```matlab
clear;close all; clc;
% Prepare image
f = imread('ImgPIA.jpg');
%convert image to gray
Igray = rgb2gray(f);

% https://uk.mathworks.com/matlabcentral/answers/24669-down-
quantization-8-bit-grey-to-n-bit-grey-n-8
% Reduce the number of bits to 6
reducedImage_6 = uint8((single(Igray)/256)*2^6);

% Reduce the number of bits to 4
reducedImage_4 = uint8((single(Igray)/256)*2^4);

% Reduce the number of bits to 2
reducedImage_2 = uint8((single(Igray)/256)*2^2);
%call functions and display relevant info
rotation = [0,45,90,135];

disp('Grayscale image');
coocurancematrix(Igray, rotation)

disp('6 Bit image');
coocurancematrix(reducedImage_6, rotation)

disp('4 Bit image');
coocurancematrix(reducedImage_4, rotation)

disp('2 Bit image');
coocurancematrix(reducedImage_2, rotation)


function coocurancematrix(image, rotation)
%set array for features
con = [];
corr = [];
energy = [];
homogen = [];
asm = [];
Image_entropy = [];
%For loop go over each different rotation and offset
for K=1:length(rotation)
    %roatate the image
    angled = imrotate(image, rotation(K));
    %0-D offset
    glcm = graycomatrix(angled, 'offset', [0 1]);
    %unpack stats
    stats = graycoprops(glcm);
    %add stats to arrays
    con = [con, [stats.Contrast]];
    corr = [corr,[stats.Correlation]];
    energy = [energy, [stats.Energy]];
```

```matlab
        homogen = [homogen, [stats.Homogeneity]];
        asm_hold = energy .* energy;
        asm = [asm_hold];
        Image_entropy = entropy(angled);
        Image_entropy = [Image_entropy];

        %-D D offset
        glcm = graycomatrix(angled, 'offset', [-1 1]);
        stats = graycoprops(glcm);
        con = [stats.Contrast];
        corr = [stats.Correlation];
        energy = [stats.Energy];
        homogen = [stats.Homogeneity];
        asm_hold = energy .* energy;
        asm = [asm_hold];

        %-D 0 offset
        glcm = graycomatrix(angled, 'offset', [-1 0]);
        stats = graycoprops(glcm);
        con = [stats.Contrast];
        corr = [stats.Correlation];
        energy = [stats.Energy];
        homogen = [stats.Homogeneity];
        asm_hold = energy .* energy;
        asm = [asm_hold];

        %-D -D offset
        glcm = graycomatrix(angled, 'offset', [-1 -1]);
        stats = graycoprops(glcm);
        con = [stats.Contrast];
        corr = [stats.Correlation];
        energy = [stats.Energy];
        homogen = [stats.Homogeneity];
        asm_hold = energy .* energy;
        asm = [asm_hold];

        %print table
        t = table(rotation(K), con, corr, energy, homogen, asm,
    Image_entropy);
        t
    end

end

Grayscale image

t =

  1×7 table

    Var1            con                   corr                   energy
        homogen               asm            Image_entropy
    ____    _____    _____    _____
    _____    _____    _____
```

```
    0       0.629842748602609     0.775898326089403     0.12504707117711
   0.802937571302352     0.0156367700099732     7.18186842913007
```

t =

  1×7 table

    Var1   con   corr   energy
       homogen   asm   Image_entropy
    ____   _____   _____   _____
   _____   _____   _____

     45   0.26813784764208   0.95649515688632   0.306895356548556
   0.912966444442263   0.0941847598710655   4.39394932038551

t =

  1×7 table

    Var1   con   corr   energy
       homogen   asm   Image_entropy
    ____   _____   _____   _____
   _____   _____   _____
   _____

     90   0.543930751564745   0.806466286027989
   0.132308352269842   0.820731967722022   0.0175055000803607
   7.18186842913007

t =

  1×7 table

    Var1   con   corr   energy
       homogen   asm   Image_entropy
    ____   _____   _____   _____
   _____   _____   _____
   _____

     135   0.302058766333932   0.950991114552273
   0.306393490432225   0.908901816876146   0.093876970979242
   4.39394741251795

6 Bit image

t =

  1×7 table
```

| Var1 | con | corr | energy | homogen | asm | Image_entropy |
|---|---|---|---|---|---|---|
| 0 | 0.142571353700854 | 0.67624282265697 | 0.437871340830931 | 0.928763795151898 | 0.191731311121078 | 5.18410740981101 |

t =

  1×7 table

| Var1 | con | corr | energy | homogen | asm | Image_entropy |
|---|---|---|---|---|---|---|
| 45 | 0.0606521290952716 | 0.768583630638378 | 0.681225443523106 | 0.969691481133276 | 0.464068104903252 | 3.44745322812702 |

t =

  1×7 table

| Var1 | con | corr | energy | homogen | asm | Image_entropy |
|---|---|---|---|---|---|---|
| 90 | 0.125467181896958 | 0.71508368199726 | 0.45039399625832 | 0.937312789053701 | 0.20285475186554 | 5.18410740981101 |

t =

  1×7 table

| Var1 | con | corr | energy | homogen | asm | Image_entropy |
|---|---|---|---|---|---|---|
| 135 | 0.0653258598480252 | 0.750742995957326 | 0.677163867392753 | 0.96736387597738 | 0.458550903302311 | 3.44745159649121 |

4 Bit image

t =

*1×7 table*

| *Var1* | *con* | *corr* | *energy* | *homogen* | *asm* | *Image_entropy* |
|------|-----|------|--------|---------|-----|---------------|
| 0 | 0 | NaN | 1 | 1 | 1 | 3.20066732497747 |

*t =*

*1×7 table*

| *Var1* | *con* | *corr* | *energy* | *homogen* | *asm* | *Image_entropy* |
|------|-----|------|--------|---------|-----|---------------|
| 45 | 0 | NaN | 1 | 1 | 1 | 2.50431015537851 |

*t =*

*1×7 table*

| *Var1* | *con* | *corr* | *energy* | *homogen* | *asm* | *Image_entropy* |
|------|-----|------|--------|---------|-----|---------------|
| 90 | 0 | NaN | 1 | 1 | 1 | 3.20066732497747 |

*t =*

*1×7 table*

| *Var1* | *con* | *corr* | *energy* | *homogen* | *asm* | *Image_entropy* |
|------|-----|------|--------|---------|-----|---------------|
| 135 | 0 | NaN | 1 | 1 | 1 | 2.50430959683886 |

*2 Bit image*

*t =*

```
  1×7 table

    Var1      con      corr     energy     homogen      asm      Image_entropy

    ____      ___      ____     _____     _____      ___

      0        0       NaN        1           1          1
  1.46133330496894


t =

  1×7 table

    Var1      con      corr     energy     homogen      asm      Image_entropy

    ____      ___      ____     _____     _____      ___

      45       0       NaN        1           1          1
  1.65915236651031


t =

  1×7 table

    Var1      con      corr     energy     homogen      asm      Image_entropy

    ____      ___      ____     _____     _____      ___

      90       0       NaN        1           1          1
  1.46133330496894


t =

  1×7 table

    Var1      con      corr     energy     homogen      asm      Image_entropy

    ____      ___      ____     _____     _____      ___

     135       0       NaN        1           1          1
  1.65916358854123
```

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