Fine-Tuning My Stable Diffusion Model

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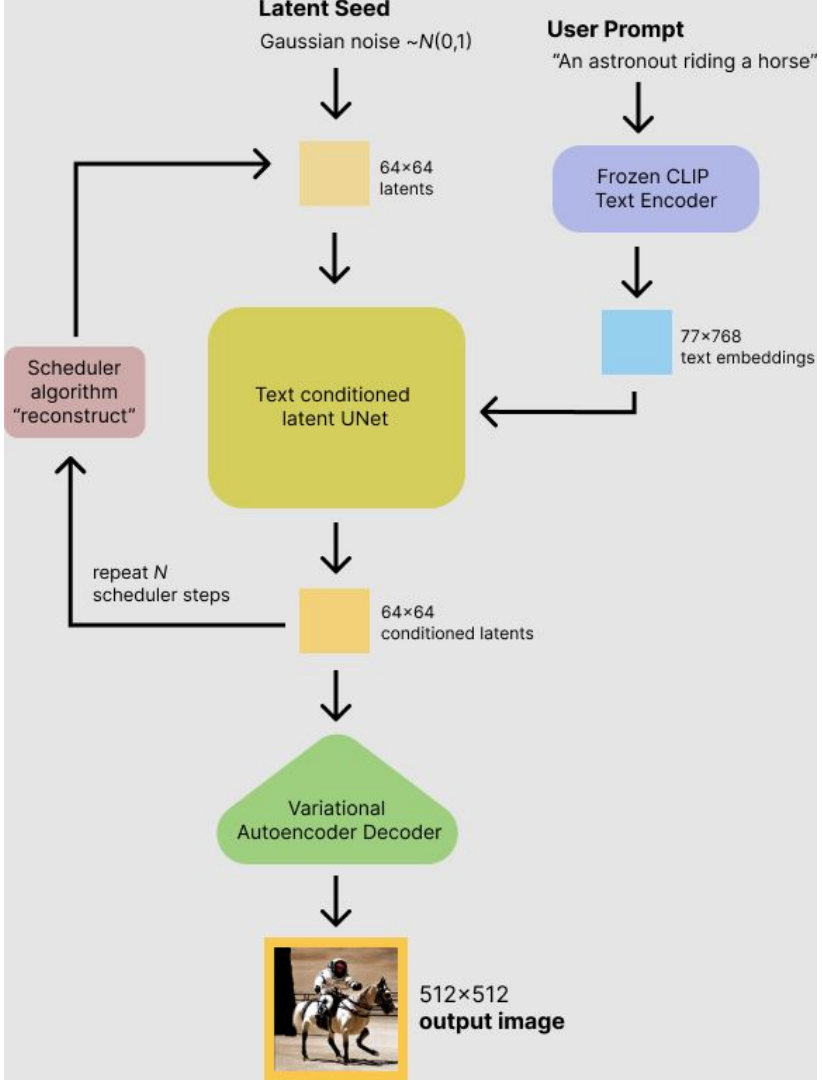
Outline

1. Create and fine-tune Stable Diffusion models using a Dreambooth template notebook.
2. Use TWCC to accelerate the training of Stable Diffusion models with GPUs.
3. Work with unfamiliar codebases and use new tools, including Dreambooth, Accelerate, and Weights & Biases.

1. **Create and fine-tune Stable Diffusion models using a Dreambooth template notebook.**

Stable Diffusion 🎨



DreamBooth: Fine Tuning Text-to-Image Diffusion Models for Subject-Driven Generation

Nataniel Ruiz Yuanzhen Li Varun Jampani Yael Pritch Michael Rubinstein Kfir Aberman

Google Research

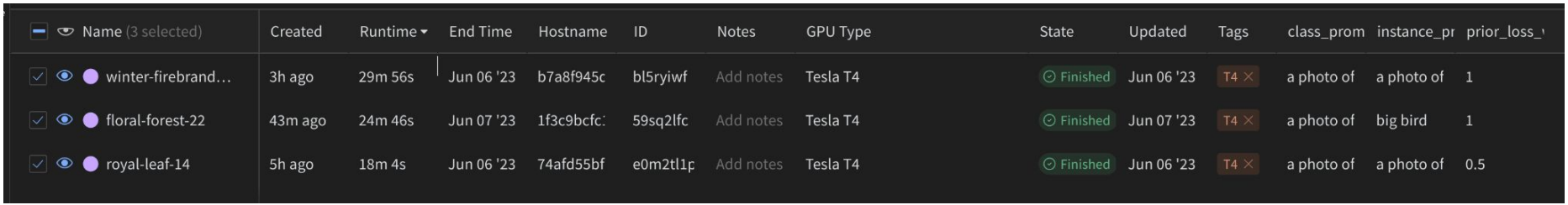
It's like a photo booth, but once the subject is captured, it can be synthesized wherever your dreams take you…

[Paper] (new!) [Dataset] [BibTeX]

Dreambooth and Stable Diffusion Example

The model usually uses one concept, and the model will modify that specific concept. In total, training takes about 20 minutes.

Runtime



Name (3 selected)	Created	Runtime	End Time	Hostname	ID	Notes	GPU Type	State	Updated	Tags	class_prom	instance_pr	prior_loss_
winter-firebrand…	3h ago	29m 56s	Jun 06 '23	b7a8f945c	bl5ryiwf	Add notes	Tesla T4	Finished	Jun 06 '23	T4	a photo of	a photo of	1
floral-forest-22	43m ago	24m 46s	Jun 07 '23	1f3c9bcfc:	59sq2lfc	Add notes	Tesla T4	Finished	Jun 07 '23	T4	a photo of	big bird	1
royal-leaf-14	5h ago	18m 4s	Jun 06 '23	74afd55bf	e0m2tl1p	Add notes	Tesla T4	Finished	Jun 06 '23	T4	a photo of	a photo of	0.5

prompt

big bird on the road

Samples 1

Run

2. Use TWCC to accelerate the training of Stable Diffusion models with GPUs.

In [22]:
```
#@title Run training
import accelerate

accelerate.notebook_launcher(training_function, args=(text_encoder, vae, unet), num_processes=1)
for param in itertools.chain(unet.parameters(), text_encoder.parameters()):
  if param.grad is not None:
    del param.grad  # free some memory
  torch.cuda.empty_cache()
```

```
/home/thomas1024/.local/lib/python3.8/site-packages/diffusers/configuration_utils.py:219: FutureWarning: It is depr
ecated to pass a pretrained model name or path to `from_config`.If you were trying to load a scheduler, please use
<class 'diffusers.schedulers.scheduling_ddpm.DDPMScheduler'>.from_pretrained(...) instead. Otherwise, please make s
ure to pass a configuration dictionary instead. This functionality will be removed in v1.0.0.
  deprecate("config-passed-as-path", "1.0.0", deprecation_message, standard_warn=False)
```

```
Launching training on one GPU.
```

Steps: 100% 300/300 [09:58<00:00, 1.78s/it, loss=0.136]

```
`text_config_dict` is provided which will be used to initialize `CLIPTextConfig`. The value `text_config["id2labe
l"]` will be overriden.
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`text_config_dict` is provided which will be used to initialize `CLIPTextConfig`. The value `text_config["id2labe
l"]` will be overriden.
```

In [23]:
```
!nvidia-smi
```

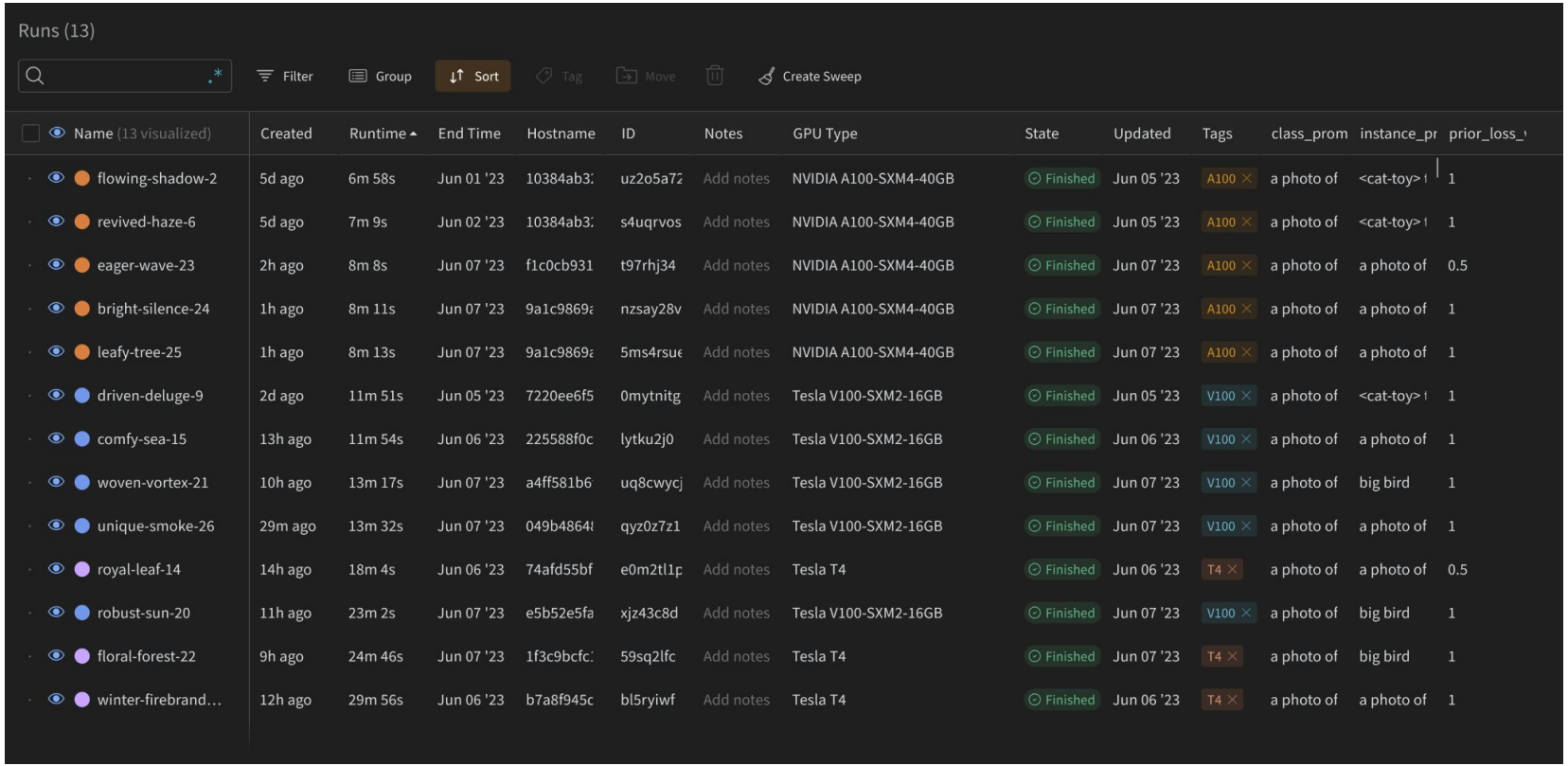
```
Wed Jun  7 09:33:49 2023
+-----------------------------------------------------------------------------+
| NVIDIA-SMI 470.161.03   Driver Version: 470.161.03   CUDA Version: 12.0     |
|-------------------------------+----------------------+----------------------+
| GPU  Name        Persistence-M| Bus-Id        Disp.A | Volatile Uncorr. ECC |
| Fan  Temp  Perf  Pwr:Usage/Cap|         Memory-Usage | GPU-Util  Compute M. |
|                               |                      |               MIG M. |
|===============================+======================+======================|
|   0  Tesla V100-SXM2...  On   | 00000000:1B:00.0 Off |                    0 |
| N/A   30C    P0    69W / 300W |   5071MiB / 32510MiB |    100%      Default |
|                               |                      |                  N/A |
+-------------------------------+----------------------+----------------------+

+-----------------------------------------------------------------------------+
| Processes:                                                                  |
|  GPU   GI   CI        PID   Type   Process name                  GPU Memory |
|        ID   ID                                                   Usage      |
|=============================================================================|
+-----------------------------------------------------------------------------+
```

Report: link


system/gpu.0.memoryAllocatedBytes
eager-wave-23
bright-silence-24
leafy-tree-25
unique-smoke-26
Time (minutes)
GPU Power Usage (W)
Showing first 10 runs
flowing-shadow-2
revived-haze-6
driven-deluge-9
GPU Power Usage (%)
GPU Memory Allocated (%)
GPU Time Spent Accessing Memory (%)
GPU Temp (°C)
GPU Utilization (%)
Network Traffic (bytes)
flowing-shadow-2 Network Traffic Received (bytes)
revived-haze-6 Network Traffic Received (bytes)
eager-wave-23 Network Traffic Received (bytes)
Disk Utilization (%)

Runtime



Name (13 visualized)	Created	Runtime	End Time	Hostname	ID	Notes	GPU Type	State	Updated	Tags	class_prom	instance_pr	prior_loss_
flowing-shadow-2	5d ago	6m 58s	Jun 01 '23	10384ab3	uz2o5a7	Add notes	NVIDIA A100-SXM4-40GB	Finished	Jun 05 '23	A100	a photo of	<cat-toy>	1
revived-haze-6	5d ago	7m 9s	Jun 02 '23	10384ab3	s4uqrvos	Add notes	NVIDIA A100-SXM4-40GB	Finished	Jun 05 '23	A100	a photo of	<cat-toy>	1
eager-wave-23	2h ago	8m 8s	Jun 07 '23	f1c0cb931	t97rhj34	Add notes	NVIDIA A100-SXM4-40GB	Finished	Jun 07 '23	A100	a photo of	a photo of	0.5
bright-silence-24	1h ago	8m 11s	Jun 07 '23	9a1c9869	nzsay28v	Add notes	NVIDIA A100-SXM4-40GB	Finished	Jun 07 '23	A100	a photo of	a photo of	1
leafy-tree-25	1h ago	8m 13s	Jun 07 '23	9a1c9869	5ms4rsue	Add notes	NVIDIA A100-SXM4-40GB	Finished	Jun 07 '23	A100	a photo of	a photo of	1
driven-deluge-9	2d ago	11m 51s	Jun 05 '23	7220ee6f5	0mytnitg	Add notes	Tesla V100-SXM2-16GB	Finished	Jun 05 '23	V100	a photo of	<cat-toy>	1
comfy-sea-15	13h ago	11m 54s	Jun 06 '23	225588f0c	lytku2j0	Add notes	Tesla V100-SXM2-16GB	Finished	Jun 06 '23	V100	a photo of	a photo of	1
woven-vortex-21	10h ago	13m 17s	Jun 07 '23	a4ff581b6	uq8cwycj	Add notes	Tesla V100-SXM2-16GB	Finished	Jun 07 '23	V100	a photo of	big bird	1
unique-smoke-26	29m ago	13m 32s	Jun 07 '23	049b4864	qyz0z7z1	Add notes	Tesla V100-SXM2-16GB	Finished	Jun 07 '23	V100	a photo of	a photo of	1
royal-leaf-14	14h ago	18m 4s	Jun 06 '23	74afd55bf	e0m2tl1p	Add notes	Tesla T4	Finished	Jun 06 '23	T4	a photo of	a photo of	0.5
robust-sun-20	11h ago	23m 2s	Jun 07 '23	e5b52e5fa	xjz43c8d	Add notes	Tesla V100-SXM2-16GB	Finished	Jun 07 '23	V100	a photo of	big bird	1
floral-forest-22	9h ago	24m 46s	Jun 07 '23	1f3c9bcfc	59sq2lfc	Add notes	Tesla T4	Finished	Jun 07 '23	T4	a photo of	big bird	1
winter-firebrand…	12h ago	29m 56s	Jun 06 '23	b7a8f945c	bl5ryiwf	Add notes	Tesla T4	Finished	Jun 06 '23	T4	a photo of	a photo of	1

Accelerate

Accelerate

🤗 Accelerate is a library that enables the same PyTorch code to be run across any distributed configuration by adding just four lines of code! In short, training and inference at scale made simple, efficient and adaptable.

```
+ from accelerate import Accelerator
+ accelerator = Accelerator()

+ model, optimizer, training_dataloader, scheduler = accelerator.prepare(
+     model, optimizer, training_dataloader, scheduler
+ )

  for batch in training_dataloader:
      optimizer.zero_grad()
      inputs, targets = batch
      inputs = inputs.to(device)
      targets = targets.to(device)
      outputs = model(inputs)
      loss = loss_function(outputs, targets)
+     accelerator.backward(loss)
      optimizer.step()
      scheduler.step()
```

Built on `torch_xla` and `torch.distributed`, 🤗 Accelerate takes care of the heavy lifting, so you don't have to write any custom code to adapt to these platforms. Convert existing codebases to utilize DeepSpeed, perform fully sharded data parallelism, and have automatic support for mixed-precision training!

> To get a better idea of this process, make sure to check out the Tutorials!

This code can then be launched on any system through Accelerate's CLI interface:

```
accelerate launch {my_script.py}
```

```
RuntimeError: CUDA has been initialized before the `notebook_launcher` could create a forked subprocess. This likel
y stems from an outside import causing issues once the `notebook_launcher()` is called. Please review your imports
and test them when running the `notebook_launcher()` to identify which one is problematic.
```

In [ ]:

In [23]:
```
!nvidia-smi
```

```
Wed Jun  7 10:08:22 2023
+-----------------------------------------------------------------------------+
| NVIDIA-SMI 470.161.03   Driver Version: 470.161.03   CUDA Version: 12.0     |
|-------------------------------+----------------------+----------------------+
| 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  Tesla V100-SXM2...  On   | 00000000:3E:00.0 Off |                    0 |
| N/A   29C    P0    41W / 300W |      3MiB / 32510MiB |      0%      Default |
|                               |                      |                  N/A |
+-------------------------------+----------------------+----------------------+
|   1  Tesla V100-SXM2...  On   | 00000000:B2:00.0 Off |                    0 |
| N/A   29C    P0    43W / 300W |      3MiB / 32510MiB |      0%      Default |
|                               |                      |                  N/A |
+-------------------------------+----------------------+----------------------+

+-----------------------------------------------------------------------------+
| Processes:                                                                  |
|  GPU   GI   CI        PID   Type   Process name                  GPU Memory |
|        ID   ID                                                   Usage      |
|=============================================================================|
|  No running processes found                                                 |
+-----------------------------------------------------------------------------+
```

Thanks for your attention.

Reference

1. **Stable Diffusion with 🧨 Diffusers : link**
2. **Training Stable Diffusion with Dreambooth : link**
3. **Accelerate_sd_dreambooth_training : link**
4. **sd-dreambooth-library/big-bird : link**
5. **Hugging Face Accelerate Super Charged With Weights & Biases : link**