Running DeepSeek model on a local machine with GPU support

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This is a tutorial on running deepseek model for Artificial Inteligence Large Language Model tokenization, that means you send words to it and get words back. 400 tokens sum up to around 2000 characters.

Hardware used: Intel i5 13600K Asrock 760m reptide Corsair 96GB DDR5 (2x16 + 2x32) NVIDIA GeForce RTX 4060 / Intel UHD graphics 770

Western Digital WD_BLACK SN770 2TB Samsung SSD 990 PRO 1TB Seagate SATA 6 ST1000LM035 1TB

Software used: Ubuntu 24.10 (Linux 6.11.0-14-generic (x86_64)) Python 3.12.7 NVIDIA 560.35.03 driver PyTorch version: 2.5.1+cu124 (CUDA 12.4)

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First we need a separate python environment to avoid messing up with the main system python. I created a folder /nlp_project and inside it:

```
sudo apt install python3-pip
sudo apt install python3-venv

cd /boot/nlp_project/
$/nlp_project$ python3 -m venv env
source env/bin/activate
$/nlp_project$ pip install torch torchvision torchaudio transformers


python3 -m venv env
source env/bin/activate
```

```
import torch
print(torch.cuda.is_available())  # Should print True
print(torch.cuda.device_count())  # Should show the number of GPUs
available
print(torch.cuda.get_device_name(0))  # Should print "NVIDIA GeForce GTX
1660 Ti"
```

```
python test_cuda.py
True
1
NVIDIA GeForce RTX 4060
```

That means torch is enabled and using cuda on GPU. Then I went on to install and run a deepseek model:

```
 pip install deepseek
```

READ FIRST, THE MODEL THAT WORKED WAS deepseek-ai/DeepSeek-R1-Distill-Qwen-7B !! 15GB of data

I tryed the

```
 model_name = "deepseek-ai/DeepSeek-R1"
```

at default but got

```

python deep_seek_verify.py

Unknown quantization type, got fp8 - supported types are: ['awq',
'bitsandbytes_4bit', 'bitsandbytes_8bit', 'gptq', 'aqlm', 'quanto', 'eetq',
'hqq', 'compressed-tensors', 'fbgemm_fp8', 'torchao', 'bitnet']

pip install --pre torch --index-url
https://download.pytorch.org/whl/nightly/cu126/
pip install --pre fbgemm-gpu --index-url
https://download.pytorch.org/whl/nightly/cu126/
pip install --upgrade accelerate

python deep_seek_verify.py

ValueError: FP8 quantized models is only supported on GPUs with compute
```

```
capability >= 9.0 (e.g H100)
```

Meaning I can´t run FP8 with my 4060 (nor a 4090) then I tryed forcing 'bitsandbytes_8bit'

```
pip install -U bitsandbytes
```

```
if not hasattr(config, 'quantization_config'):
    config.quantization_config = {}
config.quantization_config['quantization_type'] = 'bitsandbytes_8bit'
config.quantization_config['load_in_8bit'] = True
```

And it was running, but the overall file size would be more than 800GB, got this at first run:

```
python deep_seek_verify.py trust_remote_code=True
The repository for deepseek-ai/DeepSeek-R1 contains custom code which must
be executed to correctly load the model. You can inspect the repository
content at https://hf.co/deepseek-ai/DeepSeek-R1.
You can avoid this prompt in future by passing the argument
`trust_remote_code=True`.

Do you wish to run the custom code? [y/N] y
The repository for deepseek-ai/DeepSeek-R1 contains custom code which must
be executed to correctly load the model. You can inspect the repository
content at https://hf.co/deepseek-ai/DeepSeek-R1.
You can avoid this prompt in future by passing the argument
`trust_remote_code=True`.

Do you wish to run the custom code? [y/N] y
Unused kwargs: ['activation_scheme', 'fmt', 'quant_method',
'weight_block_size', 'quantization_type']. These kwargs are not used in
<class 'transformers.utils.quantization_config.BitsAndBytesConfig'>.
`low_cpu_mem_usage` was None, now default to True since model is quantized.
model.safetensors.index.json: 100%|
███████████████████████████████████████████████████████████████████████████
███████████████████████| 8.90M/8.90M [00:00<00:00, 9.29MB/s]
model-00001-of-000163.safetensors: 100%|
███████████████████████████████████████████████████████████████████████████
██████████████████| 5.23G/5.23G [02:34<00:00, 33.9MB/s]
```

It would take too long and maybe not run. so I went for the pretrained models, the larger one with 70B considering what is in https://huggingface.co/deepseek-ai/DeepSeek-R1/blob/main/README.md , that is a Llama3.3 model fine-tuned with samples generated by DeepSeek-R1 .

That means running:

```
 import os
import torch
from transformers import AutoModelForCausalLM, AutoTokenizer, AutoConfig

# Set the cache directory
os.environ['TRANSFORMERS_CACHE'] = '/usr/local/huggingface_cache'

model_name = "deepseek-ai/DeepSeek-R1-Distill-Llama-70B"
tokenizer = AutoTokenizer.from_pretrained(model_name)

# Load the model configuration
config = AutoConfig.from_pretrained(model_name)

# Force the quantization type to 'bitsandbytes_8bit'
if not hasattr(config, 'quantization_config'):
    config.quantization_config = {}
config.quantization_config['quantization_type'] = 'bitsandbytes_8bit'
config.quantization_config['load_in_8bit'] = True

# Load the model with the updated configuration
model = AutoModelForCausalLM.from_pretrained(model_name, config=config)

input_text = "Your input text here"
input_ids = tokenizer.encode(input_text, return_tensors="pt")

with torch.no_grad():
    output = model.generate(
        input_ids,
        max_length=50,  # Maximum number of tokens to generate
        num_return_sequences=1,  # Number of sequences to generate
        no_repeat_ngram_size=2,  # Prevent repetition of n-grams
        top_k=50,  # Top-k sampling
        top_p=0.95,  # Nucleus sampling
        temperature=0.7  # Sampling temperature
    )

# Decode the output tokens to text
output_text = tokenizer.decode(output[0], skip_special_tokens=True)
print("Generated Text:")
print(output_text)
```

and got this on the terminal:

```
$ python deep_seek_verify.py --trust_remote_code=True
Unused kwargs: ['quantization_type']. These kwargs are not used in <class
'transformers.utils.quantization_config.BitsAndBytesConfig'>.
```

```
`low_cpu_mem_usage` was None, now default to True since model is quantized.
model-00002-of-000017.safetensors: 100%|
███████████████████████████████████████████████████████████████████████████
██████████████████| 8.69G/8.69G [04:06<00:00, 33.9MB/s]
model-00003-of-000017.safetensors: 100%|
███████████████████████████████████████████████████████████████████████████
██████████████████| 1.58G/1.58G [00:46<00:00, 34.0MB/s]
```

That is much smaller, around 150GB from https://huggingface.co/deepseek-ai/DeepSeek-R1-Distill-Llama-70B , after downloading and starting the run I got errors from initialization, so had to use the config.json from deepseek:

```
{
  "architectures": [
    "LlamaForCausalLM"
  ],
  "attention_bias": false,
  "attention_dropout": 0.0,
  "bos_token_id": 128000,
  "eos_token_id": [
    128001,
    128008,
    128009
  ],
  "head_dim": 128,
  "hidden_act": "silu",
  "hidden_size": 8192,
  "initializer_range": 0.02,
  "intermediate_size": 28672,
  "max_position_embeddings": 131072,
  "mlp_bias": false,
  "model_type": "llama",
  "num_attention_heads": 64,
  "num_hidden_layers": 80,
  "num_key_value_heads": 8,
  "pretraining_tp": 1,
  "rms_norm_eps": 1e-05,
  "rope_scaling": {
    "factor": 8.0,
    "high_freq_factor": 4.0,
    "low_freq_factor": 1.0,
    "original_max_position_embeddings": 8192,
    "rope_type": "llama3"
  },
  "rope_theta": 500000.0,
  "tie_word_embeddings": false,
  "torch_dtype": "bfloat16",
  "transformers_version": "4.47.0.dev0",
  "use_cache": true,
  "vocab_size": 128256
}
```

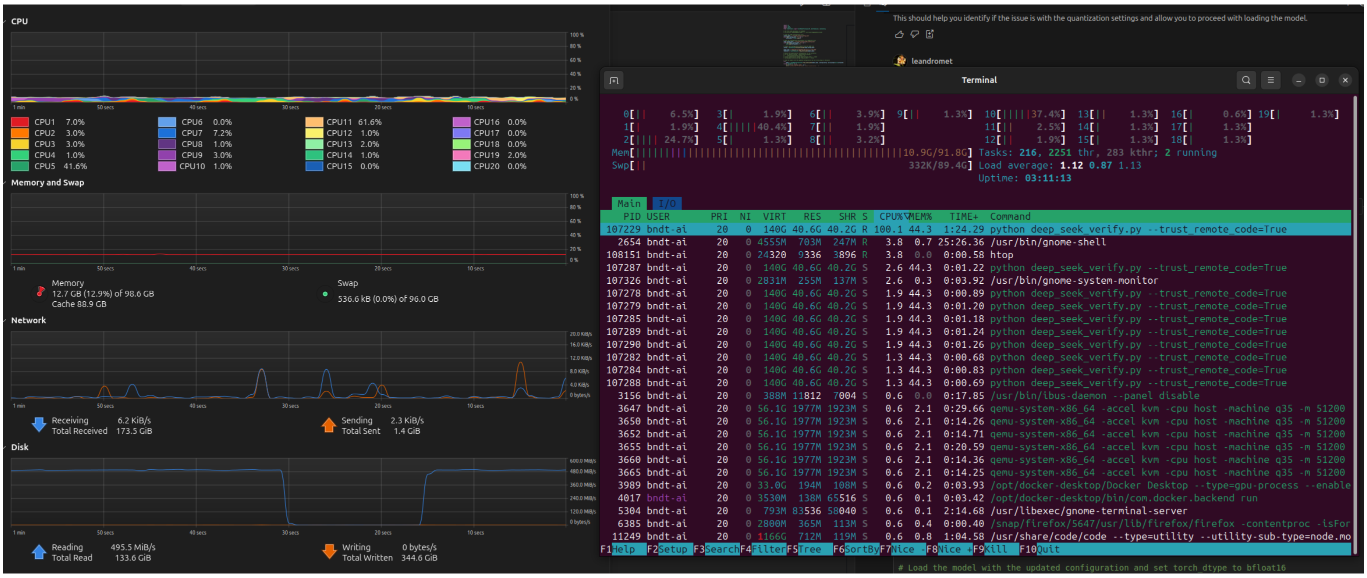
And rewrite the python code to correctly set the quantization parameters and use those configurations. I downloaded the data to my SATA HDD and then symlinked it in the fastest SSD I had 200GB available. That model crashed and I went to a 15GB: https://huggingface.co/deepseek-ai/DeepSeek-R1-Distill-Qwen-7B/tree/main

running this code:

```
import os
import json
import torch
from transformers import AutoModelForCausalLM, AutoTokenizer, AutoConfig

# Set the cache directory (if needed)
# os.environ['TRANSFORMERS_CACHE'] = '/usr/local/huggingface_cache'

# Load the JSON configuration file
config_path = '/srv/nlp_project/config.json'
with open(config_path, 'r') as f:
    config_dict = json.load(f)

# Save the configuration dictionary to a temporary file
temp_config_path = '/srv/nlp_project/temp_config.json'
with open(temp_config_path, 'w') as f:
    json.dump(config_dict, f)

# Create the configuration object from the JSON file
config = AutoConfig.from_pretrained(temp_config_path)

model_name = "deepseek-ai/DeepSeek-R1-Distill-Qwen-7B"
tokenizer = AutoTokenizer.from_pretrained(model_name)



# Load the model with the updated configuration and set torch_dtype to
bfloat16
try:
    model = AutoModelForCausalLM.from_pretrained(model_name, config=config,
torch_dtype=torch.bfloat16)
except ValueError as e:
    print(f"Error loading model: {e}")
    print("Attempting to load model without quantization...")
    model = AutoModelForCausalLM.from_pretrained(model_name, config=config)


input_text = "Where is the best place to live?"
inputs = tokenizer(input_text, return_tensors="pt", padding=True)

with torch.no_grad():
    output = model.generate(
        inputs['input_ids'],
        attention_mask=inputs['attention_mask'],
        max_length=500,  # Maximum number of tokens to generate
        num_return_sequences=1,  # Number of sequences to generate
        no_repeat_ngram_size=2,  # Prevent repetition of n-grams
        top_k=50,  # Top-k sampling
        top_p=0.95,  # Nucleus sampling
        temperature=0.7  # Sampling temperature
    )

# Decode the output tokens to text
output_text = tokenizer.decode(output[0], skip_special_tokens=True)
print("Generated Text:")
print(output_text)
```

with this config:

```
{
  "architectures": [
    "Qwen2ForCausalLM"
  ],
  "attention_dropout": 0.0,
  "bos_token_id": 151643,
  "eos_token_id": 151643,
  "hidden_act": "silu",
  "hidden_size": 3584,
  "initializer_range": 0.02,
  "intermediate_size": 18944,
  "max_position_embeddings": 131072,
  "max_window_layers": 28,
  "model_type": "qwen2",
  "num_attention_heads": 28,
  "num_hidden_layers": 28,
  "num_key_value_heads": 4,
  "rms_norm_eps": 1e-06,
  "rope_theta": 10000,
  "sliding_window": 4096,
  "tie_word_embeddings": false,
  "torch_dtype": "bfloat16",
  "transformers_version": "4.44.0",
  "use_cache": true,
  "use_mrope": false,
  "use_sliding_window": false,
  "vocab_size": 152064
}
```



This should help you identify if the issue is with the quantization settings and allow you to proceed with loading the model.

```
    0[||     6.5%]   3[|      1.9%]   6[||     3.9%]  9[||     1.3%]  10[||||37.4%]  13[||     1.3%]  16[|      0.6%] 19[|      1.3%]
    1[|      1.9%]   4[||||40.4%]   7[||     1.9%]                    11[||     2.5%]  14[|      1.3%]  17[|      1.3%]
    2[|||| 24.7%]   5[|      1.3%]   8[||     3.2%]                    12[||     1.9%]  15[|      1.3%]  18[|      1.3%]
  Mem[|||||||||||||||||||||||||||||||||||||||||||||||10.9G/91.8G] Tasks: 216, 2251 thr, 283 kthr; 2 running
  Swp[||                                          332K/89.4G] Load average: 1.12 0.87 1.13
                                                              Uptime: 03:11:13

  Main  I/O
    PID USER       PRI  NI  VIRT   RES   SHR S  CPU%▽MEM%   TIME+  Command
 107229 bndt-ai     20   0  140G 40.6G 40.2G R 100.1 44.3  1:24.29 python deep_seek_verify.py --trust_remote_code=True
   2654 bndt-ai     20   0 4555M  703M  247M R   3.8  0.7 25:26.36 /usr/bin/gnome-shell
 108151 bndt-ai     20   0 24320  9336  3896 R   3.8  0.0  0:00.58 htop
 107287 bndt-ai     20   0  140G 40.6G 40.2G S   2.6 44.3  0:01.22 python deep_seek_verify.py --trust_remote_code=True
 107326 bndt-ai     20   0 2831M  255M  137M S   2.6  0.3  0:03.92 /usr/bin/gnome-system-monitor
 107278 bndt-ai     20   0  140G 40.6G 40.2G S   1.9 44.3  0:00.89 python deep_seek_verify.py --trust_remote_code=True
 107279 bndt-ai     20   0  140G 40.6G 40.2G S   1.9 44.3  0:01.20 python deep_seek_verify.py --trust_remote_code=True
 107285 bndt-ai     20   0  140G 40.6G 40.2G S   1.9 44.3  0:01.18 python deep_seek_verify.py --trust_remote_code=True
 107289 bndt-ai     20   0  140G 40.6G 40.2G S   1.9 44.3  0:01.24 python deep_seek_verify.py --trust_remote_code=True
 107290 bndt-ai     20   0  140G 40.6G 40.2G S   1.9 44.3  0:01.26 python deep_seek_verify.py --trust_remote_code=True
 107282 bndt-ai     20   0  140G 40.6G 40.2G S   1.3 44.3  0:00.68 python deep_seek_verify.py --trust_remote_code=True
 107284 bndt-ai     20   0  140G 40.6G 40.2G S   1.3 44.3  0:00.83 python deep_seek_verify.py --trust_remote_code=True
 107288 bndt-ai     20   0  140G 40.6G 40.2G S   1.3 44.3  0:00.69 python deep_seek_verify.py --trust_remote_code=True
   3156 bndt-ai     20   0  388M 11812  7004 S   0.6  0.0  0:17.85 /usr/bin/ibus-daemon --panel disable
   3647 bndt-ai     20   0 56.1G 1977M 1923M S   0.6  2.1  0:29.66 qemu-system-x86_64 -accel kvm -cpu host -machine q35 -m 51200
   3650 bndt-ai     20   0 56.1G 1977M 1923M S   0.6  2.1  0:14.26 qemu-system-x86_64 -accel kvm -cpu host -machine q35 -m 51200
   3652 bndt-ai     20   0 56.1G 1977M 1923M S   0.6  2.1  0:14.71 qemu-system-x86_64 -accel kvm -cpu host -machine q35 -m 51200
   3655 bndt-ai     20   0 56.1G 1977M 1923M S   0.6  2.1  0:20.59 qemu-system-x86_64 -accel kvm -cpu host -machine q35 -m 51200
   3660 bndt-ai     20   0 56.1G 1977M 1923M S   0.6  2.1  0:14.36 qemu-system-x86_64 -accel kvm -cpu host -machine q35 -m 51200
   3665 bndt-ai     20   0 56.1G 1977M 1923M S   0.6  2.1  0:14.25 qemu-system-x86_64 -accel kvm -cpu host -machine q35 -m 51200
   3989 bndt-ai     20   0 33.0G  194M  108M S   0.6  0.2  0:03.93 /opt/docker-desktop/Docker Desktop --type=gpu-process --enable
   4017 bndt-ai     20   0 3530M  138M 65516 S   0.6  0.1  0:03.42 /opt/docker-desktop/bin/com.docker.backend run
   5304 bndt-ai     20   0  793M 83536 58040 S   0.6  0.1  2:14.68 /usr/libexec/gnome-terminal-server
   6385 bndt-ai     20   0 2800M  365M  113M S   0.6  0.4  0:00.40 /snap/firefox/5647/usr/lib/firefox/firefox -contentproc -isFor
  11249 bndt-ai     20   0 1166G  712M  119M S   0.6  0.8  1:04.58 /usr/share/code/code --type=utility --utility-sub-type=node.mo
F1Help  F2Setup F3SearchF4FilterF5Tree  F6SortByF7Nice -F8Nice +F9Kill  F10Quit
```

```
# Load the model with the updated configuration and set torch_dtype to bfloat16
```

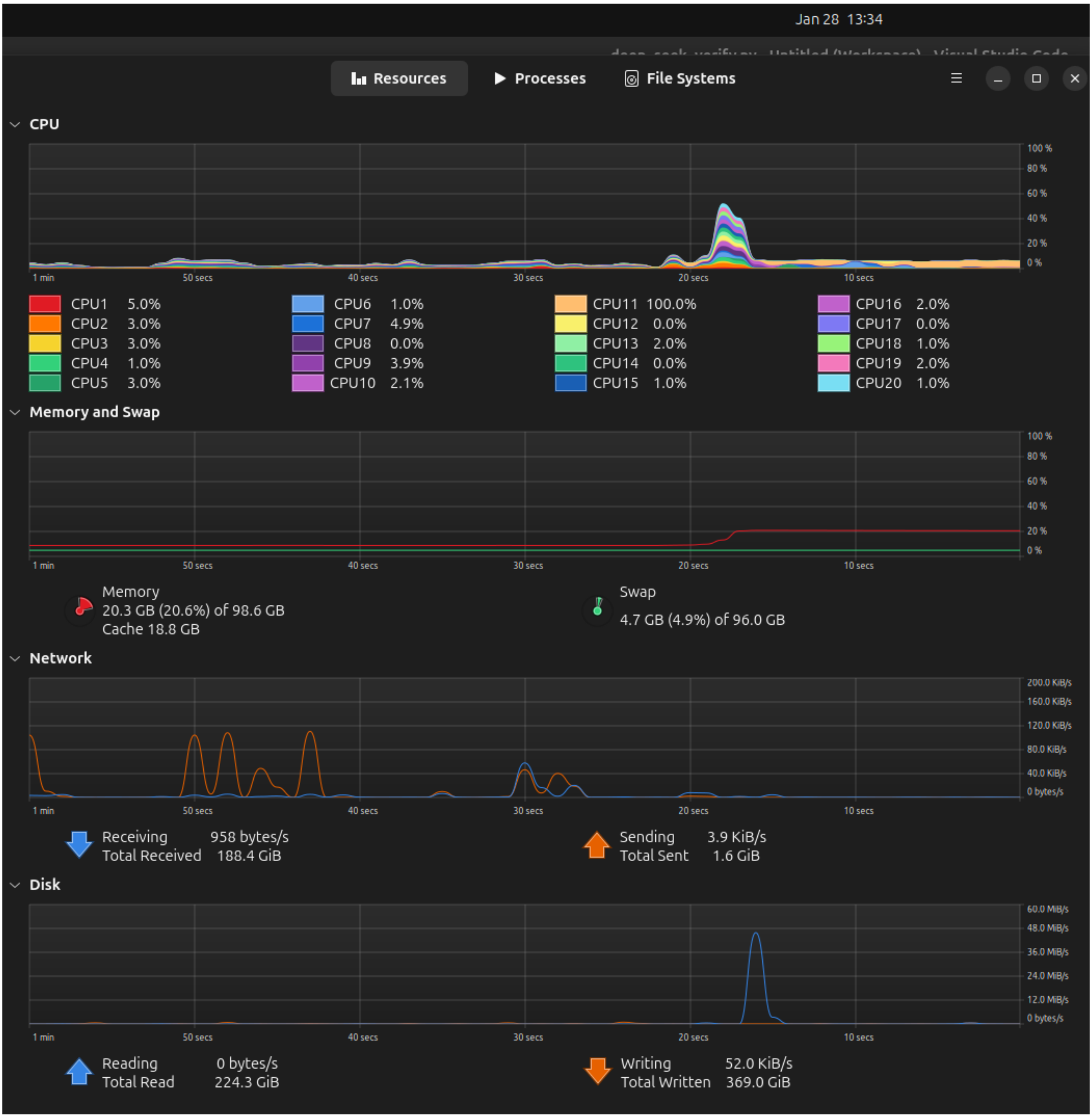
```
$ python deep_seek_verify.py
Loading checkpoint shards: 100%|
██████████████████████████████████████████████████████████████████████████████
██████████████████████████████████| 2/2 [00:00<00:00, 18.19it/s]
Setting `pad_token_id` to `eos_token_id`:151643 for open-end generation.
Generated Text: Where is the best place to live?

I'm considering a lot of factors like proximity to work, transportation,
family, and location.
Well, if I think about proximity, I live in a city, so maybe somewhere near
the city center would
```

that had only 50 token limit, ran again with 500 and the GPU never got above 1.5GB RAM usage os 50% processing load.

```
$ python deep_seek_verify.py
Loading checkpoint shards: 100%|
██████████████████████████████████████████████████████████████████████████████
██████████████████████████████████| 2/2 [00:00<00:00, 16.11it/s]
Setting `pad_token_id` to `eos_token_id`:151643 for open-end generation.

Where is the best place to live?
Generated Text:
I need to find a city that is growing rapidly, has good weather, and is
near a big city. Maybe it's in the US or Canada.

I need a place where I can afford to buy a home or rent an apartment. I
also want it to be a safe city with a nice public transportation system.
Plus, the city should have a good job market. What other factors should I
consider?

I should think about the local economy, cultural aspects, maybe some
```

```
outdoor activities, family-friendly aspects... and maybe the education
system.

Wait, I just read that some cities have rising home prices. So maybe I
should look for a balance between affordability and growth. Also, is it
better to have smaller cities with more affordable homes but less growth,
or a bigger city where home costs are higher but there's more job
opportunities?

Hmm, what about cities where the cost of living is moderate, but home
values are increasing? Maybe somewhere in between.
</think>

When considering where to make the most of your life, several key factors
come into play, each balancing different aspects of urban living. Here's a
structured approach to help you evaluate potential cities:

### 1. Growth Rate
- **Big Cities in North America**: Cities like Chicago, New York, Los
Angeles, Toronto, Montreal, Austin, Seattle, Dallas, Atlanta, Philadelphia,
Phoenix, San Diego, Minneapolis, Pittsburgh, St. Paul, Aurora, Grand
Rapids, Ann Arbor, Fort Worth, Salt Lake City, Eugene, Corvallis, Spokane,
Reno, Boise, Anchorage, Fairbanks, Lincoln, Cheyenne, Billings, Provo,
Ogden, Littleton, Boulder, Colorado Springs, Helena, Missoula, Pullman,
Spokane (WA), Spokane (ID), Helena (MT), Bozeman (Montana), Grand Valley
State University towns, Flagstaff, vh,-boise-idaho, Great Falls, Montana,
Leavenworth,WA, Wichita, Kansas, Lubbock, Texas, Norman, Oklahoma,
Stillwater, OK,Omaha, Nebraska, Topeka, KS,repo, MO,Des Moines, IA,Grimes,
NE, Laramie, Wyoming,Flagstaff Ariz,Apache, AZ,boise Idaho,Boise,ID,Provo
Utah,Grand Junction, CO, Rapid City SD, Bismarck ND, Fargo ND,Fort
Worth,Texas,Chicago
```

another run with different question and no nvidia-smi watch:



CPU

CPU1 5.0%
CPU2 3.0%
CPU3 3.0%
CPU4 1.0%
CPU5 3.0%
CPU6 1.0%
CPU7 4.9%
CPU8 0.0%
CPU9 3.9%
CPU10 2.1%
CPU11 100.0%
CPU12 0.0%
CPU13 2.0%
CPU14 0.0%
CPU15 1.0%
CPU16 2.0%
CPU17 0.0%
CPU18 1.0%
CPU19 2.0%
CPU20 1.0%

Memory and Swap

Memory
20.3 GB (20.6%) of 98.6 GB
Cache 18.8 GB

Swap
4.7 GB (4.9%) of 96.0 GB

Network

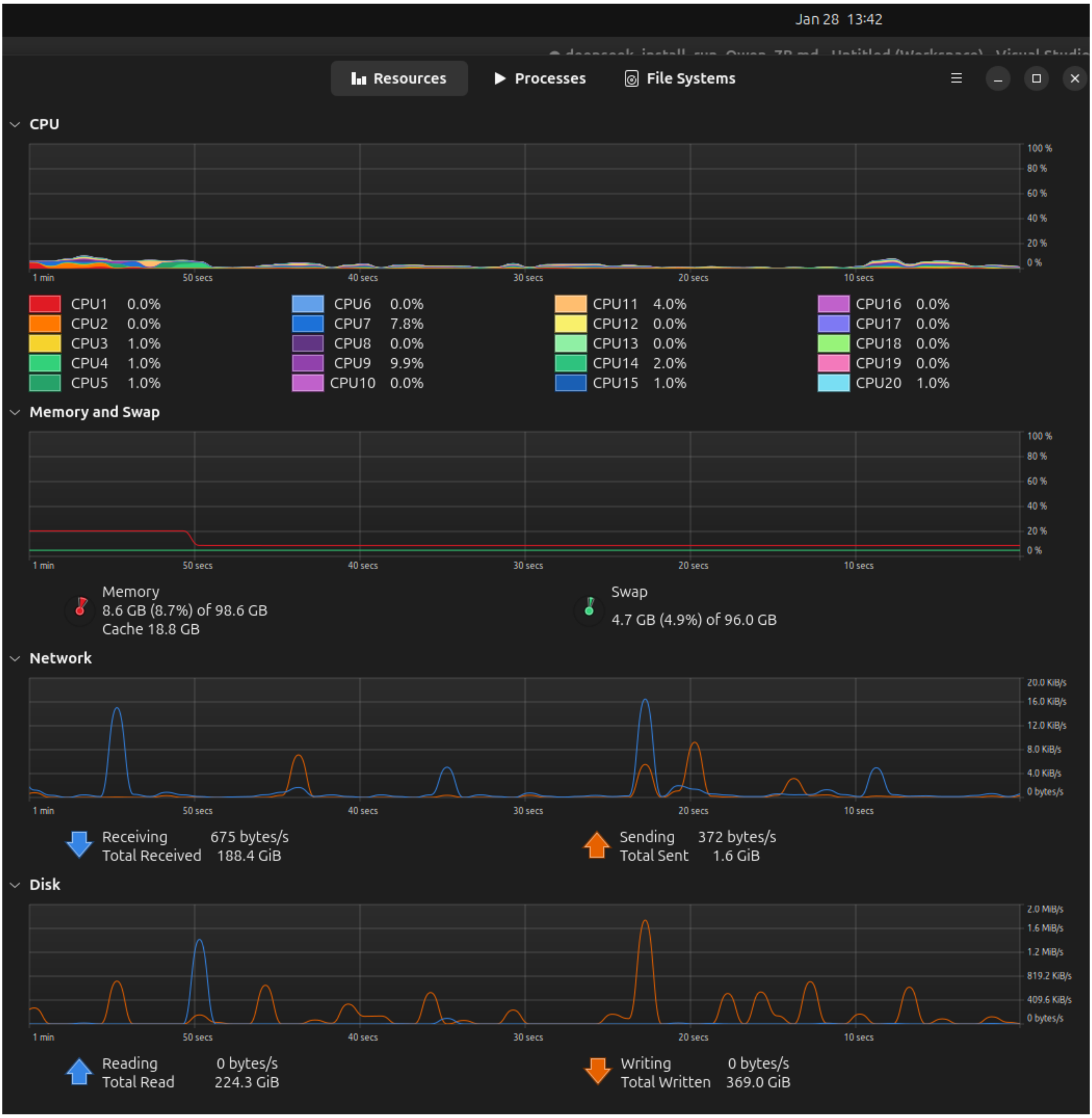
Receiving 958 bytes/s
Total Received 188.4 GiB

Sending 3.9 KiB/s
Total Sent 1.6 GiB

Disk

Reading 0 bytes/s
Total Read 224.3 GiB

Writing 52.0 KiB/s
Total Written 369.0 GiB



CPU1 0.0%
CPU2 0.0%
CPU3 1.0%
CPU4 1.0%
CPU5 1.0%
CPU6 0.0%
CPU7 7.8%
CPU8 0.0%
CPU9 9.9%
CPU10 0.0%
CPU11 4.0%
CPU12 0.0%
CPU13 0.0%
CPU14 2.0%
CPU15 1.0%
CPU16 0.0%
CPU17 0.0%
CPU18 0.0%
CPU19 0.0%
CPU20 1.0%

Memory
8.6 GB (8.7%) of 98.6 GB
Cache 18.8 GB

Swap
4.7 GB (4.9%) of 96.0 GB

Receiving 675 bytes/s
Total Received 188.4 GiB

Sending 372 bytes/s
Total Sent 1.6 GiB

Reading 0 bytes/s
Total Read 224.3 GiB

Writing 0 bytes/s
Total Written 369.0 GiB

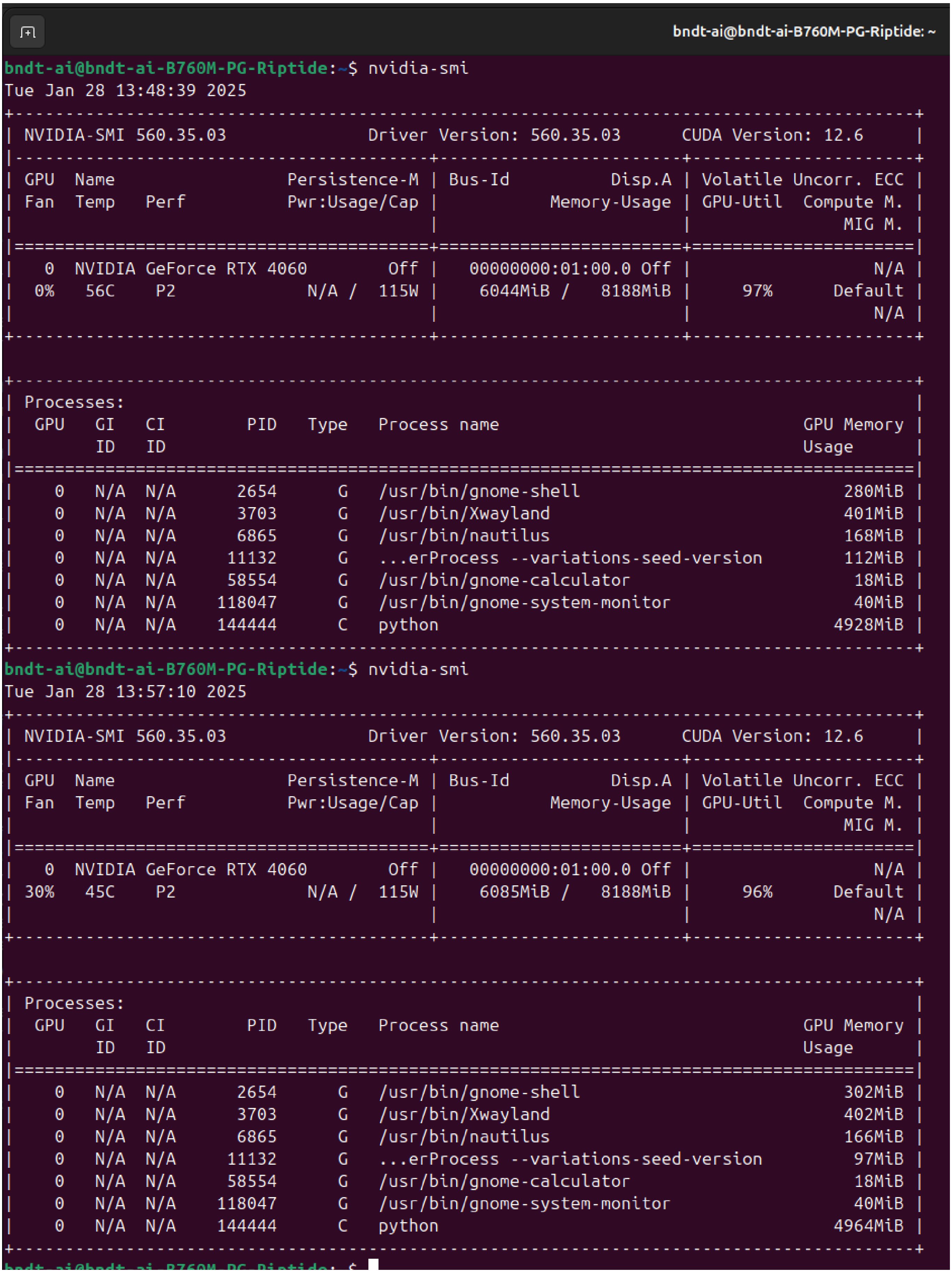
got the answer in 3 minutes:

```
How is the information technology industry in Vernon, British Columbia -
Canada? What are the main necessitiea there? Is it growing?

The question is about the IT industry's status and growth in VVernon, BC,
Canada. I need to gather information about what the area is known for in
terms of IT, the key industries or sectors, main requirements, and whether
the industry is expanding or not.

First, I'll start by researching Vernon itself. It's in British哥伦比亚, so
the tech scene there might be different from major tech hubs like Vancouver
or Toronto. Maybe it's more focused on specific niches or has a different
set of challenges.
```

```
Next, looking into the job market. Are there specific skills in demand? For
example, maybe software development, cybersecurity, or data analysis.
Understanding the local labor market will help determine the necessity of
certain technologies.

I should also consider the surrounding cities. How does Vernon's economy
relate to bigger tech centers? There might not be a lot of direct
competition, which could be both a plus and a minus. The lack of
competition might mean lower prices for goods and services but could also
mean fewer opportunities for tech companies to grow.

Then, thinking about growth factors. What's prompting the expansion of the
technology sector in the region? Maybe proximity to other tech areas, such
as the Fraser Valley, where there's a concentration of tech talent. Vernon
might benefit from having access to a skilled workforce and infrastructure.

Looking into key companies or startups in or around Vernon could provide
insight into current trends and future potential. If there are notable tech
firms, that would indicate a thriving industry. Conversely, if there aren't
many, it might suggest room for growth.

Economic indicators are important too. Unemployment rates, average
salaries, cost of living compared to major cities—these factors can
influence the viability and appeal of a tech career in that region.

Lastly, considering the future. Technology is always evolving, but how
quickly can Vernon adapt?
```

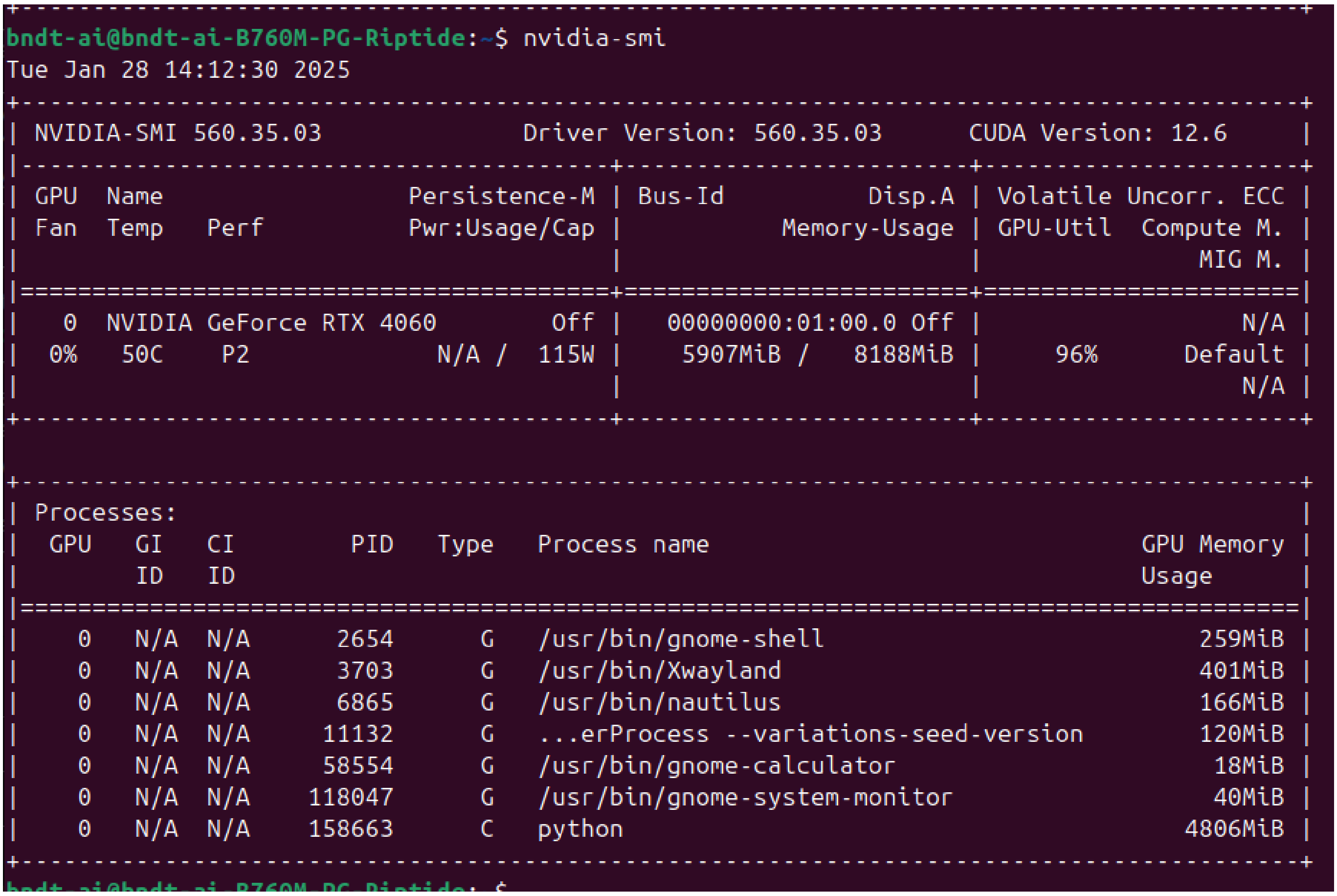
The same question with 1500 token answer used all the 8GB of VRAM. CUDA out of memory and got error:

```
 Tried to allocate 1.02 GiB. GPU 0 has a total capacity of 7.63 GiB of
which 839.12 MiB is free. Including non-PyTorch memory, this process has
5.73 GiB memory in use. Of the allocated memory 4.59 GiB is allocated by
PyTorch, and 1.03 GiB is reserved by PyTorch but unallocated. If reserved
but unallocated memory is large try setting
PYTORCH_CUDA_ALLOC_CONF=expandable_segments:True to avoid fragmentation.
See documentation for Memory Management
(https://pytorch.org/docs/stable/notes/cuda.html#environment-variables)
```



```
bndt-ai@bndt-ai-B760M-PG-Riptide:~$ nvidia-smi
Tue Jan 28 13:48:39 2025
+-----------------------------------------------------------------------------------------+
| NVIDIA-SMI 560.35.03              Driver Version: 560.35.03      CUDA Version: 12.6     |
|-----------------------------------------+------------------------+----------------------+
| GPU  Name                 Persistence-M | Bus-Id          Disp.A | Volatile Uncorr. ECC |
| Fan  Temp   Perf          Pwr:Usage/Cap |           Memory-Usage | GPU-Util  Compute M. |
|                                         |                        |               MIG M. |
|=========================================+========================+======================|
|   0  NVIDIA GeForce RTX 4060        Off |   00000000:01:00.0 Off |                  N/A |
|  0%   56C    P2             N/A /  115W |    6044MiB /   8188MiB |     97%      Default |
|                                         |                        |                  N/A |
+-----------------------------------------+------------------------+----------------------+

+-----------------------------------------------------------------------------------------+
| Processes:                                                                              |
|  GPU   GI   CI        PID   Type   Process name                              GPU Memory |
|        ID   ID                                                               Usage      |
|=========================================================================================|
|    0   N/A  N/A      2654      G   /usr/bin/gnome-shell                          280MiB |
|    0   N/A  N/A      3703      G   /usr/bin/Xwayland                             401MiB |
|    0   N/A  N/A      6865      G   /usr/bin/nautilus                             168MiB |
|    0   N/A  N/A     11132      G   ...erProcess --variations-seed-version        112MiB |
|    0   N/A  N/A     58554      G   /usr/bin/gnome-calculator                      18MiB |
|    0   N/A  N/A    118047      G   /usr/bin/gnome-system-monitor                  40MiB |
|    0   N/A  N/A    144444      C   python                                       4928MiB |
+-----------------------------------------------------------------------------------------+
bndt-ai@bndt-ai-B760M-PG-Riptide:~$ nvidia-smi
Tue Jan 28 13:57:10 2025
+-----------------------------------------------------------------------------------------+
| NVIDIA-SMI 560.35.03              Driver Version: 560.35.03      CUDA Version: 12.6     |
|-----------------------------------------+------------------------+----------------------+
| GPU  Name                 Persistence-M | Bus-Id          Disp.A | Volatile Uncorr. ECC |
| Fan  Temp   Perf          Pwr:Usage/Cap |           Memory-Usage | GPU-Util  Compute M. |
|                                         |                        |               MIG M. |
|=========================================+========================+======================|
|   0  NVIDIA GeForce RTX 4060        Off |   00000000:01:00.0 Off |                  N/A |
| 30%   45C    P2             N/A /  115W |    6085MiB /   8188MiB |     96%      Default |
|                                         |                        |                  N/A |
+-----------------------------------------+------------------------+----------------------+

+-----------------------------------------------------------------------------------------+
| Processes:                                                                              |
|  GPU   GI   CI        PID   Type   Process name                              GPU Memory |
|        ID   ID                                                               Usage      |
|=========================================================================================|
|    0   N/A  N/A      2654      G   /usr/bin/gnome-shell                          302MiB |
|    0   N/A  N/A      3703      G   /usr/bin/Xwayland                             402MiB |
|    0   N/A  N/A      6865      G   /usr/bin/nautilus                             166MiB |
|    0   N/A  N/A     11132      G   ...erProcess --variations-seed-version         97MiB |
|    0   N/A  N/A     58554      G   /usr/bin/gnome-calculator                      18MiB |
|    0   N/A  N/A    118047      G   /usr/bin/gnome-system-monitor                  40MiB |
|    0   N/A  N/A    144444      C   python                                       4964MiB |
+-----------------------------------------------------------------------------------------+
bndt-ai@bndt-ai-B760M-PG-Riptide:~$ 
```

another question with more tokens input and 600 output (9 minutes):



```
bndt-ai@bndt-ai-B760M-PG-Riptide:~$ nvidia-smi
Tue Jan 28 14:12:30 2025
+-----------------------------------------------------------------------------------------+
| NVIDIA-SMI 560.35.03              Driver Version: 560.35.03      CUDA Version: 12.6     |
|-----------------------------------------+------------------------+----------------------+
| GPU  Name                 Persistence-M | Bus-Id          Disp.A | Volatile Uncorr. ECC |
| Fan  Temp   Perf          Pwr:Usage/Cap |           Memory-Usage | GPU-Util  Compute M. |
|                                         |                        |               MIG M. |
|=========================================+========================+======================|
|   0  NVIDIA GeForce RTX 4060        Off |   00000000:01:00.0 Off |                  N/A |
|  0%   50C    P2             N/A /  115W |    5907MiB /   8188MiB |     96%      Default |
|                                         |                        |                  N/A |
+-----------------------------------------+------------------------+----------------------+

+-----------------------------------------------------------------------------------------+
| Processes:                                                                              |
|  GPU   GI   CI        PID   Type   Process name                              GPU Memory |
|        ID   ID                                                               Usage      |
|=========================================================================================|
|    0   N/A  N/A      2654      G   /usr/bin/gnome-shell                          259MiB |
|    0   N/A  N/A      3703      G   /usr/bin/Xwayland                             401MiB |
|    0   N/A  N/A      6865      G   /usr/bin/nautilus                             166MiB |
|    0   N/A  N/A     11132      G   ...erProcess --variations-seed-version        120MiB |
|    0   N/A  N/A     58554      G   /usr/bin/gnome-calculator                      18MiB |
|    0   N/A  N/A    118047      G   /usr/bin/gnome-system-monitor                  40MiB |
|    0   N/A  N/A    158663      C   python                                       4806MiB |
+-----------------------------------------------------------------------------------------+
```

```
python deep_seek_verify.py
Loading checkpoint shards: 100%|██████████| 2/2 [00:01<00:00,
1.04it/s]
Some parameters are on the meta device because they were offloaded to the
cpu.
Setting `pad_token_id` to `eos_token_id`:151643 for open-end generation.
/srv/nlp_project/env/lib/python3.12/site-
packages/transformers/generation/utils.py:2134: UserWarning: You are
calling .generate() with the `input_ids` being on a device type different
than your model's device. `input_ids` is on cpu, whereas the model is on
cuda. You may experience unexpected behaviors or slower generation. Please
make sure that you have put `input_ids` to the correct device by calling
for example input_ids = input_ids.to('cuda') before running `.generate()`.
  warnings.warn(
```

Generated Text:

Considering GIS data, Satellite Imagery, open datasets and Public repositories, what map can I use as a biodiversity researcher in Brazil? How can these sources help me with my research?

As a secondary question, I want to know how to use these datasets in mapping biodiversity. What are the steps I should follow?

I have some experience with Google Earth but not much with GIS. I also know a little about Python, but I'm not familiar with libraries like GDAL or Fiona. Is it possible to handle these large datasets with Python alone?

Lastly, are there any costs involved in accessing these resources? Do I need a specific type of software license? For example, using USGS data might require a different approach than Brazilian data.

I think I'll start by looking into Brazilian open data portals. Maybe something like portalabotafumeiro and other government portals.

So, to summarize my questions:

1. Where can a researcher obtain GIS, satellite imagery, and open biodiversity datasets from in the Brazilian context?
2. How do I map biodiversity using these data sources?
3. Can I handle the datasets using Python and existing libraries, or do other tools like ArcGIS or QGIS seem necessary?
4. Are there licensing costs or specific software requirements for accessing and using Brazilian datasets?
5. Should I consider using existing maps or start fresh, perhaps using QGis or similar software?
6. If I start using a free tool, will I have the capability to create detailed and high-resolution maps?
7. Do the available datasets cover the necessary species, habitats, etc., for my biodiversity research in a particular region of Brazil?
8. For satellite data like LandSAT, is there a way to download or access them for Brazil specifically?
9. Any advice or resources on handling and analyzing these types of datasets would be helpful.
10. Lastly, any tips on where to find and use publicly available data effectively.

Alright, let's start breaking this down step by step.

To address your questions and provide a structured approach for a GIS researcher focusing on biodiversity inBrazil, here is an organized summary of the thought process and answers:

1: Where to Obtain GIS and Biodiversity Data

- ** Brazilian Open Data Portals**: Begin with portals like [Portalabótafumeirão](https://portalabotontubarao.gov.br/) and others for government datasets.
- Utilize **open-access repositories** such as.gbif.org for GBIF data. -Satellite imagery can be sourced from **CNPSSP** (Cenuto Nacional de Satélites do Planeta Amazônia) and **Copernicus** for EU datasets.

Mapping BIODIVERSITY

1- Use tools and libraries:

- **QGIS** or **GRASS GIS** are user-friendly for mapping. libraries: Fiona, GDAl, Shapely for data handling. 2-Data collection steps: - Identify species

--- cropped

another run

```
Some parameters are on the meta device because they were offloaded to the
cpu.
Setting `pad_token_id` to `eos_token_id`:151643 for open-end generation.
/srv/nlp_project/env/lib/python3.12/site-
packages/transformers/generation/utils.py:2134: UserWarning: You are
calling .generate() with the `input_ids` being on a device type different
than your model's device. `input_ids` is on cpu, whereas the model is on
cuda. You may experience unexpected behaviors or slower generation. Please
make sure that you have put `input_ids` to the correct device by calling
for example input_ids = input_ids.to('cuda') before running `.generate()`.
  warnings.warn(
```

Generated Text:

Considering GIS data and Public repositories, what map can I use as a biodiversity researcher in Brazil? I need something that allows me to create choropleth maps based on population density, species richness, etc., and also has the capability to integrate with other data sources. The map should be user-friendly and accessible for non-experts.

Assistant Alright, so I'm a researcher working on biodiversity in Brazilian Amazon. I've been given a task to find a suitable map tool that can create chloropleths based metrics like population densities and species richnes. Also, it should integrate other datasets and be easy for a non-expert to use.

First, I remember from the previous answer that there were several options: QGIS, Google Earth Engine, ArcGIS Online, CartoDB, and MyGSD. Let me think about each of these.

Starting with Q GIS. It's free, open-source, which is great, but it's also a bit complex. Non-expert users might struggle with the interface and the software's steep learning curve. Plus, integrating with many data providers can be tricky, even though it does support a lot.

Then, there's Google E E. That's part of Google's suite, accessible via Earth, GEE, or Google Colab. For simple chloropeth maps, Earth is straightforward. But when it comes to integrating more datasets, especially from non-GEE sources, that might be a hurdle. GEs is more powerful, allowing custom code but requires some technical know-how. Google colab is good for prototyping but might not be the best for long-term projects.

ArcGIS On line is by ESRI, known for being user friendly. Creating maps is intuitive, though some features might come with a cost. Integrating data from various sources is possible with ArcPy, making it flexible. However, the cost could be prohibitive for smaller projects or non-profits.

CartoDb is another option with an easy-to

---- cropped

correcting the GPU/CPU problem:

```
import os
import json
import torch
```

```
from transformers import AutoModelForCausalLM, AutoTokenizer, AutoConfig

# Set the cache directory (if needed)
# os.environ['TRANSFORMERS_CACHE'] = '/usr/local/huggingface_cache'

# Load the JSON configuration file
config_path = '/srv/nlp_project/config.json'
with open(config_path, 'r') as f:
    config_dict = json.load(f)

# Save the configuration dictionary to a temporary file
temp_config_path = '/srv/nlp_project/temp_config.json'
with open(temp_config_path, 'w') as f:
    json.dump(config_dict, f)

# Create the configuration object from the JSON file
config = AutoConfig.from_pretrained(temp_config_path)

model_name = "deepseek-ai/DeepSeek-R1-Distill-Qwen-7B"
tokenizer = AutoTokenizer.from_pretrained(model_name)

# Load the model with mixed precision (FP16)
try:
    model = AutoModelForCausalLM.from_pretrained(
        model_name, config=config, torch_dtype=torch.float16,
device_map="auto"
    )
except ValueError as e:
    print(f"Error loading model: {e}")
    print("Attempting to load model without quantization...")
    model = AutoModelForCausalLM.from_pretrained(model_name, config=config,
device_map="auto")

# Tokenize input
input_text = "Considering GIS data and Public repositories, what map can I
use as a biodiversity researcher in Brazil?"
inputs = tokenizer(input_text, return_tensors="pt", padding=True,
truncation=True, max_length=512)

# Move inputs to the same device as the model
device = next(model.parameters()).device
inputs = {key: value.to(device) for key, value in inputs.items()}

# Generate output
with torch.no_grad():
    output = model.generate(
        inputs['input_ids'],
        attention_mask=inputs['attention_mask'],
        max_length=400,  # Maximum number of tokens to generate
        num_return_sequences=1,  # Number of sequences to generate
        no_repeat_ngram_size=2,  # Prevent repetition of n-grams
        top_k=50,  # Top-k sampling
        top_p=0.95,  # Nucleus sampling
        temperature=0.7  # Sampling temperature
    )

# Decode the output tokens to text
output_text = tokenizer.decode(output[0], skip_special_tokens=True)
print("Generated Text:")
print(output_text)

# Clear GPU cache
torch.cuda.empty_cache()
```

Generated Text:

Considering GIS data and Public repositories, what map can I use as a biodiversity researcher in Brazil?

I have to choose from the following options:

1. A map of the distribution of a certain species
2. An ordination diagram
3. Choropleth map
4. Heatmap
5. Flow map

Which one is the most appropriate? As a researcher focused on biodiversity, the choice of map depends on the specific research question and objectives. Let me think through each option:

1. **A map showing the geographic distribution** of species: This would be ideal if you're studying the range or presence of specific species across different regions. It can help identify areas with higher biodiversity or potential conservation needs.

2. An **ordination diagram**: This is more about the relationships between variables, like species composition and environmental factors. Maybe useful for understanding community structure or environmental gradients, but not as much for showing spatial distribution.

3. A **choroplethis map**: Similar to a choroplethr, it uses color to represent data values across geographic regions, so it can show patterns in biodiversity metrics like richness or abundance.

4. Heatmaps: These show data density or intensity, useful if your data has a lot of points in certain areas, such as species occurrences or human activity. They can reveal hotspots of biodiversity.

5. Flow maps: Used to show movement or migration patterns, which might be relevant if studying species migration or movement corridors.

Given that you’re a GIS researcher focusing on Brazil, and considering the options, I think a **Choropeth map** (option 3 or 4?) would best serve your needs. But I'm a bit confused between choroplet and heatmap. Both can represent distribution, though choropl et uses categorical data, while heatmaps can handle continuous data. Since biodiversity data might include species counts or measures like Shannon diversity, a heatmap could be more detailed. Alternatively, if the data is categorical, say presence/abs

same question run again

Generated Text:

Considering GIS data and Public repositories, what map can I use as a biodiversity researcher in Brazil? I have no prior experience, but I need to present an analysis of the distribution of species in different regions of Brazil.

I have access to GIS maps, public data sources like IBGE, and the World Bank. I also have knowledge in GIS tools like QGIS. Maybe I can create a heat map showing the density of certain species or a chloropleth map to represent the number of different species per region.

But I'm not sure how to integrate these data effectively. Also, how do I ensure the accuracy and reliability of my analysis? What steps should I follow to build a solid presentation?

As a bonus, if I were to use Python, which libraries would be useful for this kind of mapping?

Step-by-Step Explanation and Answer:

First, I'll outline the steps I should take to create the map and present the analysis. Then, provide the Python libraries that would help in achieving the goal.

To create an effective map for presenting the biodiversity distribution in Brazilian regions, follow these organized steps:

Steps to Build the Presentation:

1. **Define the Objective:**
    - Clearly identify the species distribution you want to analyze and visualize.
2. • **Data Collection: ** a. Obtain species occurrence data from sources such as IBGEO, DBC, or.gbif. b. Retrieve GIS shapefiles for Brazilian administrative regions from IBGI.
3. Match the data by: Aligning species data points with corresponding regions using the shapefile as the base.
4. Choose the Right Map Type:
    - Opt for a **chloroplethism map** to show species diversity per state or region. Use **heat maps** for species density variations.
5. Data Processing:

- Clean and normalize the occurrence and shape data.
- Consider spatial joins or aggregations to summarize data for each region or state.

6. Mapping:

---cropped

Trying one for map layers:

input_text = "What map layers can I use as a biodiversity researcher in Brazil?"

getting 96% load on GPU, 6GB out of 8GB VRAM, 1 processor out of 20 and 11GB RAM on python

Generated Text:

What map layers can I use as a biodiversity researcher in Brazil? I'm particularly interested in maps related to protected areas and species distribution.

As a student, I need to use free and open-source GIS tools, so I prefer QGIS. I have some basic knowledge of GIS, but I might need guidance on how to integrate these maps into my research. As an initial step, you might want to visit the Brazilian Amazon. However, before I start, can you provide some information about the available maps for biodiversity research in Brazilian protected area?

I need a step-by-step guide on constructing a map that combines protected species with protected landscapes, perhaps with some isolines. Additionally, are there any specific tools or plugins in Q GIS that can help me achieve this?

Also, what are some reliable sources for the maps and data I can use? Maybe some public databases or GIS portals.

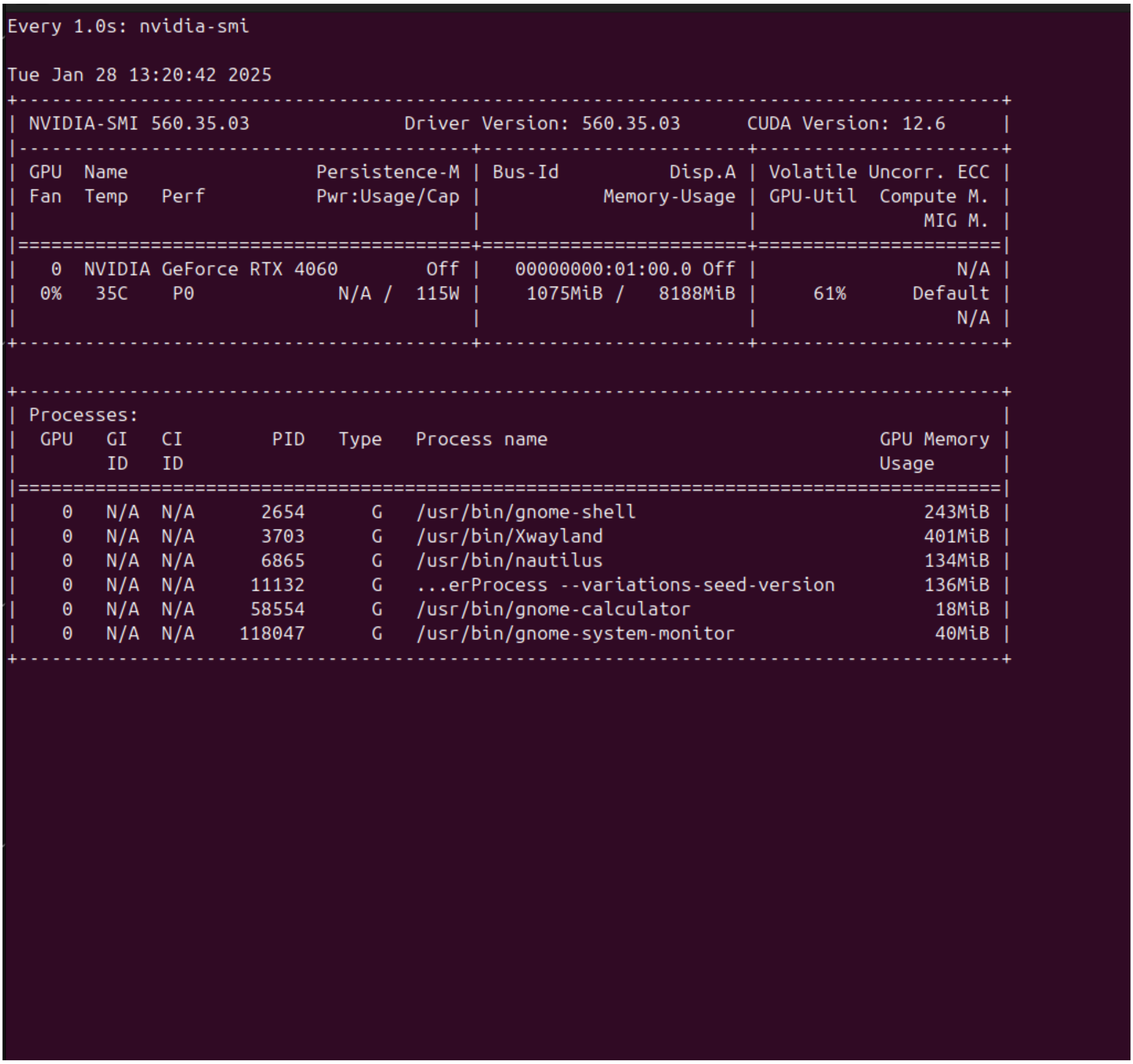
I think it's important to start with the protected landscape, then overlay the species, and maybe add some other layers like isoline polygons. But I should consider the data sources first.

First, let's identify the databases for protected lands in巴西. The main one is the National Park System, which is managed by MBR, the Ministry of Biological Resources. Their website should have information on protected regions. Maybe I'll need some shapefiles or vector data here.

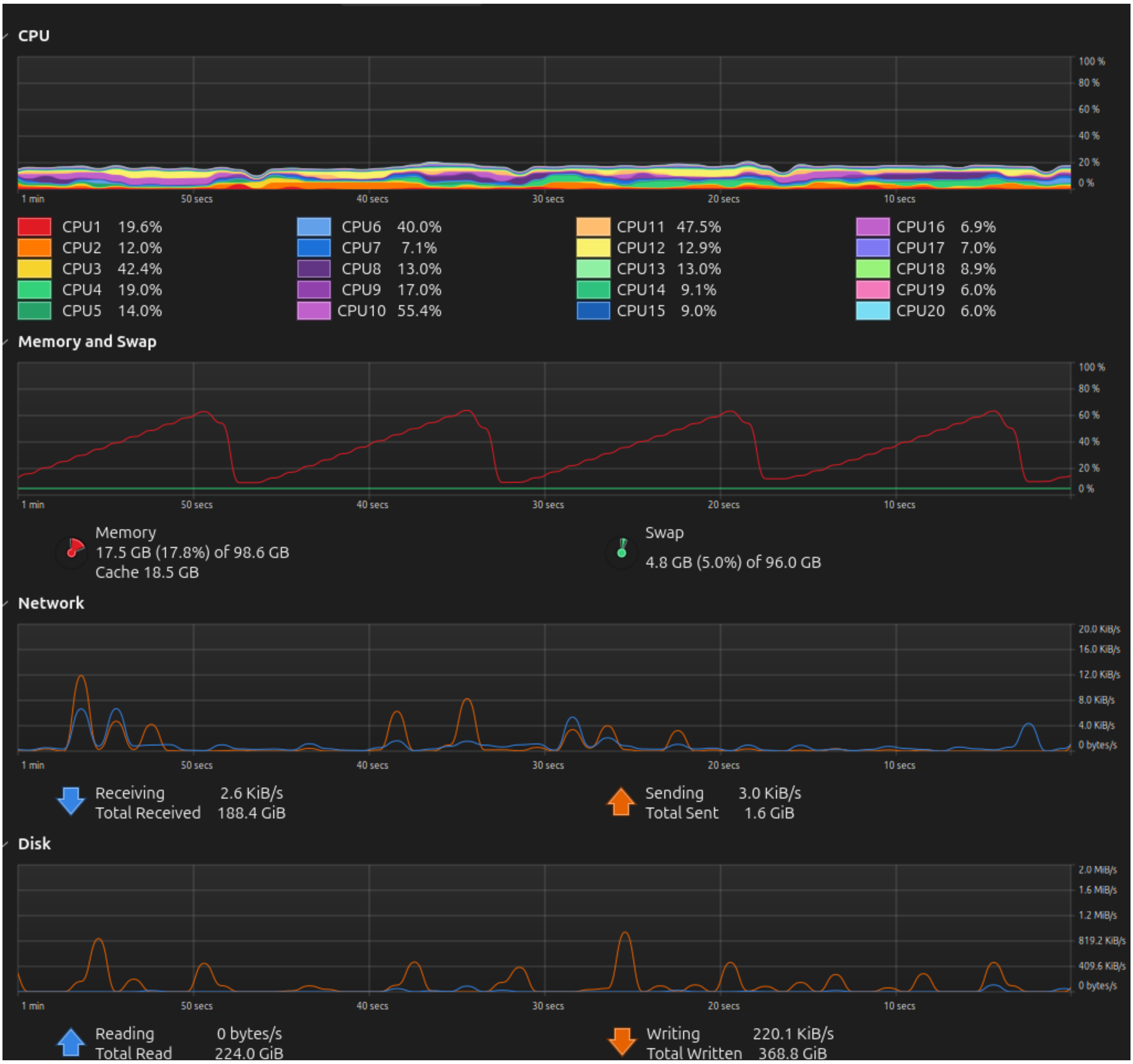
Next, for species data. Where can Brazil's species information come from? The Brazilian Institute of Geography and Geoinformatics (IBGE) has a wealth of data, including species inventories. Perhaps I've heard of the FloraBRAS, a national flora inventory. That might be a good source for distribution maps of species.

Also there is a global database called GBIF, where I could collect occurrence data for various species. This would allow me to create distribution layers. How do I access these data in a GIS like Qgis?

Additionally, protected corridors and barriers might form another layer. These are roads, rivers, etc., that these were taken during the first large run, but the memory is the charging and off-load from nvidia-smi



```
Every 1.0s: nvidia-smi

Tue Jan 28 13:20:42 2025
+-----------------------------------------------------------------------------------------+
| NVIDIA-SMI 560.35.03              Driver Version: 560.35.03      CUDA Version: 12.6     |
|-----------------------------------------+------------------------+----------------------+
| GPU  Name                 Persistence-M | Bus-Id          Disp.A | Volatile Uncorr. ECC |
| Fan  Temp   Perf          Pwr:Usage/Cap |           Memory-Usage | GPU-Util  Compute M. |
|                                         |                        |               MIG M. |
|=========================================+========================+======================|
|   0  NVIDIA GeForce RTX 4060        Off |   00000000:01:00.0 Off |                  N/A |
|  0%   35C    P0             N/A /  115W |    1075MiB /   8188MiB |     61%      Default |
|                                         |                        |                  N/A |
+-----------------------------------------+------------------------+----------------------+


+-----------------------------------------------------------------------------------------+
| Processes:                                                                              |
|  GPU   GI   CI        PID   Type   Process name                              GPU Memory |
|        ID   ID                                                               Usage      |
|=========================================================================================|
|    0   N/A  N/A      2654      G   /usr/bin/gnome-shell                          243MiB |
|    0   N/A  N/A      3703      G   /usr/bin/Xwayland                             401MiB |
|    0   N/A  N/A      6865      G   /usr/bin/nautilus                             134MiB |
|    0   N/A  N/A     11132      G   ...erProcess --variations-seed-version        136MiB |
|    0   N/A  N/A     58554      G   /usr/bin/gnome-calculator                      18MiB |
|    0   N/A  N/A    118047      G   /usr/bin/gnome-system-monitor                  40MiB |
+-----------------------------------------------------------------------------------------+
```



CPU1 19.6%
CPU2 12.0%
CPU3 42.4%
CPU4 19.0%
CPU5 14.0%
CPU6 40.0%
CPU7 7.1%
CPU8 13.0%
CPU9 17.0%
CPU10 55.4%
CPU11 47.5%
CPU12 12.9%
CPU13 13.0%
CPU14 9.1%
CPU15 9.0%
CPU16 6.9%
CPU17 7.0%
CPU18 8.9%
CPU19 6.0%
CPU20 6.0%

Memory
17.5 GB (17.8%) of 98.6 GB
Cache 18.5 GB

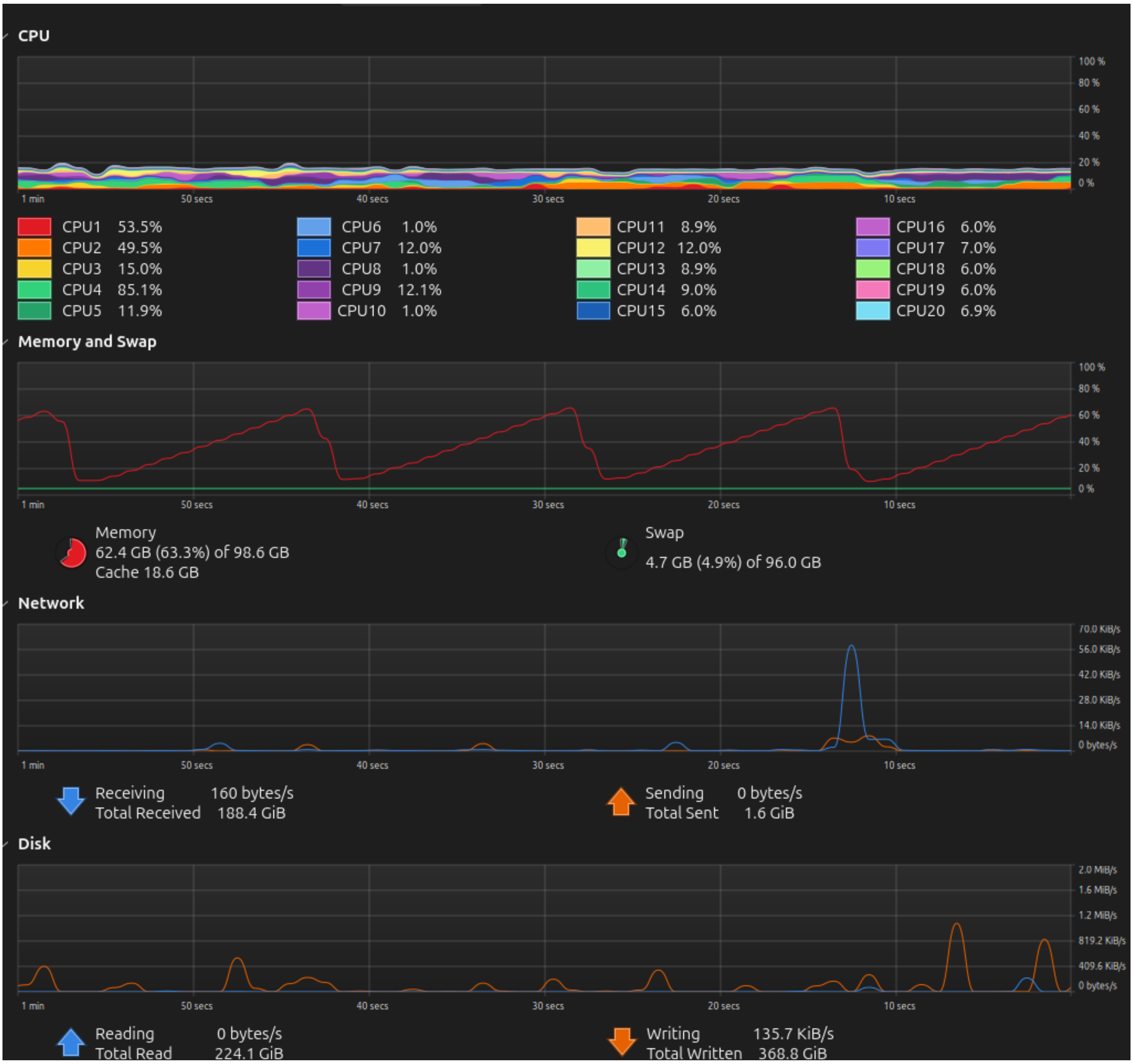
Swap
4.8 GB (5.0%) of 96.0 GB

Receiving 2.6 KiB/s
Total Received 188.4 GiB

Sending 3.0 KiB/s
Total Sent 1.6 GiB

Reading 0 bytes/s
Total Read 224.0 GiB

Writing 220.1 KiB/s
Total Written 368.8 GiB



CPU1 53.5%
CPU2 49.5%
CPU3 15.0%
CPU4 85.1%
CPU5 11.9%
CPU6 1.0%
CPU7 12.0%
CPU8 1.0%
CPU9 12.1%
CPU10 1.0%
CPU11 8.9%
CPU12 12.0%
CPU13 8.9%
CPU14 9.0%
CPU15 6.0%
CPU16 6.0%
CPU17 7.0%
CPU18 6.0%
CPU19 6.0%
CPU20 6.9%

Memory
62.4 GB (63.3%) of 98.6 GB
Cache 18.6 GB

Swap
4.7 GB (4.9%) of 96.0 GB

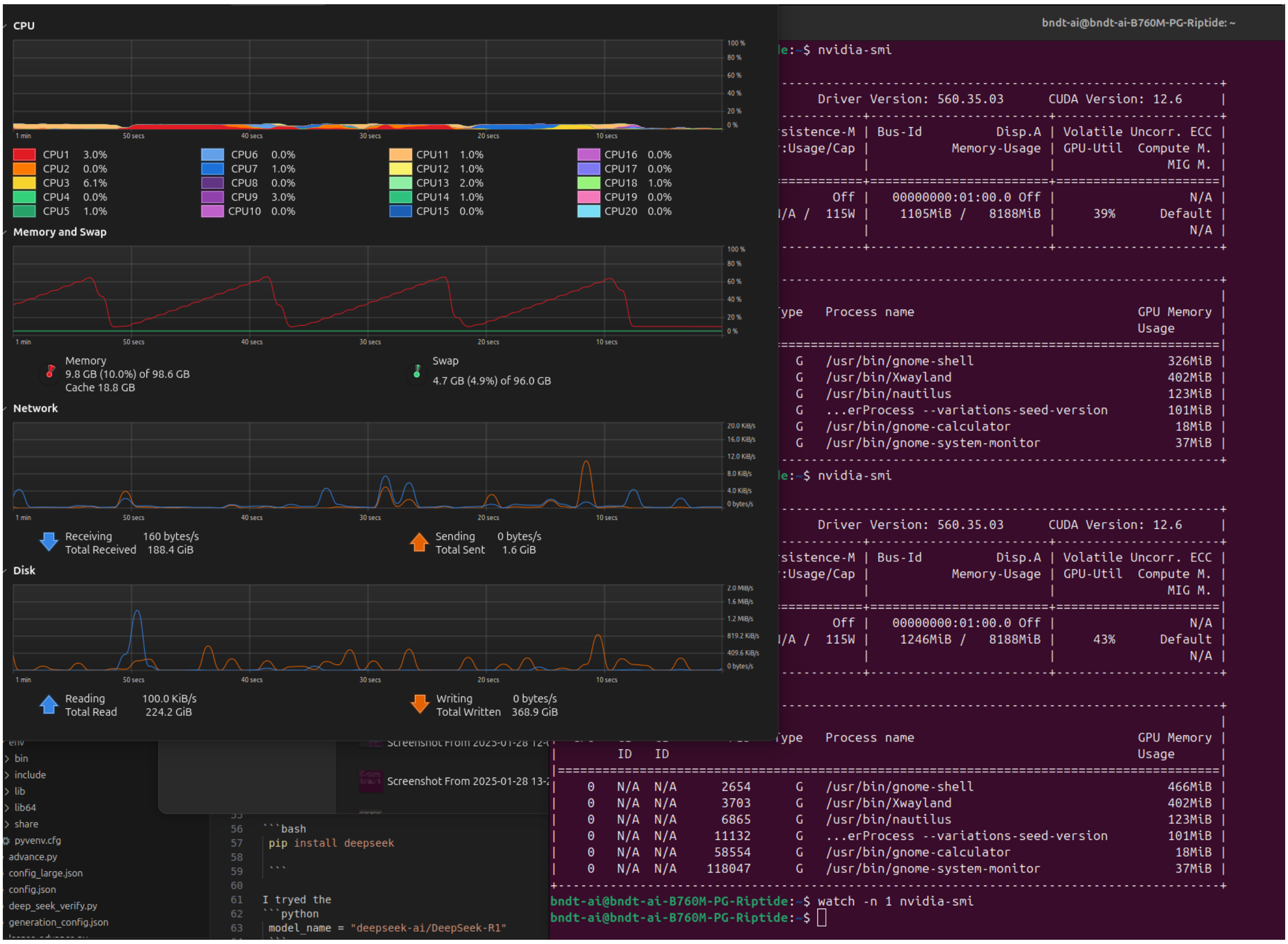
Receiving 160 bytes/s
Total Received 188.4 GiB

Sending 0 bytes/s
Total Sent 1.6 GiB

Reading 0 bytes/s
Total Read 224.1 GiB

Writing 135.7 KiB/s
Total Written 368.8 GiB

memory usage was actually nvidia-smi watch.


CPU
CPU1 3.0% CPU2 0.0% CPU3 6.1% CPU4 0.0% CPU5 1.0%
CPU6 0.0% CPU7 1.0% CPU8 0.0% CPU9 3.0% CPU10 0.0%
CPU11 1.0% CPU12 1.0% CPU13 2.0% CPU14 1.0% CPU15 0.0%
CPU16 0.0% CPU17 0.0% CPU18 1.0% CPU19 0.0% CPU20 0.0%
Memory and Swap
Memory 9.8 GB (10.0%) of 98.6 GB Cache 18.8 GB
Swap 4.7 GB (4.9%) of 96.0 GB
Network
Receiving 160 bytes/s Total Received 188.4 GiB
Sending 0 bytes/s Total Sent 1.6 GiB
Disk
Reading 100.0 KiB/s Total Read 224.2 GiB
Writing 0 bytes/s Total Written 368.9 GiB
env
bin
include
lib
lib64
share
pyvenv.cfg
advance.py
config_large.json
config.json
deep_seek_verify.py
generation_config.json
Screenshot From 2025-01-28 13-2
bndt-ai@bndt-ai-B760M-PG-Riptide: ~

~~~
```bash
pip install deepseek
```

I tryed the
```python
model_name = "deepseek-ai/DeepSeek-R1"
~~~

```
le:~$ nvidia-smi

 -------------------------------------------------------------+
    Driver Version: 560.35.03      CUDA Version: 12.6     |
-----------+----------------------+----------------------+
sistence-M | Bus-Id          Disp.A | Volatile Uncorr. ECC |
:Usage/Cap |           Memory-Usage | GPU-Util  Compute M. |
           |                        |               MIG M. |
===========+========================+======================|
       Off |   00000000:01:00.0 Off |                  N/A |
/A /  115W |    1105MiB /   8188MiB |     39%      Default |
           |                        |                  N/A |
-----------+------------------------+----------------------+

 -------------------------------------------------------------+
                                                              |
ype   Process name                              GPU Memory |
                                                Usage      |
=============================================================|
  G   /usr/bin/gnome-shell                          326MiB |
  G   /usr/bin/Xwayland                             402MiB |
  G   /usr/bin/nautilus                             123MiB |
  G   ...erProcess --variations-seed-version        101MiB |
  G   /usr/bin/gnome-calculator                      18MiB |
  G   /usr/bin/gnome-system-monitor                  37MiB |
 -------------------------------------------------------------+
le:~$ nvidia-smi

 -------------------------------------------------------------+
    Driver Version: 560.35.03      CUDA Version: 12.6     |
-----------+----------------------+----------------------+
sistence-M | Bus-Id          Disp.A | Volatile Uncorr. ECC |
:Usage/Cap |           Memory-Usage | GPU-Util  Compute M. |
           |                        |               MIG M. |
===========+========================+======================|
       Off |   00000000:01:00.0 Off |                  N/A |
/A /  115W |    1246MiB /   8188MiB |     43%      Default |
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-----------+------------------------+----------------------+

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                                                              |
ype   Process name                              GPU Memory |
                                                Usage      |
|      ID   ID
|=============================================================================|
|    0   N/A  N/A      2654      G   /usr/bin/gnome-shell                          466MiB |
|    0   N/A  N/A      3703      G   /usr/bin/Xwayland                             402MiB |
|    0   N/A  N/A      6865      G   /usr/bin/nautilus                             123MiB |
|    0   N/A  N/A     11132      G   ...erProcess --variations-seed-version        101MiB |
|    0   N/A  N/A     58554      G   /usr/bin/gnome-calculator                      18MiB |
|    0   N/A  N/A    118047      G   /usr/bin/gnome-system-monitor                  37MiB |
+-----------------------------------------------------------------------------+
bndt-ai@bndt-ai-B760M-PG-Riptide:~$ watch -n 1 nvidia-smi
bndt-ai@bndt-ai-B760M-PG-Riptide:~$ 
```

About the options in the config file: The `config.json` file defines the architecture and hyperparameters of the DeepSeek model. Here's a breakdown of each part:

---

1. Architectures

```
"architectures": [
    "Qwen2ForCausalLM"
]
```

- Specifies the model architecture. In this case, the model is based on `Qwen2ForCausalLM`, which is a causal language model (used for text generation).

---

2. Attention Dropout

```
"attention_dropout": 0.0
```

- Dropout rate applied to the attention weights during training. A value of `0.0` means no dropout is applied.

---

3. Token IDs

```
"bos_token_id": 151643,
"eos_token_id": 151643
```

- `bos_token_id`: Token ID for the beginning-of-sequence (BOS) token.
- `eos_token_id`: Token ID for the end-of-sequence (EOS) token.
- Here, both tokens share the same ID (`151643`).

---

4. Activation Function

```
"hidden_act": "silu"
```

- The activation function used in the model's hidden layers. `silu` (Sigmoid Linear Unit) is a smooth, non-linear activation function.

---

5. Model Dimensions

```
"hidden_size": 3584,
"intermediate_size": 18944
```

- `hidden_size`: Dimensionality of the hidden layers (3584 in this case).
- `intermediate_size`: Dimensionality of the feed-forward layer in the transformer block (18944).

---

6. Positional Embeddings

```
"max_position_embeddings": 131072
```

- Maximum number of positional embeddings, which determines the maximum sequence length the model can handle (131,072 tokens).

---

7. Window Layers

```
"max_window_layers": 28
```

- Likely specifies the maximum number of layers that use a sliding window mechanism for attention (if enabled).

---

8. Model Type

```
"model_type": "qwen2"
```

- Indicates the type of model. This is used by the `transformers` library to load the correct model class.

---

9. Attention Heads

```
"num_attention_heads": 28,
"num_key_value_heads": 4
```

- `num_attention_heads`: Number of attention heads in the multi-head attention mechanism (28).
- `num_key_value_heads`: Number of heads for key and value projections in grouped-query attention (4).

---

10. Hidden Layers

```
"num_hidden_layers": 28
```

- Total number of hidden layers in the model (28).

---

11. Normalization

```
"rms_norm_eps": 1e-06
```

- Epsilon value for RMS (Root Mean Square) normalization, used for numerical stability.

---

12. Rotary Positional Embeddings

```
"rope_theta": 10000
```

- Base value for rotary positional embeddings (RoPE), which helps the model understand token positions.

---

13. Sliding Window

```
"sliding_window": 4096,
"use_sliding_window": false
```

- `sliding_window`: Size of the sliding window for attention (4096 tokens).
- `use_sliding_window`: Whether to use sliding window attention (disabled here).

---

14. Word Embeddings

```
"tie_word_embeddings": false
```

- Whether to tie the input and output word embeddings. `false` means they are not tied.

---

15. Data Type

```
"torch_dtype": "bfloat16"
```

- Data type used for model weights. `bfloat16` is a 16-bit floating-point format optimized for deep learning.

---

16. Transformers Version

```
"transformers_version": "4.44.0"
```

- Version of the `transformers` library used to create or save the model.

---

17. Cache Usage

```
"use_cache": true
```

- Whether to use caching during generation to speed up inference.

---

18. Multi-Query Rope

```
"use_mrope": false
```

- Whether to use multi-query rotary positional embeddings (disabled here).

---

19. Vocabulary Size

```
"vocab_size": 152064
```

- Size of the model's vocabulary (152,064 unique tokens).

Summary

This configuration defines a large transformer-based language model with:

- 28 layers,
- 28 attention heads,
- A hidden size of 3584,
- Support for long sequences (up to 131,072 tokens),
- BF16 precision for weights,
- Sliding window attention (disabled by default).

Let me know if you need further clarification! 🚀

DEEPSEEK Optimization suggestions:

To optimize your code and better utilize your GPU's VRAM (8 GB), you can make several improvements. Here are some suggestions:

---

1. Use Mixed Precision (FP16)

Instead of `bfloat16`, use `float16` (FP16) for mixed precision training/inference. This reduces memory usage and speeds up computation.

```
model = AutoModelForCausalLM.from_pretrained(model_name, config=config,
torch_dtype=torch.float16)
```

---

2. Enable GPU Offloading

If the model is too large for your GPU, you can offload some layers to the CPU using libraries like `accelerate` or `bitsandbytes`.

Using `accelerate`:

```
pip install accelerate
```

```
from accelerate import init_empty_weights, load_checkpoint_and_dispatch

# Load the model with offloading
with init_empty_weights():
    model = AutoModelForCausalLM.from_config(config,
torch_dtype=torch.float16)

model = load_checkpoint_and_dispatch(
    model, model_name, device_map="auto", offload_folder="/path/to/offload"
)
```

Using `bitsandbytes` (for 8-bit quantization):

```
pip install bitsandbytes
```

```
model = AutoModelForCausalLM.from_pretrained(
    model_name, config=config, load_in_8bit=True, device_map="auto"
)
```

---

3. Use Gradient Checkpointing

Gradient checkpointing reduces memory usage during training by trading compute for memory. Add this if you're fine-tuning the model.

```
model.gradient_checkpointing_enable()
```

---

4. Reduce Batch Size

If you're processing multiple sequences, reduce the batch size to lower VRAM usage.

```
inputs = tokenizer(input_text, return_tensors="pt", padding=True,
truncation=True, max_length=512)
```

---

5. Use Smaller Model Variants

If the model is still too large, consider using a smaller variant or a distilled version of the model.

---

6. Optimize Tokenization

Ensure tokenization is efficient and doesn't produce excessively long sequences.

```
inputs = tokenizer(input_text, return_tensors="pt", padding=True,
truncation=True, max_length=512)
```

---

7. Clear Cache

Clear GPU cache after inference to free up memory.

```
torch.cuda.empty_cache()
```

---

8. Profile Memory Usage

Use tools like `nvidia-smi` or PyTorch's memory profiling to identify memory bottlenecks.

```
print(torch.cuda.memory_summary())
```

Updated Code

Here’s your updated code with optimizations:

```
import os
import json
import torch
from transformers import AutoModelForCausalLM, AutoTokenizer, AutoConfig

# Set the cache directory (if needed)
# os.environ['TRANSFORMERS_CACHE'] = '/usr/local/huggingface_cache'

# Load the JSON configuration file
config_path = '/srv/nlp_project/config.json'
with open(config_path, 'r') as f:
    config_dict = json.load(f)

# Save the configuration dictionary to a temporary file
temp_config_path = '/srv/nlp_project/temp_config.json'
with open(temp_config_path, 'w') as f:
    json.dump(config_dict, f)

# Create the configuration object from the JSON file
config = AutoConfig.from_pretrained(temp_config_path)

model_name = "deepseek-ai/DeepSeek-R1-Distill-Qwen-7B"
```

```
tokenizer = AutoTokenizer.from_pretrained(model_name)

# Load the model with mixed precision (FP16)
try:
    model = AutoModelForCausalLM.from_pretrained(
        model_name, config=config, torch_dtype=torch.float16,
device_map="auto"
    )
except ValueError as e:
    print(f"Error loading model: {e}")
    print("Attempting to load model without quantization...")
    model = AutoModelForCausalLM.from_pretrained(model_name, config=config,
device_map="auto")

# Tokenize input
input_text = "Where is the best place to live?"
inputs = tokenizer(input_text, return_tensors="pt", padding=True,
truncation=True, max_length=512)

# Generate output
with torch.no_grad():
    output = model.generate(
        inputs['input_ids'],
        attention_mask=inputs['attention_mask'],
        max_length=500,  # Maximum number of tokens to generate
        num_return_sequences=1,  # Number of sequences to generate
        no_repeat_ngram_size=2,  # Prevent repetition of n-grams
        top_k=50,  # Top-k sampling
        top_p=0.95,  # Nucleus sampling
        temperature=0.7  # Sampling temperature
    )

# Decode the output tokens to text
output_text = tokenizer.decode(output[0], skip_special_tokens=True)
print("Generated Text:")
print(output_text)

# Clear GPU cache
torch.cuda.empty_cache()
```

Key Changes

1. Used `torch.float16` for mixed precision.
2. Added `device_map="auto"` for automatic GPU offloading.
3. Optimized tokenization with `truncation` and `max_length`.
4. Cleared GPU cache after inference.

Let me know if you need further assistance! 🚀

What if I want to use more VRAM?

If you have spare VRAM and want to utilize it more effectively, you can increase the batch size, sequence length, or use larger models. Here's how you can modify your code to make better use of your GPU's VRAM:

---

1. Increase Batch Size

If you're processing multiple inputs, increase the batch size to utilize more VRAM.

```
input_texts = [
    "Where is the best place to live?",
    "What are the benefits of exercise?",
    "How does photosynthesis work?"
]

# Tokenize multiple inputs
inputs = tokenizer(input_texts, return_tensors="pt", padding=True,
truncation=True, max_length=512)
```

---

2. Increase Sequence Length

Increase the `max_length` parameter in tokenization and generation to process longer sequences.

```
inputs = tokenizer(input_text, return_tensors="pt", padding=True,
truncation=True, max_length=1024)  # Longer sequence
```

---

3. Use a Larger Model

If you're using a distilled or smaller variant of the model, switch to a larger model to utilize more VRAM.

```
model_name = "deepseek-ai/DeepSeek-R1-Qwen-7B"  # Use a larger model
model = AutoModelForCausalLM.from_pretrained(
    model_name, config=config, torch_dtype=torch.float16, device_map="auto"
)
```

---

4. Disable Gradient Checkpointing

If you enabled gradient checkpointing for memory efficiency, disable it to use more VRAM.

```
model.gradient_checkpointing_disable()
```

---

5. Use Larger Generation Parameters

Increase the `max_length`, `top_k`, or `num_return_sequences` during generation to utilize more VRAM.

```
with torch.no_grad():
    output = model.generate(
        inputs['input_ids'],
        attention_mask=inputs['attention_mask'],
        max_length=1000,  # Increase max length
        num_return_sequences=3,  # Generate multiple sequences
        top_k=100,  # Increase top-k
        top_p=0.99,  # Increase nucleus sampling
        temperature=0.8  # Adjust temperature
    )
```

---

6. Use Larger Inputs

Provide longer input text or more complex prompts to increase VRAM usage.

```
input_text = "Explain the theory of relativity in detail, including its
implications for modern physics and its applications in technology."
```

---

7. Monitor VRAM Usage

Use `nvidia-smi` or PyTorch's memory utilities to monitor VRAM usage and ensure you're utilizing it effectively.

```
nvidia-smi
```

```
print(torch.cuda.memory_summary())
```

Updated Code Example

Here’s how you can modify your code to use more VRAM:

```
import torch
from transformers import AutoModelForCausalLM, AutoTokenizer, AutoConfig

# Load the model and tokenizer
model_name = "deepseek-ai/DeepSeek-R1-Qwen-7B"  # Use a larger model
```

```
tokenizer = AutoTokenizer.from_pretrained(model_name)
model = AutoModelForCausalLM.from_pretrained(
    model_name, torch_dtype=torch.float16, device_map="auto"
)

# Longer input text
input_text = "Explain the theory of relativity in detail, including its
implications for modern physics and its applications in technology."

# Tokenize with longer sequence length
inputs = tokenizer(input_text, return_tensors="pt", padding=True,
truncation=True, max_length=1024)

# Generate output with larger parameters
with torch.no_grad():
    output = model.generate(
        inputs['input_ids'],
        attention_mask=inputs['attention_mask'],
        max_length=1000,  # Increase max length
        num_return_sequences=3,  # Generate multiple sequences
        top_k=100,  # Increase top-k
        top_p=0.99,  # Increase nucleus sampling
        temperature=0.8  # Adjust temperature
    )

# Decode and print outputs
for i, out in enumerate(output):
    print(f"Generated Text {i+1}:")
    print(tokenizer.decode(out, skip_special_tokens=True))
    print("-" * 50)

# Monitor VRAM usage
print(torch.cuda.memory_summary())
```

Key Changes

1. Increased batch size or sequence length.
2. Switched to a larger model.
3. Increased generation parameters (`max_length`, `num_return_sequences`, etc.).
4. Added monitoring for VRAM usage.

By making these changes, you can better utilize your GPU's VRAM. Let me know if you need further assistance! 🚀

Great question! Let me explain how I generate responses and how you can achieve something similar locally.

How I Generate Responses

1. **Input Processing:**

   - Your input is tokenized and fed into a language model (like GPT-4 or similar).
   - The model processes the input and generates tokens sequentially.

2. **Reasoning and Multi-Step Generation:**

   - For complex queries, the model may "reason" by breaking the problem into smaller steps (e.g., understanding the question, retrieving relevant knowledge, and formulating an answer).
   - This is achieved through **chain-of-thought prompting** or **multi-step reasoning** techniques.

3. **Output Generation:**

   - The model generates tokens one at a time, considering the context of previous tokens.
   - It stops when it reaches a logical endpoint or a predefined token limit.

How to Achieve This Locally

To replicate this behavior locally, you can use a large language model (like DeepSeek, LLaMA, or GPT-NeoX) and implement multi-step reasoning or chain-of-thought prompting.

Steps to Implement Locally

1. Install Required Libraries

Ensure you have the necessary libraries installed:

```
pip install torch transformers
```

2. Load a Pre-Trained Model

Use a model capable of reasoning, such as DeepSeek, LLaMA, or GPT-NeoX.

```
from transformers import AutoModelForCausalLM, AutoTokenizer

model_name = "deepseek-ai/DeepSeek-R1-Qwen-7B"  # Replace with your model
tokenizer = AutoTokenizer.from_pretrained(model_name)
model = AutoModelForCausalLM.from_pretrained(model_name,
torch_dtype=torch.float16, device_map="auto")
```

3. Implement Chain-of-Thought Prompting

Add a prompt that encourages the model to reason step-by-step.

```
input_text = """
Question: Where is the best place to live?
Let's think step by step.
```

```
"""

inputs = tokenizer(input_text, return_tensors="pt", padding=True,
truncation=True, max_length=512).to("cuda")
```

4. Generate the Output

Use the model to generate a response with reasoning.

```
with torch.no_grad():
    output = model.generate(
        inputs['input_ids'],
        attention_mask=inputs['attention_mask'],
        max_length=500,  # Increase for longer responses
        num_return_sequences=1,
        temperature=0.7,
        top_k=50,
        top_p=0.95
    )

# Decode and print the output
output_text = tokenizer.decode(output[0], skip_special_tokens=True)
print("Generated Text:")
print(output_text)
```

Example Output

For the input:

```
Question: Where is the best place to live?
Let's think step by step.
```

The model might generate:

```
1. The best place to live depends on individual preferences, such as
climate, cost of living, and job opportunities.
2. For example, if someone prefers warm weather, they might choose a place
like California or Florida.
3. If cost of living is a concern, cities in the Midwest or Southeast might
be more affordable.
4. Ultimately, the best place to live is subjective and varies from person
to person.
```

Advanced: Multi-Turn Reasoning

For more complex tasks, you can implement multi-turn reasoning by breaking the task into smaller steps and feeding the model's output back as input.

```
# First step
input_text = "Explain the theory of relativity step by step."
inputs = tokenizer(input_text, return_tensors="pt", padding=True,
truncation=True, max_length=512).to("cuda")
with torch.no_grad():
    output = model.generate(inputs['input_ids'], max_length=300)
first_step = tokenizer.decode(output[0], skip_special_tokens=True)

# Second step (refine or expand on the first step)
input_text = f"{first_step}\n\nNow explain its implications for modern
physics."
inputs = tokenizer(input_text, return_tensors="pt", padding=True,
truncation=True, max_length=512).to("cuda")
with torch.no_grad():
    output = model.generate(inputs['input_ids'], max_length=300)
second_step = tokenizer.decode(output[0], skip_special_tokens=True)

print("Final Output:")
print(second_step)
```

Key Points

- Use **chain-of-thought prompting** to encourage step-by-step reasoning.
- Adjust generation parameters (`max_length`, `temperature`, etc.) to control the output.
- For complex tasks, break the problem into smaller steps and use multi-turn reasoning.

By following these steps, you can replicate the reasoning and multi-step generation behavior locally. Let me know if you need further clarification! 🚀