

Finetuning LLMs to Extract Closure Information From National Park Comments

Austin Lackey



This Image Is Generated by DALL-E3

Background

- Example Scenario

MONTH	COMMENT
January	South entrance closed for construction.
February	Annual Parade drove v...
March	
...	...

ENTRANCE/ LOCATION	JAN	FEB	MAR
North Counter	401	200	189	...
South Counter	0	147	235	...
Alpine Peak Trailhead	35	42	36	...
Moose Lodge Campground	0	90	80	...
...

The Problem

- 400 Parks
- 12 Months of data
- 12x400=~4,000 comments
- 3-5 Iterations...

MONTH	COMMENT
January	1.) BAIS Ranger left position at beginning of the month. 2.) MIIN has had broken HVAC/air conditioning since June. Idaho has seen record number of days at temps of high 90s-100s; prolonged heat wave has resulted in MIIN Visitor Center closing 3 to 4.5 hours early to mitigate heat exhaustion amongst staff and visitors. 3.) Yellowstone temporarily closed due to severe flooding and, even after reopening, has seen decreased visitation due to cancelled travel plans or potential visitors not knowing that the park is open. A significant portion of MIIN visitation comes from the traffic between YELL and the Pacific Northwest, so MIIN visitation may have similarly decreased. 4.) A large portion of MIIN visitors are semi/retired RV travelers; MIIN visitation may have decreased due to high cost of gas throughout the summer (national average \$5.00+). BAIS -- Estimated with a 10% decrease from July BAIS FY22 assumed from the lack of BAIS Ranger during the month of July. Bainbridge Island Japanese American Exclusion Memorial people counters have been broken since 03/2021. MIIN staff based out of Idaho and not able to easily make fixes to BAIS in WA state. The memorial is collectively cared for by the Bainbridge Island Japanese American Exclusion Memorial Association, the Bainbridge Island Japanese American Community, the Bainbridge Island Historical Museum, Bainbridge Island Parks & Recreation District and the Klondike Gold Rush National Historical Park - Seattle.
February	July, 2005 was an exceedingly hot month, with a few days that broke records. High heat in the mid to upper 90s with 70 to 80% humidity resulting in a high heat index. The excessive heat may have been responsible for lower visitation numbers at the Elizabeth Cady Stanton House, which is not air conditioned. The staff at the information desk is careful to inform visitors of this fact on hot days, so that those who have trouble with the heat may make an informed decision on whether or not to take the tour. 4-Jul: Special Event- Reading of the Declaration of Sentiments- 9 10-Jul: AAVW- 13, chapel, film, exhibits, Stanton 11-Jul: Syracuse University- 52 15-Jul: Methodist Center- 20 17-Jul: Women's (Democratic Politicians) Event in Chapel 10:10-10:40 am (Samara Barend for Congress)- 10; Women's Rights Convention Dramatization- 150, 2pm; Fix Air Conditioning!!! 19-Jul: Camp Wanapee- 13 20-Jul: Fix Air Conditioning on 1st Floor!! Had a few complaints from guests. 21-Jul: Rochester Int'l Council ""
...

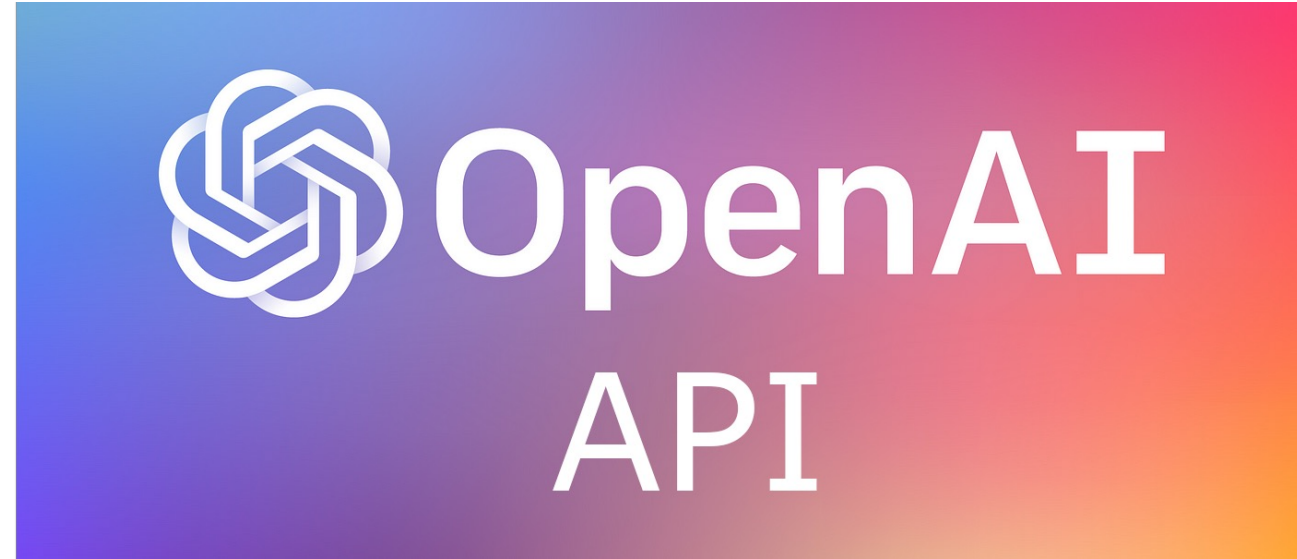
The Goal

- Turn long verbose comments into concise closure-specific segments.

The Goal: Extract Closure Information	
Input:	Comment for January: Averages for the following counters were submitted: Belle Haven (vehicles and MVT) Daingerfield (vehicles and MVT) Fort Hunt Park Turkey Run Gravelly Point Note: The sign crew supervisor will check the above counters. Averages for the follwing vehicle and traffic counters were used: U.S. Marines Corps War Memorial, Great Falls Park, Lane 1(National Airport) and Lanes 2, 3,4,5 (National Airport) Note: Data Collector was notified by email of the vehicle and traffic counters. Claude Moore Colonial Farm - annual January closure
Output:	January: Claude Moore Colonial Farm was closed for the entire month

Table 1: Input and Output Example

LLMs are great but...



\$\$\$

Open Source LLMs



Tasks

Libraries




Datasets

Languages


















Licenses

Other













Multimodal

-  Image-Text-to-Text
-  Visual Question Answering
-  Document Question Answering

Computer Vision

-  Depth Estimation
-  Image Classification
-  Object Detection
-  Image Segmentation
-  Text-to-Image
-  Image-to-Text
-  Image-to-Image
-  Image-to-Video
-  Unconditional Image Generation
-  Video Classification
-  Text-to-Video
-  Zero-Shot Image Classification
-  Mask Generation
-  Zero-Shot Object Detection
-  Text-to-3D
-  Image-to-3D
-  Image Feature Extraction

Natural Language Processing

-  Text Classification
-  Token Classification
-  Table Question Answering
-  Question Answering
-  Zero-Shot Classification
-  Translation
-  Summarization
-  Feature Extraction
-  Text Generation
-  Text2Text Generation
-  Fill-Mask
-  Sentence Similarity

Audio

Models 630,480

apple/OpenELM

Updated 7 days ago • 910

microsoft/Phi-3-mini-128k-instruct

Text Generation • Updated 1 day ago • 163k • 1k

snowflake/snowflake-arctic-instruct

Text Generation • Updated 5 days ago • 2.34k • 282

microsoft/Phi-3-mini-4k-instruct

Text Generation • Updated 1 day ago • 119k • 421

ByteDance/Hyper-SD

Text-to-Image • Updated about 21 hours ago • 41.8k • 316

shenzhi-wang/Llama3-8B-Chinese-Chat

Text Generation • Updated 2 days ago • 4.57k • 306

microsoft/Phi-3-mini-4k-instruct-gguf

Text Generation • Updated 9 days ago • 65k • 260

meta-llama/Meta-Llama-3-70B

Text Generation • Updated 7 days ago • 309k • 537

apple/OpenELM-3B

Text Generation • Updated 7 days ago • 1.79k • 85

meta-llama/Meta-Llama-3-8B

Text Generation • Updated 7 days ago • 590k • 2.93k

meta-llama/Meta-Llama-3-8B-Instruct

Text Generation • Updated 7 days ago • 823k • 1.64k

gradientai/Llama-3-8B-Instruct-Gradient-1048k

Text Generation • Updated 1 day ago • 5.75k • 272

apple/OpenELM-3B-Instruct

Text Generation • Updated 7 days ago • 4.53k • 217

gradientai/Llama-3-8B-Instruct-262k

Text Generation • Updated about 19 hours ago • 14.2k • 182

meta-llama/Meta-Llama-3-70B-Instruct

Text Generation • Updated 7 days ago • 112k • 817

aaditya/Llama3-OpenBioLLM-70B

Text Generation • Updated 5 days ago • 4.05k • 125

mistralai/Mistral-7B-Instruct-v0.2

Text Generation • Updated Mar 23 • 2.46M • 2.1k

OpenGVLab/InternVL-Chat-V1-5

Visual Question Answering • Updated 1 day ago • 3.83k • 129

Llama 3 8B

- Developed by Meta
- Free to download
- Goal: Finetune Llama 3 for specific NPS tasks **LOCALLY**



Credit: DALLE 3

Finetuning

Utilizing the models original knowledge, while training it to **specific tasks**

Full Parameter Fine Tuning

- Updates all weights (8B)
- Requires lots of time
- Requires lots of compute
- Requires lots of memory

Meta Base Llama



Credit: iStock

NPS Finetuned Llama



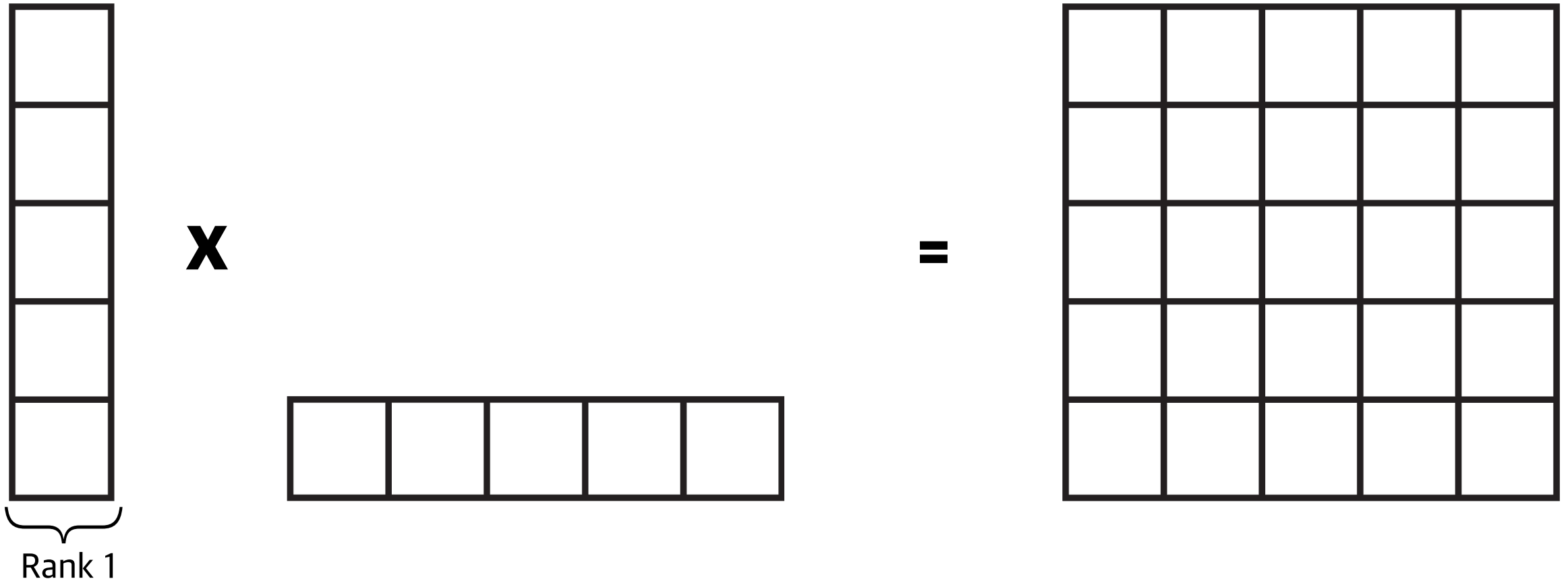
Credit: DALLE 3

LoRA Finetuning

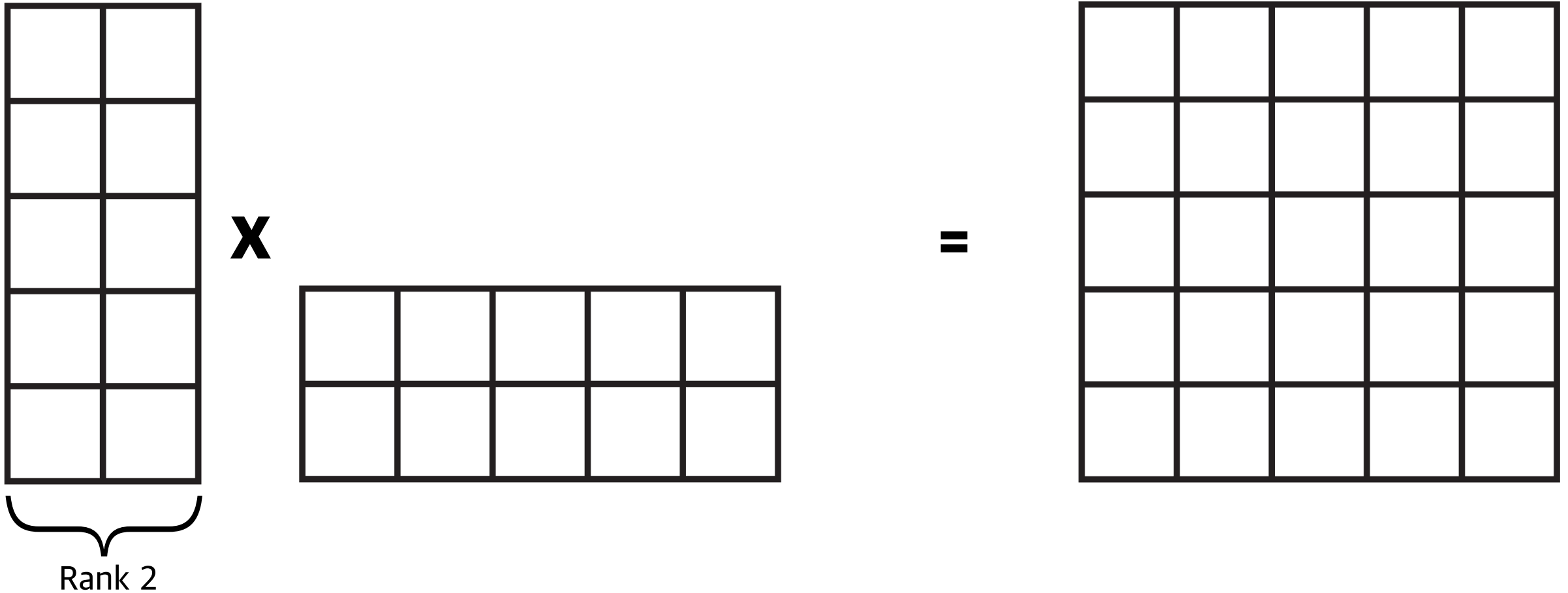
- Leaves original weights “untouched”
- Tracks changes
- Uses small “Low rank” matrices

Low Rank Adaptation (LoRA)

10 trainable parameters vs. 25

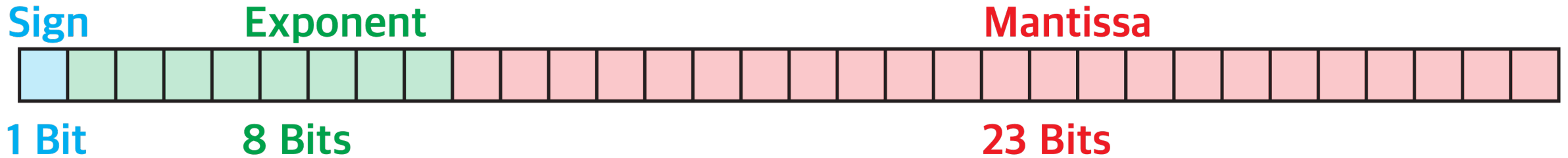


Low Rank Adaptation (LoRA)



Quantized Low Rank Adaptation (QLoRA)

Float 32



Credit: Austin Lackey

Int 4



4 Bits

Credit: Austin Lackey

Quantized Low Rank Adaptation (QLoRA)

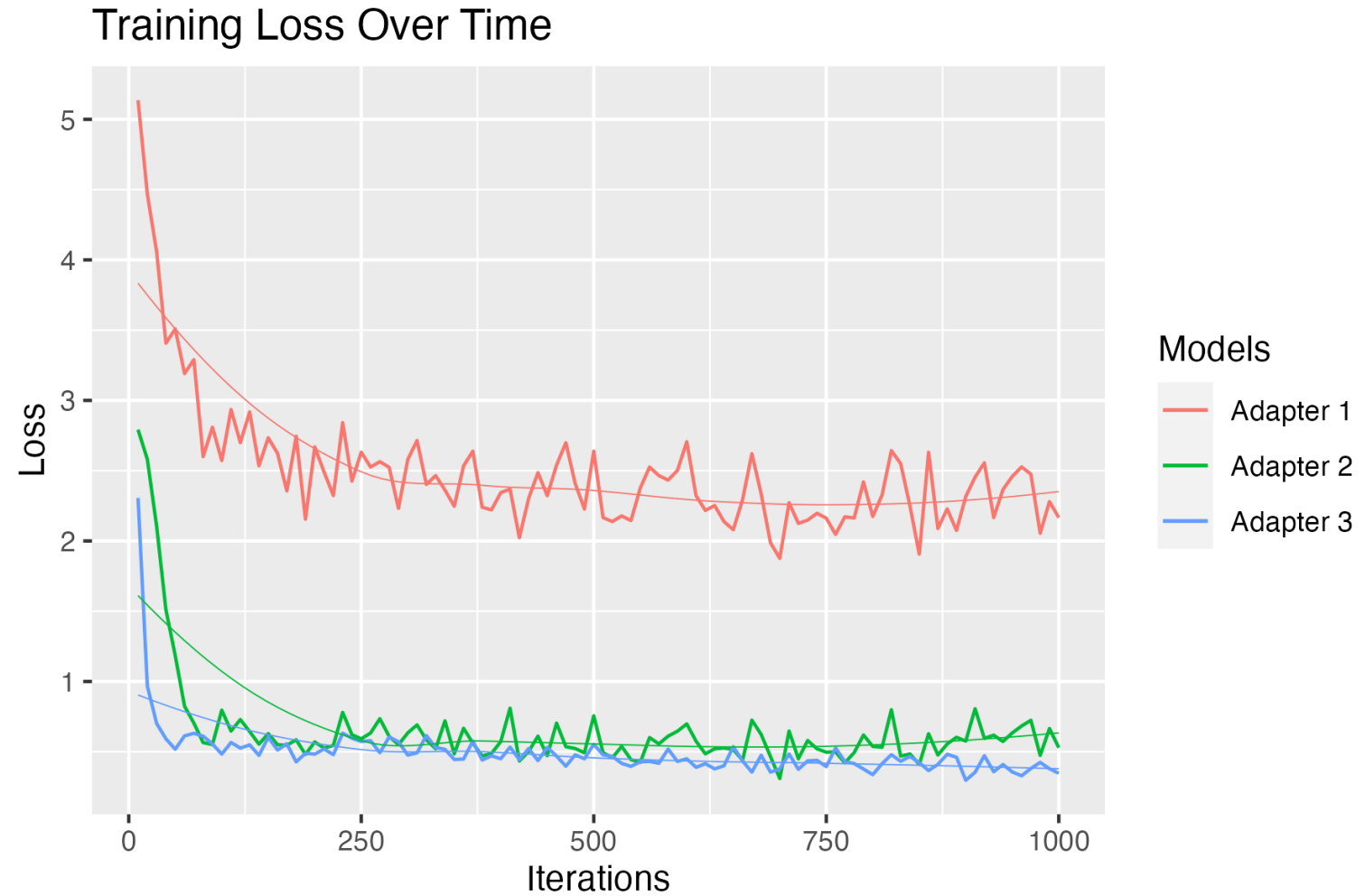
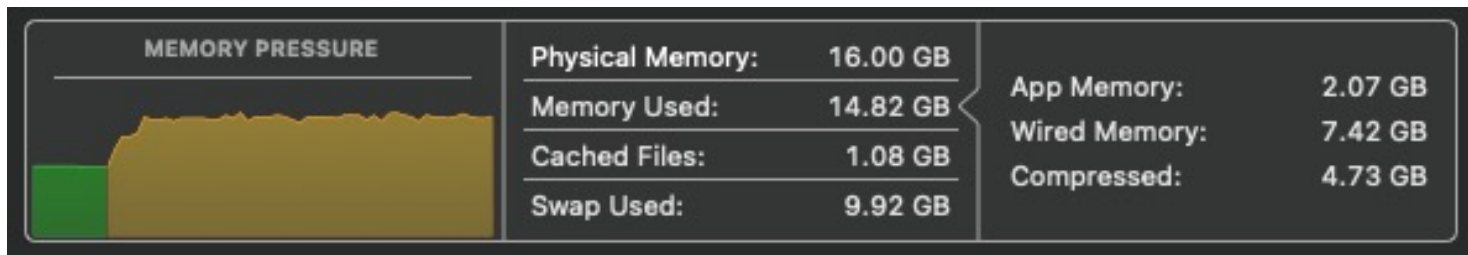
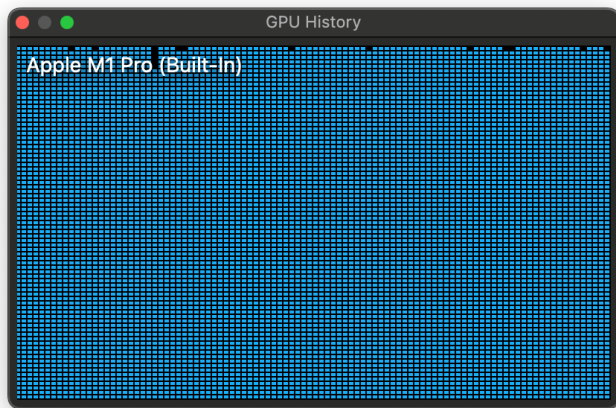
- Llama 3 8B ~ 8 Billion Parameters/Weights

$$8,000,000,000 \times \frac{32 \text{ bits}}{8} = 32,000,000,000 \text{ bytes} \quad 32\text{GB}$$

$$8,000,000,000 \times \frac{4 \text{ bits}}{8} = 4,000,000,000 \text{ bytes} \quad 4\text{GB}$$

Training Time

- ~1,500 I/O Samples
- 10 Hours (max GPU)



Results




INPUT: Comment for July: 1.) BAIS Ranger left position at beginning of the month. 2.) MIIN has had broken HVAC/air conditioning since June. Idaho has seen record number of days at temps of high 90s-100s; prolonged heat wave has resulted in MIIN Visitor Center closing 3 to 4.5 hours early to mitigate heat exhaustion amongst staff and visitors. 3.) Yellowstone temporarily closed due to severe flooding and, even after reopening, has seen decreased visitation due to cancelled travel plans or potential visitors not knowing that the park is open. A significant portion of MIIN visitation comes from the traffic between YELL and the Pacific Northwest, so MIIN visitation may have similarly decreased. 4.) A large portion of MIIN visitors are semi/retired RV travelers; MIIN visitation may have decreased due to high cost of gas throughout the summer (national average \$5.00+). BAIS -- Estimated with a 10% decrease from July BAIS FY22 assumed from the lack of BAIS Ranger during the month of July. Bainbridge Island Japanese American Exclusion Memorial people counters have been broken since 03/2021. MIIN staff based out of Idaho and not able to easily make fixes to BAIS in WA state. The memorial is collectively cared for by the Bainbridge Island Japanese American Exclusion Memorial Association, the Bainbridge Island Japanese American Community, the Bainbridge Island Historical Museum, Bainbridge Island Parks & Recreation District and the Klondike Gold Rush National Historical Park - Seattle.

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OUTPUT: July: MIIN Visitor Center closed 3 to 4.5 hours early due to heat exhaustion; Yellowstone temporarily closed due to severe flooding; MIIN visitation may have decreased due to high cost of gas and cancelled travel plans.

Credit: Austin Lackey

Significance

Name	Size	Kind
 adapters1.npz	1.7 MB	Document
 adapters2.npz	1.7 MB	Document
 adapters5.npz	13.7 MB	Document

Credit: Austin Lackey



Credit: DALLE 3

Significance

Base Model (GBs)



Swappable Adapters (MB)



All of these Images are Generated by DALLE3



Thanks!