



SHARDA
UNIVERSITY

Beyond Boundaries

AGENTIC AI-LAB

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CS-F-G1

CHUNKING METHOD

```
#!/usr/bin/env python3
"""
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fine tuning [LAB-1]
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General-purpose fine-tuning script for Hugging Face Transformers.

Supports:

- sequence classification (binary/multi-class)
- causal language modeling (GPT-style)

Usage examples:

```
# classification from CSV with columns "text" and "label"
```

```
python "fine tuning [LAB-1]" \
  --task classification \
  --model_name_or_path gpt2 \
  --dataset_name_or_path /path/to/data.csv \
  --dataset_format csv \
  --text_column text \
  --label_column label \
  --output_dir ./outputs/classifier \
  --num_train_epochs 3 \
  --per_device_train_batch_size 8
```

```
# causal LM using a HF dataset
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```
python "fine tuning [LAB-1]" \
  --task causal_lm \
  --model_name_or_path gpt2 \
  --dataset_name_or_path wikitext \
  --dataset_config_name wikitext-2-raw-v1 \
  --output_dir ./outputs/gpt2-lm \
  --do_train
```

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"""
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```
import argparse
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```
import logging
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```
import os
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```
from dataclasses import dataclass
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```
from typing import Optional, Dict, Any
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```
import numpy as np
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```
from datasets import load_dataset, DatasetDict
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```
from transformers import (
```

```
    AutoConfig,
```

```

AutoModelForSequenceClassification,
AutoModelForCausalLM,
AutoTokenizer,
DataCollatorForLanguageModeling,
DataCollatorWithPadding,
Trainer,
TrainingArguments,
)
from sklearn.metrics import accuracy_score, f1_score

logger = logging.getLogger(__name__)
logging.basicConfig(level=logging.INFO)

def parse_args():
    parser = argparse.ArgumentParser(description="Fine-tune a Transformers model (classification or causal LM).")
    parser.add_argument("--task", type=str, required=True, choices=["classification", "causal_lm"],
                        help="Task to run.")
    parser.add_argument("--model_name_or_path", type=str, required=True,
                        help="Pretrained model name or path.")
    parser.add_argument("--dataset_name_or_path", type=str, required=True,
                        help="Hugging Face dataset identifier or local path (CSV/JSON/dir).")
    parser.add_argument("--dataset_config_name", type=str, default=None,
                        help="Dataset config name (if applicable).")
    parser.add_argument("--dataset_format", type=str, default=None, choices=[None, "csv", "json"],
                        help="If loading from local file, specify format.")
    parser.add_argument("--text_column", type=str, default="text", help="Name of the text column.")
    parser.add_argument("--label_column", type=str, default="label", help="Name of the label column (classification).")
    parser.add_argument("--max_length", type=int, default=512)
    parser.add_argument("--output_dir", type=str, default="./outputs")
    parser.add_argument("--per_device_train_batch_size", type=int, default=8)
    parser.add_argument("--per_device_eval_batch_size", type=int, default=8)
    parser.add_argument("--learning_rate", type=float, default=5e-5)
    parser.add_argument("--weight_decay", type=float, default=0.0)
    parser.add_argument("--num_train_epochs", type=int, default=3)
    parser.add_argument("--seed", type=int, default=42)
    parser.add_argument("--do_train", action="store_true")
    parser.add_argument("--do_eval", action="store_true")
    parser.add_argument("--overwrite_output_dir", action="store_true")
    parser.add_argument("--save_total_limit", type=int, default=3)
    parser.add_argument("--logging_steps", type=int, default=100)
    parser.add_argument("--evaluation_strategy", type=str, default="steps", choices=["no", "steps", "epoch"])
    parser.add_argument("--eval_steps", type=int, default=500)
    parser.add_argument("--save_steps", type=int, default=500)

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    parser.add_argument("--block_size", type=int, default=1024, help="For LM: max sequence length")
    return parser.parse_args()
```

```
def load_data(args):
    # tries to be flexible: if dataset_name_or_path is a local file, use dataset_format
    load_kwargs = {}
    if args.dataset_config_name:
        load_kwargs["name"] = args.dataset_config_name

    if args.dataset_format:
        # local file(s)
        if os.path.isdir(args.dataset_name_or_path):
            ds = load_dataset(args.dataset_format, data_files={
                "train": os.path.join(args.dataset_name_or_path, "train." + args.dataset_format),
                "validation": os.path.join(args.dataset_name_or_path, "validation." +
args.dataset_format),
            })
        else:
            ds = load_dataset(args.dataset_format, data_files=args.dataset_name_or_path)
        return ds
    else:
        # try HF hub
        ds = load_dataset(args.dataset_name_or_path, **load_kwargs)
        return ds
```

```
def preprocess_for_classification(dataset, tokenizer, args):
    def preprocess_fn(examples):
        texts = examples[args.text_column]
        if isinstance(texts, str):
            texts = [texts]
        return tokenizer(texts, truncation=True, max_length=args.max_length)
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    mapped = dataset.map(preprocess_fn, batched=True)
    return mapped
```

```
def compute_classification_metrics(predictions, references) -> Dict[str, float]:
    preds = np.argmax(predictions, axis=1)
    acc = accuracy_score(references, preds)
    f1 = f1_score(references, preds, average="weighted")
    return {"accuracy": acc, "f1": f1}
```

```
def main():
    args = parse_args()
    # Repro
    np.random.seed(args.seed)

    # Load tokenizer & model
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logger.info("Loading tokenizer and model from %s", args.model_name_or_path)
tokenizer = AutoTokenizer.from_pretrained(args.model_name_or_path, use_fast=True)

if args.task == "classification":
    # Load dataset
    raw_datasets = load_data(args)
    # If labels are not ints, try to map to ints
    # Ensure dataset has train/validation splits (Trainer expects them)
    if "train" not in raw_datasets:
        # if single-file dataset, datasets returns dict with key name; try to split
        raw_datasets = DatasetDict({"train": raw_datasets})
    # map labels to ints if needed
    # Try to infer label list from dataset features
    label_list = None
    try:
        features = raw_datasets["train"].features
        if args.label_column in features and hasattr(features[args.label_column], "names"):
            label_list = features[args.label_column].names
    except Exception:
        label_list = None

    # Tokenize
    tokenized = preprocess_for_classification(raw_datasets, tokenizer, args)

    # Model config; if label_list is known, set num_labels
    num_labels = None
    if label_list:
        num_labels = len(label_list)
    else:
        # infer from dataset labels
        try:
            labels = tokenized["train"][args.label_column]
            num_labels = len(set(labels))
        except Exception:
            num_labels = 2

    config = AutoConfig.from_pretrained(args.model_name_or_path, num_labels=num_labels)
    model = AutoModelForSequenceClassification.from_pretrained(args.model_name_or_path,
config=config)

    data_collator = DataCollatorWithPadding(tokenizer=tokenizer)

    def compute_metrics(eval_pred):
        logits, labels = eval_pred
        return compute_classification_metrics(logits, labels)

    training_args = TrainingArguments(
        output_dir=args.output_dir,

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        overwrite_output_dir=args.overwrite_output_dir,
        num_train_epochs=args.num_train_epochs,
        per_device_train_batch_size=args.per_device_train_batch_size,
        per_device_eval_batch_size=args.per_device_eval_batch_size,
        learning_rate=args.learning_rate,
        weight_decay=args.weight_decay,
        evaluation_strategy=args.evaluation_strategy if args.do_eval else "no",
        eval_steps=args.eval_steps,
        save_steps=args.save_steps,
        save_total_limit=args.save_total_limit,
        logging_steps=args.logging_steps,
        seed=args.seed,
    )

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trainer = Trainer(
    model=model,
    args=training_args,
    train_dataset=tokenized.get("train", None),
    eval_dataset=tokenized.get("validation", None),
    tokenizer=tokenizer,
    data_collator=data_collator,
    compute_metrics=compute_metrics,
)

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if args.do_train:
    trainer.train()
    trainer.save_model()

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if args.do_eval:
    result = trainer.evaluate()
    logger.info("Evaluation results: %s", result)

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elif args.task == "causal_lm":
    # Language modeling path
    raw_datasets = load_data(args)

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    # We expect text column; if the dataset items are strings, adjust accordingly
    text_col = args.text_column

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def tokenize_function(examples):
    # examples can be dict or string
    texts = examples[text_col] if isinstance(examples, dict) and text_col in examples else
examples
    return tokenizer(texts, return_special_tokens_mask=True, truncation=True,
max_length=args.block_size)

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# If the dataset provides splits, operate on them
if "train" not in raw_datasets and not isinstance(raw_datasets, DatasetDict):

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raw_datasets = DatasetDict({"train": raw_datasets})

tokenized = raw_datasets.map(
    tokenize_function,
    batched=True,
    remove_columns=[c for c in raw_datasets["train"].column_names if c != text_col] if
text_col in raw_datasets["train"].column_names else None,
)

# Group into blocks
def group_texts(examples):
    concatenated = {k: sum(examples[k], []) for k in examples.keys()}
    total_length = len(concatenated[next(iter(concatenated))])
    block_size = args.block_size
    total_length = (total_length // block_size) * block_size
    result = {}
    for k, v in concatenated.items():
        result[k] = [v[i : i + block_size] for i in range(0, total_length, block_size)]
    result["labels"] = result["input_ids"].copy()
    return result

lm_datasets = tokenized.map(group_texts, batched=True)

model = AutoModelForCausalLM.from_pretrained(args.model_name_or_path)
data_collator = DataCollatorForLanguageModeling(tokenizer=tokenizer, mlm=False)

training_args = TrainingArguments(
    output_dir=args.output_dir,
    overwrite_output_dir=args.overwrite_output_dir,
    num_train_epochs=args.num_train_epochs,
    per_device_train_batch_size=args.per_device_train_batch_size,
    per_device_eval_batch_size=args.per_device_eval_batch_size,
    learning_rate=args.learning_rate,
    weight_decay=args.weight_decay,
    evaluation_strategy=args.evaluation_strategy if args.do_eval else "no",
    eval_steps=args.eval_steps,
    save_steps=args.save_steps,
    save_total_limit=args.save_total_limit,
    logging_steps=args.logging_steps,
    seed=args.seed,
)

trainer = Trainer(
    model=model,
    args=training_args,
    train_dataset=lm_datasets.get("train", None),
    eval_dataset=lm_datasets.get("validation", None),
    tokenizer=tokenizer,

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        data_collator=data_collator,
    )

    if args.do_train:
        trainer.train()
        trainer.save_model()

    if args.do_eval:
        result = trainer.evaluate()
        logger.info("Evaluation results: %s", result)

    else:
        raise ValueError(f"Unknown task {args.task}")

if __name__ == "__main__":
    main()
```