

Mohanty_R_HW2_computing_1

March 12, 2020

1 HW2 Computing Problem 1

```
[1]: import scipy as spy
import numpy as np
import matplotlib.pyplot as plt
%matplotlib inline
from scipy.io import loadmat
import math
import pandas as pd
```

```
[3]: P1 = np.array( [[ 1, 1, 1, 1],
                    [ 1, 0, 0, 1],
                    [ 1, 0, 0, 1],
                    [ 1, 0, 0, 1],
                    [ 1, 1, 1, 1]], )
```

```
[4]: P2 = np.array( [[ 1, 1, 1, 1],
                    [ 0, 0, 0, 1],
                    [ 0, 0, 0, 1],
                    [ 0, 0, 0, 1],
                    [ 1, 1, 1, 1]], )
```

```
[5]: P3 = np.array( [[ 1, 1, 1, 1],
                    [ 0, 0, 0, 0],
                    [ 0, 0, 0, 0],
                    [ 0, 0, 0, 0],
                    [ 1, 1, 1, 1]], )
```

```
[2]: P_new = np.array( [[ 1, 1, 1, 1],
                    [ 0, 1, 0, 1],
                    [ 0, 1, 0, 1],
                    [ 0, 1, 0, 1],
                    [ 1, 1, 1, 1]], )
```

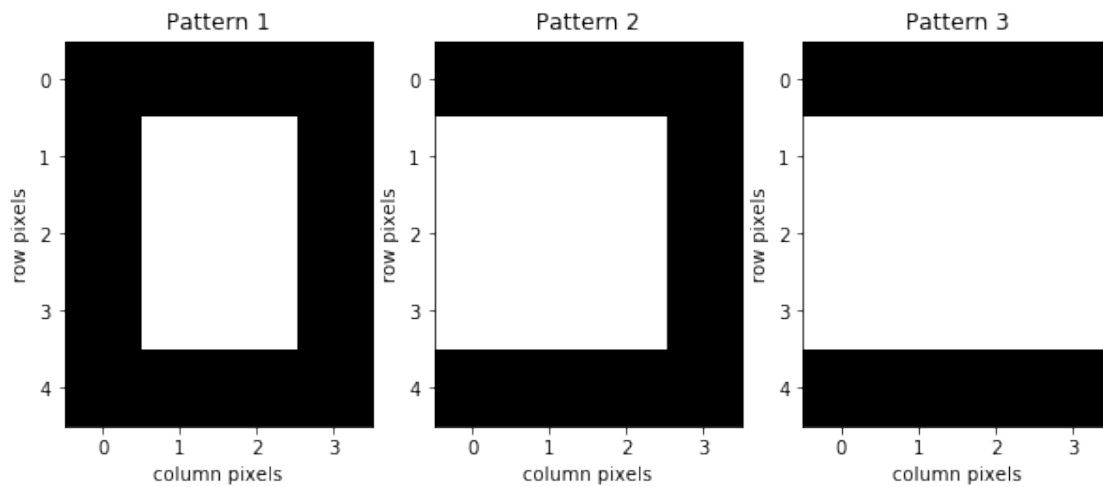
```
[6]: fig, ax = plt.subplots(1, 3, figsize=(10,10))
ax[0].set_title('Pattern 1')
ax[0].set_xlabel('column pixels')
ax[0].set_ylabel('row pixels')
```

```

ax[0].imshow(1-P1,cmap='gray')
ax[1].set_title('Pattern 2')
ax[1].set_xlabel('column pixels')
ax[1].set_ylabel('row pixels')
ax[1].imshow(1-P2,cmap='gray')
ax[2].set_title('Pattern 3')
ax[2].set_xlabel('column pixels')
ax[2].set_ylabel('row pixels')
ax[2].imshow(1-P3,cmap='gray')

```

[61]: <matplotlib.image.AxesImage at 0xb19af8940>

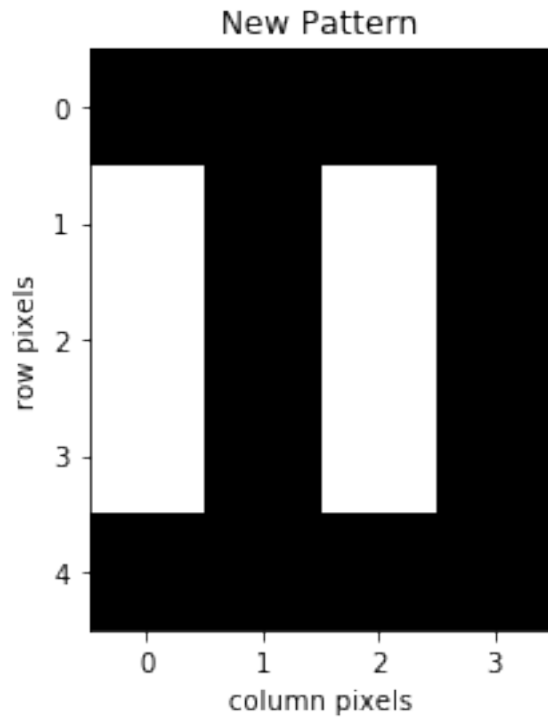


```

[63]: fig, ax = plt.subplots(1, 1)
ax.set_title('New Pattern')
ax.set_xlabel('column pixels')
ax.set_ylabel('row pixels')
ax.imshow(1-P_new,cmap='gray')

```

[63]: <matplotlib.image.AxesImage at 0xb19e48588>



```
[9]: P1_f=P1.flatten()  
     P2_f=P2.flatten()  
     P3_f=P3.flatten()
```

[64]: V

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

```
[1, 1, 1]])
```

```
[13]: V=np.array([P1_f,P2_f,P3_f]).T
```

```
[19]: M=sparse.linalg.orth(V)
```

checking for orthogonal vectors

```
[20]: np.dot(M[:,0],M[:,1])
```

```
[20]: 2.7755575615628914e-17
```

Checking for norm = 1

```
[21]: np.linalg.norm(M[:,0])
```

```
[21]: 0.9999999999999999
```

```
[22]: np.linalg.norm(M[:,1])
```

```
[22]: 1.0000000000000002
```

```
[24]: P=np.matmul(M,M.T)
```

```
[28]: P_new_f=P_new.flatten()
```

```
[29]: P_new_f.shape
```

```
[29]: (20,)
```

```
[27]: P.shape
```

```
[27]: (20, 20)
```

```
[41]: proj_P_new = np.matmul(P,P_new_f)
```

```
[42]: proj_P_new=np.round(proj_P_new)
```

```
[36]: P_new
```

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

```
[43]: proj_P_new
```

```
[43]: array([[1., 1., 1., 1., 0., 0., 0., 1., 0., 0., 0., 1., 0., 0., 0., 1., 1.,  
        1., 1., 1.]])
```

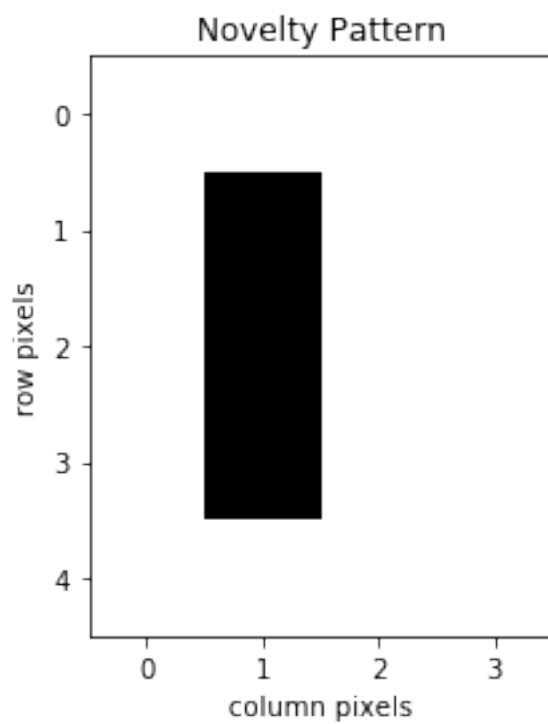
```
[44]: P_new_f
```

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

```
[54]: Novelty_pattern=np.subtract(P_new_f,proj_P_new).reshape(5,4)
```

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

```
[65]: <matplotlib.image.AxesImage at 0xb1a022b70>
```



```
[ ]:
```