计算机视觉原理与算法作业

1、复现PSNR

先计算两幅图点对点的均方差，再带入公式求psnr即可。

```
def PSNR(img1, img2, maxI=255):
    # img1为参考图像 img2为待评估图像
    mse = np.mean((img1 - img2)**2)
    psnr = 10 * np.log10(maxI*maxI/mse)
    return psnr
```

2、SSIM探索

2.1 为什么要基于滑动窗计算SSIM

- 通过分块处理图像，可以减少计算量并提高效率，可以并行处理不同的滑动窗口。
- 图像的全局相似性很大程度上取决于局部区域之间的相似性。

2.2 SSIM代码复现

- 参考源码使用高斯窗加权，默认`sigma=1.5, K1=0.01, k2=0.03`;
- 参考源码使用近似的方法计算方差和协方差;
- 默认`win_size=9`。

```
def SSIM(img1, img2, K1=0.01, K2=0.03, win_size=9, sigma=1.5, L=255):
    # img1为参考图像 img2为待评估图像
    C1 = (K1*L)**2
    C2 = (K2*L)**2
    # 高斯加权滑动窗口
    mu1 = gaussian_filter(img1, sigma)
    mu2 = gaussian_filter(img2, sigma)
    # 方差 和 协方差
    NP = win_size ** 2
    cov_norm = NP / (NP - 1)  # 样本方差
    sigma1 = (gaussian_filter(img1 * img1, sigma) - mu1*mu1) * cov_norm
    sigma2 = (gaussian_filter(img2 * img2, sigma) -mu2*mu2) * cov_norm
    sigma12 = (gaussian_filter(img1 * img2, sigma) - mu1*mu2) * cov_norm
    # ssim
    A1 = 2*mu1*mu2+C1
    A2 = 2*sigma12+C2
    B1 = mu1**2 + mu2**2 + C1
    B2 = sigma1 + sigma2 + C2
    ssim = (A1*A2)/(B1*B2)
    ssim = np.mean(ssim)
    return ssim
```

3、代码运行

切换到根目录下，直接运行脚本即可，会激活相应的虚拟环境并安装`requirements.txt`里对应的依赖库。

```
opencv-python
numpy
scipy
```

在命令行输入指令`sh run.sh`，可以得到score_test.csv文件，输出信息如下图，分别代表序号，参考图像，待评估图像，PSNR分数，SSIM分数。

```
15628@LAPTOP-BMB99FG3 MINGW64 /d/homework/cv/homework
$ sh run.sh
running begin...
Requirement already satisfied: opencv-python in d:\homework\
Requirement already satisfied: numpy in d:\homework\cv\homew
Requirement already satisfied: scipy in d:\homework\cv\homew

[notice] A new release of pip is available: 23.2.1 -> 24.3.1
[notice] To update, run: python.exe -m pip install --upgrade
1 1600.png 1600.AWGN.1.png 41.27867 0.97283435
2 1600.png 1600.AWGN.2.png 35.80285 0.9169306
3 1600.png 1600.AWGN.3.png 31.005915 0.8114508
4 1600.png 1600.AWGN.4.png 26.86979 0.6763986
5 1600.png 1600.AWGN.5.png 23.511297 0.5457604
6 fisher.png 1600.AWGN.1.png 9.038673 0.23173118
7 fisher.png 1600.AWGN.2.png 9.047929 0.20740029
8 fisher.png 1600.AWGN.3.png 9.056634 0.16274646
9 fisher.png 1600.AWGN.4.png 9.066684 0.113995016
10 fisher.png 1600.AWGN.5.png 9.090446 0.07835376
11 sunset_sparrow.png 1600.AWGN.1.png 8.976535 0.2098011
12 sunset_sparrow.png 1600.AWGN.2.png 8.9838 0.18655407
13 sunset_sparrow.png 1600.AWGN.3.png 8.987946 0.14564067
14 sunset_sparrow.png 1600.AWGN.4.png 8.997134 0.10216202
15 sunset_sparrow.png 1600.AWGN.5.png 9.012167 0.07086721
calculate ending----------------
running finished!
```