Exercise 1
Math foundation of computer graphics and vision

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Task1)

1.1

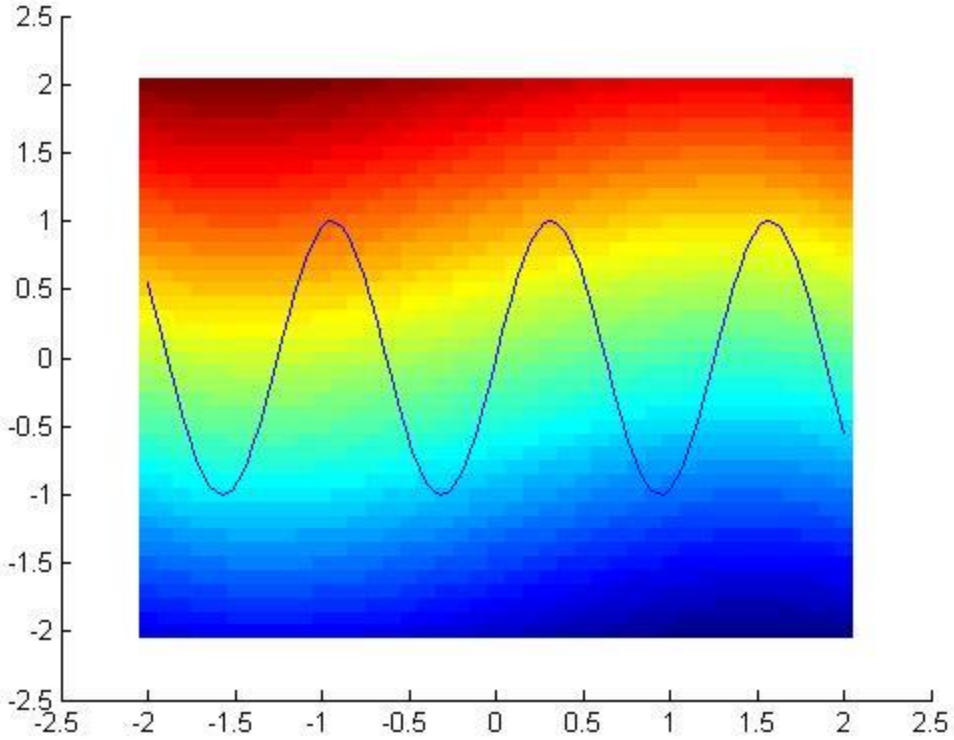
The implicit function is:

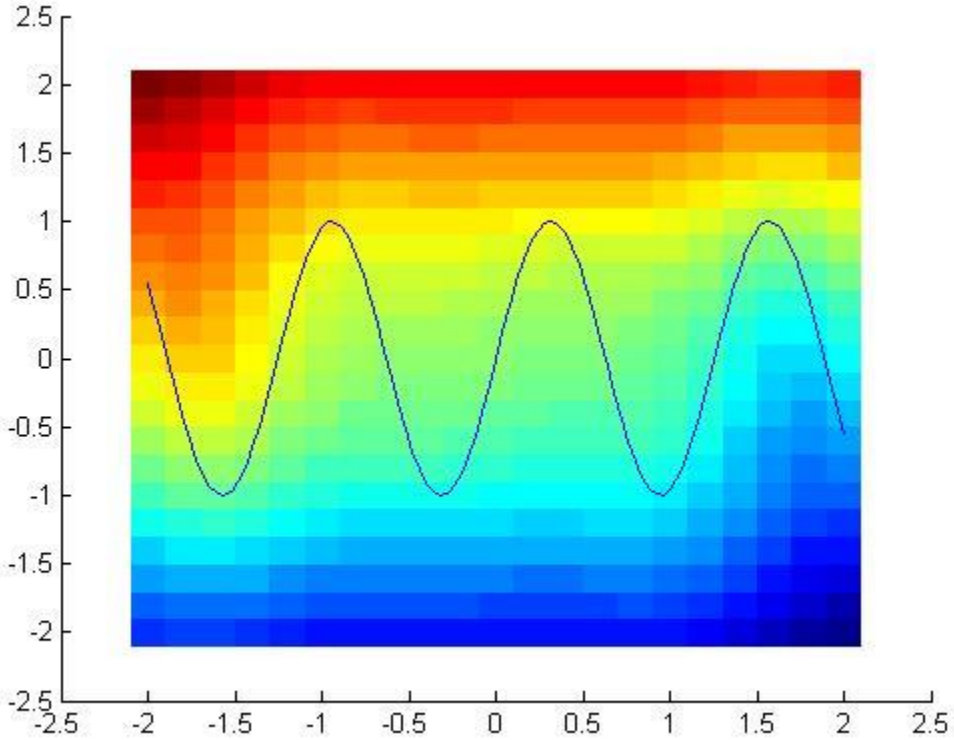
$$f(x) = \frac{\sum_i Q_i\,(x) n_i^T (x - x_i)}{\sum_i Q_i(x)}$$

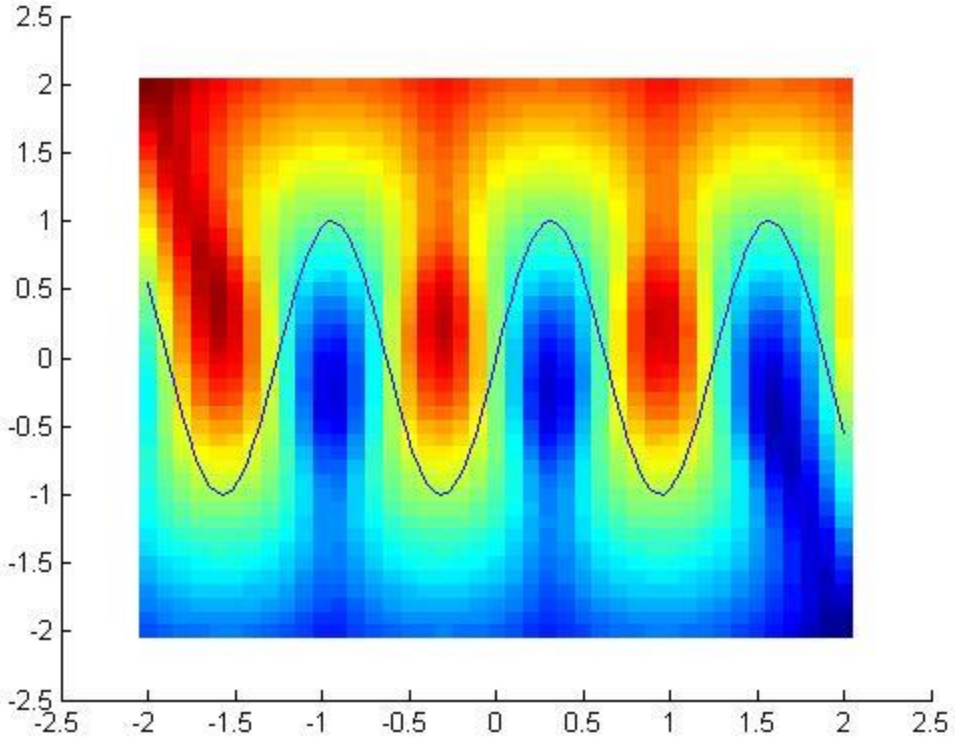
1.2

One can run the program for task 1.2 and 1.3 with Matlab scripts named task1_2.m and task1_3.m. Data set name and sigma are defined in each file.

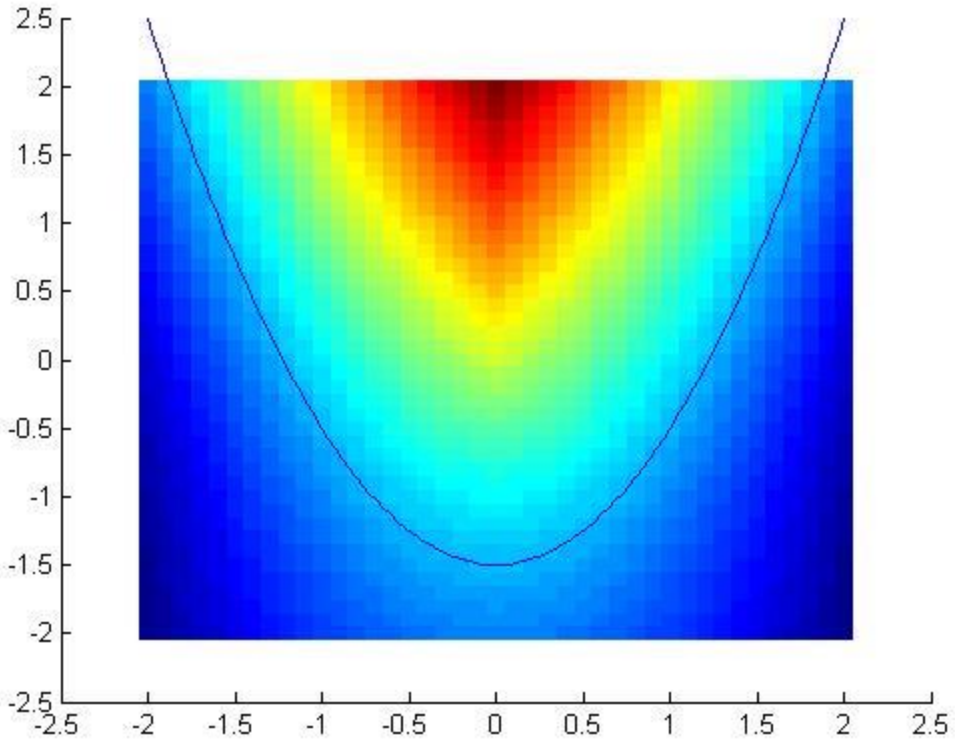
Results with different sigma (respectively 2, 1, 0.4) for first dataset are shown here:


2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
-2.5
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5

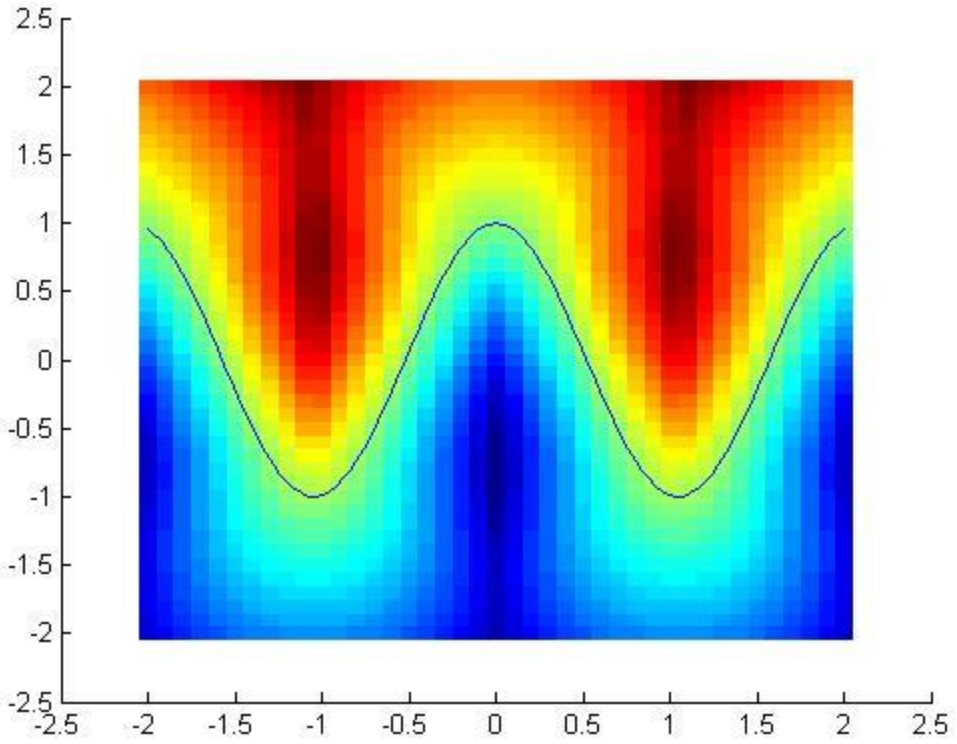

2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
-2.5
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5



Also, a result from second dataset with sigma 0.3 is as follows:



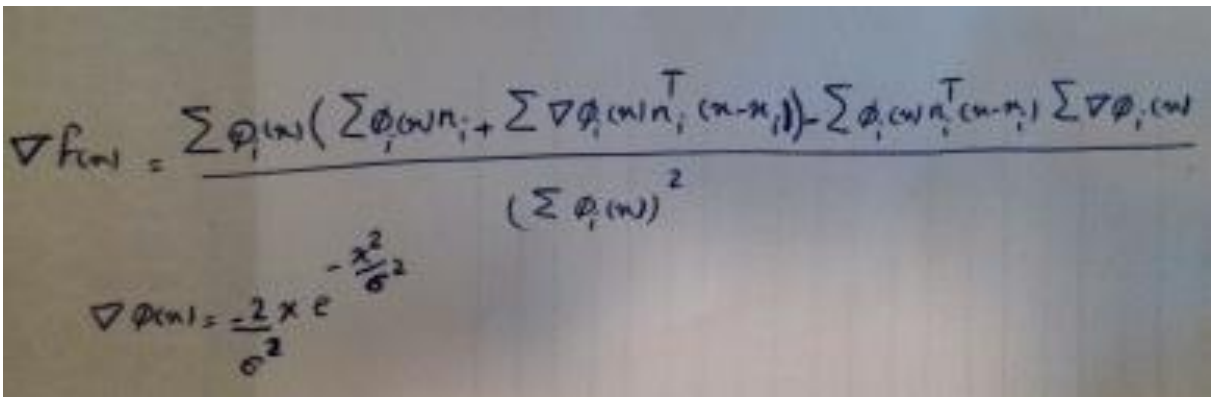
And one result with sigma 0.3 for third data set.



We can see that with increasing sigma, approximated function becomes smoother and with decreasing sigma it gets sharper.

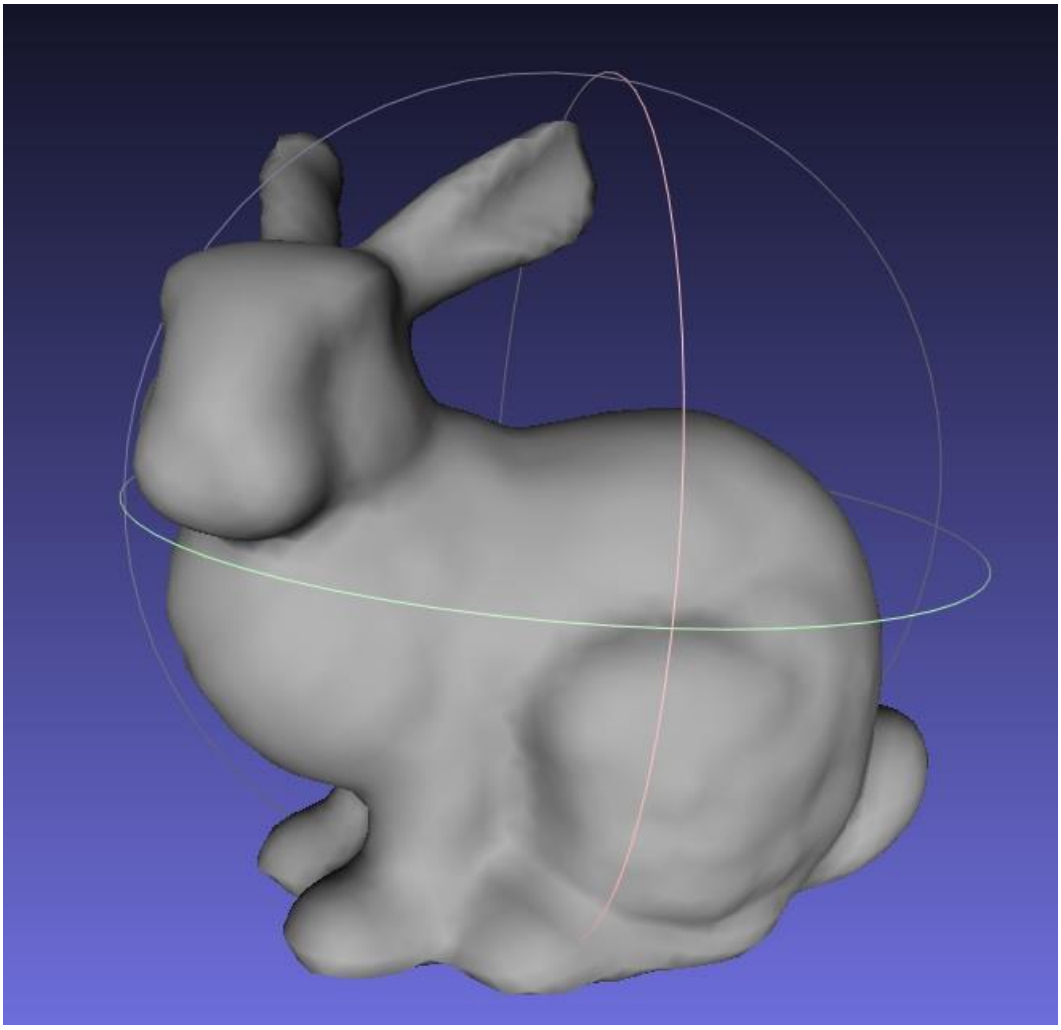
1.3

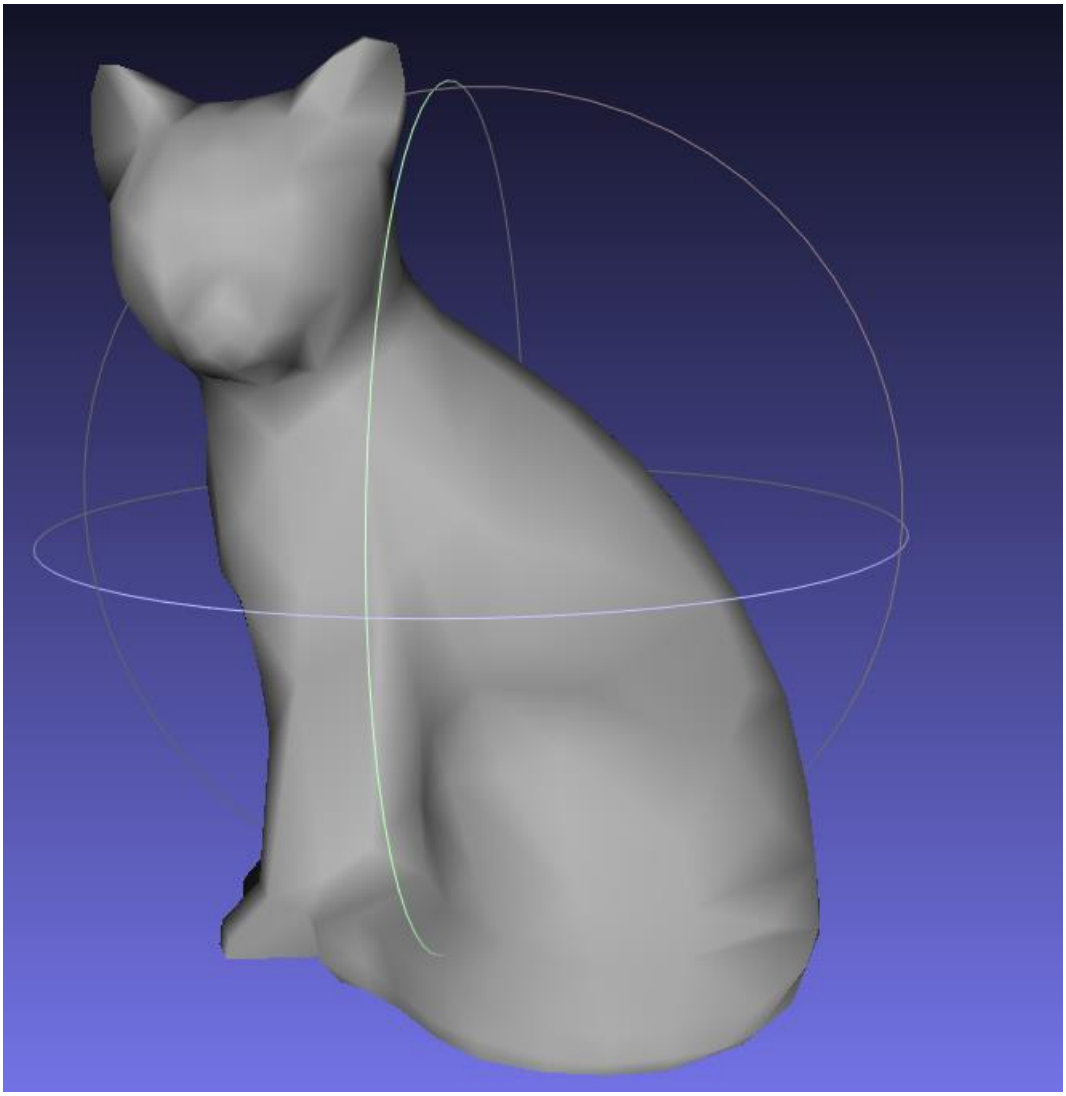
The derivative of f(x) would be:



And the resulting mesh images are as follows:

This results are with sigma=5 and 10 iterations.





Task2)

One can demo the code of this task by running task2.m file. The function names are self-explanatory.

Original

Similarity deformation

Rigid deformation

Original

Similarity deformation

Rigid deformation