EECS 331 Homework 2

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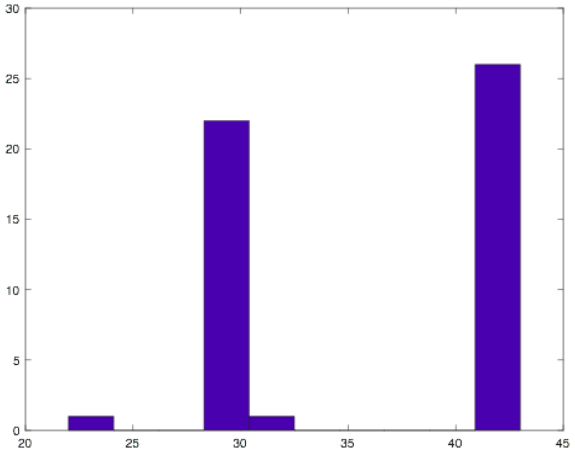
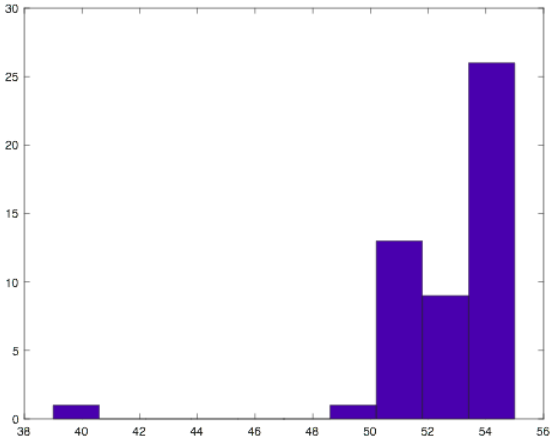
Histogram of different pixels

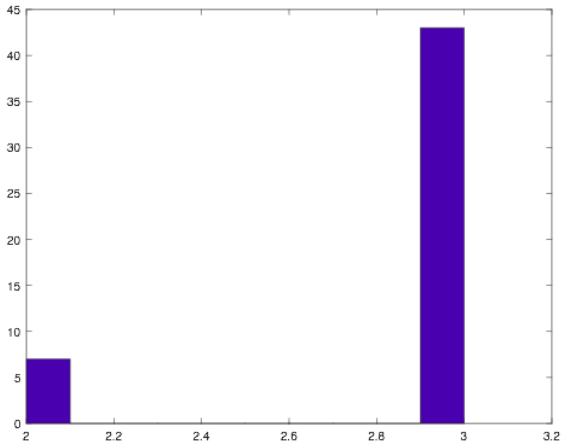
- Maximum gain
  - (50,50)



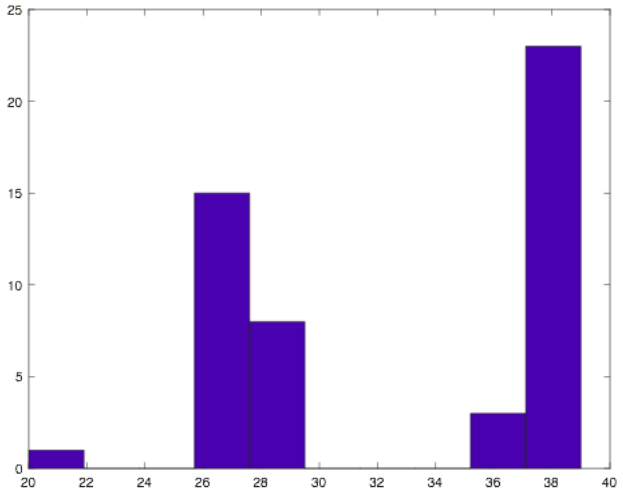
  - (100,200)



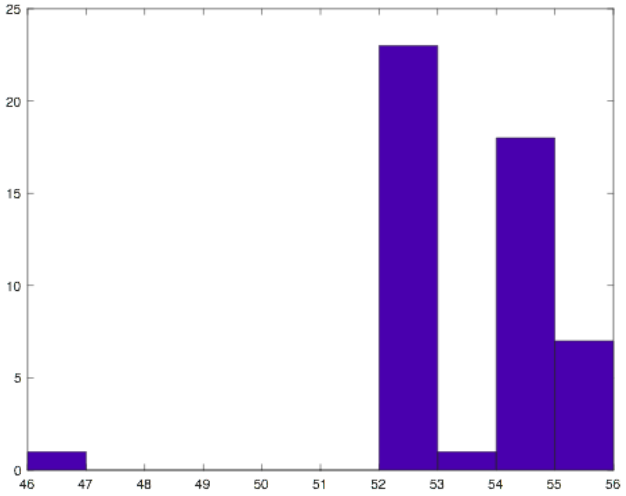
  - (500,700)


45
40
35
30
25
20
15
10
5
0
2
2.2
2.4
2.6
2.8
3
3.2

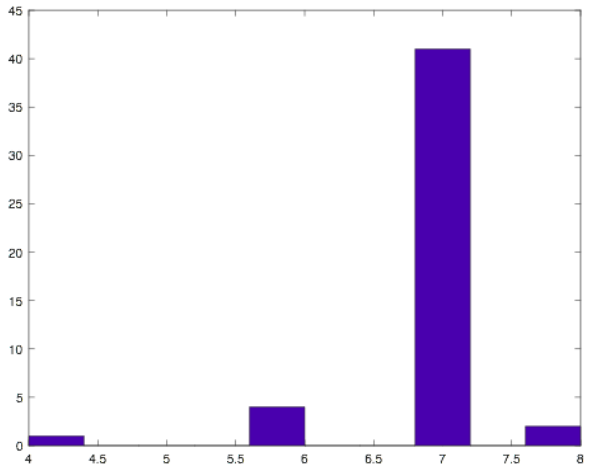
- (10,60)


25
20
15
10
5
0
20
22
24
26
28
30
32
34
36
38
40

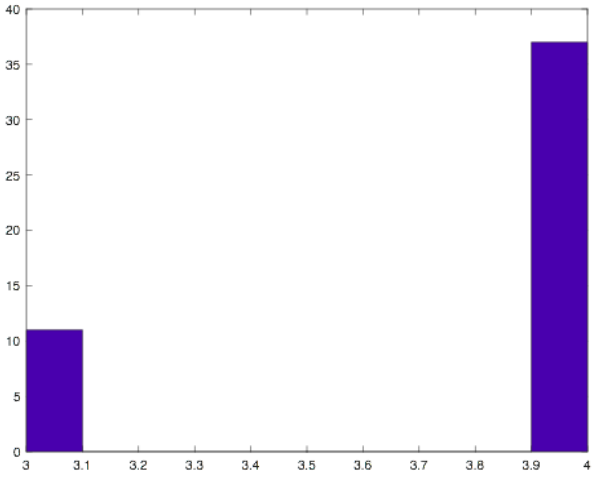
- (200,300)


25
20
15
10
5
0
46
47
48
49
50
51
52
53
54
55
56

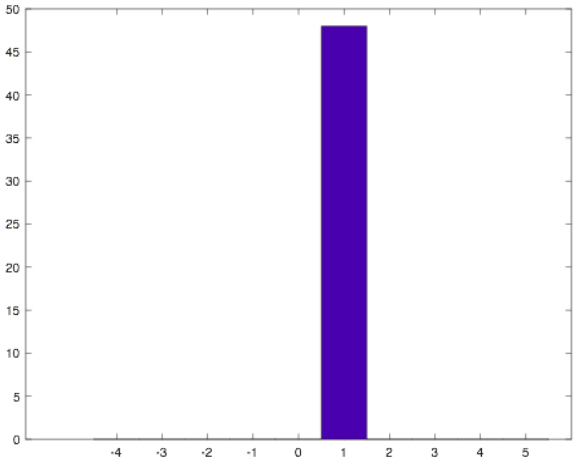
- Minimum gain
  - (50,50)



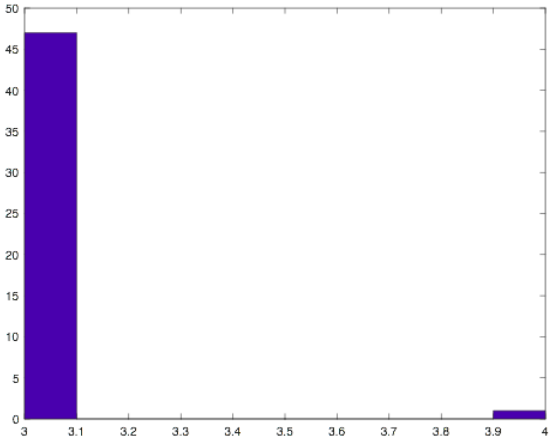
  - (100,200)



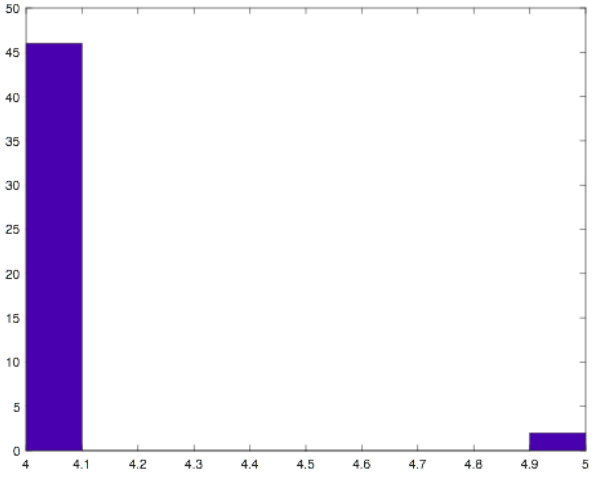
  - (500,700)



- (10,60)



- (200,300)



In the maximum gain setting, the color distribution of the given pixel looks uneven, but it's much more consistent in the minimum gain setting.

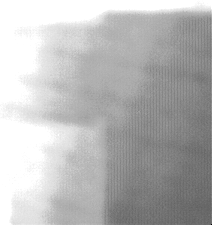
A few of the Original Images:

t=0

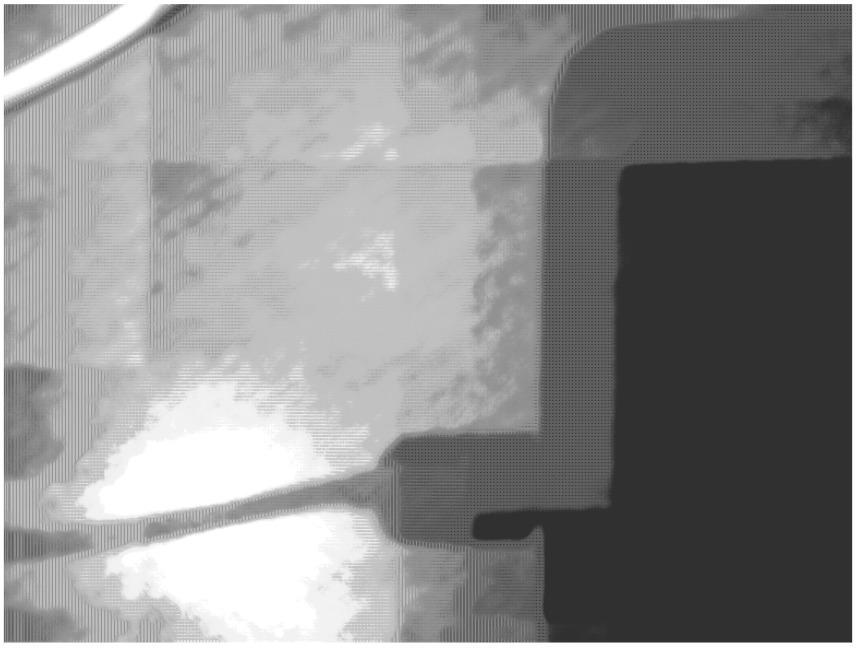
t=49

Mean (of 50 images):

- Maximum gain



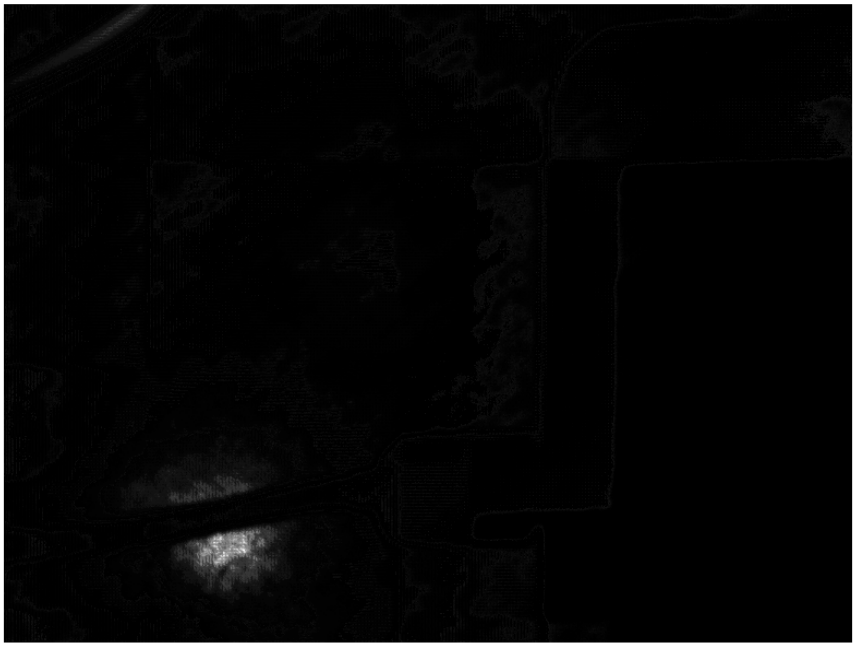
- Minimun gain



Variance (of 50 images):

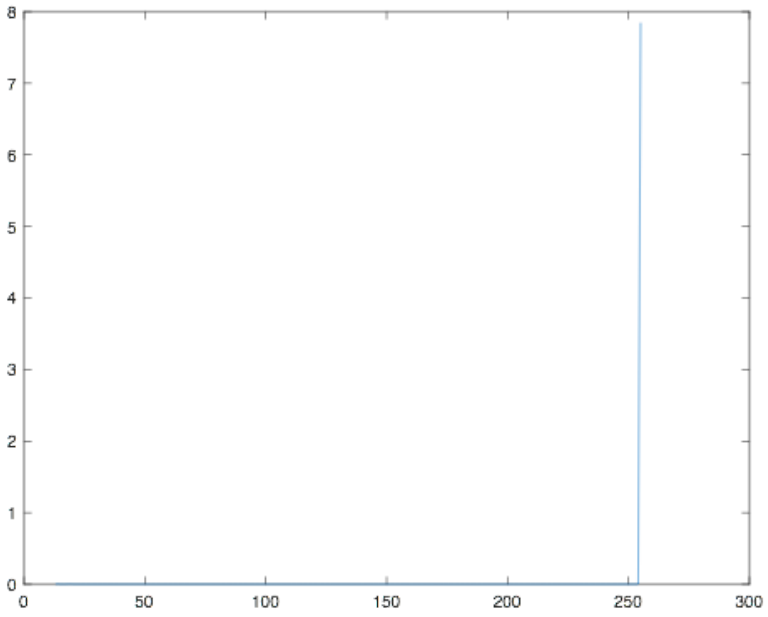
- Maximun gain

- Minimun gain

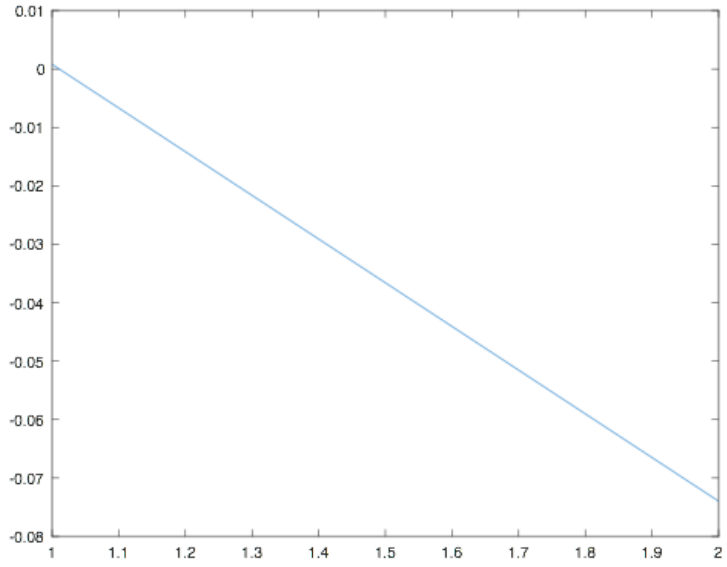


The average variance for each mean value:

- Maximun gain



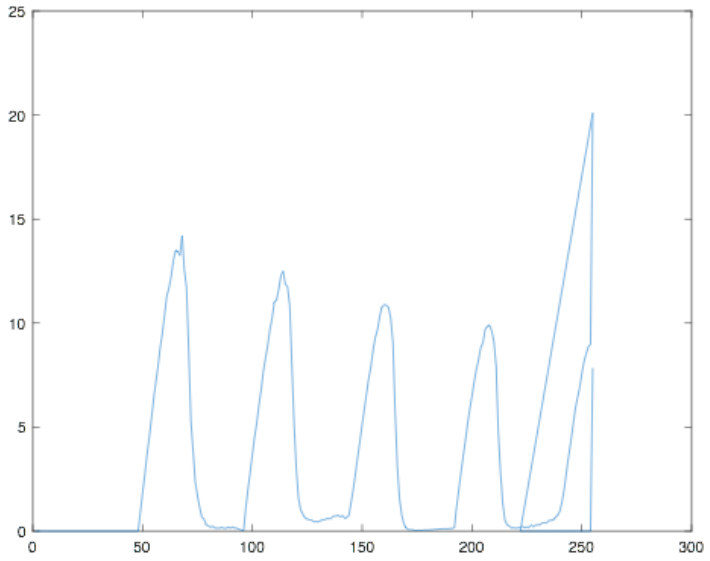
➢ fit a line to the plotted data



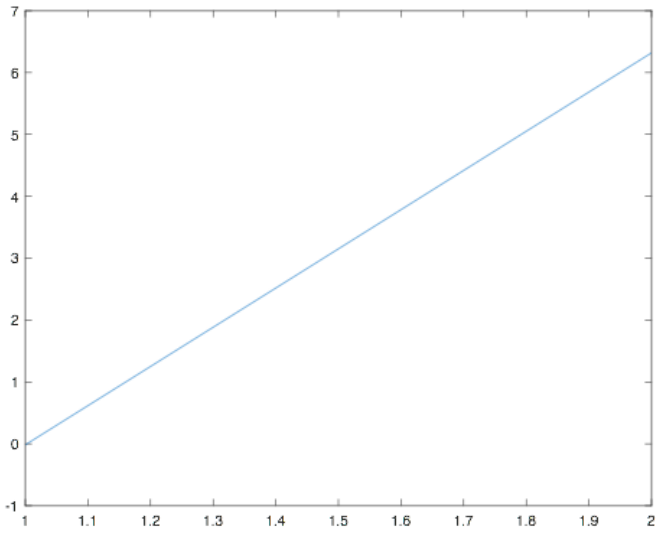
camera gain g = 0.0008

ADC noise variance σ_{ADC}^2 = -0.0740

- Minimum gain



➢ fit a line to the plotted data



camera gain g = -0.0175

ADC noise variance σ^2_{ADC} = 6.3179

- The read noise variance σ_{read}^2 :

$$\sigma_i^2 = (\phi_i \cdot t)g^2 + \sigma_{read}^2 \cdot g^2 + \sigma_{ADC} \quad \textbf{(4)}$$

$$= \mu_i \cdot g + \sigma_{read}^2 \cdot g^2 + \sigma_{ADC}^2 \quad \textbf{(5)}$$

Max:

1 = 178 * (0.0008)+ σ_{read}^2 *(0.0008)^2-0.0740

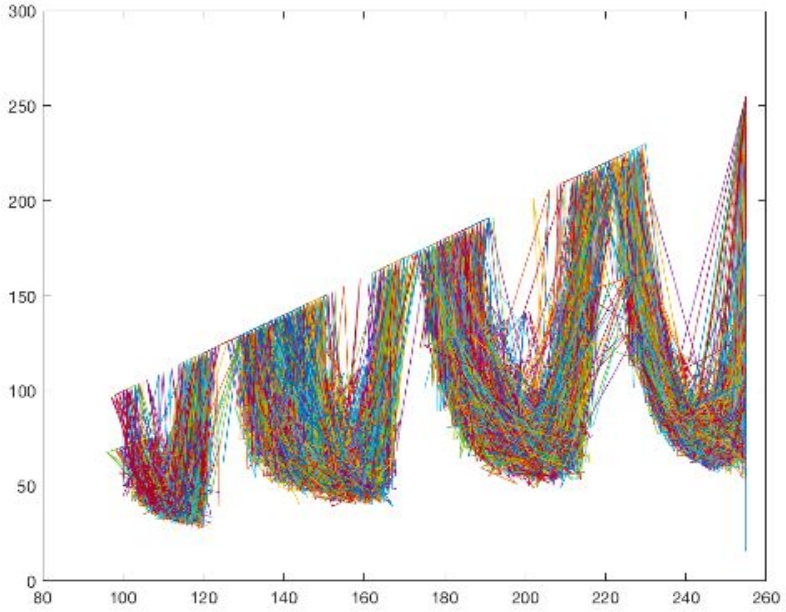
Min:

2 = 98 * (-0.0175)+ σ_{read}^2 *(-0.0175)^2+6.3179

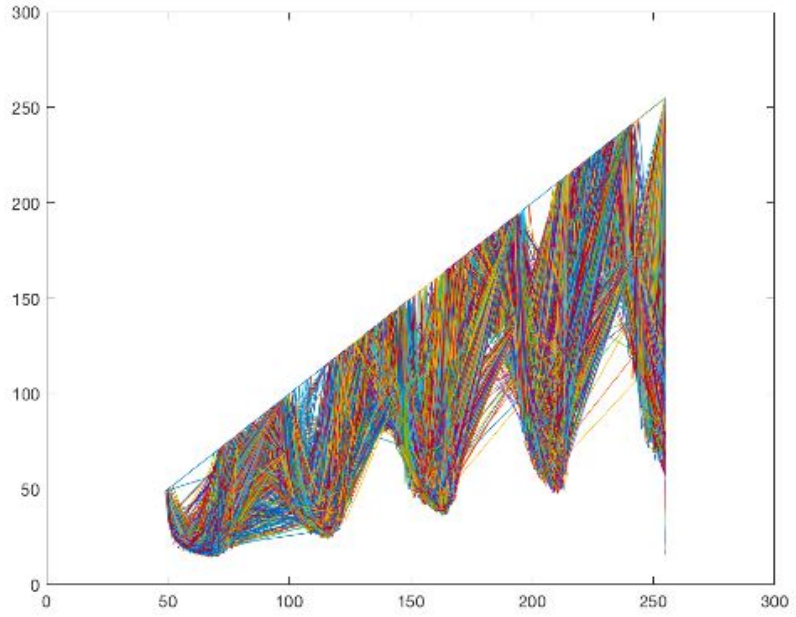
=> σ_{read}^2 =1206.5

Plot the SNR as a function of mean pixel value:

- Maximun gain



- Minimun gain



The max value of SNR of the mean pixel value is related to a constant slope.

How does it relate to the three types of noise from equations (4) and (5)?
What is the maximum SNR that can be achieved by the Tegra camera?