Marra_Fingerprint_Generation

May 14, 2021

[ ]:
```
import torch
import random
import numpy as np
import matplotlib.pyplot as plt
```

[ ]:
```
from google.colab import drive
drive.mount('/content/gdrive', force_remount=True)
```

```
Mounted at /content/gdrive
```

[ ]:
```
import sys
sys.path.append('/content/gdrive/My Drive/')
```

[ ]:
```
import model_architectures as ma
import fp_utilities as fp_utils
import plot_utilities as plot_utils
```

[ ]:
```
manualSeed = 500

torch.manual_seed(manualSeed)
random.seed(manualSeed)
np.random.seed(manualSeed)

fixed_noise = torch.randn(512,  ma.nz, 1, 1)
```

[ ]:
```
netG1, netG2, netG3 = fp_util.initialise_generators()
```

[ ]:
```
#generate images to compute fingerprints from

fake1_finger = netG1(fixed_noise).detach().numpy().reshape(512,28,28)
fake2_finger = netG2(fixed_noise).detach().numpy().reshape(512,28,28)
fake3_finger = netG3(fixed_noise).detach().numpy().reshape(512,28,28)

test_loader = torch.utils.data.DataLoader(torchvision.datasets.MNIST('/files/',␣
 ↪train=False, download=True, transform=torchvision.transforms.ToTensor()),␣
 ↪batch_size=512)
real_finger, _ = next(iter(test_loader))
```

```
Downloading http://yann.lecun.com/exdb/mnist/train-images-idx3-ubyte.gz to
/files/MNIST/raw/train-images-idx3-ubyte.gz

HBox(children=(FloatProgress(value=1.0, bar_style='info', max=1.0), HTML(value='')))


Extracting /files/MNIST/raw/train-images-idx3-ubyte.gz to /files/MNIST/raw
Downloading http://yann.lecun.com/exdb/mnist/train-labels-idx1-ubyte.gz to
/files/MNIST/raw/train-labels-idx1-ubyte.gz

HBox(children=(FloatProgress(value=1.0, bar_style='info', max=1.0), HTML(value='')))


Extracting /files/MNIST/raw/train-labels-idx1-ubyte.gz to /files/MNIST/raw
Downloading http://yann.lecun.com/exdb/mnist/t10k-images-idx3-ubyte.gz to
/files/MNIST/raw/t10k-images-idx3-ubyte.gz

HBox(children=(FloatProgress(value=1.0, bar_style='info', max=1.0), HTML(value='')))


Extracting /files/MNIST/raw/t10k-images-idx3-ubyte.gz to /files/MNIST/raw
Downloading http://yann.lecun.com/exdb/mnist/t10k-labels-idx1-ubyte.gz to
/files/MNIST/raw/t10k-labels-idx1-ubyte.gz

HBox(children=(FloatProgress(value=1.0, bar_style='info', max=1.0), HTML(value='')))


Extracting /files/MNIST/raw/t10k-labels-idx1-ubyte.gz to /files/MNIST/raw
Processing...
Done!

/usr/local/lib/python3.6/dist-packages/torchvision/datasets/mnist.py:480:
UserWarning: The given NumPy array is not writeable, and PyTorch does not
support non-writeable tensors. This means you can write to the underlying
(supposedly non-writeable) NumPy array using the tensor. You may want to copy
the array to protect its data or make it writeable before converting it to a
tensor. This type of warning will be suppressed for the rest of this program.
(Triggered internally at  /pytorch/torch/csrc/utils/tensor_numpy.cpp:141.)
  return torch.from_numpy(parsed.astype(m[2], copy=False)).view(*s)
```

[ ]:

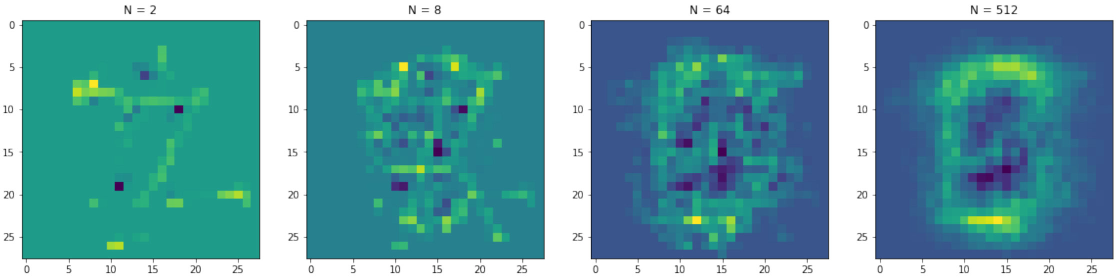
```
np.save('/content/gdrive/My Drive/Diss/Marra/Images_Fingerprints/GAN_1_images',␣
  ↪fake1_finger)
np.save('/content/gdrive/My Drive/Diss/Marra/Images_Fingerprints/GAN_2_images',␣
  ↪fake2_finger)
np.save('/content/gdrive/My Drive/Diss/Marra/Images_Fingerprints/GAN_3_images',␣
  ↪fake3_finger)
np.save('/content/gdrive/My Drive/Diss/Marra/Images_Fingerprints/Real_images',␣
  ↪real_finger)
```

[ ]:
```
def compute_source_fingerprint(gan_num, denoising_method="median blur"):
  fig, ax = plt.subplots(1,4, figsize = (20,15))
  N = [2,8,64,512]
  file_name_load = "GAN_{:d}_images.npy".format(gan_num) if gan_num > 0 else␣
↪"Real_images.npy"
  images_finger = np.load('/content/gdrive/My Drive/Diss/Marra/
↪Images_Fingerprints/'+file_name_load)
  for ind, num in enumerate(N,0):
    residue_sum = np.zeros((28,28))
    for i in range(num):
      img = images_finger[i]
      residual = fp_util.extract_fingerprint(img, 'Marra', denoising_method)
      residue_sum += residue
    residue_sum /= num
    if(num == 512):
      file_name_save = "print_GAN_{:d}".format(gan_num) if gan_num > 0 else␣
↪"print_real"
      np.save('/content/gdrive/My Drive/Diss/Marra/Fingerprints/
↪'+file_name_save+'_{}'.format(denoising_method.replace(" ","_")),␣
↪residue_sum)
    ax[ind].imshow(residue_sum)
    ax[ind].set_title('N = {:d}'.format(num))
```

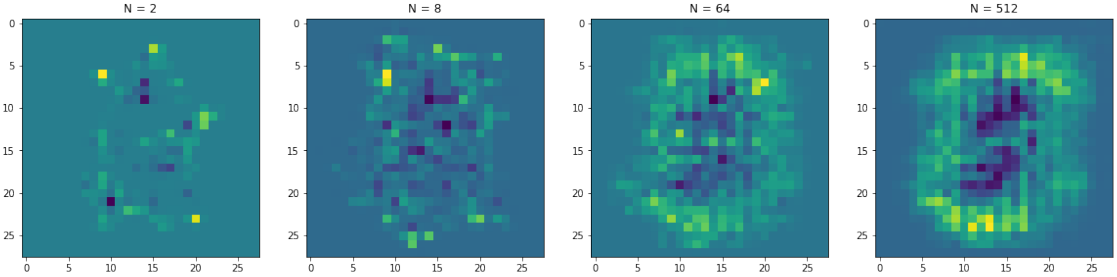
0.1 Evolution of Fingerprints

Visualising how the fingerprints evolve as the number of residuals used to compute them is increased

[ ]:
```
compute_source_fingerprint(0, "median blur")
```

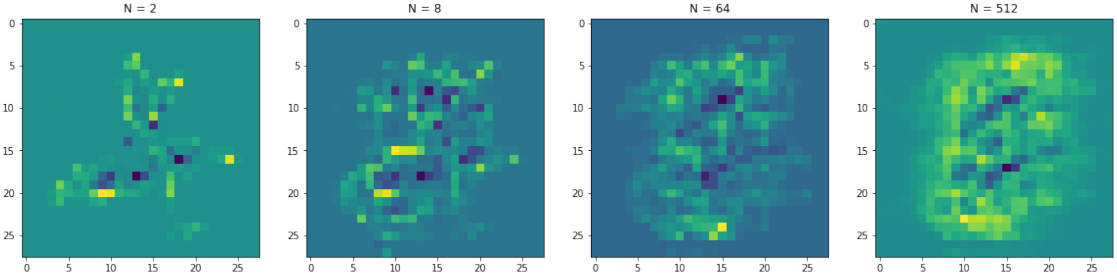


[ ]:
```
compute_source_fingerprint(1, "median blur")
```



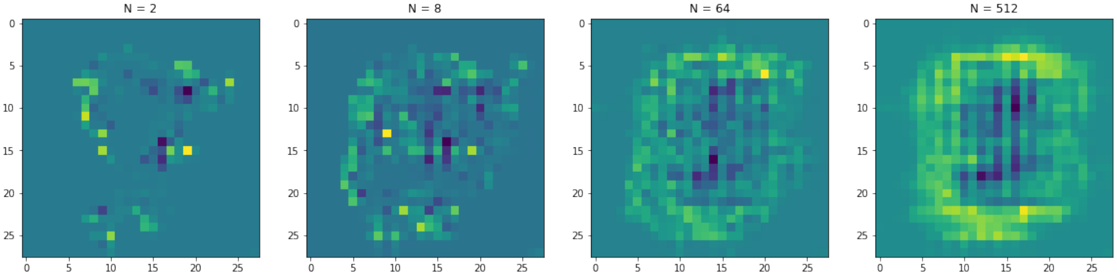
[ ]:

```
compute_source_fingerprint(2, "median blur")
```



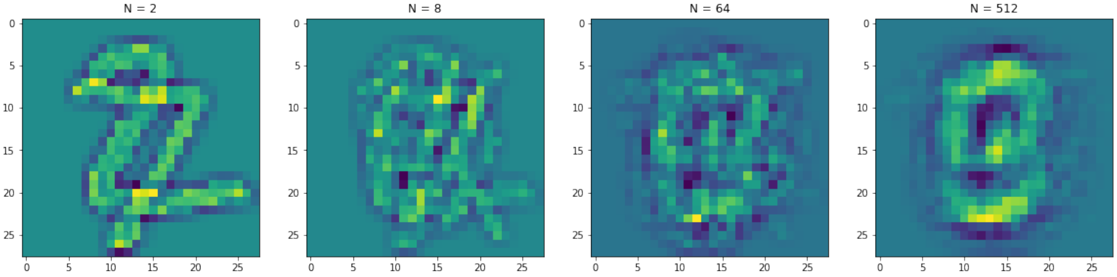
[ ]:

```
compute_source_fingerprint(3, "median blur")
```

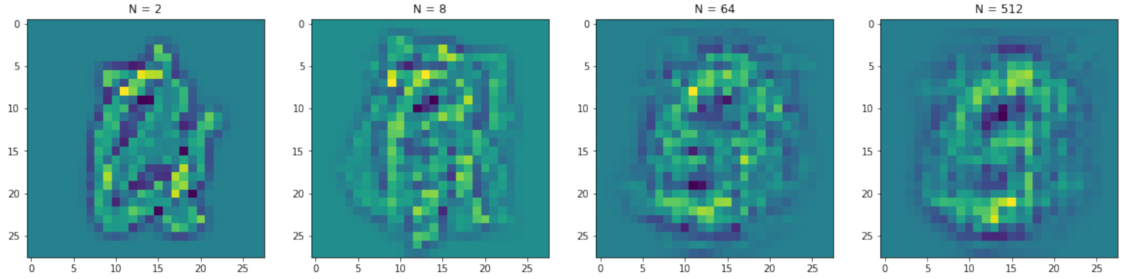


[ ]:

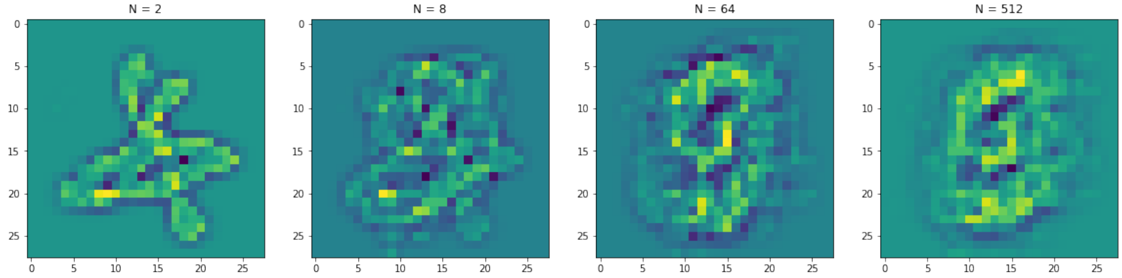
```
compute_source_fingerprint(0, "gaussian blur")
```



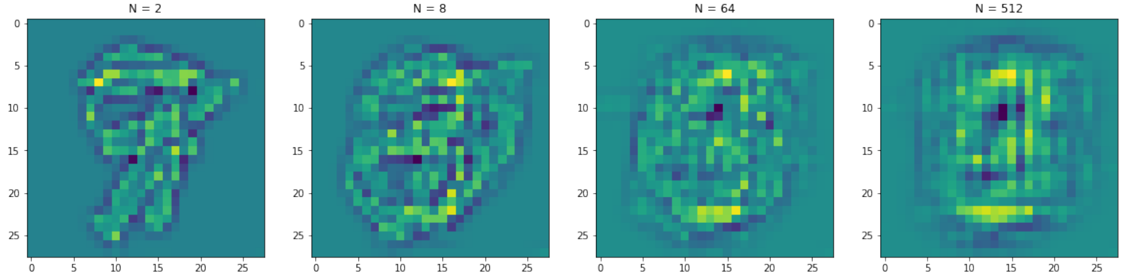
```
[ ]: compute_source_fingerprint(1, "gaussian blur")
```



```
[ ]: compute_source_fingerprint(2, "gaussian blur")
```

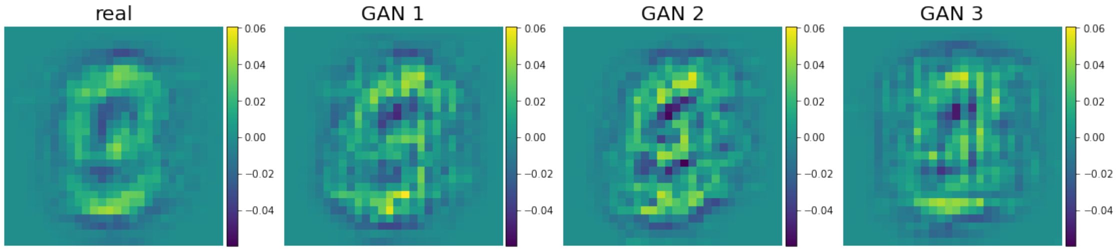


```
[ ]: compute_source_fingerprint(3, "gaussian blur")
```



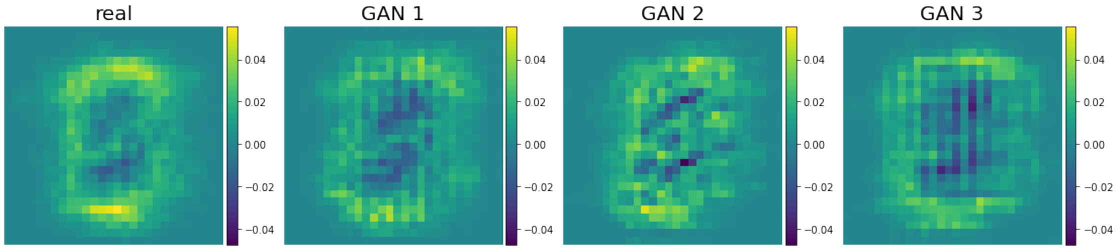
0.2 Handcrafted Fingerprints (Gaussian)

```
[ ]: plot_utils.plot_fingerprints('Marra', 'gaussian blur')
```



0.3 Handcrafted Fingerprints (Median)

[ ]:
```
plot_utils.plot_fingerprints('Marra', 'median blur')
```


real
GAN 1
GAN 2
GAN 3