

Mohanty_R_HW2_Computing_2

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1 HW2 Computing Problem 2

```
[3]: import numpy as np
import matplotlib.pyplot as plt
%matplotlib inline
from imageio import imread
import pandas as pd
```

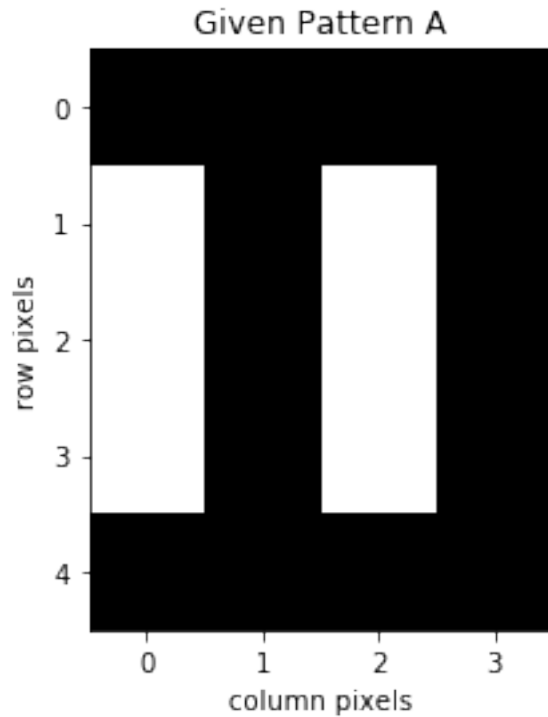
```
[4]: A = np.array( [[ 1, 1, 1, 1],
                    [ 0, 1, 0, 1],
                    [ 0, 1, 0, 1],
                    [ 0, 1, 0, 1],
                    [ 1, 1, 1, 1]], )
```

```
[5]: A
```

```
[5]: array([[1, 1, 1, 1],
          [0, 1, 0, 1],
          [0, 1, 0, 1],
          [0, 1, 0, 1],
          [1, 1, 1, 1]])
```

```
[15]: fig, ax = plt.subplots(1, 1)
ax.set_title('Given Pattern A')
ax.set_xlabel('column pixels')
ax.set_ylabel('row pixels')
ax.imshow(1-A, cmap='gray')
```

```
[15]: <matplotlib.image.AxesImage at 0x117783f98>
```



```
[7]: A.shape
```

```
[7]: (5, 4)
```

```
[8]: U,S,V=np.linalg.svd(A)
```

```
[14]: rank_k=[1,2,3,4]
```

```
position=[(0,0),(0,1),(1,0),(1,1)]
```

```
fig, ax = plt.subplots(2, 2,figsize=(10,10))
```

```
fig.suptitle('Reconstruction of matrix A', fontsize=20)
```

```
i=0
```

```
for k in rank_k:
```

```
    A_k = np.dot(U[:, :k], np.dot(np.diag(S[:k]), V[:k, :]))
```

```
    ax[position[i][0], position[i][1]].set_title('Rank '+str(k))
```

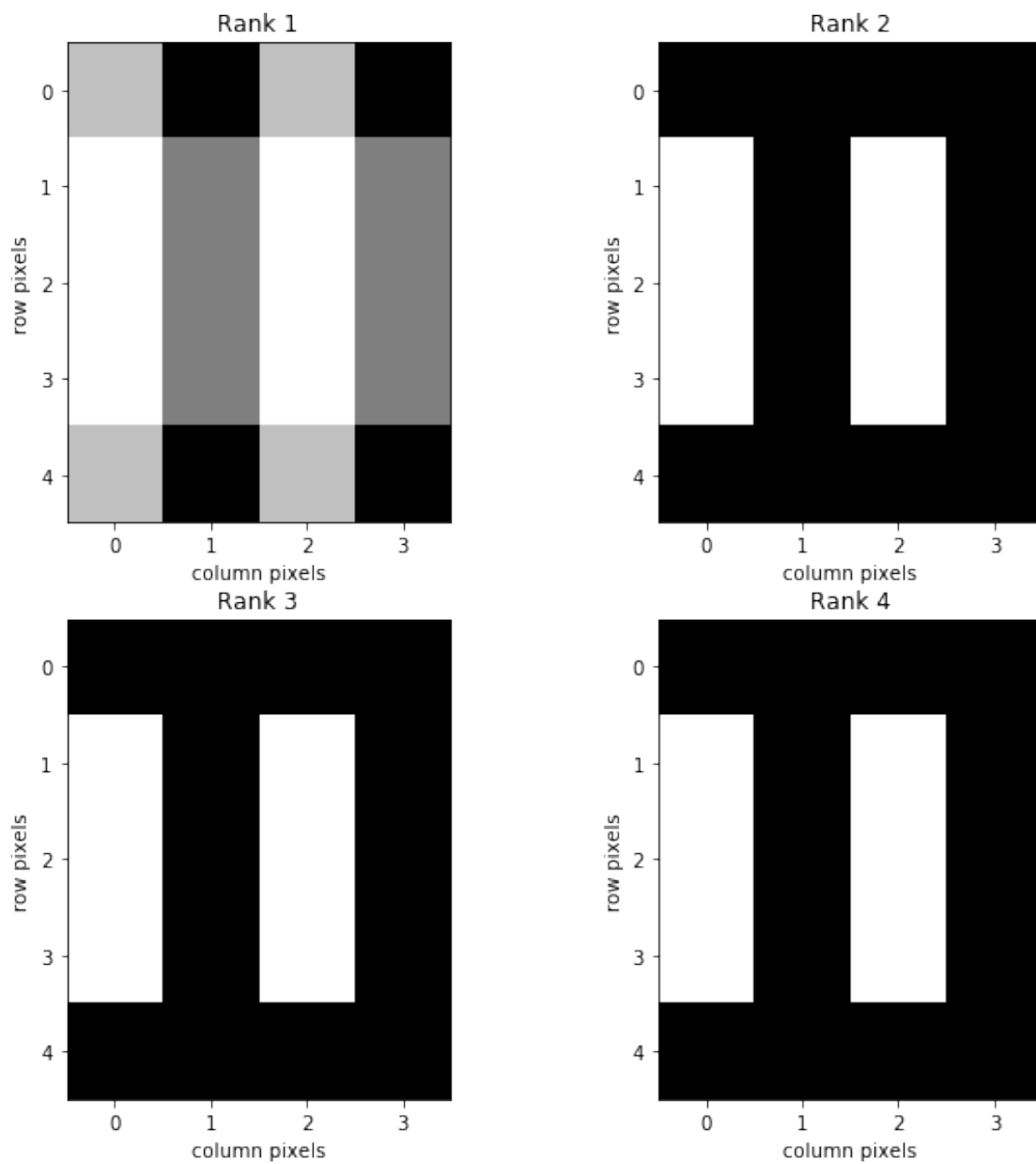
```
    ax[position[i][0], position[i][1]].set_xlabel('column pixels')
```

```
    ax[position[i][0], position[i][1]].set_ylabel('row pixels')
```

```
    ax[position[i][0], position[i][1]].imshow(1-A_k, cmap='gray')
```

```
    i+=1
```

Reconstruction of matrix A



```
[10]: pd.DataFrame(A)
```

```
[10]:  0  1  2  3
0  1  1  1  1
1  0  1  0  1
2  0  1  0  1
3  0  1  0  1
```

```
4 1 1 1 1
```

```
[11]: print("Original matrix A\n")
      print(pd.DataFrame(A))
```

Original matrix A

```
   0  1  2  3
0  1  1  1  1
1  0  1  0  1
2  0  1  0  1
3  0  1  0  1
4  1  1  1  1
```

```
[12]: i=0
      for k in rank_k:
          A_k = np.dot(U[:, :k], np.dot(np.diag(S[:k]), V[:, :]))
          A_k = np.round(A_k, 2)
          print("Rank " + str(k) + " matrix\n")
          print(pd.DataFrame(A_k))
          print("\n")
```

Rank 1 matrix

```
   0  1  2  3
0  0.6 1.2 0.6 1.2
1  0.4 0.8 0.4 0.8
2  0.4 0.8 0.4 0.8
3  0.4 0.8 0.4 0.8
4  0.6 1.2 0.6 1.2
```

Rank 2 matrix

```
   0  1  2  3
0  1.0 1.0 1.0 1.0
1  0.0 1.0 0.0 1.0
2  0.0 1.0 0.0 1.0
3  0.0 1.0 0.0 1.0
4  1.0 1.0 1.0 1.0
```

Rank 3 matrix

```
   0  1  2  3
0  1.0 1.0 1.0 1.0
1  0.0 1.0 -0.0 1.0
```

```
2  0.0  1.0  0.0  1.0
3  0.0  1.0  0.0  1.0
4  1.0  1.0  1.0  1.0
```

Rank 4 matrix

```
      0    1    2    3
0  1.0  1.0  1.0  1.0
1  0.0  1.0 -0.0  1.0
2  0.0  1.0  0.0  1.0
3  0.0  1.0  0.0  1.0
4  1.0  1.0  1.0  1.0
```

`[]:`