `s3fs->datasets[s3]==2.18.0`)

Downloading `aiobotocore-1.4.2.tar.gz` (52 kB)

52.5/52.5 kB 6.0 MB/s eta

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`etaddata (setup.py) ... datasets[s3]==2.18.0`

Downloading `s3fs-2021.10.1-py3-none-any.whl` (26 kB)

Downloading `s3fs-2021.10.0-py3-none-any.whl` (26 kB)

Downloading `s3fs-2021.9.0-py3-none-any.whl` (26 kB)

Downloading `s3fs-2021.8.1-py3-none-any.whl` (26 kB)

Downloading `s3fs-2021.8.0-py3-none-any.whl` (26 kB)

Downloading `s3fs-2021.7.0-py3-none-any.whl` (25 kB)

Downloading `s3fs-2021.6.1-py3-none-any.whl` (25 kB)

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Download s3fs-2021.6.0-py3-none-any.whl (24 kB)
Download s3fs-2021.5.0-py3-none-any.whl (24 kB)
Download s3fs-2021.4.0-py3-none-any.whl (23 kB)
Download s3fs-0.6.0-py3-none-any.whl (23 kB)
Collecting aiobotocore>=1.0.1 (from s3fs->datasets[s3]==2.18.0)
  Downloading aiobotocore-2.12.0-py3-none-any.whl (76 kB)
    _____ 76.1/76.1 kB 5.8 MB/s eta
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    _____ 76.1/76.1 kB 4.8 MB/s eta
0:00:00
ultiple versions of aiobotocore to determine which version is
compatible with other requirements. This could take a while.
  Downloading aiobotocore-2.11.1-py3-none-any.whl (76 kB)
    _____ 76.1/76.1 kB 4.6 MB/s eta
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    _____ 76.1/76.1 kB 9.1 MB/s eta
0:00:00
    _____ 75.9/75.9 kB 9.9 MB/s eta
0:00:00
    _____ 75.8/75.8 kB 9.5 MB/s eta
0:00:00
    _____ 76.0/76.0 kB 10.7 MB/s eta
0:00:00
ight need to provide the dependency resolver with stricter constraints
to reduce runtime. See https://pip.pypa.io/warnings/backtracking for
guidance. If you want to abort this run, press Ctrl + C.
  Downloading aiobotocore-2.8.0-py3-none-any.whl (75 kB)
    _____ 75.0/75.0 kB 10.6 MB/s eta
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    _____ 73.4/73.4 kB 9.8 MB/s eta
0:00:00
    _____ 66.8/66.8 kB 8.7 MB/s eta
0:00:00
    _____ 65.8/65.8 kB 8.0 MB/s eta
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    _____ 65.7/65.7 kB 8.1 MB/s eta
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etadata (setup.py) ... _____
104.8/104.8 kB 9.1 MB/s eta 0:00:00
etadata (setup.py) ... _____
65.3/65.3 kB 8.1 MB/s eta 0:00:00
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65.1/65.1 kB 7.1 MB/s eta 0:00:00
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57.5/57.5 kB 6.9 MB/s eta 0:00:00
etadata (setup.py) ... _____
54.6/54.6 kB 5.7 MB/s eta 0:00:00
etadata (setup.py) ... _____
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etadata (setup.py) ... _____
52.3/52.3 kB 5.6 MB/s eta 0:00:00
etadata (setup.py) ... _____
51.6/51.6 kB 4.9 MB/s eta 0:00:00
etadata (setup.py) ... _____
50.6/50.6 kB 6.4 MB/s eta 0:00:00
etadata (setup.py) ... _____
49.1/49.1 kB 5.9 MB/s eta 0:00:00
etadata (setup.py) ... _____
48.8/48.8 kB 5.7 MB/s eta 0:00:00
etadata (setup.py) ... _____
48.2/48.2 kB 5.2 MB/s eta 0:00:00
etadata (setup.py) ... _____
48.1/48.1 kB 6.2 MB/s eta 0:00:00
etadata (setup.py) ... _____
48.0/48.0 kB 6.0 MB/s eta 0:00:00
etadata (setup.py) ... _____
47.3/47.3 kB 5.6 MB/s eta 0:00:00
etadata (setup.py) ... _____
45.1/45.1 kB 5.6 MB/s eta 0:00:00

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_____ 42.1/42.1 kB 5.7 MB/s eta
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_____ 40.8/40.8 kB 5.1 MB/s eta
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```

```

_____ 40.7/40.7 kB 5.0 MB/s eta
0:00:00

```

```

datasets[s3]==2.18.0)
  Downloading s3fs-0.5.2-py3-none-any.whl (22 kB)
  Downloading s3fs-0.5.1-py3-none-any.whl (21 kB)
  Downloading s3fs-0.5.0-py3-none-any.whl (21 kB)
  Downloading s3fs-0.4.2-py3-none-any.whl (19 kB)

```

```

Requirement already satisfied: wcwidth in
/usr/local/lib/python3.10/dist-packages (from prompt-
toolkit<4.0.0,>=3.0.1->InquirerPy==0.3.4->huggingface_hub[cli])
(0.2.13)

```

```

Installing collected packages: xxhash, smdebug-rulesconfig, schema,
ppft, pox, pfzy, jmespath, importlib-metadata, dill, multiprocessing,

```



```
InquirerPy, huggingface_hub, docker, boto3, s3transfer, s3fs,
pathos, transformers, datasets, boto3, sagemaker
Attempting uninstall: importlib-metadata
Found existing installation: importlib-metadata 7.1.0
Uninstalling importlib-metadata-7.1.0:
Successfully uninstalled importlib-metadata-7.1.0
Attempting uninstall: huggingface_hub
Found existing installation: huggingface-hub 0.20.3
Uninstalling huggingface-hub-0.20.3:
Successfully uninstalled huggingface-hub-0.20.3
Attempting uninstall: transformers
Found existing installation: transformers 4.38.2
Uninstalling transformers-4.38.2:
Successfully uninstalled transformers-4.38.2
Successfully installed InquirerPy-0.3.4 boto3-1.34.72 botocore-1.34.72
datasets-2.18.0 dill-0.3.8 docker-7.0.0 huggingface_hub-0.22.1
importlib-metadata-6.11.0 jmespath-1.0.1 multiprocessing-0.70.16 pathos-
0.3.2 pfzy-0.3.4 pox-0.3.4 ppft-1.7.6.8 s3fs-0.4.2 s3transfer-0.10.1
sagemaker-2.214.1 schema-0.7.5 smdebug-rulesconfig-1.0.1 transformers-
4.39.1 xxhash-3.4.1
```

```
!huggingface-cli login --token hf_jwOURKKKVG0UrnbQZZQgJTPhfyTHqidWd
```

Token has not been saved to git credential helper. Pass  
`add\_to\_git\_credential=True` if you want to set the git credential as  
well.

Token is valid (permission: read).

Your token has been saved to /root/.cache/huggingface/token

Login successful

```
!aws configure
```

```
Requirement already satisfied: sagemaker in
/usr/local/lib/python3.10/dist-packages (2.214.1)
Requirement already satisfied: attrs<24,>=23.1.0 in
/usr/local/lib/python3.10/dist-packages (from sagemaker) (23.2.0)
Requirement already satisfied: boto3<2.0,>=1.33.3 in
/usr/local/lib/python3.10/dist-packages (from sagemaker) (1.34.72)
Requirement already satisfied: cloudpickle==2.2.1 in
/usr/local/lib/python3.10/dist-packages (from sagemaker) (2.2.1)
Requirement already satisfied: google-pasta in
/usr/local/lib/python3.10/dist-packages (from sagemaker) (0.2.0)
Requirement already satisfied: numpy<2.0,>=1.9.0 in
/usr/local/lib/python3.10/dist-packages (from sagemaker) (1.25.2)
Requirement already satisfied: protobuf<5.0,>=3.12 in
/usr/local/lib/python3.10/dist-packages (from sagemaker) (3.20.3)
Requirement already satisfied: smdebug-rulesconfig==1.0.1 in
/usr/local/lib/python3.10/dist-packages (from sagemaker) (1.0.1)
Requirement already satisfied: importlib-metadata<7.0,>=1.4.0 in
/usr/local/lib/python3.10/dist-packages (from sagemaker) (6.11.0)
```

Requirement already satisfied: packaging>=20.0 in  
/usr/local/lib/python3.10/dist-packages (from sagemaker) (24.0)  
Requirement already satisfied: pandas in  
/usr/local/lib/python3.10/dist-packages (from sagemaker) (1.5.3)  
Requirement already satisfied: pathos in  
/usr/local/lib/python3.10/dist-packages (from sagemaker) (0.3.2)  
Requirement already satisfied: schema in  
/usr/local/lib/python3.10/dist-packages (from sagemaker) (0.7.5)  
Requirement already satisfied: PyYAML~=6.0 in  
/usr/local/lib/python3.10/dist-packages (from sagemaker) (6.0.1)  
Requirement already satisfied: jsonschema in  
/usr/local/lib/python3.10/dist-packages (from sagemaker) (4.19.2)  
Requirement already satisfied: platformdirs in  
/usr/local/lib/python3.10/dist-packages (from sagemaker) (4.2.0)  
Requirement already satisfied: tblib<4,>=1.7.0 in  
/usr/local/lib/python3.10/dist-packages (from sagemaker) (3.0.0)  
Requirement already satisfied: urllib3<3.0.0,>=1.26.8 in  
/usr/local/lib/python3.10/dist-packages (from sagemaker) (2.0.7)  
Requirement already satisfied: requests in  
/usr/local/lib/python3.10/dist-packages (from sagemaker) (2.31.0)  
Requirement already satisfied: docker in  
/usr/local/lib/python3.10/dist-packages (from sagemaker) (7.0.0)  
Requirement already satisfied: tqdm in /usr/local/lib/python3.10/dist-  
packages (from sagemaker) (4.66.2)  
Requirement already satisfied: psutil in  
/usr/local/lib/python3.10/dist-packages (from sagemaker) (5.9.5)  
Requirement already satisfied: botocore<1.35.0,>=1.34.72 in  
/usr/local/lib/python3.10/dist-packages (from boto3<2.0,>=1.33.3-  
>sagemaker) (1.34.72)  
Requirement already satisfied: jmespath<2.0.0,>=0.7.1 in  
/usr/local/lib/python3.10/dist-packages (from boto3<2.0,>=1.33.3-  
>sagemaker) (1.0.1)  
Requirement already satisfied: s3transfer<0.11.0,>=0.10.0 in  
/usr/local/lib/python3.10/dist-packages (from boto3<2.0,>=1.33.3-  
>sagemaker) (0.10.1)  
Requirement already satisfied: zipp>=0.5 in  
/usr/local/lib/python3.10/dist-packages (from importlib-  
metadata<7.0,>=1.4.0->sagemaker) (3.18.1)  
Requirement already satisfied: charset-normalizer<4,>=2 in  
/usr/local/lib/python3.10/dist-packages (from requests->sagemaker)  
(3.3.2)  
Requirement already satisfied: idna<4,>=2.5 in  
/usr/local/lib/python3.10/dist-packages (from requests->sagemaker)  
(3.6)  
Requirement already satisfied: certifi>=2017.4.17 in  
/usr/local/lib/python3.10/dist-packages (from requests->sagemaker)  
(2024.2.2)  
Requirement already satisfied: six in /usr/local/lib/python3.10/dist-  
packages (from google-pasta->sagemaker) (1.16.0)

Requirement already satisfied: jsonschema-specifications>=2023.03.6 in /usr/local/lib/python3.10/dist-packages (from jsonschema->sagemaker) (2023.12.1)  
Requirement already satisfied: referencing>=0.28.4 in /usr/local/lib/python3.10/dist-packages (from jsonschema->sagemaker) (0.34.0)  
Requirement already satisfied: rpds-py>=0.7.1 in /usr/local/lib/python3.10/dist-packages (from jsonschema->sagemaker) (0.18.0)  
Requirement already satisfied: python-dateutil>=2.8.1 in /usr/local/lib/python3.10/dist-packages (from pandas->sagemaker) (2.8.2)  
Requirement already satisfied: pytz>=2020.1 in /usr/local/lib/python3.10/dist-packages (from pandas->sagemaker) (2023.4)  
Requirement already satisfied: ppft>=1.7.6.8 in /usr/local/lib/python3.10/dist-packages (from pathos->sagemaker) (1.7.6.8)  
Requirement already satisfied: dill>=0.3.8 in /usr/local/lib/python3.10/dist-packages (from pathos->sagemaker) (0.3.8)  
Requirement already satisfied: pox>=0.3.4 in /usr/local/lib/python3.10/dist-packages (from pathos->sagemaker) (0.3.4)  
Requirement already satisfied: multiprocessing>=0.70.16 in /usr/local/lib/python3.10/dist-packages (from pathos->sagemaker) (0.70.16)  
Requirement already satisfied: contextlib2>=0.5.5 in /usr/local/lib/python3.10/dist-packages (from schema->sagemaker) (21.6.0)

```
import sagemaker
import boto3
sess = sagemaker.Session()
# sagemaker session bucket -> used for uploading data, models and logs
# sagemaker will automatically create this bucket if it not exists
sagemaker_session_bucket=None
if sagemaker_session_bucket is None and sess is not None:
    # set to default bucket if a bucket name is not given
    sagemaker_session_bucket = sess.default_bucket()

try:
    role = sagemaker.get_execution_role()
except ValueError:
    iam = boto3.client('iam')
    role = iam.get_role(RoleName='SageMakerTest')['Role']['Arn']

sess = sagemaker.Session(default_bucket=sagemaker_session_bucket)

print(f"sagemaker role arn: {role}")
```

```
print(f"sagemaker bucket: {sess.default_bucket()}")
print(f"sagemaker session region: {sess.boto_region_name}")
```

WARNING:sagemaker:Couldn't call 'get\_role' to get Role ARN from role name collab to get Role path.

```
sagemaker role arn: arn:aws:iam::381491942612:role/SageMakerTest
sagemaker bucket: sagemaker-ap-southeast-2-381491942612
sagemaker session region: ap-southeast-2
```

```
from datasets import load_dataset
```

```
# Convert dataset to OAI messages
```

```
system_message = """You are an text to SQL query translator. Users
will ask you questions in English and you will generate a SQL query
based on the provided SCHEMA.
SCHEMA:
{schema}"""
```

```
def create_conversation(sample):
```

```
    return {
        "messages": [
            {"role": "system", "content":
system_message.format(schema=sample["context"])},
            {"role": "user", "content": sample["question"]},
            {"role": "assistant", "content": sample["answer"]}
        ]
    }
```

```
# Load dataset from the hub
```

```
dataset = load_dataset("b-mc2/sql-create-context", split="train")
dataset = dataset.shuffle().select(range(12500))
```

```
# Convert dataset to OAI messages
```

```
dataset = dataset.map(create_conversation,
remove_columns=dataset.features, batched=False)
# split dataset into 10,000 training samples and 2,500 test samples
dataset = dataset.train_test_split(test_size=2500/12500)
```

```
print(dataset["train"][345]["messages"])
```

```
{"model_id": "7b46ed1fb9c24fef419ccb433abadab", "version_major": 2, "version_minor": 0}
```

```
{"model_id": "7f8522589dec4c9482404efe2c2bc25b", "version_major": 2, "version_minor": 0}
```

```
{"model_id": "bfeaaab2c1904277be9127ec8b18f87a", "version_major": 2, "version_minor": 0}
```

```
{"model_id": "9a90c1a09428458db59b0c27f858d1aa", "version_major": 2, "version_minor": 0}
```

```
[{'content': 'You are an text to SQL query translator. Users will ask you questions in English and you will generate a SQL query based on the provided SCHEMA.\nSCHEMA:\nCREATE TABLE table_12962773_4 (no INTEGER, player VARCHAR)', 'role': 'system'}, {'content': 'What No is the player Zoran Erceg', 'role': 'user'}, {'content': 'SELECT MIN(no) FROM table_12962773_4 WHERE player = "Zoran Erceg"', 'role': 'assistant'}]
```

```
# save train_dataset to s3 using our SageMaker session
training_input_path = f"s3://{sess.default_bucket()}/datasets/text-to-sql"
```

```
# save datasets to s3
dataset["train"].to_json(f"{training_input_path}/train_dataset.json",
orient="records")
dataset["test"].to_json(f"{training_input_path}/test_dataset.json",
orient="records")
```

```
print(f"Training data uploaded to:")
print(f"{training_input_path}/train_dataset.json")
print(f"https://s3.console.aws.amazon.com/s3/buckets/{sess.default_bucket()}/?region={sess.boto_region_name}&prefix={training_input_path.split('/', 3)[-1]}/")
```

```
{"model_id": "6d695dea42dd4a48b424e616c5ecd8f", "version_major": 2, "version_minor": 0}
```

```
{"model_id": "31e23aadb45f476c8f50b91fb0a2db5a", "version_major": 2, "version_minor": 0}
```

Training data uploaded to:

s3://sagemaker-ap-southeast-2-381491942612/datasets/text-to-sql/train\_dataset.json

https://s3.console.aws.amazon.com/s3/buckets/sagemaker-ap-southeast-2-381491942612/?region=ap-southeast-2&prefix=datasets/text-to-sql/

```
# hyperparameters, which are passed into the training job
```

```
hyperparameters = {
```

```
    ### SCRIPT PARAMETERS ###
```

```
    'dataset_path': '/opt/ml/input/data/training/train_dataset.json', #
    path where sagemaker will save training dataset
```

```
    'model_id': "code llama/CodeLlama-7b-hf", # or
    'mistralai/Mistral-7B-v0.1'
```

```
    'max_seq_len': 3072, # max sequence
    length for model and packing of the dataset
```

```
    'use_qlora': True, # use QLoRA model
```

```
    ### TRAINING PARAMETERS ###
```

```

    'num_train_epochs': 3,                # number of
    training epochs                      # batch size per
    'per_device_train_batch_size': 1,    # batch size per
    device during training              # number of steps
    'gradient_accumulation_steps': 4,    # number of steps
    before performing a backward/update pass
    'gradient_checkpointing': True,      # use gradient
    checkpointing to save memory        # use fused adamw
    'optim': "adamw_torch_fused",       # use fused adamw
    optimizer                          # log every 10
    'logging_steps': 10,                # log every 10
    steps                              # save checkpoint
    'save_strategy': "epoch",           # save checkpoint
    every epoch                        # learning rate,
    'learning_rate': 2e-4,              # learning rate,
    based on QLoRA paper                # use bfloat16
    'bf16': False,                      # use bfloat16
    precision                           # use tf32
    'tf32': True,                       # use tf32
    precision                           # max gradient
    'max_grad_norm': 0.3,               # max gradient
    norm based on QLoRA paper           # warmup ratio
    'warmup_ratio': 0.03,               # warmup ratio
    based on QLoRA paper                # use constant
    'lr_scheduler_type': "constant",    # use constant
    learning rate scheduler             # report metrics
    'report_to': "tensorboard",         # report metrics
    to tensorboard                     # Temporary
    'output_dir': '/tmp/tun',           # Temporary
    output directory for model checkpoints
    'merge_adapters': True,             # merge LoRA
    adapters into model for easier deployment
}

```

```

from sagemaker.huggingface import HuggingFace

```

```

# define Training Job Name

```

```

job_name = f'codellama-7b-hf-text-to-sql-exp1'

```

```

# create the Estimator

```

```

huggingface_estimator = HuggingFace(
    entry_point      = 'run_sft.py',    # train script
    source_dir       =
    '/content/',    # 'https://github.com/philschmid/llm-sagemaker-sample/blob/
main/scripts/trl', # directory which includes all the files
needed for training
    instance_type    = 'ml.t3.medium', # instances type used for
the training job
    instance_count   = 1,               # the number of
instances used for training

```

```

    max_run                = 2*24*60*60,          # maximum runtime in
seconds (days * hours * minutes * seconds)
    base_job_name          = job_name,            # the name of the
training job
    role                   = role,                # Iam role used in
training job to access AWS ressources, e.g. S3
    volume_size            = 300,                 # the size of the EBS
volume in GB
    transformers_version   = '4.36',              # the transformers
version used in the training job
    pytorch_version        = '2.1',               # the pytorch_version
version used in the training job
    py_version             = 'py310',            # the python version
used in the training job
    hyperparameters        = hyperparameters,    # the hyperparameters
passed to the training job
    disable_output_compression = True,            # not compress output to
save training time and cost
    environment            = {
        "HUGGINGFACE_HUB_CACHE": "/tmp/.cache", #
set env variable to cache models in /tmp
        "HF_TOKEN":
"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" # huggingface token to access
gated models, e.g. llama 2
    },
)

# define a data input dictionary with our uploaded s3 uris
data = {'training': training_input_path}

# starting the train job with our uploaded datasets as input
huggingface_estimator.fit(data, wait=True)

from sagemaker.huggingface import get_huggingface_llm_image_uri

# retrieve the llm image uri
llm_image = get_huggingface_llm_image_uri(
    "huggingface",
    version="1.4.0",
    session=sess,
)

# print ecr image uri
print(f"llm image uri: {llm_image}")

llm_image_uri:
763104351884.dkr.ecr.ap-southeast-2.amazonaws.com/huggingface-pytorch-
tgi-inference:2.1.1-tgi1.4.0-gpu-py310-cu121-ubuntu20.04

```

```

import json
from sagemaker.huggingface import HuggingFaceModel

# s3 path where the model will be uploaded
# if you try to deploy the model to a different time add the s3 path
here
model_s3_path = huggingface_estimator.model_data["S3DataSource"]
["S3Uri"]

# sagemaker config
instance_type = "ml.g5.2xlarge"
number_of_gpu = 1
health_check_timeout = 300

# Define Model and Endpoint configuration parameter
config = {
    'HF_MODEL_ID': "/opt/ml/model", # path to where sagemaker stores the
model
    'SM_NUM_GPUS': json.dumps(number_of_gpu), # Number of GPU used per
replica
    'MAX_INPUT_LENGTH': json.dumps(1024), # Max length of input text
    'MAX_TOTAL_TOKENS': json.dumps(2048), # Max length of the generation
(including input text)
}

# create HuggingFaceModel with the image uri
llm_model = HuggingFaceModel(
    role=role,
    image_uri=llm_image,
    model_data={'S3DataSource': {'S3Uri': model_s3_path, 'S3DataType':
'S3Prefix', 'CompressionType': 'None'}},
    env=config
)

# Deploy model to an endpoint
#
https://sagemaker.readthedocs.io/en/stable/api/inference/model.html#sa
gemaker.model.Model.deploy
llm = llm_model.deploy(
    initial_instance_count=1,
    instance_type=instance_type,
    container_startup_health_check_timeout=health_check_timeout, # 10
minutes to give SageMaker the time to download the model
)

from transformers import AutoTokenizer
from sagemaker.s3 import S3Downloader

# Load the tokenizer

```



```

tokenizer = AutoTokenizer.from_pretrained("code llama/CodeLlama-7b-hf")

# Load the test dataset from s3
S3Downloader.download(f"{training_input_path}/test_dataset.json", ".")
test_dataset = load_dataset("json",
data_files="test_dataset.json",split="train")
random_sample = test_dataset[345]

def request(sample):
    prompt = tokenizer.apply_chat_template(sample, tokenize=False,
add_generation_prompt=True)
    outputs = llm.predict({
        "inputs": prompt,
        "parameters": {
            "max_new_tokens": 512,
            "do_sample": False,
            "return_full_text": False,
            "stop": ["<|im_end|>"],
        }
    })
    return {"role": "assistant", "content": outputs[0]
["generated_text"].strip()}

print(random_sample["messages"][1])
request(random_sample["messages"][:2])

from transformers import AutoTokenizer
from sagemaker.s3 import S3Downloader

# Load the tokenizer
tokenizer = AutoTokenizer.from_pretrained("code llama/CodeLlama-7b-hf")

# Load the test dataset from s3
S3Downloader.download(f"{training_input_path}/test_dataset.json", ".")
test_dataset = load_dataset("json",
data_files="test_dataset.json",split="train")
random_sample = test_dataset[345]

def request(sample):
    prompt = tokenizer.apply_chat_template(sample, tokenize=False,
add_generation_prompt=True)
    outputs = llm.predict({
        "inputs": prompt,
        "parameters": {
            "max_new_tokens": 512,
            "do_sample": False,
            "return_full_text": False,
            "stop": ["<|im_end|>"],
        }
    })

```

```

        return {"role": "assistant", "content": outputs[0]
["generated_text"].strip()}

print(random_sample["messages"][1])
request(random_sample["messages"][:2])

from tqdm import tqdm

def evaluate(sample):
    predicted_answer = request(sample["messages"][:2])
    if predicted_answer["content"] == sample["messages"][2]
["content"]:
        return 1
    else:
        return 0

success_rate = []
number_of_eval_samples = 1000
# iterate over eval dataset and predict
for s in
tqdm(test_dataset.shuffle().select(range(number_of_eval_samples))):
    success_rate.append(evaluate(s))

# compute accuracy
accuracy = sum(success_rate)/len(success_rate)

print(f"Accuracy: {accuracy*100:.2f}%")

!m.delete_model()
!m.delete_endpoint()

```