“Deploy Hugging Face Transformers on AWS in just a few lines of code“

Talent Garden Cosenza

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Background

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What's Hugging Face?

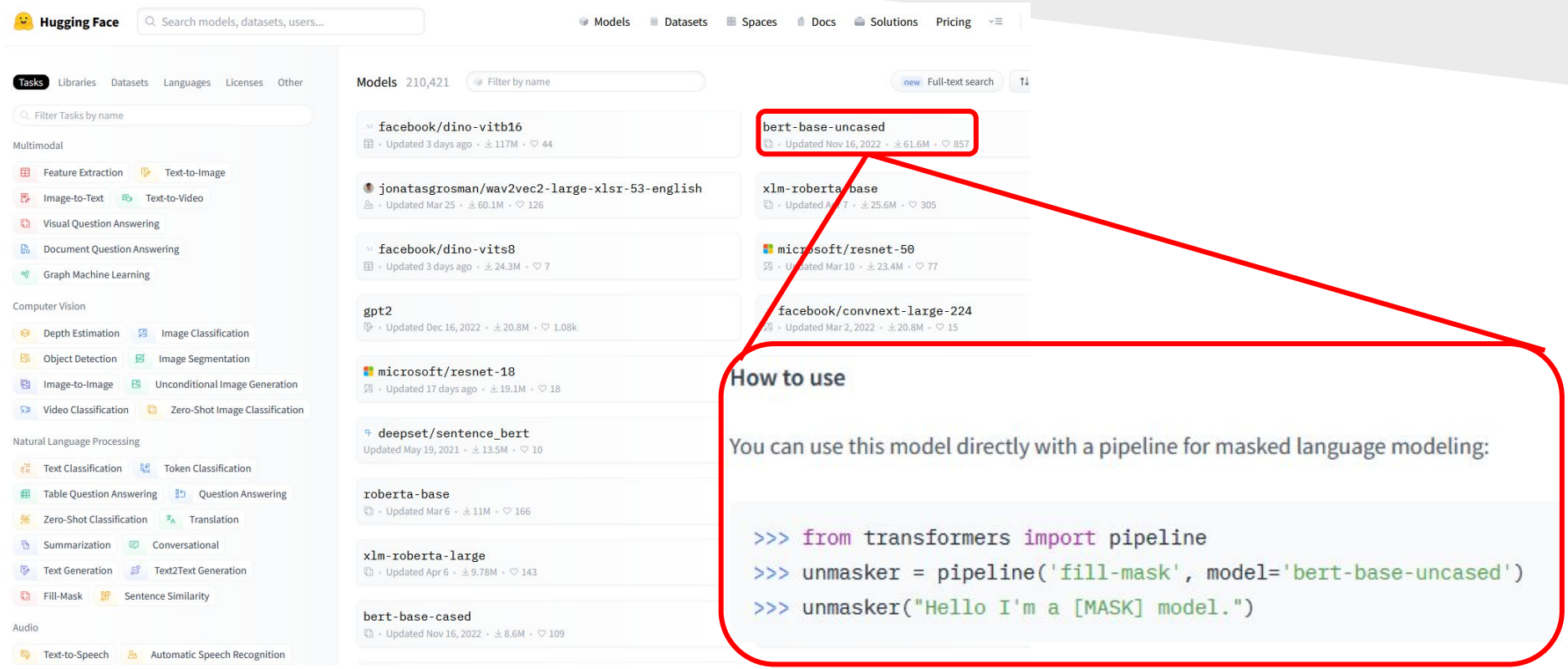
*"We are on a mission to democratize **good** machine learning, one commit at a time"*

- **Hugging Face** is the collaboration platform for the machine learning community.
- **The Hugging Face Hub** works as a central place where anyone can share, explore, discover, and experiment with open-source ML.
- With the fast-growing community, some of the most used **open-source ML libraries** and tools, and a talented science team exploring the edge of tech, **Hugging Face is at the heart of the AI revolution.**

★ Models: > 210K
★ Datasets: > 36K

★ Transformers: 102K stars on GitHub
★ Datasets: > 16.3K
★ Diffusers: > 14K
★ …

Hub & Libraries



Why Hugging Face on AWS?

Hugging Face Deep Learning Containers are available on AWS Sagemaker beacuse there are many advantages:

- **One command is all you need**
- **Accelerate machine learning from science to production (AWS Toolkit)**
- **Built-in performance**
- **Costs**

On Sagemaker you can:

- train
- deploy
- accelerate
- …

your models

```
from sagemaker.huggingface import HuggingFaceModel


# create Hugging Face Model Class and deploy it as SageMaker Endpoint
huggingface_model = HuggingFaceModel(...).deploy()
```

Focus on Deploy

Deploy an Hugging Face model is easy with Inference Toolkit.
First step install and setup the environment.

```
pip install sagemaker --upgrade
```

Sagemaker Environment

```
import sagemaker
sess = sagemaker.Session()
role = sagemaker.get_execution_role()
```

Local Environment

```
import sagemaker
import boto3

iam_client = boto3.client('iam')
role = iam_client.get_role(RoleName='role-name-of-your-iam-role-with-right-permissions')['Role']['Arn']
sess = sagemaker.Session()
```

Deploy from Model Hub

- Choose your model from Hugging Face Hub and create a model config.
  - {HF_MODEL_ID: checkpoint, HF_TASK: text-classification}

- Create your model class

```
# create Hugging Face Model Class
huggingface_model = HuggingFaceModel(
   env=hub,
   role=role,
   transformers_version="4.26",
   pytorch_version="1.13",
   py_version='py39',
)
```

- Deploy the endpoint

```
# deploy model to SageMaker Inference
predictor = huggingface_model.deploy(
   initial_instance_count=1,
   instance_type="ml.m5.xlarge"
)
```

REMEMBER!
Each HF_TASK has an inputs format!!!

Deploy from S3

- Create a *.tar.gz* file contains your model
- Create your role and model class

```
import sagemaker
import boto3

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

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

```
from sagemaker.huggingface import HuggingFaceModel

# create Hugging Face Model Class
huggingface_model = HuggingFaceModel(
    model_data="s3://hf-sagemaker-inference/model.tar.gz",  # path to your trained sagemaker model
    role=role, # iam role with permissions to create an Endpoint
    transformers_version="4.26", # transformers version used
    pytorch_version="1.13", # pytorch version used
    py_version="py39", # python version of the DLC
)
```

Serverless Inference

- Deploy and scale ML models in a Serverless fashion
- Serverless endpoints automatically launch compute resources and scale them in and out depending on traffic similar to AWS Lambda.
- Serverless Inference is ideal for workloads which have idle periods between traffic spurts and can tolerate cold starts.
- Pay-per-use model
- Some Limitations:
  - Memory size
  - Concurrent Invocations
  - Cold Start

Serverless Inference

How the code changes?

Only import a module,
the object initialization and
a few parameters settings

```
from sagemaker.huggingface.model import HuggingFaceModel
from sagemaker.serverless import ServerlessInferenceConfig

# Hub Model configuration. <https://huggingface.co/models>
hub = {
    'HF_MODEL_ID':'distilbert-base-uncased-finetuned-sst-2-english',
    'HF_TASK':'text-classification'
}

# create Hugging Face Model Class
huggingface_model = HuggingFaceModel(
   env=hub,                      # configuration for loading model from Hub
   role=role,                    # iam role with permissions to create an Endpoint
   transformers_version="4.26",  # transformers version used
   pytorch_version="1.13",        # pytorch version used
   py_version='py39',            # python version used
)

# Specify MemorySizeInMB and MaxConcurrency in the serverless config object
serverless_config = ServerlessInferenceConfig(
    memory_size_in_mb=4096, max_concurrency=10,
)

# deploy the endpoint endpoint
predictor = huggingface_model.deploy(
    serverless_inference_config=serverless_config
)
```

Deploy Custom Models

- You need to use libraries not directly supported by the toolkit (es. **SetFit**, Sentence Transformers, SpanMarker, …)
- Your output format isn’t the default
- Other reasons why you cannot use the inference endpoint as it is

Deploy Custom Models

In our model folder we must add:

1. requirements.txt
2. handler.py
3. code/inference.py

Create a deploy.py, the script which is creating your endpoint.

requirements.txt is the file that contains the dependencies, in my case it had only one line: ***setfit.***
For S3 endpoint put it into code folder.

Deploy Custom Models

handler.py defines:

- how the endpoint must **load the model**
- what the **input** looks like
- what should return as **output**

```python
from typing import Dict, List, Any
from setfit import SetFitModel


class EndpointHandler:
    def __init__(self, path=""):
        # load model
        self.model = SetFitModel.from_pretrained(path)
        # ag_news id to label mapping
        self.id2label = {0: "World", 1: "Sports", 2: "Business", 3: "Sci/Tech"}

    def __call__(self, data: Dict[str, Any]) -> List[Dict[str, Any]]:
        """
         data args:
              inputs (:obj: `str`)
        Return:
              A :obj:`list` | `dict`: will be serialized and returned
        """
        # get inputs
        inputs = data.pop("inputs", data)
        if isinstance(inputs, str):
            inputs = [inputs]

        # run normal prediction
        scores = self.model.predict_proba(inputs)[0]

        return [{"label": self.id2label[i], "score": score.item()} for i, score in enumerate(scores)]
```

Deploy Custom Models

The **code folder** contains ***inference.py:***

- model_fn

```
def model_fn(model_dir):
    model = SetFitModel.from_pretrained(model_dir)
    return model
```

- input_fn

```
def input_fn(input_data, content_type):
    decoded_input_data = decoder_encoder.decode(input_data, content_type)
    return decoded_input_data
```

- predict_fn

```
def predict_fn(data, model):
    setFit_model = model

    inputs = data.pop("inputs", data)
    if isinstance(inputs, str):
        inputs = [inputs]

    # run normal prediction
    scores = model.predict_proba(inputs)[0]

    return [{"label": model_id2label[i], "score": round(score.item(),4)} for i, score in enumerate(scores)]
```

- output_fn → decode the result

Deploy Custom Models

Create the endpoint, file ***deploy.py***:

```
hf_model = HuggingFaceModel(
        model_data="s3://call-your-model/model1.tar.gz",
        role=role,
        transformers_version="4.6.1",
        pytorch_version="1.7.1",
        source_dir="code",
        py_version="py36",
        source_dir="model1/code"
        entry_point="inference.py",
    )
```

```
def predict(input):
    predictor = HuggingFacePredictor(
        endpoint_name="huggingface-endpoint")
    resp = predictor.predict({"inputs": input})
    print(resp)
    out = [data['label'] for data in resp if data['score'] >= 0.5]
    return out
```

```
predictor = huggingface_model.deploy(
    serverless_inference_config = ServerlessInferenceConfig(memory_size_in_mb=6144),
)
```

Notes

- **Code repository:**
  - *Hugging Face Sagemaker workshop series*
  - *Hugging Face notebooks on Sagemaker*

- **Follow Philipp Schmid (Hugging Face ML Eng & AWS ML Hero):**
  - *github*
  - *website*

- **Blog:**
  - *The Partnership: Amazon SageMaker and Hugging Face*
  - *Deploy Hugging Face models easily with Amazon SageMaker*

Thanks!

LET'S CHAT!

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