

# Practical 6

## Compare cpu, gpu, tpu

### Comparison of CPU, GPU, and TPU in Google Colab

Google Colab is a cloud-based platform provided by Google that enables users to write and execute Python code in a web-based environment. One of the major advantages of using Colab is its ability to offer hardware accelerators like GPUs and TPUs in addition to traditional CPUs. Understanding the differences between CPU (Central Processing Unit), GPU (Graphics Processing Unit), and TPU (Tensor Processing Unit) is essential for optimizing computational tasks such as machine learning, deep learning, and data analysis.

#### 1. Central Processing Unit (CPU)

##### Architecture and Function:

- The CPU is the most general-purpose processor in any computing environment.
- It consists of a few cores optimized for sequential serial processing.
- It is designed to handle a wide variety of tasks, including arithmetic, logic, control, and I/O operations.

##### Use in Colab:

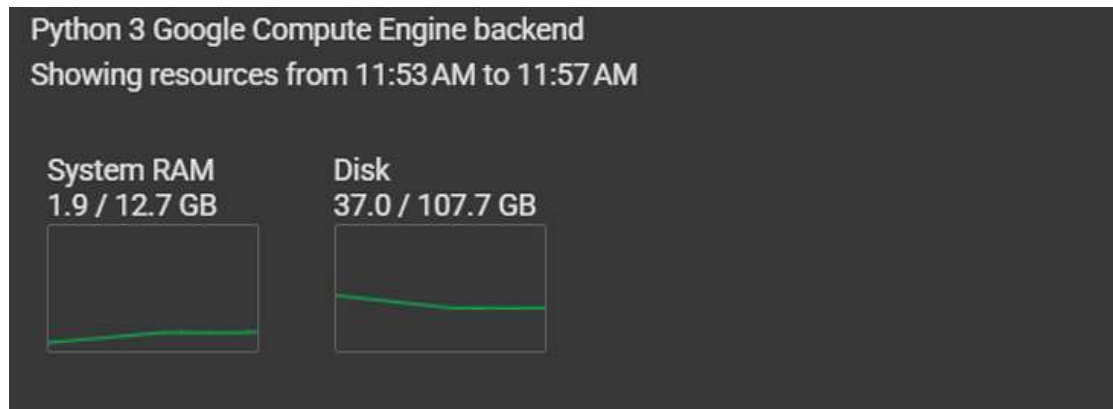
- In Google Colab, the default hardware is the CPU.
- Suitable for tasks like basic data analysis, preprocessing, and running small machine learning models.
- Limited in performance when dealing with large neural networks or deep learning tasks due to its sequential nature.

##### Advantages:

- Flexibility to handle a wide range of operations.
- Efficient in single-threaded and lightly parallelized tasks.

##### Limitations:

- Slower in handling large-scale matrix operations.
- Cannot match the parallel processing capabilities of GPUs and TPUs for deep learning



## 2. Graphics Processing Unit (GPU)

### Architecture and Function:

- Originally designed for rendering graphics, GPUs are optimized for parallel processing.
- They contain thousands of smaller cores that can perform mathematical computations simultaneously.
- This makes them ideal for matrix and vector operations common in machine learning.

### Use in Colab:

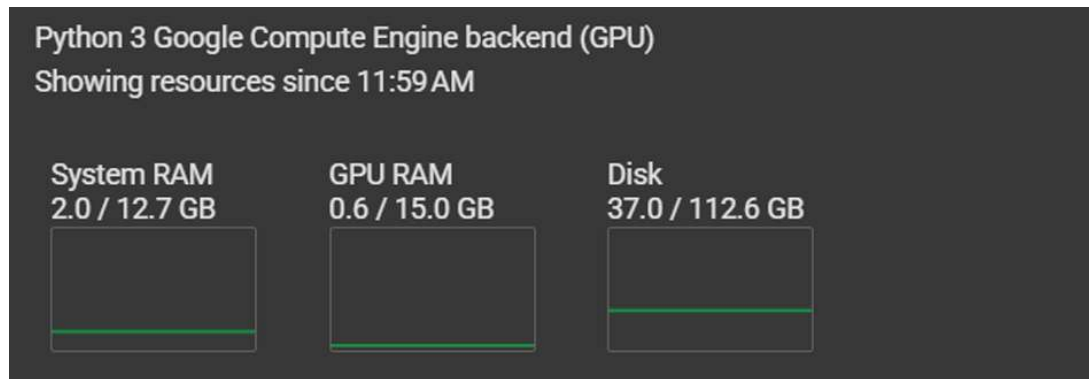
- Google Colab offers free access to NVIDIA GPUs such as Tesla K80, T4, and P100.
- Significantly accelerates training time for neural networks, especially deep learning models built with TensorFlow or PyTorch.

### Advantages:

- Greatly improves performance for deep learning tasks.
- Highly parallel architecture makes it efficient for large-scale data processing.

### Limitations:

- Higher power consumption compared to CPUs.
- More expensive and may require better memory management.



### 3. Tensor Processing Unit (TPU)

#### Architecture and Function:

- TPUs are custom-built by Google specifically for machine learning tasks.
- They are application-specific integrated circuits (ASICs) designed to accelerate TensorFlow operations.
- TPUs excel in executing large-scale matrix multiplication with extremely high throughput and efficiency.

#### Use in Colab:

- Google Colab provides access to TPU v2 and v3.
- Best suited for training and inference of very large deep learning models using TensorFlow.
- Requires code to be written specifically to support TPU computation (e.g., using `tf.data` and `TPUStrategy`).

#### Advantages:

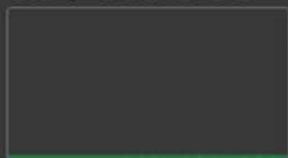
- Exceptional speed and efficiency in TensorFlow-based deep learning workloads.
- High performance per watt, making it more energy efficient.

#### Limitations:

- Limited support outside TensorFlow (not compatible with PyTorch).
- Steeper learning curve due to different code requirements and debugging complexity.

Python 3 Google Compute Engine backend (TPU)  
Showing resources from 12:00 PM to 12:03 PM

System RAM  
5.7 / 334.6 GB



Disk  
20.6 / 225.3 GB

