

**OM KADAM AND MANAV GHADI**

```
In [1]: import numpy as np
import warnings
warnings.filterwarnings("ignore", category=DeprecationWarning)
```

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In [2]: joint = np.array([[1/8,1/16,1/32,1/32], [1/16,1/8,1/32,1/32], [1/16,1/16,1/16,1/16],
print(joint)

[[0.125  0.0625  0.03125 0.03125]
 [0.0625  0.125   0.03125 0.03125]
 [0.0625  0.0625  0.0625  0.0625 ]
 [0.25    0.       0.       0.       ]]
```

```
In [3]: joint_temp=joint.flatten()
H_XY=-np.sum(p*np.log2(p) for p in joint_temp if p>0)
H_XY
```

Out[3]: 3.375

```
In [4]: PX = np.sum(joint,axis = 1)
print("\nPX = ",PX)

HX = -np.sum(p * np.log2(p) for p in PX if p>0)
print("\nHX = ",HX)

PY = np.sum(joint,axis = 0)
print("\nPY = ",PY)

HY = -np.sum(p * np.log2(p) for p in PY if p>0)
print("\nHY = ",HY)
```

PX = [0.25 0.25 0.25 0.25]

HX = 2.0

PY = [0.5 0.25 0.125 0.125]

HY = 1.75

```
In [5]: PX_given_Y = joint/PY
print("\nP(X/Y) = ",PX_given_Y )
mask = PX_given_Y > 0

HX_given_Y = -np.sum(joint[mask] * np.log2(PX_given_Y[mask]))
print("\nH(X/Y) = ",HX_given_Y)
```

P(X/Y) = [[0.25 0.25 0.25 0.25 ]
 [0.125 0.5 0.25 0.25 ]
 [0.125 0.25 0.5 0.5 ]
 [0.5 0. 0. 0. ]]

H(X/Y) = 1.625

```
In [6]: PY_given_X=joint/PX
```

```

print("Py_given_x =\n",PY_given_X)
mask=PY_given_X>0

HY_given_X=-np.sum(joint[mask]*np.log2(PY_given_X[mask]))
print("Hy_given_x =\n",HY_given_X)

```

```

Py_given_x =
[[0.5   0.25  0.125 0.125]
 [0.25  0.5   0.125 0.125]
 [0.25  0.25  0.25  0.25 ]
 [1.    0.    0.    0.   ]]
Hy_given_x =
1.375

```

```

In [7]: IXY = HX + HY - H_XY
print("\nI(XY) = ", IXY)
IXY = HX - HX_given_Y
print("\nI(XY) = ", IXY)
IXY = HY - HY_given_X
print("\nI(XY) = ", IXY)
IXY = H_XY - HX_given_Y - HY_given_X
print("\nI(XY) = ", IXY)

```

I(XY) = 0.375

I(XY) = 0.375

I(XY) = 0.375

I(XY) = 0.375