test_2b

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0.1 Intermediate Deep Learning Test 2b

Per Piazza post allowing a Python script, the following code calculates the FID scores for 2 sets of fake images and determines the best set.

The code follows this equation:

$$\text{FID}(\mu_r, \Sigma_r, \mu_g, \Sigma_g) = \|\mu_r - \mu_g\|^2 + \text{Tr}\left(\Sigma_r + \Sigma_g - 2(\Sigma_r \Sigma_g)^{\frac{1}{2}}\right)$$

```python
[4]: import numpy as np
     from scipy.linalg import sqrtm

     # Real image statistics
     mu_real = np.array([0.5, 0.2, 0.7, 0.4])
     sigma_real = np.array([
         [0.2, 0.1, 0.05, 0.02],
         [0.1, 0.3, 0.1, 0.05],
         [0.05, 0.1, 0.4, 0.1],
         [0.02, 0.05, 0.1, 0.2]
     ])

     # Fake set I statistics
     mu1 = np.array([0.4, 0.3, 0.5, 0.6])
     sigma1 = np.array([
         [0.7, 0.1, 0.05, 0.02],
         [0.1, 0.2, 0.1, 0.05],
         [0.05, 0.1, 0.3, 0.1],
         [0.02, 0.05, 0.1, 0.15]
     ])

     # Fake set II statistics
     mu2 = np.array([0.7, 0.1, 0.3, 0.5])
     sigma2 = np.array([
         [0.4, 0.05, 0.05, 0.01],
         [0.05, 0.3, 0.1, 0.05],
         [0.05, 0.1, 0.2, 0.05],
         [0.01, 0.05, 0.05, 0.2]
     ])
```

```python
def calculate_fid(real_mu, real_sigma, x_mu, x_sigma):
    diff = real_mu - x_mu # calculate difference
    mean_diff = np.sum(diff**2) # matrix mean distance

    # Matrix square root of product of covariances
    covmean, _ = sqrtm(real_sigma @ x_sigma, disp=False)

    fid = mean_diff + np.trace(real_sigma + x_sigma - 2 * covmean) # sum of
  ↪squared differences + sum along diagonals
    return fid

# Calculate FIDs
fid1 = calculate_fid(mu_real, sigma_real, mu1, sigma1)
fid2 = calculate_fid(mu_real, sigma_real, mu2, sigma2)

print(f"FID between Real and Fake Set I: {fid1:.4f}")
print(f"FID between Real and Fake Set II: {fid2:.4f}")

# Determine better set
better = "Set I" if fid1 < fid2 else "Set II"
print(f"\nBased on FID score, Fake Image {better} is better")
```

FID between Real and Fake Set I: 0.2811
FID between Real and Fake Set II: 0.3044

Based on FID score, Fake Image Set I is better