ECE 470: Introduction to Robotics Homework 6

Question 1.

A region of interest (ROI) from row 181 to 200 and column 101 to 120 of an original image **I** is specified as ROI_01= **I** (181:200, 101:120) to encompass a window in the scene with an array of intensity values as shown in Fig. 1.

```
I = rgb2gray( imread('originalImage.png'))
```
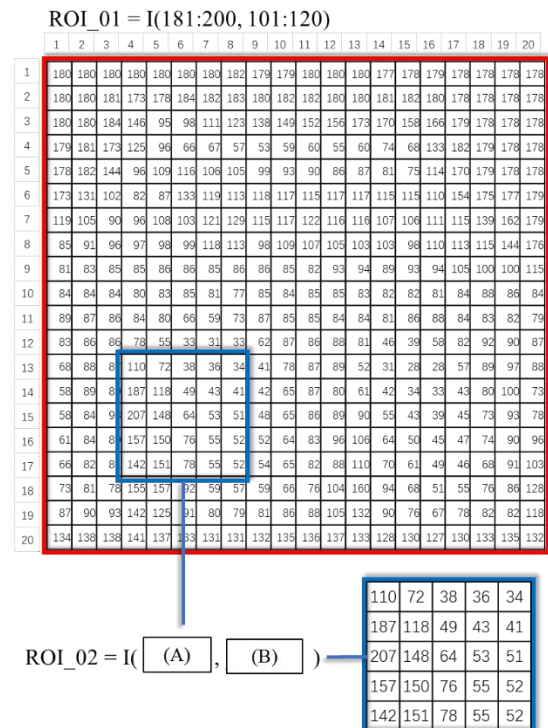
ROI_01 = I(181:200, 101:120)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	180	180	180	180	180	180	180	182	179	179	180	180	180	177	178	179	178	178	178	178
2	180	180	181	173	178	184	182	183	180	182	182	180	180	181	182	180	178	178	178	178
3	180	180	184	146	95	98	111	123	138	149	152	156	173	170	158	166	179	178	178	178
4	179	181	173	125	96	66	67	57	53	59	60	55	60	74	68	133	182	179	178	178
5	178	182	144	96	109	116	106	105	99	93	90	86	87	81	75	114	170	179	178	178
6	173	131	102	82	87	133	119	113	118	117	115	117	117	115	115	110	154	175	177	179
7	119	105	90	96	108	103	121	129	115	117	122	116	116	107	106	111	115	139	162	179
8	85	91	96	97	98	99	118	113	98	109	107	105	103	103	98	110	113	115	144	176
9	81	83	85	85	86	86	85	86	86	85	82	93	94	89	93	94	105	100	100	115
10	84	84	84	80	83	85	81	77	85	84	85	85	83	82	82	81	84	88	86	84
11	89	87	86	84	80	66	59	73	87	85	85	84	84	81	86	88	84	83	82	79
12	83	86	86	78	55	33	31	33	62	87	86	88	81	46	39	58	82	92	90	87
13	68	88	8	110	72	38	36	34	41	78	87	89	52	31	28	28	57	89	97	88
14	58	89	8	187	118	49	43	41	42	65	87	80	61	42	34	33	43	80	100	73
15	58	84	9	207	148	64	53	51	48	65	86	89	90	55	43	39	45	73	93	78
16	61	84	8	157	150	76	55	52	52	64	83	96	106	64	50	45	47	74	90	96
17	66	82	8	142	151	78	55	52	54	65	82	88	110	70	61	49	46	68	91	103
18	73	81	78	155	157	92	59	57	59	66	76	104	160	94	68	51	55	76	86	128
19	87	90	93	142	125	91	80	79	81	86	88	105	132	90	76	67	78	82	82	118
20	134	138	138	141	137	133	131	131	132	135	136	137	133	128	130	127	130	133	135	132

ROI_02 = I((A) , (B))

110	72	38	36	34
187	118	49	43	41
207	148	64	53	51
157	150	76	55	52
142	151	78	55	52

Fig. 1

a) For a 5x5 sub-region ROI_02 specified as shown in Fig 1.
   i. Write down the expressions in (A) and (B) indexing from image **I**.   *(2 point)*
   ii. Tabulate the available intensity values and their respective occurrence in ROI_2. Plot the histogram   *(4 points)*
   iii. Perform histogram equalization and plot the new histogram   *(6 points)*
   iv. Comment on the histograms produced in (ii) and (iii)   *(2 points)*

b) Determine the transformed intensity value of ROI_02 (2,2) if a 3 x 3 mean filter kernel is applied to the second ROI.   *(1 points)*.

Question 2

The image, **I** is being applied with filters as described below:

F1: Mean filter with kernel size of 15 x 15

F2: Gaussian filter with kernel size 15 x 15 and standard deviation, σ=1

F3: Gaussian filter with kernel size 15 x 15 and standard deviation, σ=3

a) Match the filter with their respective output images in Fig. 2.　　　*(3 points)*

(A)　　　　　　　(B)　　　　　　　(C)

Fig. 2

b) Match the output images (A) and (B) to the associated edge detection methods performed, namely, (I) Canny edge detection and (II) Sobel edge detector, assuming the original image is a noisy image as depicted in Fig. 3.　　　*(2 points)*
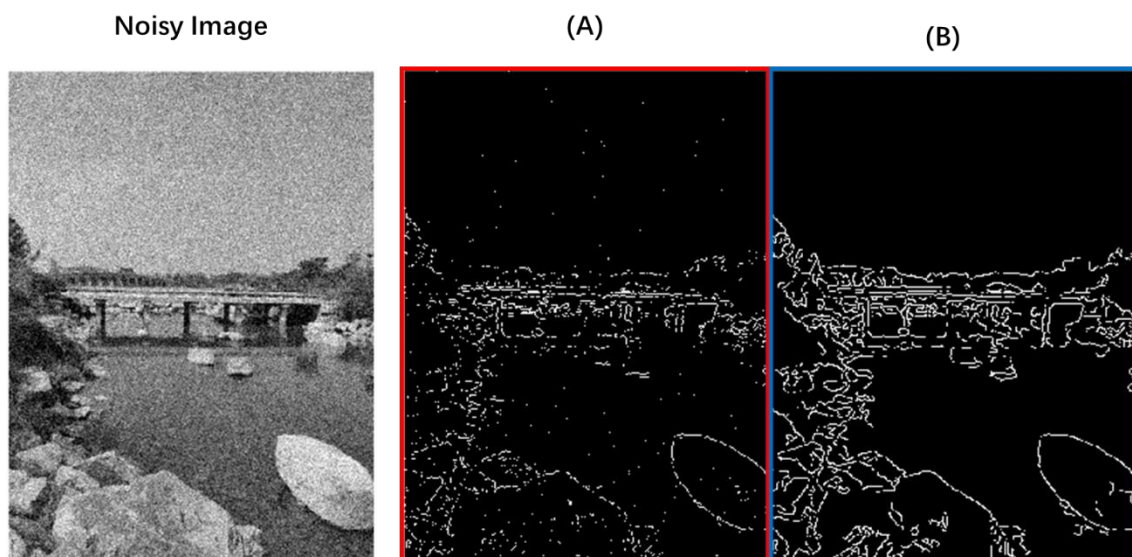
Noisy Image　　　　　(A)　　　　　　(B)

Fig. 3