```
!pip install evaluate
```

```
  Downloading dill-0.3.9-py3-none-any.whl.metadata (10 kB)
Requirement already satisfied: pandas in /usr/local/lib/python3.11/dist-packages (from evaluate) (2.2.2)
Requirement already satisfied: requests>=2.19.0 in /usr/local/lib/python3.11/dist-packages (from evaluate)
Requirement already satisfied: tqdm>=4.62.1 in /usr/local/lib/python3.11/dist-packages (from evaluate) (4.6
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Collecting dill (from evaluate)
  Downloading dill-0.3.8-py3-none-any.whl.metadata (10 kB)
Collecting multiprocess (from evaluate)
  Downloading multiprocess-0.70.16-py311-none-any.whl.metadata (7.2 kB)
Collecting fsspec>=2021.05.0 (from fsspec[http]>=2021.05.0->evaluate)
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Downloading fsspec-2024.9.0-py3-none-any.whl (179 kB)
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Downloading multiprocess-0.70.16-py311-none-any.whl (143 kB)
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Downloading xxhash-3.5.0-cp311-cp311-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (194 kB)
   ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 194.8/194.8 kB 9.3 MB/s eta 0:00:00
Installing collected packages: xxhash, fsspec, dill, multiprocess, datasets, evaluate
  Attempting uninstall: fsspec
    Found existing installation: fsspec 2024.10.0
    Uninstalling fsspec-2024.10.0:
      Successfully uninstalled fsspec-2024.10.0
ERROR: pip's dependency resolver does not currently take into account all the packages that are installed.
gcsfs 2024.10.0 requires fsspec==2024.10.0, but you have fsspec 2024.9.0 which is incompatible.
Successfully installed datasets-3.2.0 dill-0.3.8 evaluate-0.4.3 fsspec-2024.9.0 multiprocess-0.70.16 xxhash
```

```
pip install transformers datasets torch evaluate seqeval
```

```
Requirement already satisfied: regex!=2019.12.17 in /usr/local/lib/python3.11/dist-packages (from transform
Requirement already satisfied: requests in /usr/local/lib/python3.11/dist-packages (from transformers) (2.3
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Requirement already satisfied: pyarrow>=15.0.0 in /usr/local/lib/python3.11/dist-packages (from datasets) (
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Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.11/dist-packages (from python-dateutil>=2
Building wheels for collected packages: seqeval
  Building wheel for seqeval (setup.py) ... done
  Created wheel for seqeval: filename=seqeval-1.2.2-py3-none-any.whl size=16161 sha256=0b0b084f8df9c6857c97
  Stored in directory: /root/.cache/pip/wheels/bc/92/f0/243288f899c2eacdfa8c5f9aede4c71a9bad0ee26a01dc5ead
Successfully built seqeval
Installing collected packages: seqeval
Successfully installed seqeval-1.2.2
```

```
import evaluate
import numpy as np
```

```
from transformers import AutoTokenizer, AutoModelForTokenClassification, Trainer, TrainingArguments
from datasets import load_dataset

# Token to authenticate with Hugging Face platform
HF_TOKEN = "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"

# Load the dataset
dataset = load_dataset("ncbi_disease")

# Load BioBERT tokenizer and model
model_name = "dmis-lab/biobert-base-cased-v1.1"
tokenizer = AutoTokenizer.from_pretrained(model_name, use_auth_token=HF_TOKEN)
model = AutoModelForTokenClassification.from_pretrained(model_name, num_labels=3)

# Preprocess the dataset: Tokenization and label alignment
def tokenize_and_align_labels(examples):
    tokenized_inputs = tokenizer(
        examples["tokens"], truncation=True, padding="max_length", max_length=128, is_split_into_words=True
    )
    labels = []
    for i, label in enumerate(examples["ner_tags"]):
        word_ids = tokenized_inputs.word_ids(batch_index=i)  # Map tokens to words
        label_ids = [-100 if word_id is None else label[word_id] for word_id in word_ids]
        labels.append(label_ids)
    tokenized_inputs["labels"] = labels
    return tokenized_inputs

# Apply tokenization and label alignment to the dataset
tokenized_datasets = dataset.map(tokenize_and_align_labels, batched=True)

# Split into training and testing datasets
train_dataset = tokenized_datasets["train"]
test_dataset = tokenized_datasets["test"]

# Load seqeval metric for Named Entity Recognition
metric = evaluate.load("seqeval")

def compute_metrics(predictions):
    logits, labels = predictions
```

```
        # Get the label names from the dataset
        label_names = dataset["train"].features["ner_tags"].feature.names

        # Convert logits to predictions
        predictions = logits.argmax(axis=-1)

        # Map predictions and references from indices to label names
        true_predictions = [
            [label_names[p] for p, l in zip(pred, label) if l != -100]
            for pred, label in zip(predictions, labels)
        ]
        true_labels = [
            [label_names[l] for p, l in zip(pred, label) if l != -100]
            for pred, label in zip(predictions, labels)
        ]

        # Compute the metrics using the string labels
        results = metric.compute(predictions=true_predictions, references=true_labels)
        return {
            "precision": results["overall_precision"],
            "recall": results["overall_recall"],
            "f1": results["overall_f1"],
            "accuracy": results["overall_accuracy"],
        }


    # Training arguments
    training_args = TrainingArguments(
        output_dir="./results",
        evaluation_strategy="epoch",
        learning_rate=5e-5,
        per_device_train_batch_size=8,
        per_device_eval_batch_size=8,
        num_train_epochs=3,
        weight_decay=0.01,
        logging_dir="./logs",
        logging_steps=10,
    )
```

```
# Initialize Trainer
trainer = Trainer(
    model=model,
    args=training_args,
    train_dataset=train_dataset,
    eval_dataset=test_dataset,
    tokenizer=tokenizer,
    compute_metrics=compute_metrics,
)

# Train the model
trainer.train()

# Evaluate the model
results = trainer.evaluate()
print("Evaluation Results:", results)
```

ist-packages/huggingface_hub/utils/_auth.py:94: UserWarning:
ıot exist in your Colab secrets.
gging Face Hub, create a token in your settings tab (https://huggingface.co/settin
ıis secret in all of your notebooks.
tion is recommended but still optional to access public models or datasets.

9.70k/9.70k [00:00<00:00, 609kB/s]

5.83k/5.83k [00:00<00:00, 419kB/s]

ease contains custom code which must be executed to correctly load the dataset. Yo
ı future by passing the argument `trust_remote_code=True`.

ɔm code? [y/N] y

1.14M/? [00:00<00:00, 18.9MB/s]

200k/? [00:00<00:00, 11.3MB/s]

206k/? [00:00<00:00, 12.1MB/s]

5433/5433 [00:01<00:00, 4133.83 examples/s]

924/924 [00:00<00:00, 3838.77 examples/s]

941/941 [00:00<00:00, 3686.59 examples/s]

ist-packages/transformers/models/auto/tokenization_auto.py:810: FutureWarning: The

313/313 [00:00<00:00, 17.1kB/s]

213k/213k [00:00<00:00, 4.53MB/s]

436M/436M [00:03<00:00, 78.1MB/s]

ıClassification were not initialized from the model checkpoint at dmis-lab/biobert
ıis model on a down-stream task to be able to use it for predictions and inference

5433/5433 [00:02<00:00, 2698.42 examples/s]

924/924 [00:00<00:00, 2557.11 examples/s]

941/941 [00:00<00:00, 2157.41 examples/s]

6.34k/6.34k [00:00<00:00, 459kB/s]

ist-packages/transformers/training_args.py:1575: FutureWarning: `evaluation_strate

```
e6>:83: FutureWarning: `tokenizer` is deprecated and will be removed in version 5.

e` is currently set to the same value as `TrainingArguments.output_dir`. If this w
i.wandb.ai to your netrc file: /root/.netrc
the SDK backend.  Please refer to https://wandb.me/wandb-core for more information
.2
t/wandb/run-20250118_044825-j4d87802
ases (docs)
medlemine-telmoudy-ensam-rabat/huggingface
dlemine-telmoudy-ensam-rabat/huggingface/runs/j4d87802
 [ 2/2040 : < :, Epoch 0.00/3]

ation Loss

---------------------------------------------------
                Traceback (most recent call last)
e6> in <cell line: 0>()



l

 6 frames
ist-packages/torch/autograd/graph.py in _engine_run_backward(t_outputs, *args,

nooks = _register_logging_hooks_on_whole_graph(t_outputs)

able._execution_engine.run_backward(  # Calls into the C++ engine to run the

ts, *args, **kwargs
into the C++ engine to run the backward pass
```

```
import evaluate
import numpy as np
from transformers import AutoTokenizer, AutoModelForTokenClassification, Trainer, TrainingArguments
from datasets import load_dataset

# Token to authenticate with Hugging Face platform
HF_TOKEN = "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"

# Load the dataset
dataset = load_dataset("ncbi_disease")

# Reducing dataset to a smaller fraction
train_dataset = dataset["train"].select(range(len(dataset["train"]) // 4))
test_dataset = dataset["test"].select(range(len(dataset["test"]) // 4))

# Load BioBERT tokenizer and model
model_name = "dmis-lab/biobert-base-cased-v1.1"
tokenizer = AutoTokenizer.from_pretrained(model_name, use_auth_token=HF_TOKEN)
model = AutoModelForTokenClassification.from_pretrained(model_name, num_labels=3)

# Preprocess the dataset: Tokenization and label alignment
def tokenize_and_align_labels(examples):
    tokenized_inputs = tokenizer(
        examples["tokens"], truncation=True, padding="max_length", max_length=128, is_split_into_words=True
    )
    labels = []
    for i, label in enumerate(examples["ner_tags"]):
        word_ids = tokenized_inputs.word_ids(batch_index=i)  # Map tokens to words
        label_ids = [-100 if word_id is None else label[word_id] for word_id in word_ids]
        labels.append(label_ids)
    tokenized_inputs["labels"] = labels
    return tokenized_inputs

# Apply tokenization and label alignment to the dataset
tokenized_train = train_dataset.map(tokenize_and_align_labels, batched=True)
tokenized_test = test_dataset.map(tokenize_and_align_labels, batched=True)
```

```
    # Load seqeval metric for Named Entity Recognition
    metric = evaluate.load("seqeval")

    def compute_metrics(predictions):
        logits, labels = predictions

        # Get the label names from the dataset
        label_names = dataset["train"].features["ner_tags"].feature.names

        # Convert logits to predictions
        predictions = logits.argmax(axis=-1)

        # Map predictions and references from indices to label names
        true_predictions = [
            [label_names[p] for p, l in zip(pred, label) if l != -100]
            for pred, label in zip(predictions, labels)
        ]
        true_labels = [
            [label_names[l] for p, l in zip(pred, label) if l != -100]
            for pred, label in zip(predictions, labels)
        ]

        # Compute the metrics using the string labels
        results = metric.compute(predictions=true_predictions, references=true_labels)
        return {
            "precision": results["overall_precision"],
            "recall": results["overall_recall"],
            "f1": results["overall_f1"],
            "accuracy": results["overall_accuracy"],
        }

    # Training arguments with checkpoint saving
    training_args = TrainingArguments(
        output_dir="./results",  # Directory to save the model and checkpoints
        evaluation_strategy="epoch",
        learning_rate=5e-5,
        per_device_train_batch_size=8,
        per_device_eval_batch_size=8,
        num_train_epochs=2,  # Reduced epochs to avoid long training times
```

```
        weight_decay=0.01,
        logging_dir="./logs",
        logging_steps=10,
        save_strategy="epoch",  # Save checkpoints at the end of every epoch
        save_steps=100,  # Save model every 100 steps
        load_best_model_at_end=True,  # Load the best model when training ends
        metric_for_best_model="f1",  # Use F1 score to select the best model
    )

    # Initialize Trainer with checkpoint callback
    trainer = Trainer(
        model=model,
        args=training_args,
        train_dataset=tokenized_train,
        eval_dataset=tokenized_test,
        tokenizer=tokenizer,
        compute_metrics=compute_metrics,
    )

    # Train the model
    trainer.train()

    # Evaluate the model
    results = trainer.evaluate()
    print("Evaluation Results:", results)
```

```
/usr/local/lib/python3.11/dist-packages/huggingface_hub/utils/_auth.py:94: UserWarning:
The secret `HF_TOKEN` does not exist in your Colab secrets.
To authenticate with the Hugging Face Hub, create a token in your settings tab (https://huggingface.co/settin
You will be able to reuse this secret in all of your notebooks.
Please note that authentication is recommended but still optional to access public models or datasets.
  warnings.warn(
README.md: 100%  9.70k/9.70k [00:00<00:00, 577kB/s]
ncbi_disease.py: 100%  5.83k/5.83k [00:00<00:00, 334kB/s]
Downloading data:  1.14M/? [00:00<00:00, 23.9MB/s]
Downloading data:  200k/? [00:00<00:00, 6.34MB/s]
Downloading data:  206k/? [00:00<00:00, 6.84MB/s]
Generating train split: 100%  5433/5433 [00:01<00:00, 4362.32 examples/s]
Generating validation split: 100%  924/924 [00:00<00:00, 4006.63 examples/s]
Generating test split: 100%  941/941 [00:00<00:00, 3505.78 examples/s]
/usr/local/lib/python3.11/dist-packages/transformers/models/auto/tokenization_auto.py:810: FutureWarning: The
  warnings.warn(
config.json: 100%  313/313 [00:00<00:00, 14.5kB/s]
vocab.txt: 100%  213k/213k [00:00<00:00, 6.65MB/s]
pytorch_model.bin: 100%  436M/436M [00:05<00:00, 23.9MB/s]
Some weights of BertForTokenClassification were not initialized from the model checkpoint at dmis-lab/biober
You should probably TRAIN this model on a down-stream task to be able to use it for predictions and inference
Map: 100%  1358/1358 [00:00<00:00, 2449.43 examples/s]
Map: 100%  235/235 [00:00<00:00, 1327.48 examples/s]
Downloading builder script: 100%  6.34k/6.34k [00:00<00:00, 468kB/s]
/usr/local/lib/python3.11/dist-packages/transformers/training_args.py:1575: FutureWarning: `evaluation_strate
  warnings.warn(
<ipython-input-3-12214082883d>:87: FutureWarning: `tokenizer` is deprecated and will be removed in version 5
  trainer = Trainer(
wandb: WARNING The `run_name` is currently set to the same value as `TrainingArguments.output_dir`. If this v
wandb: Logging into wandb.ai. (Learn how to deploy a W&B server locally: https://wandb.me/wandb-server)
wandb: You can find your API key in your browser here: https://wandb.ai/authorize
```

```
wandb: You can find your API key in your browser here: https://wandb.ai/authorize
wandb: Paste an API key from your profile and hit enter, or press ctrl+c to quit:wandb: Appending key for ap
wandb: Using wandb-core as the SDK backend.  Please refer to https://wandb.me/wandb-core for more informatio
```

Tracking run with wandb version 0.19.2
Run data is saved locally in `/content/wandb/run-20250118_050403-vz2t8ou0`
Syncing run **./results** to Weights & Biases (docs)
View project at https://wandb.ai/mohamedlemine-telmoudy-ensam-rabat/huggingface
View run at https://wandb.ai/mohamedlemine-telmoudy-ensam-rabat/huggingface/runs/vz2t8ou0

[290/340 1:02:02 < 10:46, 0.08 it/s, Epoch 1.70/2]

Epoch	Training Loss	Validation Loss	Precision	Recall	F1	Accuracy
1	0.061500	0.088064	0.753676	0.818363	0.784689	0.968949

[240/240 1:14:46, Epoch 2/2]