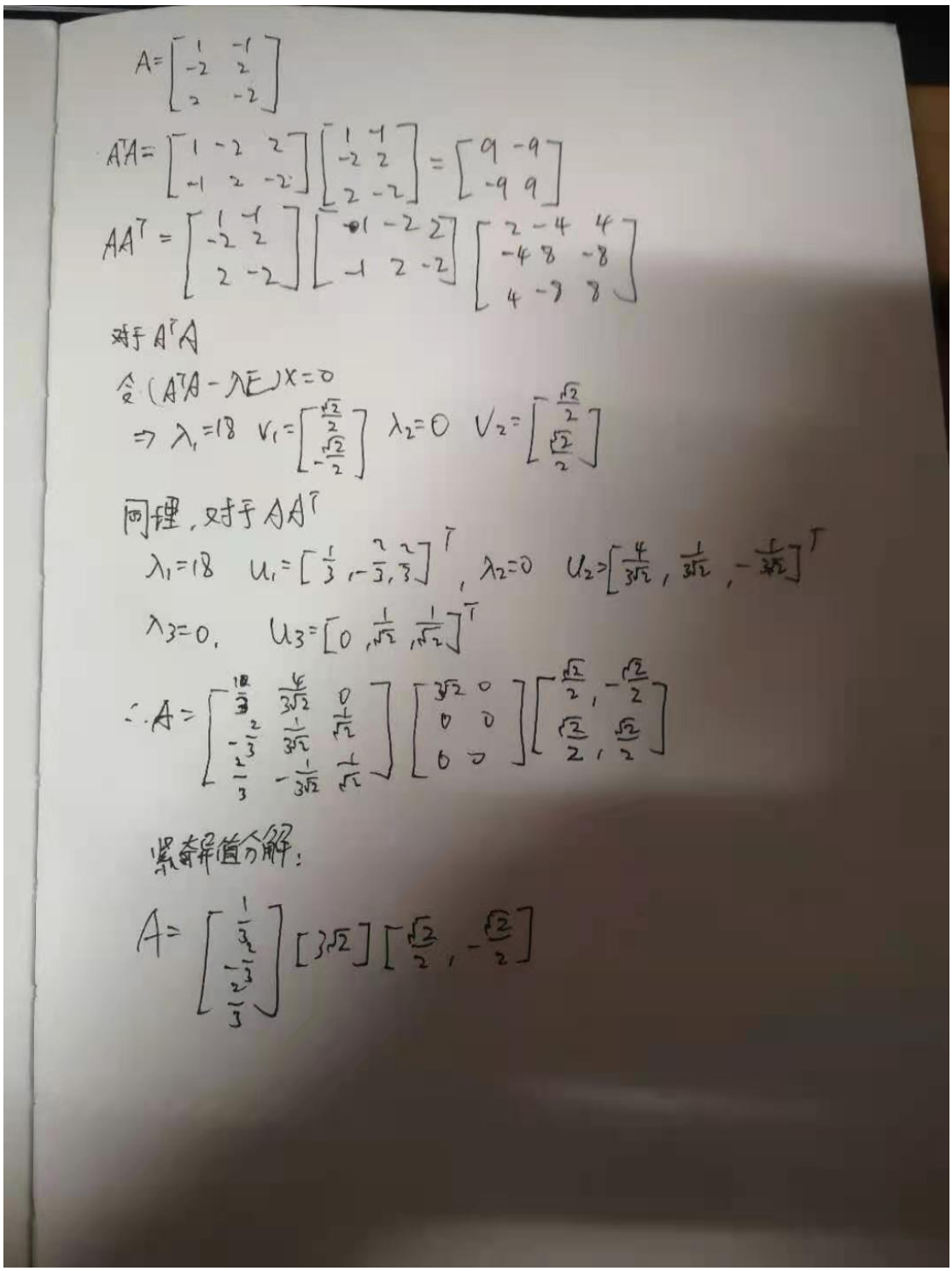
大数据管理方法与应用作业 1

大数据 81 郭英明

1. 求下列矩阵的一个完全奇异值分解，并写出相应的紧奇异值分解:



2. 利用奇异值分解压缩下列图片，对比保留不同比例（1%，2%，5%，10%，20%，30%）特征值时重构的图片与原图片的异同。

代码:

```
import numpy as np
from PIL import Image


def imgCompress(channel, percent):
    U, sigma, V_T = np.linalg.svd(channel)
    m = U.shape[0]
    n = V_T.shape[0]
    reChannel = np.zeros((m, n))

    for k in range(len(sigma)):
        reChannel = reChannel + sigma[k] * np.dot(U[:, k].reshape(m, 1),
V_T[k, :].reshape(1, n))
        if float(k) / len(sigma) > percent:
            reChannel[reChannel < 0] = 0
            reChannel[reChannel > 255] = 255
            break

    return np.rint(reChannel).astype("uint8")


oriImage = Image.open(r'D:\桌面\奇异值.jpg', 'r')
imgArray = np.array(oriImage)

R = imgArray[:, :, 0]
G = imgArray[:, :, 1]
B = imgArray[:, :, 2]
# A = imgArray[:, :, 3]

for p in [0.01, 0.02,  0.05, 0.1, 0.2, 0.3]:
    reR = imgCompress(R, p)
    reG = imgCompress(G, p)
    reB = imgCompress(B, p)
    # reA = imgCompress(A, p)
    reI = np.stack((reR, reG, reB), 2)

    Image.fromarray(reI).save("{}".format(p) + "img.png")
```

图片结果:

图片顺序依次为取特征值 1%，2%，5%，10%，20%，30%