```
!pip install diffusers transformers accelerate safetensors torch
torchvision

Requirement already satisfied: diffusers in
/usr/local/lib/python3.12/dist-packages (0.36.0)
Requirement already satisfied: transformers in
/usr/local/lib/python3.12/dist-packages (4.57.3)
Requirement already satisfied: accelerate in
/usr/local/lib/python3.12/dist-packages (1.12.0)
Requirement already satisfied: safetensors in
/usr/local/lib/python3.12/dist-packages (0.7.0)
Requirement already satisfied: torch in
/usr/local/lib/python3.12/dist-packages (2.9.0+cpu)
Requirement already satisfied: torchvision in
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Requirement already satisfied: importlib_metadata in
/usr/local/lib/python3.12/dist-packages (from diffusers) (8.7.1)
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Requirement already satisfied: httpx<1.0.0 in
/usr/local/lib/python3.12/dist-packages (from diffusers) (0.28.1)
Requirement already satisfied: huggingface-hub<2.0,>=0.34.0 in
/usr/local/lib/python3.12/dist-packages (from diffusers) (0.36.0)
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/usr/local/lib/python3.12/dist-packages (from diffusers) (2025.11.3)
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Requirement already satisfied: tokenizers<=0.23.0,>=0.22.0 in
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Requirement already satisfied: tqdm>=4.27 in
/usr/local/lib/python3.12/dist-packages (from transformers) (4.67.1)
Requirement already satisfied: psutil in
/usr/local/lib/python3.12/dist-packages (from accelerate) (5.9.5)
Requirement already satisfied: typing-extensions>=4.10.0 in
/usr/local/lib/python3.12/dist-packages (from torch) (4.15.0)
Requirement already satisfied: setuptools in
/usr/local/lib/python3.12/dist-packages (from torch) (75.2.0)
Requirement already satisfied: sympy>=1.13.3 in
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Requirement already satisfied: networkx>=2.5.1 in
/usr/local/lib/python3.12/dist-packages (from torch) (3.6.1)
Requirement already satisfied: jinja2 in
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Requirement already satisfied: fsspec>=0.8.5 in
/usr/local/lib/python3.12/dist-packages (from torch) (2025.3.0)
Requirement already satisfied: anyio in
/usr/local/lib/python3.12/dist-packages (from httpx<1.0.0->diffusers)
(4.12.1)
Requirement already satisfied: certifi in
/usr/local/lib/python3.12/dist-packages (from httpx<1.0.0->diffusers)
(2026.1.4)
Requirement already satisfied: httpcore==1.* in
/usr/local/lib/python3.12/dist-packages (from httpx<1.0.0->diffusers)
(1.0.9)
Requirement already satisfied: idna in /usr/local/lib/python3.12/dist-
packages (from httpx<1.0.0->diffusers) (3.11)
Requirement already satisfied: h11>=0.16 in
/usr/local/lib/python3.12/dist-packages (from httpcore==1.*-
>httpx<1.0.0->diffusers) (0.16.0)
Requirement already satisfied: hf-xet<2.0.0,>=1.1.3 in
/usr/local/lib/python3.12/dist-packages (from huggingface-
hub<2.0,>=0.34.0->diffusers) (1.2.0)
Requirement already satisfied: mpmath<1.4,>=1.1.0 in
/usr/local/lib/python3.12/dist-packages (from sympy>=1.13.3->torch)
(1.3.0)
Requirement already satisfied: zipp>=3.20 in
/usr/local/lib/python3.12/dist-packages (from importlib_metadata-
>diffusers) (3.23.0)
Requirement already satisfied: MarkupSafe>=2.0 in
/usr/local/lib/python3.12/dist-packages (from jinja2->torch) (3.0.3)
Requirement already satisfied: charset_normalizer<4,>=2 in
/usr/local/lib/python3.12/dist-packages (from requests->diffusers)
(3.4.4)
Requirement already satisfied: urllib3<3,>=1.21.1 in
/usr/local/lib/python3.12/dist-packages (from requests->diffusers)
(2.5.0)
```

```python
import torch
from diffusers import StableDiffusionPipeline

device = "cuda" if torch.cuda.is_available() else "cpu"
print("Using device:", device)

model_id = "runwayml/stable-diffusion-v1-5"

pipe = StableDiffusionPipeline.from_pretrained(
    model_id,
    torch_dtype=torch.float16 if device == "cuda" else torch.float32
)

pipe = pipe.to(device)
```

Flax classes are deprecated and will be removed in Diffusers v1.0.0.
We recommend migrating to PyTorch classes or pinning your version of
Diffusers.
Flax classes are deprecated and will be removed in Diffusers v1.0.0.
We recommend migrating to PyTorch classes or pinning your version of
Diffusers.

Using device: cuda

/usr/local/lib/python3.12/dist-packages/huggingface_hub/utils/
_auth.py:94: UserWarning:
The secret `HF_TOKEN` does not exist in your Colab secrets.
To authenticate with the Hugging Face Hub, create a token in your
settings tab (https://huggingface.co/settings/tokens), set it as
secret in your Google Colab and restart your session.
You will be able to reuse this secret in all of your notebooks.
Please note that authentication is recommended but still optional to
access public models or datasets.
  warnings.warn(

{"model_id":"f30196fa85c9456da0b3e53ebc201240","version_major":2,"version_minor":0}

{"model_id":"f1b0d9dd4cbd4708b6cb29426339de78","version_major":2,"version_minor":0}

{"model_id":"c6bc4e5f690445f889af552ccead4a64","version_major":2,"version_minor":0}

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{"model_id":"f4a268d251b6465d812141d7a138a450","version_major":2,"version_minor":0}

`torch_dtype` is deprecated! Use `dtype` instead!

```python
import os

dataset_path = "synthetic_dataset"
os.makedirs(dataset_path, exist_ok=True)

prompts = [
    "A futuristic city at sunset, ultra realistic",
    "A robot playing basketball, cinematic lighting",
    "A peaceful mountain village with snowfall",
    "A cyberpunk street at night with neon lights",
    "A realistic lion sitting on a rock in the jungle"
]

generated_images = []

for idx, prompt in enumerate(prompts):
    image = pipe(prompt).images[0]

    image_path = os.path.join(dataset_path, f"image_{idx+1}.png")
    image.save(image_path)

    generated_images.append(image)

print("Synthetic dataset generated and saved successfully!")
```

{"model_id":"7940b0909d4e47dab59063bbf783b371","version_major":2,"version_minor":0}

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{"model_id":"2a65d68821e34c619562d0c0591cf988","version_major":2,"version_minor":0}

Synthetic dataset generated and saved successfully!

```python
import matplotlib.pyplot as plt

plt.figure(figsize=(15, 8))

for i, img in enumerate(generated_images):
    plt.subplot(2, 3, i + 1)
    plt.imshow(img)
    plt.axis("off")
    plt.title(f"Sample {i+1}")

plt.tight_layout()
plt.show()
```
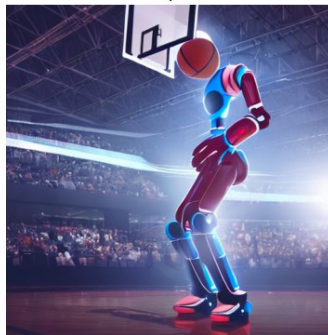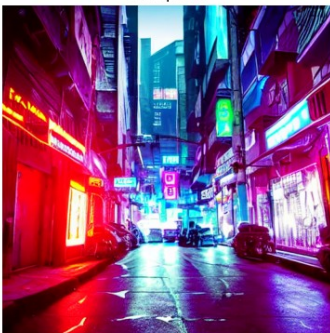

Sample 1

Sample 2

Sample 3

Sample 4

Sample 5

```python
!pip install diffusers transformers accelerate safetensors torch torchvision matplotlib

import os
```

```python
import torch
import matplotlib.pyplot as plt
from diffusers import StableDiffusionPipeline

device = "cuda" if torch.cuda.is_available() else "cpu"
print("Using device:", device)

model_id = "runwayml/stable-diffusion-v1-5"

pipe = StableDiffusionPipeline.from_pretrained(
    model_id,
    torch_dtype=torch.float16 if device == "cuda" else torch.float32
)
pipe = pipe.to(device)

prompts = {
    "pneumonia": "Chest X-ray showing bacterial pneumonia with lung
opacities, grayscale radiology image",
    "tuberculosis": "Chest X-ray showing tuberculosis with lung
cavitation, realistic medical radiology scan",
    "covid_like": "Chest X-ray showing viral pneumonia with bilateral
ground glass opacities, grayscale radiology image",
    "fracture": "Medical X-ray image of a human forearm bone fracture,
broken radius and ulna, orthopedic radiology scan, grayscale",
    "arthritis": "Knee X-ray showing osteoarthritis with joint space
narrowing, grayscale radiology image"
}

base_path = "synthetic_xray_dataset"
os.makedirs(base_path, exist_ok=True)

for disease in prompts:
    os.makedirs(os.path.join(base_path, disease), exist_ok=True)

images_per_disease = 2
generated_data = []

for disease, prompt in prompts.items():
    for i in range(images_per_disease):
        image = pipe(
            prompt,
            height=384,
            width=384,
            guidance_scale=8,
            num_inference_steps=30
        ).images[0]

        save_path = os.path.join(base_path, disease,
f"{disease}_{i+1}.png")
        image.save(save_path)
```

```
        generated_data.append((disease, image))

print("Synthetic X-ray dataset generated successfully")

plt.figure(figsize=(15, 8))

for i, (disease, img) in enumerate(generated_data):
    plt.subplot(2, 5, i + 1)
    plt.imshow(img, cmap="gray")
    plt.title(disease)
    plt.axis("off")

plt.tight_layout()
plt.show()
```

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Requirement already satisfied: diffusers in
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/usr/local/lib/python3.12/dist-packages (from torch) (2025.3.0)
Requirement already satisfied: nvidia-cuda-nvrtc-cu12==12.6.77 in
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Requirement already satisfied: nvidia-cuda-runtime-cu12==12.6.77 in
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Requirement already satisfied: urllib3<3,>=1.21.1 in
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(2.5.0)
Using device: cuda
```

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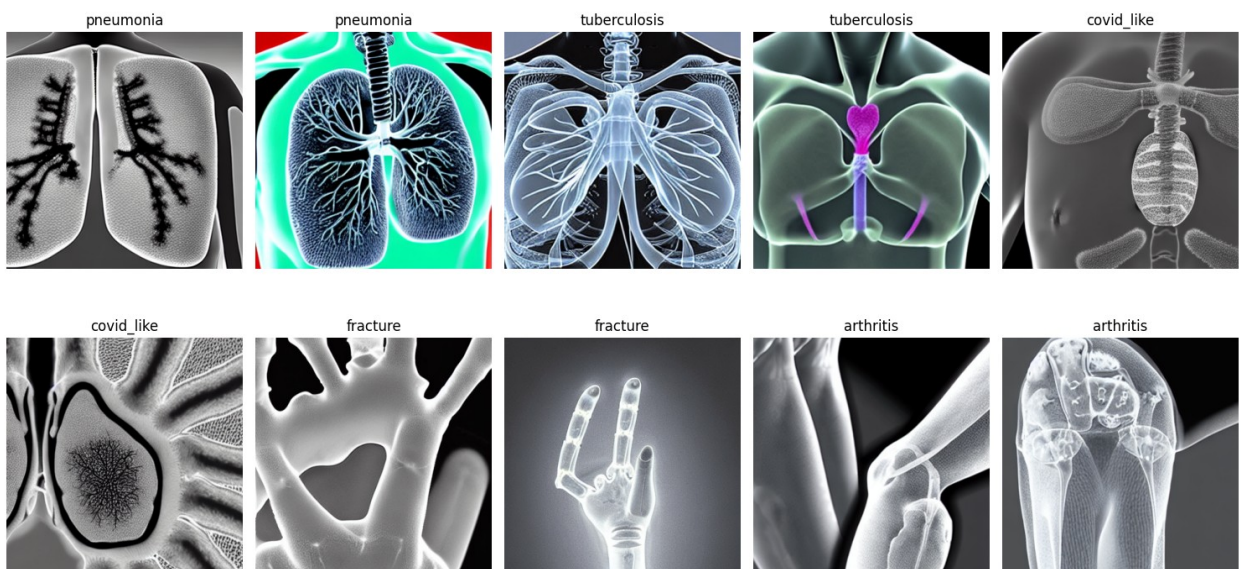{"model_id":"8f2f708da75640d78770b691f9f03a25","version_major":2,"version_minor":0}

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Synthetic X-ray dataset generated successfully

```python
import os
import torch
import torchvision.transforms as transforms
from torchvision import models
from PIL import Image
import matplotlib.pyplot as plt
import torch.nn.functional as F

device = "cuda" if torch.cuda.is_available() else "cpu"
print("Using device:", device)

model = models.densenet121(weights=models.DenseNet121_Weights.DEFAULT)
model.eval()
model = model.to(device)

transform = transforms.Compose([
    transforms.Resize((224, 224)),
    transforms.Grayscale(num_output_channels=3),
    transforms.ToTensor(),
    transforms.Normalize(
        mean=[0.485, 0.456, 0.406],
        std=[0.229, 0.224, 0.225]
    )
])

dataset_path = "synthetic_xray_dataset"

images = []
true_labels = []

for disease in os.listdir(dataset_path):
    folder = os.path.join(dataset_path, disease)
    for img_name in os.listdir(folder):
        images.append(os.path.join(folder, img_name))
        true_labels.append(disease)

plt.figure(figsize=(15, 8))

for i, img_path in enumerate(images[:5]):
    img = Image.open(img_path).convert("L")
    input_tensor = transform(img).unsqueeze(0).to(device)

    with torch.no_grad():
        outputs = model(input_tensor)
        probs = F.softmax(outputs, dim=1)
        confidence = torch.max(probs).item()

    plt.subplot(1, 5, i + 1)
    plt.imshow(img, cmap="gray")
    plt.title(f"True: {true_labels[i]}\nConf: {confidence:.2f}")
    plt.axis("off")
```

```
plt.tight_layout()
plt.show()

Using device: cuda
```


True: pneumonia
Conf: 0.10

True: pneumonia
Conf: 0.23

True: pneumonia
Conf: 0.29

True: covid_like
Conf: 0.23

True: covid_like
Conf: 0.17