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How to Fine-Tune Gemma 3 270M and Run It On-Device

5 min read · Oct 15, 2025

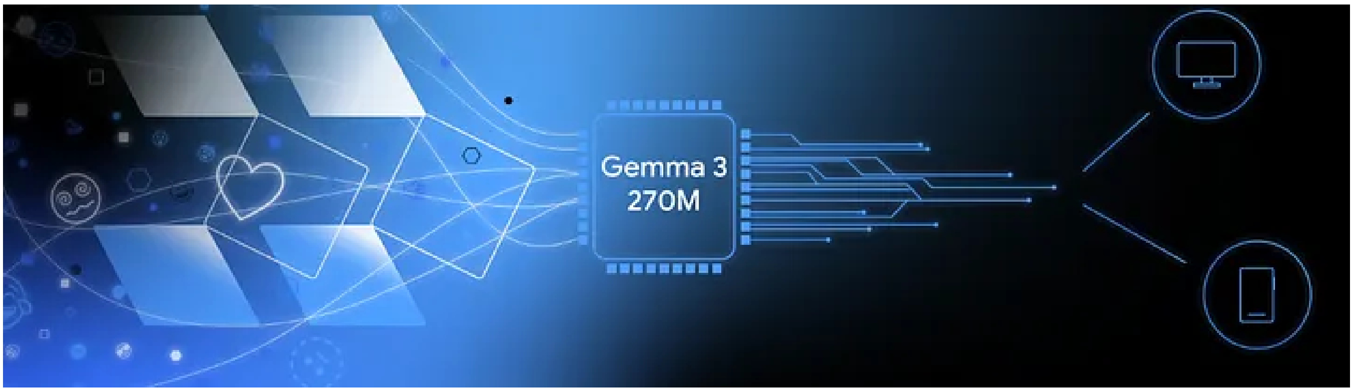
Civil Learning Following

If you've ever wished to run your own small AI model on your laptop or phone — without setting up servers or paying for GPUs — I have some good news.

Meet **Gemma 3 270M** — a small but surprisingly capable open model from Google. It's part of the Gemma family, which essentially brings the same technology used in Gemini models into a lightweight, customizable form.

And here's the fun part: you can **fine-tune it in less than an hour**, reduce its size to under **300MB**, and run it directly in your browser.

In this post, I'll show you how I created my own **emoji translator** with Gemma — a small model that converts text into emojis and runs locally.



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Step 1: Teaching Gemma to “Think in Emojis”

Out of the box, Gemma is a generalist. Ask it to translate text into emojis, and it’ll be a bit too polite about it.

Prompt:

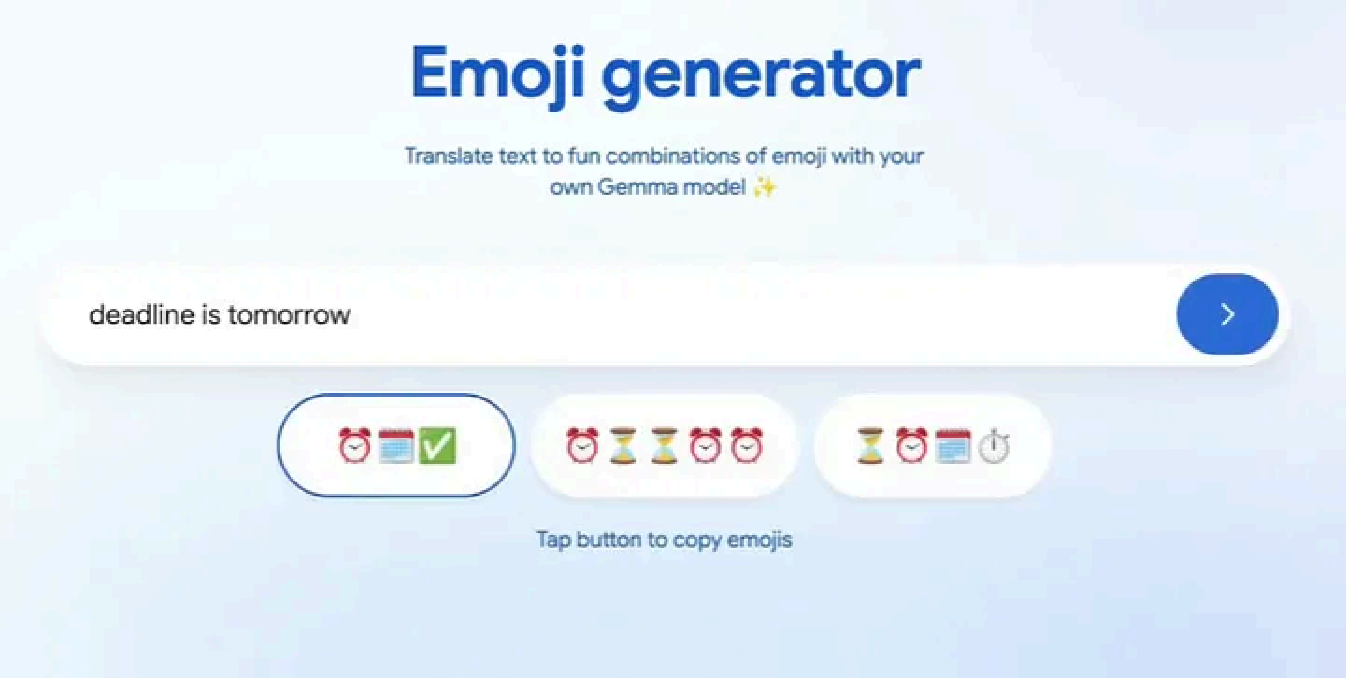
> “Translate this text into emojis: what a fun party”

Model:

> “Sure! Here is your emoji: 🥳🎉🎈 ”

Close, but not exactly what I was aiming for. For my app, I wanted **only emojis** — no words, no “sure!”, just the fun stuff.

I decided to fine-tune it.



Emoji generator

Translate text to fun combinations of emoji with your own Gemma model ✨

deadline is tomorrow

Building a tiny dataset

I began with a straightforward JSON file — text in, emoji out.

```
[
  { "input": "what a fun party", "output": "🥳🎉🎈 " },
  { "input": "good morning sunshine", "output": "☀️🌻😊 " },
  { "input": "so tired today", "output": "😴💤" }
]
```

I also had some fun with this — I asked ChatGPT (ironically) to generate different phrases for the same emoji sets. That helped the model learn variations like "that was lit 🔥" → "🎉🔥🙌".

Fine-tuning in Colab

Fine-tuning used to require an A100 GPU and patience. Not anymore. Using **QLoRA**, which updates only a few parameters, I fine-tuned the model on a **free T4 GPU** in Google Colab.

Here's an approximate overview of what that looked like:

```
from transformers import (
    AutoModelForCausalLM,
    AutoTokenizer,
    Trainer,
    TrainingArguments,
    DataCollatorForLanguageModeling
)
from peft import LoraConfig, get_peft_model
from datasets import load_dataset

model_name = "google/gemma-3-270m"
tokenizer = AutoTokenizer.from_pretrained(model_name)

# Critical: Set pad_token for Gemma
if tokenizer.pad_token is None:
    tokenizer.pad_token = tokenizer.eos_token

model = AutoModelForCausalLM.from_pretrained(
    model_name,
    torch_dtype="auto",  # Optional: Use auto dtype for efficiency
    device_map="auto"    # Optional: Auto-map to GPU if available
)

dataset = load_dataset("json", data_files="emoji_dataset.json")

# Optional: Pre-tokenize and truncate if sequences are long (Trainer can handle
# def tokenize_function(examples):
#     return tokenizer(examples["text"], truncation=True, max_length=512)
# dataset = dataset.map(tokenize_function, batched=True, remove_columns=dataset

lora_config = LoraConfig(
    r=8,
    lora_alpha=32,
    target_modules=[
        "q_proj", "k_proj", "v_proj", "o_proj",  # Attention layers
        "gate_proj", "up_proj", "down_proj"     # MLP layers
    ],
    lora_dropout=0.05,
    task_type="CAUSAL_LM"  # Explicit for clarity
)
model = get_peft_model(model, lora_config)

training_args = TrainingArguments(
    output_dir="./gemma-emoji",
    num_train_epochs=3,
    per_device_train_batch_size=4,
    save_steps=100,
    logging_steps=10,      # Optional: Log more frequently
    evaluation_strategy="no",  # Add eval_dataset if you have one
    # group_by_length=True,  # Optional: Group similar lengths for efficiency
    # max_steps=-1,          # Optional: Run for full epochs
)

# Critical: Proper collator for CLM
data_collator = DataCollatorForLanguageModeling(
    tokenizer=tokenizer,
    mlm=False  # Causal LM, not masked
)

trainer = Trainer(
    model=model,
    args=training_args,
    train_dataset=dataset["train"],
    tokenizer=tokenizer,       # Enables auto-tokenization if not pre-tokenized
    data_collator=data_collator
)
trainer.train()
```

That’s it — after training, my model began producing **only emojis**.

If you want the model to memorize specific emoji, provide more examples in the dataset.

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Step 2: Making It Tiny Enough for the Web

After fine-tuning, the model remained about 1GB — small by LLM standards, but large for the browser.

To run it locally, I quantized it to 4-bit with **LiteRT** (you could also choose the **ONNX** route if you prefer Transformers.js).

Quantisation is simply advanced math for “store numbers with fewer bits.” The result: a model that takes up less space with almost the same accuracy. Mine ended up under **300MB**.

This smaller version is ideal for **MediaPipe** or **Transformers.js**, both of which utilize **WebGPU** to access your device’s hardware. So yes — it literally runs in your browser.

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Step 3: Running the Model in the Browser

Here’s the fun part — no servers, no APIs, no waiting.

I used **MediaPipe's GenAI Tasks** to load and run my model directly in the browser.

```
const genai = await FilesetResolver.forGenAiTasks(
  'https://cdn.jsdelivr.net/npm/@mediapipe/tasks-genai@latest/wasm'
);

const llmInference = await LlmInference.createFromOptions(genai, {
  baseOptions: { modelAssetPath: 'path/to/yourmodel.task' }
});
const prompt = "Translate this text to emoji: what a fun party!";
const response = await llmInference.generateResponse(prompt);
console.log(response);
```

Once cached, it operates entirely offline. Zero latency. Complete privacy. It works even in airplane mode.

Smaller models result in a faster-loading app and better experience for end users.

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Why This Matters

This is where AI is headed — **small, private, personal models** that you manage.

You don't need large GPUs or cloud APIs. You can fine-tune, compress, and deploy a model that fits within your app and performs exactly what you trained it for.

Gemma 3 270M is an excellent platform for that — fast, lightweight, and friendly enough to experiment with.

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Final Thoughts

This project took me less than an hour from start to finish, and the result was a model that felt *mine*. It even uses my favourite emojis when I test it.

So if you've been wanting to experiment with local AI, start small. Choose a simple task, fine-tune Gemma, quantize it, and let it run right in your browser.

Because the future of AI isn't just large models in the cloud — it's the small ones that reside in your pocket.

Gemma 3 · AI · Google · Ai Agent · Llm

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Responses (2)

Bgerby

What are your thoughts?

asier etxebeste

Oct 26

I can't run the code.

Reply

Fraorchome

Oct 24 (edited)

I can't get the code to work. It's probably a problem with the prompt composition. How do you construct the prompt in the two phases (fine-tuning and inference)? The model's answers are always strange and have nothing to do with emojis.

Reply

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