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

% 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
disp('Grayscale image');
graylevelmatrix(Igray)

disp('6 Bit image');
graylevelmatrix(reducedImage_6)

disp('4 Bit image');
graylevelmatrix(reducedImage_4)

disp('2 Bit image');
graylevelmatrix(reducedImage_2)


function graylevelmatrix(Igray)
%Gray levelrunmatrix from toolbox
%https://uk.mathworks.com/matlabcentral/fileexchange/17482-gray-level-
run-length-matrix-toolbox
figure;
imshow(Igray);
[GLRLMS, SI] = grayrlmatrix(Igray);
%Get stats for gray level run
stats = grayrlprops(GLRLMS);
%set stats to be values that aren't values of e
stats = vpa(stats);
%set variables to empty array to add to table
%Short Run Emphasis (SRE)
%Long Run Emphasis (LRE)
%Gray-Level Nonuniformity (GLN)
%Run Length Nonuniformity (RLN)
%Run Percentage (RP)
%Low Gray-Level Run Emphasis (LGRE)
%High Gray-Level Run Emphasis (HGRE)
%Short Run Low Gray-Level Emphasis (SRLGE)
```

```
%Short Run High Gray-Level Emphasis (SRHGE)
%Long Run Low Gray-Level Emphasis (LRLGE)
%Long Run High Gray-Level Emphasis (LRHGE)
SRE = [];
LRE = [];
GLN = [];
RLN = [];
RP = [];
LGRE = [];
HGRE = [];
SRLGE = [];
SRHGE = [];
LRLGE = [];
LRHGE = [];
%Set angle list for offset
angle_offset = [0;45;90;135];
%for loop appending arrays
for K=1:4
    SRE = [SRE, stats(K,1)];
    LRE = [LRE, stats(K,2)];
    GLN = [GLN, stats(K,3)];
    RLN = [RLN, stats(K,4)];
    RP = [RP, stats(K,5)];
    LGRE = [LGRE, stats(K,6)];
    HGRE = [HGRE, stats(K,7)];
    SRLGE = [SRLGE, stats(K,8)];
    SRHGE = [SRHGE, stats(K,9)];
    LRLGE = [LRLGE, stats(K,10)];
    LRHGE = [LRHGE, stats(K,11)];
end

SRE = reshape(double(SRE), 4,1);
GLN = reshape(double(GLN), 4,1);
LRE = reshape(double(LRE), 4,1);
GLN = reshape(double(GLN), 4,1);
RLN = reshape(double(RLN), 4,1);
RP = reshape(double(RP), 4,1);
LGRE = reshape(double(LGRE), 4,1);
HGRE = reshape(double(HGRE), 4,1);
SRLGE = reshape(double(SRLGE), 4,1);
SRHGE = reshape(double(SRHGE), 4,1);
LRLGE = reshape(double(LRLGE), 4,1);
LRHGE = reshape(double(LRHGE), 4,1);
%Show in table
T = table(angle_offset, SRE, LRE, GLN, RLN, RP, LGRE, HGRE, SRLGE,
 SRHGE, LRLGE, LRHGE);
T

end
```

Grayscale image

T =

4×12 table

angle_offset	SRE	LRE	GLN	RLN	RP	LGRE	HGRE	SRLGE	SRHGE	LRLGE	LRHGE
0	0.0784593292468402	19.3127104240955	118249.439438919	97421.8017528187	34.8842881944444	0.556156111375924	51.3196853685423	0.0466989950861981	4.12647377339129	10.8750436445956	795.681098472878
45	0.079569230799752	19.0636796247629	121764.807179042	100889.538681697	56.9713888888889	0.560093110613626	41.5566585566829	0.048251513889183	3.28938572696002	10.7113622930819	654.057694651799
90	0.0780842738529369	19.1240514013963	107495.883916178	95227.2906882318	53.5329166666667	0.540300710164672	51.7118543367658	0.0448087696758303	4.11148542710528	10.3994325139744	825.373931407727
135	0.0766988467829542	19.2793234341856	145011.10490566	110053.011017082	62.2013888888889	0.587386273790701	35.4459350228871	0.0471864503068581	2.80281244089929	11.5073026723198	572.894982695099

6 Bit image

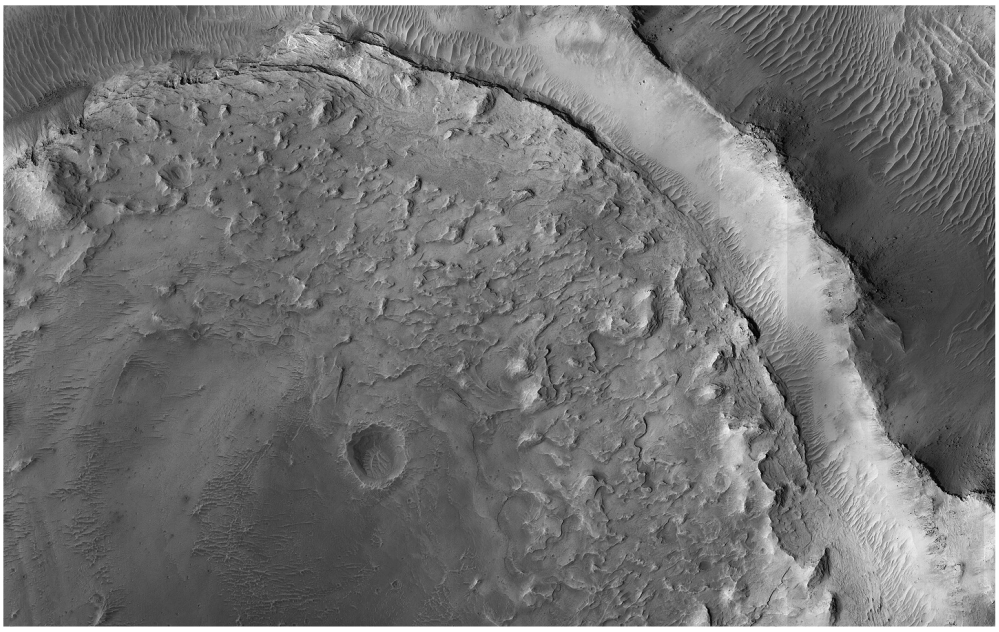
T =

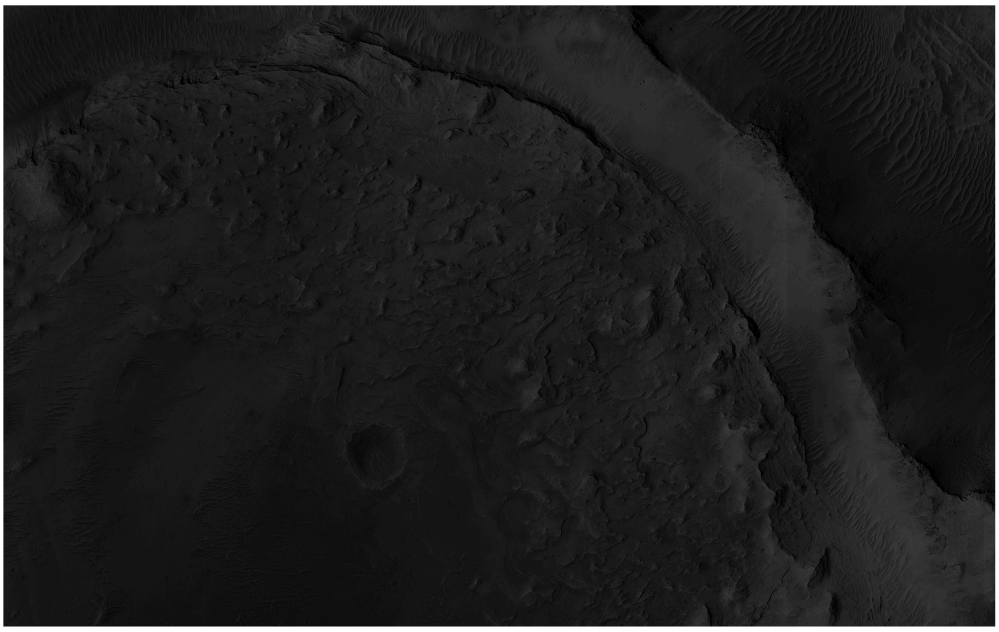
4×12 table

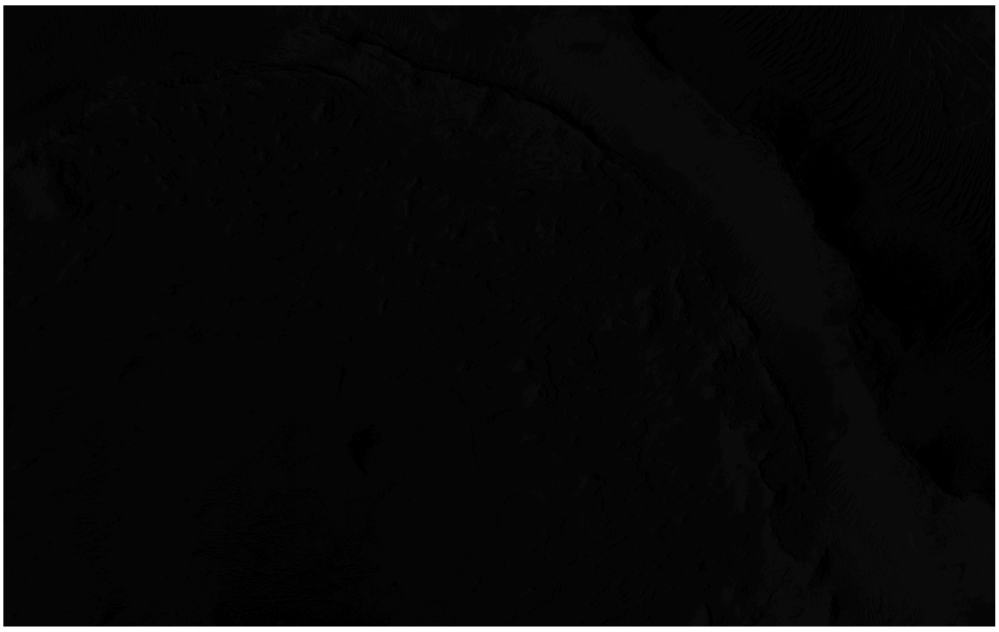
angle_offset	SRE	LRE	GLN	RLN	RP	LGRE	HGRE	SRLGE	SRHGE	LRLGE	LRHGE
0	0.584991982034795	2.85035406217723	20873.4697069798	49550.9333748965	9.32873263888889	0.449441048266283	1172.26132673286	0.317459124699417	303.118174778201	1.12225182795131	4650.02756194925
45	0.58608252960517	2.82480753092276	21781.3773488525	51026.2647498814	15.2261111111111	0.457260590409077	1027.39489911337	0.327613528132008	265.63368999404	1.09714899212831	4075.69148392746
90	0.585665831112169	2.8364848508899	18276.7601341296	46705.9177166214	13.9997222222222

```
 0.430539395782988    1360.17355503085    0.305518185849503
 352.757446686552    1.05743560835784    5391.63290938312
        135          0.584110481247998    2.84393783902654
 26283.5577220675    56884.5521347473             17.0525
 0.476210857621686    853.132010620795    0.343858890287621
 221.582993062456    1.14979585482339    3380.29184381567

4 Bit image

T =

  4×12 table

    angle_offset    SRE    LRE           GLN           RLN
   RP                      LGRE                    HGRE
  SRLGE                   SRHGE                   LRLGE
 LRHGE
    ____________    ___    ___    ________________    ____
 _________________    ____________________    _______________
 ____________________    ________________    ____________________
 ________________

          0          1      1                   900     900
        0.078125    4.82253086419753e-07             2073600
 4.82253086419753e-07             2073600    4.82253086419753e-07
        2073600
          45         1      1     126.668234288157    2339
 0.324861111111111     0.00140586258130981    394784.224027362
 0.00140586258130981    394784.224027362     0.00140586258130981
 394784.224027362
          90         1      1                  1440    1440
              0.2    1.23456790123457e-06             810000
 1.23456790123457e-06              810000    1.23456790123457e-06
        810000
         135         1      1     126.668234288157    2339
 0.324861111111111     0.00140586258130981    394784.224027362
 0.00140586258130981    394784.224027362     0.00140586258130981
 394784.224027362

2 Bit image

T =

  4×12 table

    angle_offset    SRE    LRE           GLN           RLN
   RP                      LGRE                    HGRE
  SRLGE                   SRHGE                   LRLGE
 LRHGE
    ____________    ___    ___    ________________    ____
 _________________    ____________________    _______________
 ____________________    ________________    ____________________
 ________________
```

```
         0          1      1                    900     900
       0.078125    4.82253086419753e-07             2073600
4.82253086419753e-07              2073600    4.82253086419753e-07
       2073600
         45          1      1     126.668234288157    2339
0.324861111111111     0.00140586258130981    394784.224027362
0.00140586258130981    394784.224027362     0.00140586258130981
394784.224027362
         90          1      1                   1440    1440
            0.2    1.23456790123457e-06              810000
1.23456790123457e-06               810000    1.23456790123457e-06
         810000
        135          1      1     126.668234288157    2339
0.324861111111111     0.00140586258130981    394784.224027362
0.00140586258130981    394784.224027362     0.00140586258130981
394784.224027362
```







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