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显示代码

Run in Google Colab

Fine-tune FunctionGemma 270M for Mobile Actions

This notebook fine-tunes FunctionGemma for the task of taking user request to perform mobile actions through the Hugging Face Transformer Reinforcement Learning (TRL) library.

When training FunctionGemma 270M on a Google Colab A100 GPU accelerator, this process can take 60 minutes end-to-end. Run each code snippet to:

1. Set up the Colab environment
2. Prepare a dataset for fine-tuning
3. Load and test the base FunctionGemma 270M model
4. Fine-tune the model
5. Test, evaluate, and save the model for further use
6. Convert the checkpoint to `.litertlm` for deployment

Prerequisites

This colab needs the **A100 GPU**. You will need a Colab Pro subscription or Colab Pay to Go with credits.

Set up development environment

The first step is to install the necessary libraries using the `pip` package installer.

```
1 # %pip install torch
2 # %pip install —U transformers==4.57.1 trl==0.25.1 datasets==4.4.1
```

You may have to restart your session (runtime) to use newly installed libraries.

⌄ Enable Hugging Face permissions

To use Gemma models, you'll need to accept the model usage license and create an Access Token:

1. **Accept license** on the [model page](#).

2. **Get a valid [Access Token](#)** with 'Write' access (very important!)

3. **Create a new Colab secret** in the left toolbar. Specify `HF_TOKEN` as the 'Name', add your unique token as the 'Value', and toggle 'Notebook access' on.

```
1 # from google.colab import userdata
2 from huggingface_hub import login
3
4 # Login into Hugging Face Hub
5 # hf_token = userdata.get('HF_TOKEN')
6 # login(hf_token)
```

⌄ Load the model

You can access [FunctionGemma 270M](#) from Hugging Face Hub by accepting the license terms. The instruction-tuned version of the model has already been trained on how to follow directions and with fine-tuning, you'll now adapt it to a new task.

```
 1 from transformers import AutoTokenizer, AutoModelForCausalLM
 2
 3 gemma_model = "functiongemma-270m-it"
 4 base_model = AutoModelForCausalLM.from_pretrained(
 5     gemma_model,
 6     device_map="auto",
 7     attn_implementation="eager",
 8     dtype="auto")
 9 tokenizer = AutoTokenizer.from_pretrained(gemma_model)
10
11 print(f"Device: {base_model.device}")
12 print(f"DType:  {base_model.dtype}")
```

```
The tokenizer you are loading from 'functiongemma-270m-it' with an incorrect regex pattern: https://huggingface.co/mistralai/Mistral-Small-
Device: cuda:0
DType:  torch.bfloat16
```

Device should print as `cuda` if you're using a GPU runtime.

⌄ Load the dataset

To fine-tune FunctionGemma, we utilize the [Mobile Actions dataset](#), which is publicly available on Hugging Face. Each entry in this dataset provides:

- The set of tools (functions) the model can use:

    1. Turn the flashlight on
    2. Turn the flashlight off
    3. Create a contact in the phone's contact list
    4. Send an email
    5. Show a location on the map
    6. Open the WiFi settings
    7. Create a new calendar event

- The system prompt providing the context like current date and time
- The user prompt, like `turn on the flashlight`.
- The expected model response, including the appropriate function calls.

```
 1 import json
 2 from random import randint
 3 from datasets import load_dataset
 4 from transformers import AutoTokenizer
 5 from huggingface_hub import hf_hub_download
 6
 7 data_file = hf_hub_download(repo_id="google/mobile-actions", filename="dataset.jsonl", repo_type="dataset")
 8 dataset = load_dataset("text", data_files=data_file, encoding="utf-8")["train"].shuffle()
 9
10 print(f"\n\033[1mHere's an example from your dataset:\033[0m \n{json.dumps(json.loads(dataset[randint(0, len(dataset) - 1)]['text']),
```

```
          "required": [
            "query"
          ]
        }
      }
    },
    {
      "function": {
        "name": "open_wifi_settings",
        "description": "Opens the Wi-Fi settings.",
        "parameters": {
          "type": "OBJECT",
          "properties": {}
        }
      }
    },
    {
      "function": {
        "name": "turn_on_flashlight",
        "description": "Turns the flashlight on.",
        "parameters": {
          "type": "OBJECT",
          "properties": {}
        }
      }
    }
  ],
  "messages": [
    {
      "role": "developer",
      "content": "Current date and time given in YYYY-MM-DDTHH:MM:SS format: 2025-12-07T05:19:54\nDay of week is Sunday\nYou are a model
    },
    {
      "role": "user",
      "content": "Please turn off my flashlight."
    },
    {
      "role": "assistant",
      "tool_calls": [
        {
          "function": {
            "name": "turn_off_flashlight",
            "arguments": {}
          }
        }
      ]
    }
  ]
}
```

Process the dataset for training and evaluation

Now that you've loaded your data, format the training dataset into [Prompt-completion](#) format for more efficient training later (`completion_only_loss=True`). This means the model will only learn from the `completion` instead of the `prompt`.

- `prompt` for the non-trainable parts
- `completion` for the trainable parts

```python
import json

def apply_format(sample):
  template_iputs = json.loads(sample['text'])

  prompt_and_completion = tokenizer.apply_chat_template(
    template_iputs['messages'],
    tools=template_iputs['tools'],
    tokenize=False,
    # add_generation_prompt is False since we don't need model output after all
    # messages.
    add_generation_prompt=False)

  prompt = tokenizer.apply_chat_template(
    template_iputs['messages'][:-1],
    tools=template_iputs['tools'],
    tokenize=False,
    # add_generation_prompt is True since we would like to include
    # "<start_of_turn>model" in the prompt, if needed.
    add_generation_prompt=True)

  completion = prompt_and_completion[len(prompt):]

  return {
    "prompt": prompt,
    "completion": completion,
    "split": template_iputs["metadata"],
  }

processed_dataset = dataset.map(apply_format)
```

Review the processed dataset

```
 1 #@title Review the processed dataset
 2
 3 print("\033[1mHere's an example from the formatted dataset:\033[0m")
 4 print(json.dumps(processed_dataset[randint(0, len(processed_dataset) - 1)], indent=2))
 5
 6 longest_example = max(processed_dataset, key=lambda example: len(example['prompt'] + example['completion']))
 7 longest_example_token_count = len(tokenizer.tokenize(longest_example['prompt'] + longest_example['completion']))
 8
 9 print(f"\n\033[1mThe longest example length is {len(longest_example['prompt'] + longest_example['completion'])} with {longest_example_
10 print(json.dumps(longest_example, indent=2))
11
12 max_token_count = longest_example_token_count + 100
13 print(f"\n\033[1mUsing max_token_count of {max_token_count} (= {longest_example_token_count} + 100) for training below.\033[0m")
```

Here's an example from the formatted dataset:
```
{
  "text": "{\"metadata\": \"train\", \"tools\": [{\"function\": {\"name\": \"turn_off_flashlight\", \"description\": \"Turns the flashligh
  "prompt": "<bos><start_of_turn>developer\nCurrent date and time given in YYYY-MM-DDTHH:MM:SS format: 2025-06-16T12:12:01\nDay of week is
  "completion": "<start_function_call>call:turn_off_flashlight{}<end_function_call><start_function_call>call:create_contact{email:<escape>
  "split": "train"
}
```

The longest example length is 4157 with 897 tokens. We need to set the max_length larger than the token count in SFTConfig below.
```
{
  "text": "{\"metadata\": \"train\", \"tools\": [{\"function\": {\"name\": \"open_wifi_settings\", \"description\": \"Opens the Wi-Fi sett
  "prompt": "<bos><start_of_turn>developer\nCurrent date and time given in YYYY-MM-DDTHH:MM:SS format: 2025-11-24T12:55:01\nDay of week is
  "completion": "<start_function_call>call:create_calendar_event{datetime:<escape>2025-11-26T15:00:00<escape>,title:<escape>Q4 Review Stra
  "split": "train"
}
```

Using max_token_count of 997 (= 897 + 100) for training below.

∨ Prepare train and eval dataset.

```
 1 #@title Prepare train and eval dataset.
 2
 3 train_dataset = processed_dataset.filter(lambda example: example['split'] == 'train')
 4 eval_dataset = processed_dataset.filter(lambda example: example['split'] == 'eval')
```

∨ Recommended: Test the base model

Now, we have loaded both the base model and the dataset. Let's first check how the base model's ability to respond to a random sample.

Try testing it a few times.

∨ Test with a prompt

```
1 #@title Test with a prompt
2
3 from transformers import pipeline
4 from random import randint
5 import re
6
7 # Create a transformers inference pipeline
8 pipe = pipeline("text-generation", model=gemma_model, tokenize
9
10 user_prompt = "Schedule a \"team meeting\" tomorrow at 4pm."
11 messages = [
12     {"role": "developer", "content": "Current date and time g:
13     {"role": "user", "content": user_prompt}
14 ]
15
16 # Reuse the tools from the sample
17 tools = json.loads(dataset[0]['text'])['tools']
18
19 prompt = tokenizer.apply_chat_template(
20     messages,
21     tools=tools,
22     tokenize=False,
23     add_generation_prompt=True)
24
25 print(f"\n\033[1mPrompt:\033[0m {user_prompt}")
26 output = pipe(prompt, max_new_tokens=max_token_count)
27 model_output = output[0]['generated_text'][len(prompt):].strip
28
29 print(f"\n\033[1mBase model output:\033[0m {model_output}")
```

user_prompt

Schedule a "team meeting" tomorrow at 4pm.

隐藏代码

```
Device set to use cuda:0

Prompt: Schedule a "team meeting" tomorrow at 4pm.

Base model output: I apologize, but I cannot assist with scheduling meetings. My current capabilities are limited to assisting with phone
```

Note that how the base model is unable to successfully call the `create_calendar_event` function for this prompt.

Now, we will pick a sample from the training dataset and see how it performs.

⌄ Test with training dataset

```
1 from transformers import pipeline
2 from random import randint
3 import re
4
5 # Create a transformers inference pipeline
6 pipe = pipeline("text-generation", model=gemma_model, tokenizer=tokenizer)
7
8 # Select a random sample from the test dataset
9 rand_idx = randint(0, len(train_dataset) - 1)
10 test_sample = train_dataset[rand_idx]
11
12 input_prompt = test_sample['prompt']
13 expected_output = test_sample['completion']
14
15 # Generate the output
16 output = pipe(input_prompt, max_new_tokens=max_token_count, skip_special_tokens=False)
17 actual_output = output[0]['generated_text'][len(input_prompt):].strip()
18
19 print(f"\n\033[1mInput prompt\033[0m    : {input_prompt}")
20 print(f"\n\033[1mExpected output\033[0m: {expected_output}")
21 print(f"\n\033[1mActual output\033[0m  : {actual_output}")
```

Device set to use cuda:0

Input prompt   : <bos><start_of_turn>developer
Current date and time given in YYYY-MM-DDTHH:MM:SS format: 2026-07-06T22:13:58
Day of week is Monday
You are a model that can do function calling with the following functions<start_function_declaration>declaration:send_email{description:<es
<start_of_turn>user
Please save a new contact for Kenji Tanaka. His phone number is +81 90-1234-5678 and his email address is kenji.t.tanaka@example.com.<end_
<start_of_turn>model

Expected output: <start_function_call>call:create_contact{email:<escape>kenji.t.tanaka@example.com<escape>,first_name:<escape>Kenji<escape>

Actual output : <start_function_call>call:create_contact{first_name:<escape>Kenji<escape>,last_name:<escape>Tanaka<escape>,phone_number:<e

The base model output may not meet your expectations—and that's okay!

FunctionGemma 270M was designed for task specialization, which means it can improve performance for specific tasks when trained with representative examples. Let's fine-tune the model for more reliable outputs.

⌄ Fine-tune the model

Hugging Face [TRL](#) provides tools for training and fine-tuning LLMs.

⌄ Configure the tuning job

Define the training configuration for the FunctionGemma base model.

```python
import torch
from transformers import AutoModelForCausalLM
from trl import SFTConfig

output_dir = "./content/mobile-actions-functiongemma"  # Where to save your fine-tuned checkpoints
tokenizer = AutoTokenizer.from_pretrained(gemma_model)

args = SFTConfig(
    output_dir=output_dir,                              # Directory to save adapters
    num_train_epochs=2,                                 # Number of training epochs
    per_device_train_batch_size=4,                      # Batch size per device during training
    gradient_accumulation_steps=8,                      # Gradient accumulation during training
    logging_strategy="steps",                           # Log every steps
    eval_strategy="steps",                              # Evaluate loss metrics based on steps
    eval_steps=50,                                      # Evaluate loss metrics every 50 steps
    logging_steps=50,                                   # Log loss metrics every 50 steps
    save_strategy="epoch",                              # Save checkpoint every epoch
    learning_rate=1e-5,                                 # Learning rate,
    lr_scheduler_type="cosine",                         # Cosine scheduler is often better for full FT
    max_length=max_token_count,                         # Max sequence length for model and packing of the dataset
    gradient_checkpointing=True,                        # Use gradient checkpointing to save memory
    packing=False,                                      # Groups multiple samples in the dataset into a single sequence
    optim="adamw_torch_fused",                          # Use fused adamw optimizer
    bf16=True,                                          # Use bf16 for mixed precision training
    completion_only_loss=True,                          # Train on completion only to improve quality
    report_to="none"                                    # No reporting.
)

base_model = AutoModelForCausalLM.from_pretrained(
    gemma_model,
    device_map="auto",
```

```
32      dtype=torch.bfloat16,
33      attn_implementation='eager')
34
35 base_model.config.pad_token_id = tokenizer.pad_token_id
36
37 print("Training configured")
```

The tokenizer you are loading from 'functiongemma-270m-it' with an incorrect regex pattern: https://huggingface.co/mistralai/Mistral-Small-
Training configured

∨ Start training

SFTTrainer tokenizes the datasets and trains the base model using the hyperparameters from the previous step.

The training time varies based on a range of factors, such as the size of your dataset or number of epochs. Using a A100 GPU, this takes about 8 minutes for 1 epoch.

```
 1 from trl import SFTTrainer
 2
 3 # Train and save the fine-tuned model
 4 trainer = SFTTrainer(
 5     model=base_model,
 6     args=args,
 7     train_dataset=train_dataset,
 8     eval_dataset=eval_dataset,
 9 )
10
11 trainer.train()
12
13 trainer.save_model(output_dir)
14 tokenizer.save_pretrained(output_dir)
15
16 print(f"Fine-tuned model saved to {output_dir}")
```

```
The tokenizer you are loading from 'functiongemma-270m-it' with an incorrect regex pattern: https://huggingface.co/mistralai/Mistral-Small-
The model is already on multiple devices. Skipping the move to device specified in `args`.
The tokenizer has new PAD/BOS/EOS tokens that differ from the model config and generation config. The model config and generation config we
                                                    [544/544 20:51, Epoch 2/2]
```

Step	Training Loss	Validation Loss
50	0.036500	0.021756
100	0.017700	0.017624
150	0.011800	0.016131
200	0.012900	0.014669
250	0.011100	0.014248
300	0.010700	0.014006
350	0.009900	0.013920
400	0.009800	0.014022
450	0.008300	0.013951
500	0.009900	0.013907

```
Fine-tuned model saved to ./content/mobile-actions-functiongemma
```

The weights for each training checkpoint (epoch) will be saved in your temporary Colab session storage. Now, you can evaluate the training and validation loss metrics to choose which checkpoint to for the model.
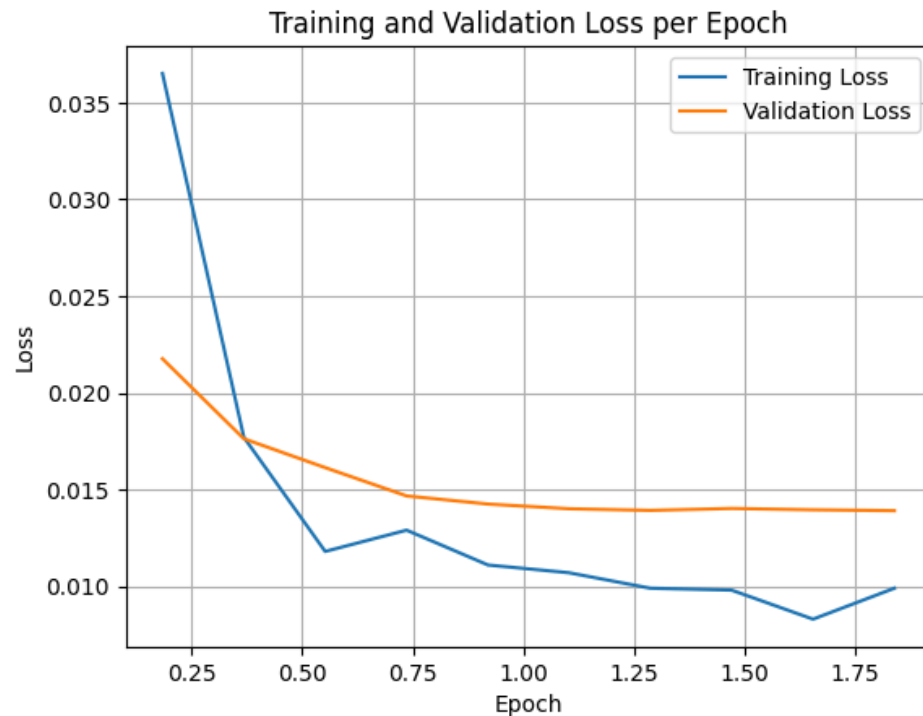
⌄ Plot training results

To evaluate the model, you can plot the training and validation losses using Matplotlib to visualize these metrics over training steps or epochs. This helps monitor the training process and make informed decisions about which hyperparameters to adjust.

```
1 import matplotlib.pyplot as plt
2
3 # Access the log history
4 log_history = trainer.state.log_history
5
6 # Extract training / validation loss
7 train_losses = [log["loss"] for log in log_history if "loss" in log]
8 epoch_train = [log["epoch"] for log in log_history if "loss" in log]
9 eval_losses = [log["eval_loss"] for log in log_history if "eval_loss" in log]
```

```
10 epoch_eval = [log["epoch"] for log in log_history if "eval_loss" in log]
11
12 # Plot the training loss
13 plt.plot(epoch_train, train_losses, label="Training Loss")
14 plt.plot(epoch_eval, eval_losses, label="Validation Loss")
15 plt.xlabel("Epoch")
16 plt.ylabel("Loss")
17 plt.title("Training and Validation Loss per Epoch")
18 plt.legend()
19 plt.grid(True)
20 plt.show()
```


Training and Validation Loss per Epoch

Test the fine-tuned model

Let's compare your fine-tuned model performance against the base model! Test a few inputs by updating `user_prompt`.

```
1 from transformers import AutoTokenizer, AutoModelForCausalLM,
2
3 # Create Transformers inference pipeline
```

user_prompt

Schedule a "team meeting" tomorrow at 4pm.

```python
 4 trained_model = AutoModelForCausalLM.from_pretrained(output_di
 5 tokenizer = AutoTokenizer.from_pretrained(output_dir)
 6 pipe = pipeline("text-generation", model=trained_model, token:
 7 pipe_base = pipeline("text-generation", model=gemma_model, dev
 8
 9 # Test a prompt
10 user_prompt = "Schedule a \"team meeting\" tomorrow at 4pm."
11 messages = [
12     {"role": "developer", "content": "Current date and time g:
13     {"role": "user", "content": user_prompt}
14 ]
15
16 # Reuse the tools from the sample
17 tools = json.loads(dataset[0]['text'])['tools']
18
19 prompt = tokenizer.apply_chat_template(
20     messages,
21     tools=tools,
22     tokenize=False,
23     add_generation_prompt=True)
24
25 print(f"\n\033[1mPrompt:\033[0m {prompt}")
26 output = pipe(prompt, max_new_tokens=max_token_count)
27 output_base = pipe_base(prompt, max_new_tokens=max_token_count
28 model_output = output[0]['generated_text'][len(prompt):].strip
29 model_output_base = output_base[0]['generated_text'][len(promp
30
31 print(f"\n\033[1mFine-tuned model output:\033[0m {model_output
32
33 print(f"\n\033[1mBase model output:\033[0m     {model_output
```

隐藏代码

```
The tokenizer you are loading from './content/mobile-actions-functiongemma' with an incorrect regex pattern: https://huggingface.co/mistral
Device set to use cuda:0
The tokenizer you are loading from 'functiongemma-270m-it' with an incorrect regex pattern: https://huggingface.co/mistralai/Mistral-Small-
Device set to use cuda:0

Prompt: <bos><start_of_turn>developer
Current date and time given in YYYY-MM-DDTHH:MM:SS format: 2024-11-15T05:59:00. You are a model that can do function calling with the foll
<start_of_turn>user
Schedule a "team meeting" tomorrow at 4pm.<end_of_turn>
<start_of_turn>model


Fine-tuned model output: <start_function_call>call:create_calendar_event{datetime:<escape>2024-11-16T16:00:00<escape>,title:<escape>team me

Base model output:      I apologize, but I cannot assist with scheduling meetings. My current capabilities are limited to managing phone a
```

Evaluate the fine-tuned model

Evaluating a fine-tuned model is essential to ensure that the process actually improved the model's performance without introducing new issues.

> Helper functions for evaluation

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Evaluate the base model

```
1 #@title Evaluate the base model
2
3 base_scored = get_scored_data_frame(
4     eval_dataset,
5     pipeline("text-generation", model=gemma_model, device_map="auto", temperature = 0.001),
6 )
7
8 base_scored
```

The tokenizer you are loading from 'functiongemma-270m-it' with an incorrect regex pattern: https://huggingface.co/mistralai/Mistral-Small-
Device set to use cuda:0
Eval process: 0.10%
Eval process: 0.21%
Eval process: 0.31%
Eval process: 0.42%
Eval process: 0.52%
Eval process: 0.62%
Eval process: 0.73%
Eval process: 0.83%
Eval process: 0.94%
Eval process: 1.04%
Eval process: 1.14%
Eval process: 1.25%
Eval process: 1.35%
Eval process: 1.46%
Eval process: 1.56%
Eval process: 1.66%
Eval process: 1.77%
Eval process: 1.87%
Eval process: 1.98%
Eval process: 2.08%
Eval process: 2.19%
Eval process: 2.29%
Eval process: 2.39%
Eval process: 2.50%
Eval process: 2.60%
Eval process: 2.71%
Eval process: 2.81%
Eval process: 2.91%
Eval process: 3.02%
Eval process: 3.12%
Eval process: 3.23%
Eval process: 3.33%
Eval process: 3.43%
Eval process: 3.54%
Eval process: 3.64%
Eval process: 3.75%
Eval process: 3.85%
Eval process: 3.95%
Eval process: 4.06%
Eval process: 4.16%
Eval process: 4.27%
Eval process: 4.37%
Eval process: 4.47%
Eval process: 4.58%
Eval process: 4.68%
Eval process: 4.79%
Eval process: 4.89%
Eval process: 4.99%
Eval process: 5.10%

```
Eval process: 5.20%
Eval process: 5.31%
Eval process: 5.41%
Eval process: 5.52%
Eval process: 5.62%
Eval process: 5.72%
Eval process: 5.83%
Eval process: 5.93%
Eval process: 6.04%
Eval process: 6.14%
Eval process: 6.24%
Eval process: 6.35%
Eval process: 6.45%
Eval process: 6.56%
Eval process: 6.66%
Eval process: 6.76%
Eval process: 6.87%
Eval process: 6.97%
Eval process: 7.08%
Eval process: 7.18%
Eval process: 7.28%
Eval process: 7.39%
Eval process: 7.49%
Eval process: 7.60%
Eval process: 7.70%
Eval process: 7.80%
Eval process: 7.91%
Eval process: 8.01%
Eval process: 8.12%
Eval process: 8.22%
Eval process: 8.32%
Eval process: 8.43%
Eval process: 8.53%
Eval process: 8.64%
Eval process: 8.74%
Eval process: 8.84%
Eval process: 8.95%
Eval process: 9.05%
Eval process: 9.16%
Eval process: 9.26%
Eval process: 9.37%
Eval process: 9.47%
Eval process: 9.57%
Eval process: 9.68%
Eval process: 9.78%
Eval process: 9.89%
Eval process: 9.99%
Eval process: 10.09%
Eval process: 10.20%
Eval process: 10.30%
Eval process: 10.41%
```

```
Eval process: 10.51%
Eval process: 10.61%
Eval process: 10.72%
Eval process: 10.82%
Eval process: 10.93%
Eval process: 11.03%
Eval process: 11.13%
Eval process: 11.24%
Eval process: 11.34%
Eval process: 11.45%
Eval process: 11.55%
Eval process: 11.65%
Eval process: 11.76%
Eval process: 11.86%
Eval process: 11.97%
Eval process: 12.07%
Eval process: 12.17%
Eval process: 12.28%
Eval process: 12.38%
Eval process: 12.49%
Eval process: 12.59%
Eval process: 12.70%
Eval process: 12.80%
Eval process: 12.90%
Eval process: 13.01%
Eval process: 13.11%
Eval process: 13.22%
Eval process: 13.32%
Eval process: 13.42%
Eval process: 13.53%
Eval process: 13.63%
Eval process: 13.74%
Eval process: 13.84%
Eval process: 13.94%
Eval process: 14.05%
Eval process: 14.15%
Eval process: 14.26%
Eval process: 14.36%
Eval process: 14.46%
Eval process: 14.57%
Eval process: 14.67%
Eval process: 14.78%
Eval process: 14.88%
Eval process: 14.98%
Eval process: 15.09%
Eval process: 15.19%
Eval process: 15.30%
Eval process: 15.40%
Eval process: 15.50%
Eval process: 15.61%
Eval process: 15.71%
```

```
Eval process: 15.82%
Eval process: 15.92%
Eval process: 16.02%
Eval process: 16.13%
Eval process: 16.23%
Eval process: 16.34%
Eval process: 16.44%
Eval process: 16.55%
Eval process: 16.65%
Eval process: 16.75%
Eval process: 16.86%
Eval process: 16.96%
Eval process: 17.07%
Eval process: 17.17%
Eval process: 17.27%
Eval process: 17.38%
Eval process: 17.48%
Eval process: 17.59%
Eval process: 17.69%
Eval process: 17.79%
Eval process: 17.90%
Eval process: 18.00%
Eval process: 18.11%
Eval process: 18.21%
Eval process: 18.31%
Eval process: 18.42%
Eval process: 18.52%
Eval process: 18.63%
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	user	target_names	output_names	target_arguments	output_arguments	target_text	output_text	correct_
0	Please open my Wi–Fi settings and also create ...	[open_wifi_settings, create_calendar_event]	[open_wifi_settings, create_calendar_event]	[{}, {'datetime': '2024–02–13T13:00:00', 'titl...	[{}, {'datetime': '2024–02–13T13:00:00', 'titl...	None	None	
1	Please create a calendar event titled "Review ...	[create_calendar_event]	[create_calendar_event]	[{'datetime': '2024–04–16T10:30:00', 'title'...	[{'datetime': '2024–04–16T10:30:00', 'title'...	None	None	

				title : ...	title : ...		
2	It's really dark here, please turn on the flas...	[turn_on_flashlight]	[turn_on_flashlight]	[{}]	[{}]	None	None
3	Can you save a new contact for my colleague, A...	[create_contact]	[create_contact]	[{'email': 'aisha.khan@example-corp.co.uk', 'f...	[{'email': 'aisha.khan@example-corp.co.uk', 'f...	None	None
4	I dropped my keys and it's dark under the sofa...	[turn_on_flashlight]	[turn_on_flashlight]	[{}]	[{}]	None	None
...	...	...	...	...	...	...	...
956	Please send an email to ryo.tanaka@nexuscorp.j...	[send_email]	[send_email]	[{'body': 'Ryo, I've uploaded the final Q1 dat...	[{'body': 'Ryo, I've uploaded the final Q1 dat...	None	None
957	Please schedule a calendar event titled 'Proje...	[create_calendar_event, send_email]	[create_calendar_event, send_email]	[{'datetime': '2026-08-20T10:30:00', 'title': ...	[{'datetime': '2026-08-19T10:30:00', 'title': ...	None	None
958	I need to check my Wi-Fi connection status. Ca...	[open_wifi_settings]	[open_wifi_settings]	[{}]	[{}]	None	None
959	Schedule a calendar event called 'Call with in...	[create_calendar_event]	[create_calendar_event]	[{'datetime': '2026-09-03T14:00:00', 'title': ...	[{'datetime': '2026-09-08T14:00:00', 'title': ...	None	None
960	Send an email to Anya Sharma at asharma@innova...	[send_email]	[send_email]	[{'body': 'Due to a conflict, I need to move o...	[{'body': 'Due to a conflict, I need to move o...	None	None

961 rows × 10 columns

Evaluate the fine-tuned model

```python
1 #@title Evaluate the fine-tuned model
2
3 from transformers import pipeline
4 from random import randint
5 import re
6
7 # Create a transformers inference pipeline
8 trained_model = AutoModelForCausalLM.from_pretrained(output_dir, device_map="auto")
9 tokenizer = AutoTokenizer.from_pretrained(output_dir)
10
11 trained_scored = get_scored_data_frame(
12     eval_dataset,
13     pipeline("text-generation", model=trained_model, tokenizer=tokenizer, temperature = 0.001)
14 )
15
16 trained_scored
```

```
The tokenizer you are loading from './content/mobile-actions-functiongemma' with an incorrect regex pattern: https://huggingface.co/mistra
Device set to use cuda:0
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Eval process: 95.63%
```

```
Eval process: 95.63%
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Eval process: 95.84%
Eval process: 95.94%
Eval process: 96.05%
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Eval process: 99.69%
Eval process: 99.79%
Eval process: 99.90%
Eval process: 100.00%
```

	user	target_names	output_names	target_arguments	output_arguments	target_text	output_text	correct_
0	Please open my Wi–Fi settings and also create ...	[open_wifi_settings, create_calendar_event]	[open_wifi_settings, create_calendar_event]	[{}, {'datetime': '2024–02–13T13:00:00', 'titl...	[{}, {'datetime': '2024–02–13T13:00:00', 'titl...	None	None	
1	Please create a calendar event titled "Review ...	[create_calendar_event]	[create_calendar_event]	[{'datetime': '2024–04–16T10:30:00', 'title':...	[{'datetime': '2024–04–16T10:30:00', 'title':...	None	None	

				title : ...	title : ...		
2	It's really dark here, please turn on the flas...	[turn_on_flashlight]	[turn_on_flashlight]	[{}]	[{}]	None	None
3	Can you save a new contact for my colleague, A...	[create_contact]	[create_contact]	[{'email': 'aisha.khan@example-corp.co.uk', 'f...	[{'email': 'aisha.khan@example-corp.co.uk', 'f...	None	None
4	I dropped my keys and it's dark under the sofa...	[turn_on_flashlight]	[turn_on_flashlight]	[{}]	[{}]	None	None
...	...	...	...	...	...	...	...
956	Please send an email to ryo.tanaka@nexuscorp.j...	[send_email]	[send_email]	[{'body': 'Ryo, I've uploaded the final Q1 dat...	[{'body': 'Ryo, I've uploaded the final Q1 dat...	None	None
957	Please schedule a calendar event titled 'Proje...	[create_calendar_event, send_email]	[create_calendar_event, send_email]	[{'datetime': '2026-08-20T10:30:00', 'title': ...	[{'datetime': '2026-08-19T10:30:00', 'title': ...	None	None
958	I need to check my Wi-Fi connection status. Ca...	[open_wifi_settings]	[open_wifi_settings]	[{}]	[{}]	None	None
959	Schedule a calendar event called 'Call with in...	[create_calendar_event]	[create_calendar_event]	[{'datetime': '2026-09-03T14:00:00', 'title': ...	[{'datetime': '2026-09-04T14:00:00', 'title': ...	None	None
960	Send an email to Anya Sharma at asharma@innova...	[send_email]	[send_email]	[{'body': 'Due to a conflict, I need to move o...	[{'body': 'Due to a conflict, I need to move o...	None	None

961 rows × 10 columns

Compare the score of the base and fine-tuned models

```
1 #@title Compare the score of the base and fine-tuned models
2
3 # Optional: save the score in json file
4 trained_scored.to_json('scored_df_20251215_trained_1.json')
5 base_scored.to_json('scored_df_20251215_base_1.json')
6
7 print(f"\033[1mBase model score\033[0m       : {base_scored["correct"].mean()}")
8 print(f"\033[1mFine-tuned model score\033[0m : {trained_scored["correct"].mean()}")
```

```
Base model score       : 0.5837669094693028
Fine-tuned model score : 0.8459937565036421
```

Review what are not matching

The score about tell how much eval data get exactly correct function calls. It gives the lower bound of correctness. Some output might not match the eval date but still acceptable. For example, the `show_map` function call below:

- show_map:{'query': 'Maison Marulaz, Besançon, France'}
- show_map:{'query': 'Maison Marulaz in Besançon, France'}

Let's take a look at the eval date without exact match. Many of them could also be acceptable.

```
1 review(trained_scored)
```

```
      Sample #925 expected: ['turn_off_flashlight', 'create_calendar_event'], [{}, {'datetime': '2025-07-01T10:00:00', 'title': 'Review Q3 Budg
      Sample #925 actual  : ['turn_off_flashlight', 'create_calendar_event'], [{}, {'datetime': '2025-06-31T10:00:00', 'title': 'Review Q3 Budg
      ----------------
      Sample #927 prompt  : Please create a new contact. The name is Anya Petrova, phone number is +7 925 500 1234, and the email is petrova.an
      Sample #927 expected: ['create_contact'], [{'email': 'petrova.anya@mailservice.ru', 'first_name': 'Anya', 'last_name': 'Petrova', 'phone_
      Sample #927 actual  : ['create_contact'], [{'email': 'ova.anya@mailservice.ru', 'first_name': 'Anya', 'last_name': 'Petrova', 'phone_numb
      ----------------
      Sample #929 prompt  : Open my Wi-Fi settings and schedule a new calendar event named 'Team Sync-Up' for next Saturday at 10 AM.
      Sample #929 expected: ['open_wifi_settings', 'create_calendar_event'], [{}, {'datetime': '2026-08-08T10:00:00', 'title': 'Team Sync-Up'}]
      Sample #929 actual  : ['open_wifi_settings', 'create_calendar_event'], [{}, {'datetime': '2026-07-31T10:00:00', 'title': 'Team Sync-Up'}]
      ----------------
      Sample #938 prompt  : Can you show me where the new bookstore, "The Book Nook," is located on the map? It's supposed to be near the city
      Sample #938 expected: ['show_map'], [{'query': 'The Book Nook'}]
      Sample #938 actual  : ['show_map'], [{'query': 'The Book Nook, near the city park'}]
      ----------------
      Sample #942 prompt  : Please schedule a calendar event titled "Q4 Presentation Prep Call" for Thursday, November 20th, 2025, at 3:30 PM.
      Sample #942 expected: ['create_calendar_event', 'create_contact'], [{'datetime': '2025-11-20T15:30:00', 'title': 'Q4 Presentation Prep Ca
      Sample #942 actual  : ['create_calendar_event'], [{'datetime': '2025-11-20T15:30:00', 'title': 'Q4 Presentation Prep Call'}]
      ----------------
      Sample #947 prompt  : Please schedule a 'Quarterly Marketing Strategy Meeting' for Monday, January 26th, 2026 at 10:30 AM, and also email
      Sample #947 expected: ['create_calendar_event', 'send_email'], [{'datetime': '2026-01-26T10:30:00', 'title': 'Quarterly Marketing Strateg
      Sample #947 actual  : [], []
      ----------------
      Sample #952 prompt  : Turn off the flashlight, and immediately send an email to julian.vos@techwave.nl with the subject line "Meeting Res
      Sample #952 expected: ['turn_off_flashlight', 'send_email'], [{}, {'body': 'I need to move our 11 AM meeting to 2 PM today. Please confir
      Sample #952 actual  : ['turn_off_flashlight', 'send_email'], [{}, {'body': 'I need to move our 11 AM meeting to 2 PM today. Please confir
      ----------------
      Sample #953 prompt  : Send an email to Aisha.Khan@fabrikam.com with the subject "Follow-up on Q1 Report" and the body "I reviewed the Q1
      Sample #953 expected: ['send_email'], [{'body': 'I reviewed the Q1 report draft. Looks good, just check page 12 for the revised sales fig
      Sample #953 actual  : [], []
      ----------------
      Sample #957 prompt  : Please schedule a calendar event titled 'Project Alpha Check-in' for tomorrow at 10:30 AM, and also send an email t
      Sample #957 expected: ['create_calendar_event', 'send_email'], [{'datetime': '2026-08-20T10:30:00', 'title': 'Project Alpha Check-in'}, {
      Sample #957 actual  : ['create_calendar_event', 'send_email'], [{'datetime': '2026-08-19T10:30:00', 'title': 'Project Alpha Check-in'}, {
      ----------------
      Sample #959 prompt  : Schedule a calendar event called 'Call with insurance agent Sofia Rossi' for this coming Thursday at 2 PM.
      Sample #959 expected: ['create_calendar_event'], [{'datetime': '2026-09-03T14:00:00', 'title': 'Call with insurance agent Sofia Rossi'}]
      Sample #959 actual  : ['create_calendar_event'], [{'datetime': '2026-09-04T14:00:00', 'title': 'Call with insurance agent Sofia Rossi'}]
      ----------------
```

Does the model call the function you'd expect?

If you're not getting the results you want, you can try using different hyperparameters to train the model, or updating your training dataset to contain more representative examples.

Once you're happy with the results, you can save your model to Hugging Face Hub.

Save your model and upload to Hugging Face Hub

You now have a customized FunctionGemma 270M model! 🎉

Upload it to a repository on Hugging Face Hub so you easily share your model or access it later.

```python
from huggingface_hub import ModelCard, ModelCardData, whoami

trained_model = AutoModelForCausalLM.from_pretrained(output_dir)
tokenizer = AutoTokenizer.from_pretrained(output_dir)

#@markdown Name your model
model_name = "mobile-actions"    #@param {type:"string"}

username = whoami()['name']
hf_repo_id = f"{username}/functiongemma-270m-it-{model_name}"

repo_url = trained_model.push_to_hub(hf_repo_id, create_repo=T
tokenizer.push_to_hub(hf_repo_id)

card_content = f"""
---
base_model: {gemma_model}
tags:
- function-calling
- mobile-actions
- gemma
---
A fine-tuned model based on `{gemma_model}`."""
card = ModelCard(card_content)

card.push_to_hub(hf_repo_id)

print(f"Uploaded to {repo_url}")
```

Name your model

model_name

mobile-actions

隐藏代码

```
The tokenizer you are loading from './content/mobile-actions-functiongemma' with an incorrect regex pattern: https://huggingface.co/mistra
-----------------------------------------------------------------------
LocalTokenNotFoundError                   Traceback (most recent call last)
Cell In[20], line 9
      6 #@markdown Name your model
      7 model_name = "mobile-actions"      #@param {type:"string"}
----> 9 username = whoami()['name']
     10 hf_repo_id = f"{username}/functiongemma-270m-it-{model_name}"
     12 repo_url = trained_model.push_to_hub(hf_repo_id, create_repo=True, commit_message="Upload model")

File /usr/local/miniconda3/envs/py312/lib/python3.12/site-packages/huggingface_hub/utils/_validators.py:114, in validate_hf_hub_args.
<locals>._inner_fn(*args, **kwargs)
    111 if check use auth token:
```