Fine-Tuning Mastery — 40 Day Detailed Battle Plan

This 40-day plan will take you from zero to a fine-tuning expert. You'll learn LoRA, QLoRA, RLHF, multi-modal fine-tuning, Stable Diffusion fine-tuning, dataset creation, deployment, and advanced optimization. Each project introduces a new concept, model, or technique, building your skills step-by-step. You will dedicate ~5 hours/day. By the end, you will be able to fine-tune almost any open-source model for any task. For each project, prerequisites, learning outcomes, and project descriptions are provided.

Stage 1 — Core Fine-Tuning (Days 1–7)

P1: Tiny GPT2 Q&A; chatbot

Prerequisites: Basic Python, Hugging Face Transformers installation

What You'll Learn: Tokenization, dataset preparation, simple fine-tuning loop

Description: We fine-tune a small GPT-2 model to answer Q&A; from a custom dataset, learning dataset loading, preprocessing, and running training.

P2: GPT2 text style transfer

Prerequisites: P1 knowledge, basic prompt design

What You'll Learn: Prompt templates, loss function tracking, generation settings

Description: Model trained to convert plain sentences into Shakespearean style, teaching you style conditioning.

P3: LLaMA-2-7B LoRA fine-tune

Prerequisites: LoRA concept, Hugging Face PEFT library

What You'll Learn: LoRA adapters, low-rank fine-tuning

Description: Fine-tune LLaMA-2-7B efficiently using LoRA for minimal GPU usage.

Stage 2 — Efficiency & Scaling (Days 8–14)

P4: LLaMA-2-7B QLoRA

Prerequisites: LoRA basics

What You'll Learn: 4-bit quantization, memory-efficient training

Description: Use QLoRA to fit large models into limited VRAM without performance loss.

P5: Gradient checkpointing & mixed precision

Prerequisites: PyTorch training loop basics

What You'll Learn: Memory optimization, FP16 training

Description: Apply gradient checkpointing and mixed precision to speed up and save VRAM.

P6: Dataset cleaning & augmentation scripts

Prerequisites: Python text processing

What You'll Learn: Data preprocessing automation

Description: Write scripts to remove duplicates, clean text, and augment datasets for better results.

Stage 3 — Specialized Models (Days 15–22)

P7: Summarization with BART

Prerequisites: Encoder–decoder model basics

What You'll Learn: Summarization datasets, evaluation metrics

Description: Fine-tune BART on news summarization dataset, exploring encoder-decoder behavior.

P8: Code generation with StarCoder or CodeLLaMA

Prerequisites: Basic coding knowledge

What You'll Learn: Training for code tasks, syntax-aware tokenization

Description: Teach a model to generate Python code from natural language prompts.

P9: Sentiment classifier with RoBERTa

Prerequisites: Classification task basics

What You'll Learn: Fine-tuning encoders for classification

Description: Fine-tune RoBERTa for positive/negative sentiment classification.

Stage 4 — Instruction Tuning & RLHF (Days 23–28)

P10: Alpaca/Dolly-style SFT

Prerequisites: LoRA/QLoRA knowledge

What You'll Learn: Instruction dataset formatting

Description: Supervised fine-tuning LLaMA to follow instructions like ChatGPT.

P11: Reward model training for RLHF

Prerequisites: Supervised training, basic RL concepts

What You'll Learn: Pairwise ranking datasets, reward modeling

Description: Train a reward model to score outputs for preference optimization.

P12: PPO stage for preference optimization

Prerequisites: Reward model knowledge

What You'll Learn: PPO training loop

Description: Optimize model outputs via reinforcement learning from human feedback.

Stage 5 — Multi-Modal & Deployment (Days 29–35)

P13: BLIP-2 image caption fine-tuning

Prerequisites: Image preprocessing basics

What You'll Learn: Text–image datasets, vision encoder–text decoder training

Description: Fine-tune BLIP-2 to generate captions for images.

P14: LLaVA visual question answering

Prerequisites: Multi-modal dataset basics

What You'll Learn: Image–text alignment, fine-tuning multi-modal LLMs

Description: Teach LLaVA to answer questions about images.

P15: Deploy with Gradio & FastAPI

Prerequisites: Basic Python web dev

What You'll Learn: Model serving & APIs

Description: Serve fine-tuned models via an interactive web app and REST API.

Stage 6 — Advanced Tricks, Custom Models & Image Generation (Days 36–40)

P16: Merge multiple LoRA adapters

Prerequisites: LoRA usage

What You'll Learn: Adapter merging

Description: Combine multiple LoRA fine-tunings into one model.

P17: Low-rank adapter search

Prerequisites: LoRA tuning

What You'll Learn: Finding optimal rank

Description: Experiment with LoRA parameters to optimize quality vs size.

P18: Stable Diffusion DreamBooth fine-tuning

Prerequisites: Stable Diffusion basics, GPU setup

What You'll Learn: Fine-tuning text-to-image models

Description: Train SD with DreamBooth for personalized image generation.

P19: Textual Inversion with Stable Diffusion

Prerequisites: P18 knowledge

What You'll Learn: Embedding-based fine-tuning

Description: Teach SD new visual concepts via learned embeddings.

Tips for Success: - Document everything — code, configs, dataset sources. - Experiment with parameters and record effects. - Read Hugging Face, PEFT, and Diffusers docs as you go. - Push your models to the Hugging Face Hub. Follow this plan strictly, and you’ll master fine-tuning across text and image domains.