PARYUL JAIN [20171083]

DSAA - ASSIGNMENT 3

REPORT

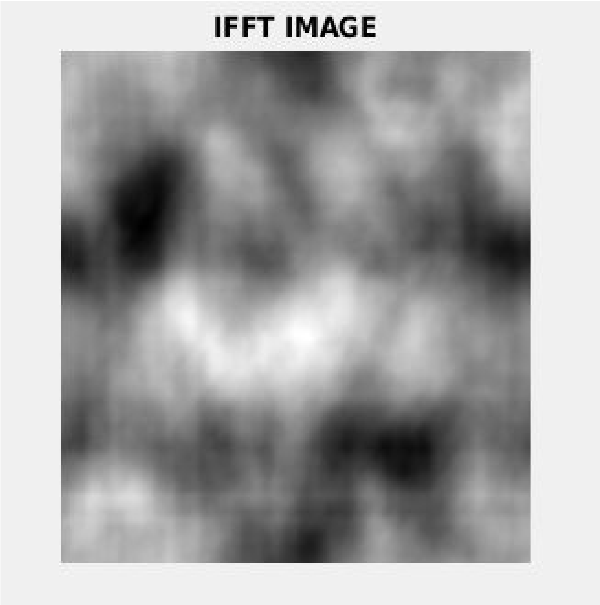
QUESTION-1

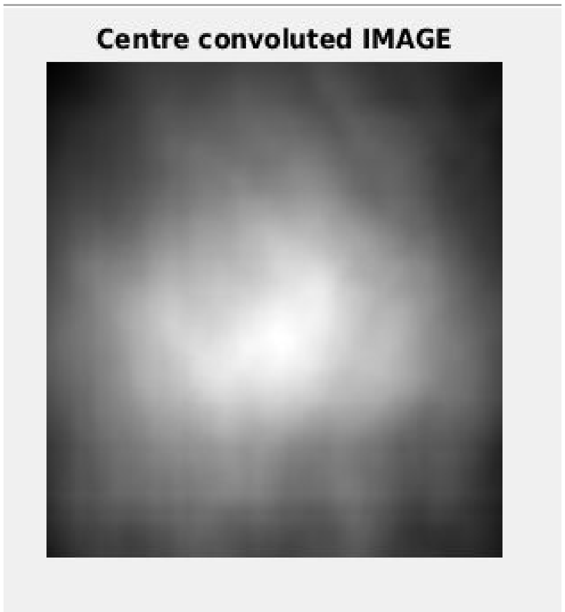
```
Constant value:
   7.7731e+04

Coefficent of size of house:
  141.8342

Coefficent of number of rooms:
   7.7731e+04

Predicted value of price:
   2.5085e+05

Error without normalising data:
     5.8637

Error with normalising data:
     5.8637

Computed mean:
   3.4922e+05

Mean:
   3.4922e+05
```

Part 4

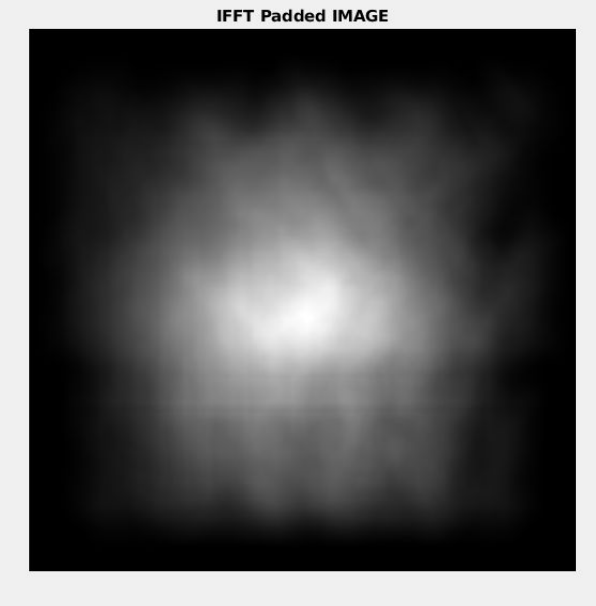
The complexity of closed form solution is O(N^3). Thus computing huge data with closed form solution method will take a huge amount of time. Thus, it would not be feasible to use this method to solve the problem with 1 million rows.

QUESTION-2





Both the images are 256*256 in size , but are not equal. This is in accordance with the convolution theorem for discrete signals , which states that the circular convolution are equal.

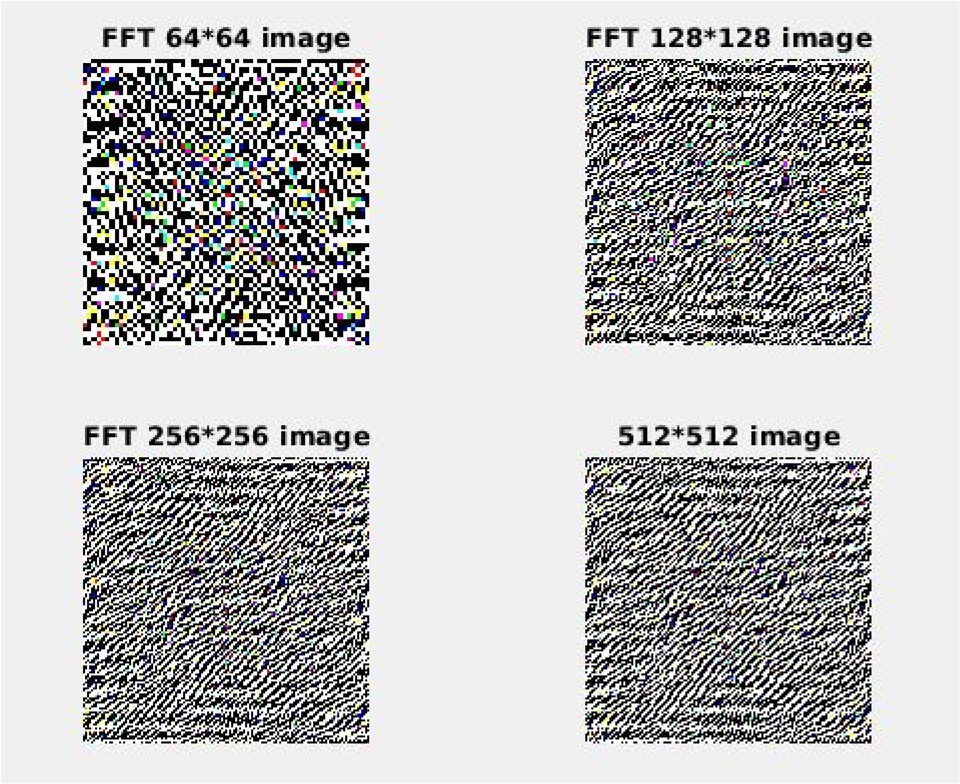


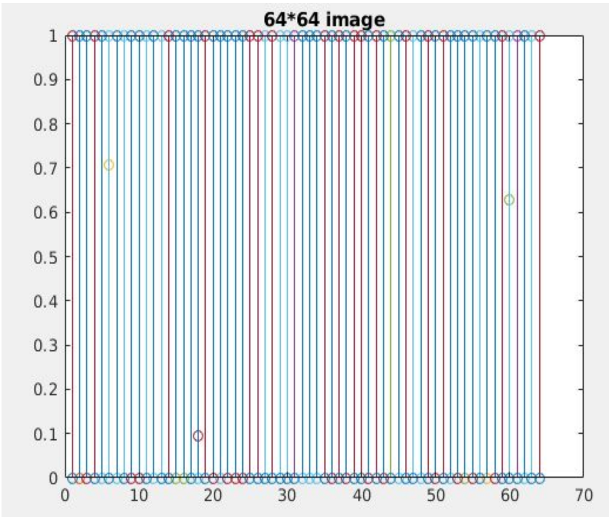
Error: 5.4193e+15

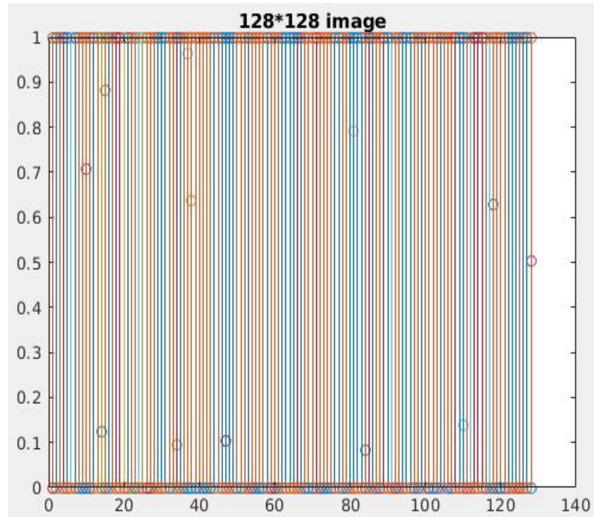
Error after padding: 6.5067e-16

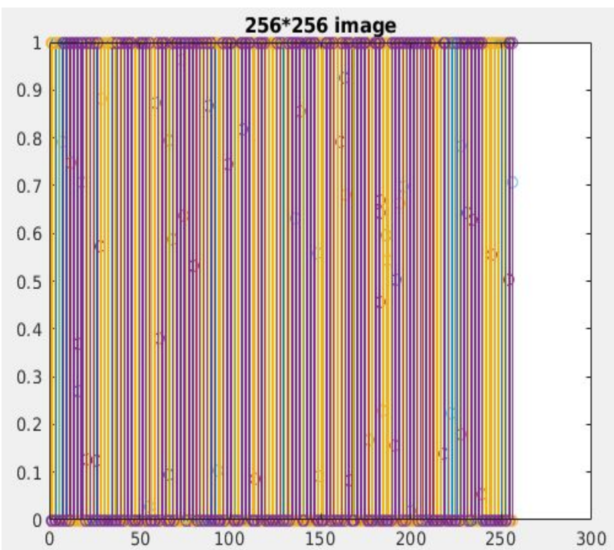
After zero padding , the image blackens out , and error decreases , since the difference between more points is added.

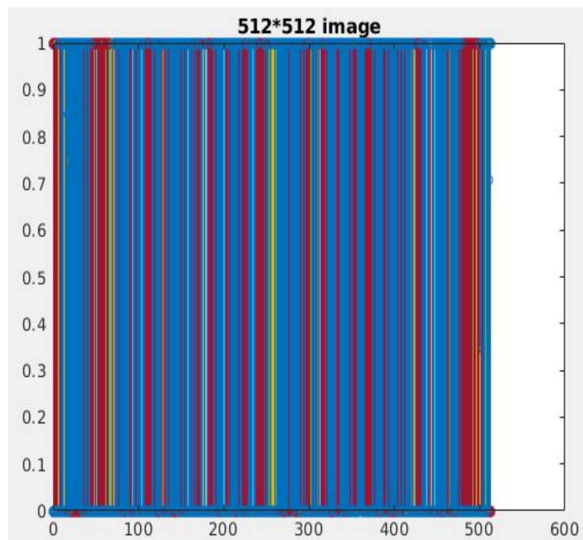
QUESTION-3





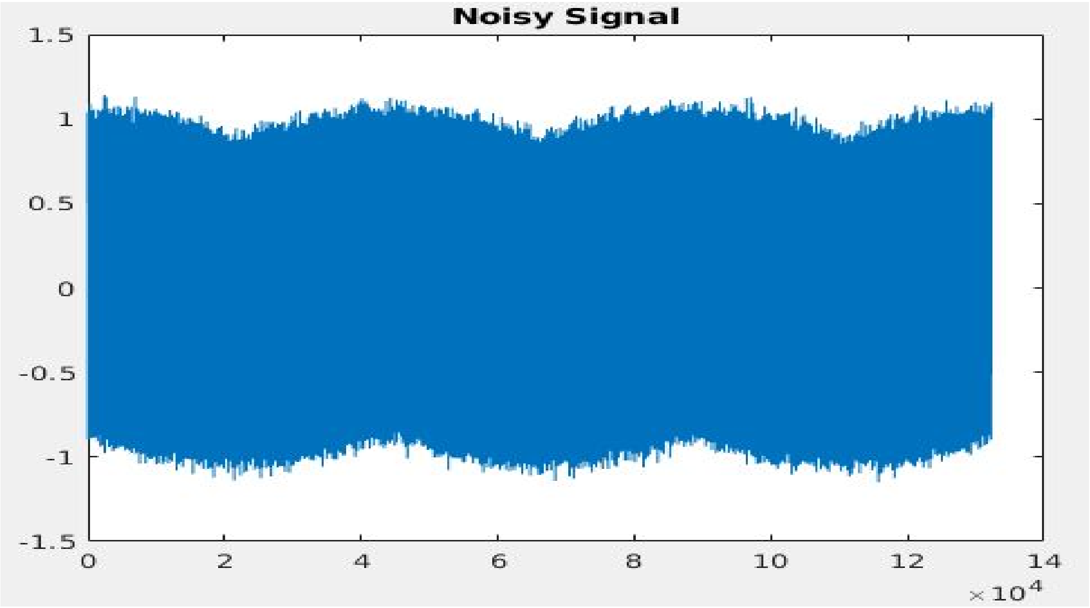


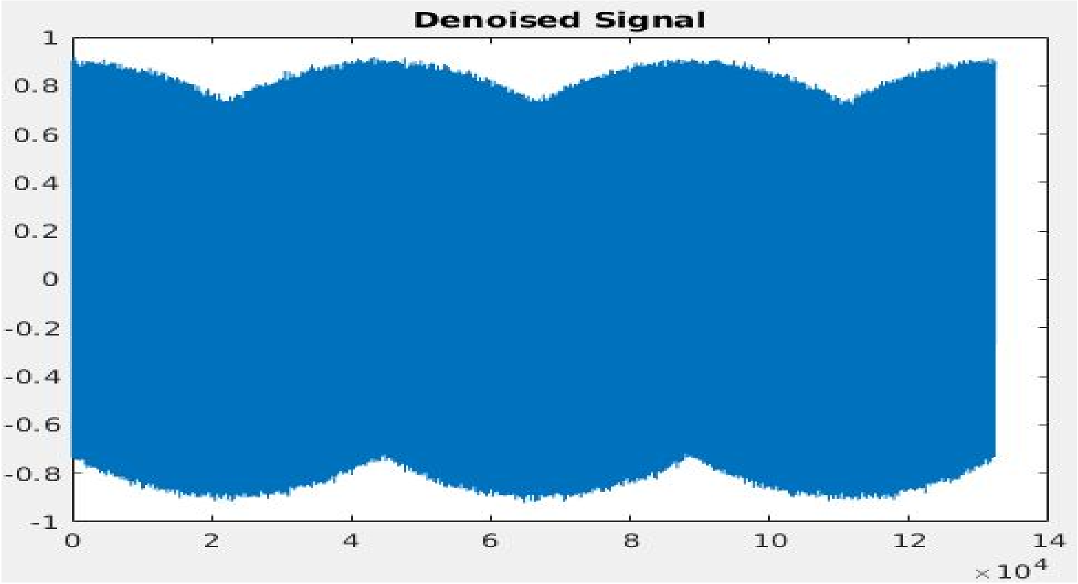


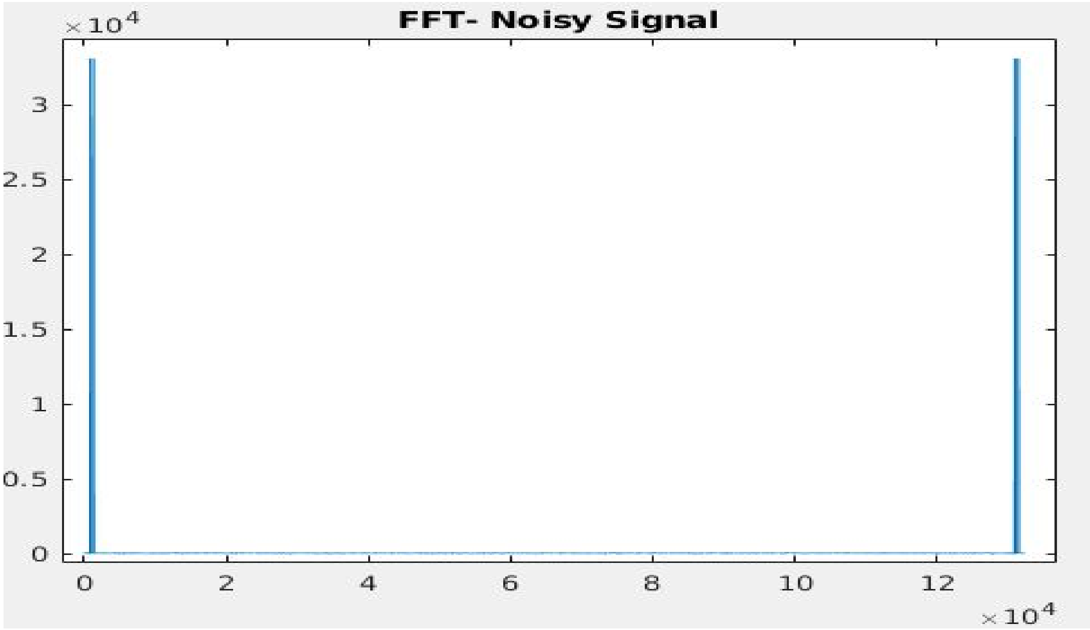


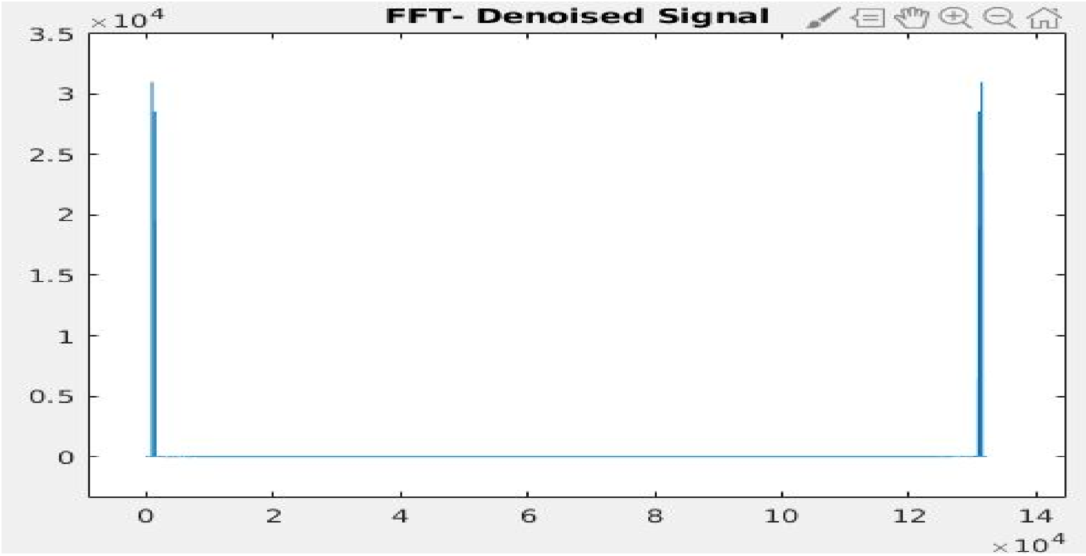
It is clear from the stem graph that the frequency resolution is increased. We get more smoother graphs. As once it was discussed in class , if the sample size(i.e the number of points over which fft is calculated is increased , the resolution increases.)
This is what zero-padding does, it allows one to use a longer fft.
It makes visualisation easier , to resolve peaks of a single isolated frequency that does not have any significant adjacent signals or noise in the spectrum.

QUESTION-4


Noisy Signal
1.5
1
0.5
0
-0.5
-1
-1.5
0
2
4
6
8
10
12
14
×10^4


Denoised Signal
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
0
2
4
6
8
10
12
14
×10^4





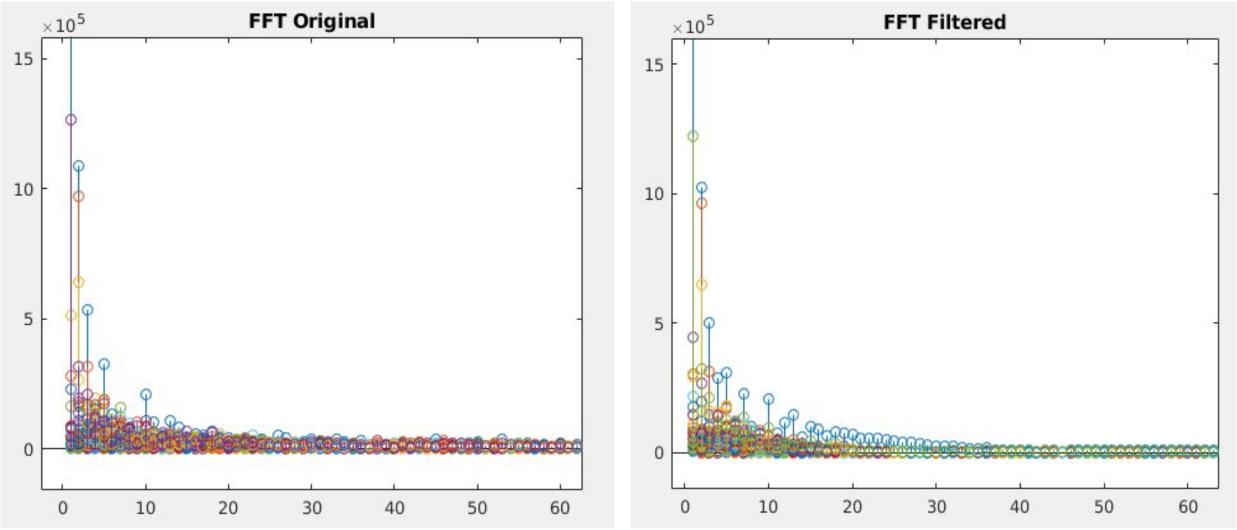
It is clear from the graphs that the frequencies present are 832 Hz and 1321 Hz.
The trick was to multiply the frequencies with Fs and then divide by L(total length) , to get the final frequencies. 278 Hz and 440 Hz.

QUESTION-5
We check the maximum correlation among the signals. (time_interval = 5 secs). The ending time_interval of one signal is found to have maximum correlation among the others. First a 5*5 loop to find the first in order. Then a single loop to find the maximum overlaps.
The **gaussian** filter removes the noise from the signal.

QUESTION-6

Part - 1

A low pass filter is the basis for most smoothing methods. An image is smoothed by decreasing the disparity between pixel values by averaging nearby pixels.
Using a low pass filter tends to retain the low frequency information within an image while reducing the high frequency information.

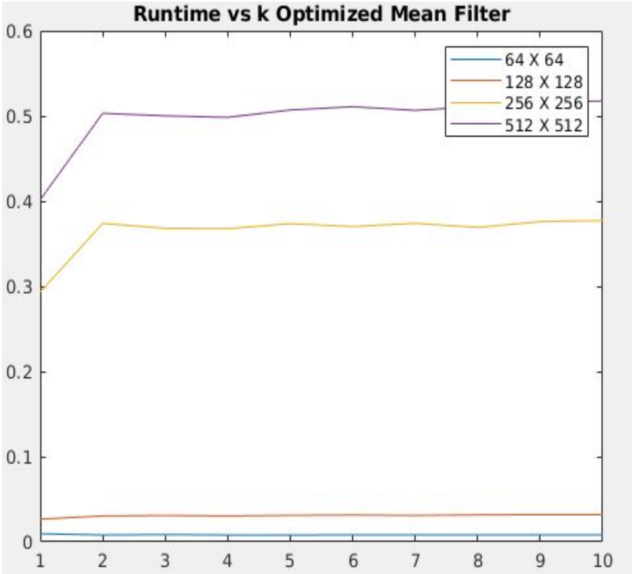


As evident from the image that the high frequency components have been removed , and also the signal has been smoothened out.

PART B. (OPTIMISED)

To avoid recomputing the same thing again and again, we can use certain optimisations. Once we have computed a window, to compute the mean of the next window, we subtract the values of the column not included and add the values of the next column which is included in the new window. Thus the common pixels are not recomputed every time. Just like sliding window technique in Cpro.

The runtime vs k graph, the execution time is almost constant as size of filter is increased. This is because once the initial window is computed, we just need to add certain values and subtract certain values.



QUESTION-7

2 methods are used.

1. **BATCH GRADIENT DESCENT:** whole batch(x_vals) is taken to give the ans.
2. **STOCHASTIC GD :** at every element we compute the slope. This of course takes more time(2 for loops), but gives better results as well.

Conclusion

The Assignment was really difficult . Please spare us.