Homework 3

1 Understanding Point Clouds and Sensor Data

(c) Visualization of the down samped point cloud

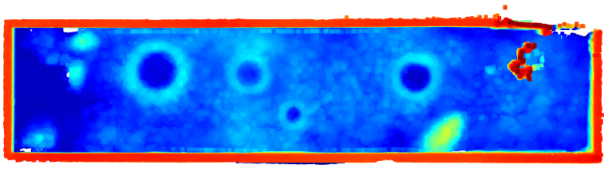

Figure 1: Terrain (top)

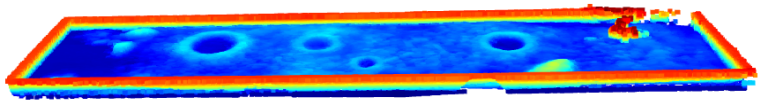

Figure 2: Terrain (front)

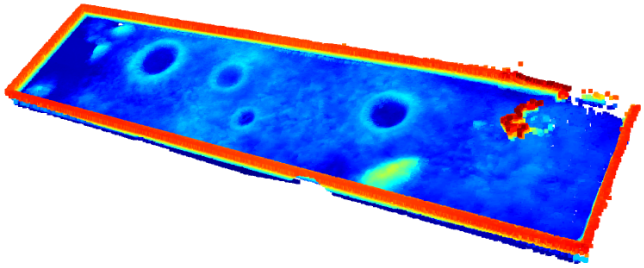

Figure 3: Terrain (side)

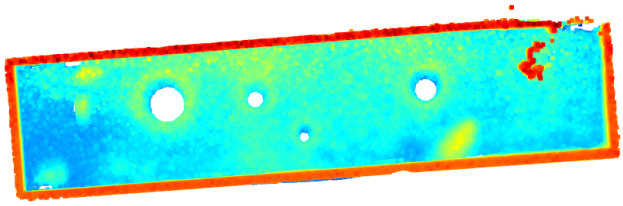

Figure 4: Terrain_noisy (top)

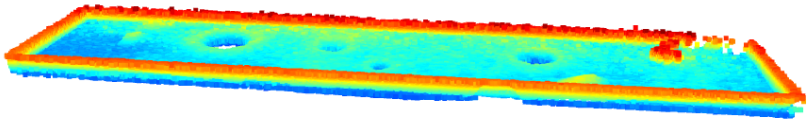

Figure 5: Terrain_noisy (front)

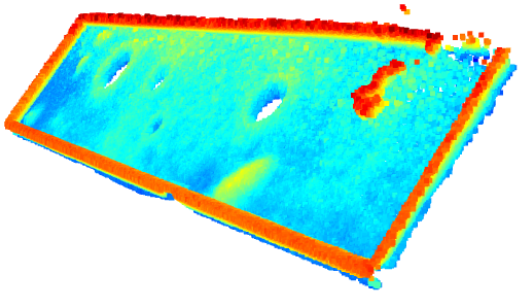

Figure 6: Terrain_noisy (side)

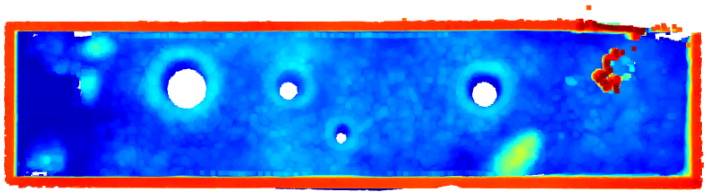

Figure 7: Terrain_partial (top)

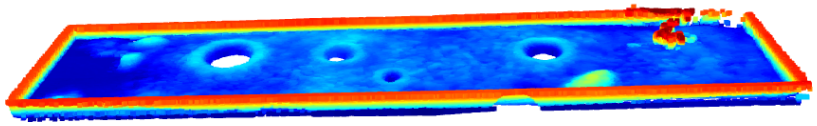

Figure 8: Terrain_partial (front)

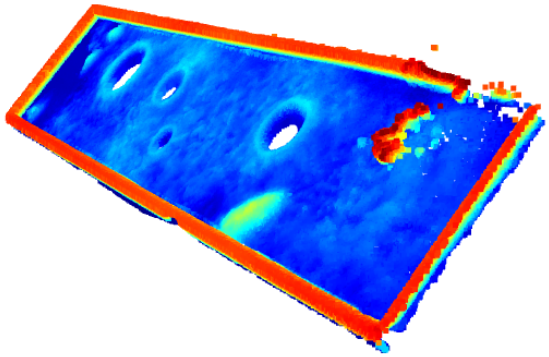

Figure 9: Terrain_partial (side)

(d) Chamfer Distance

The Chamfer distance between the denoised pc and ground-truth is: 0.00040969444983181166
The Chamfer distance between the noisy pc and ground-truth is: 0.0006414638119259131
The Chamfer distance between the partial pc and ground-truth is: 0.00020744294757761195

2 Kernels in Gaussian Processes

The combined kernel performs the bets for this data.

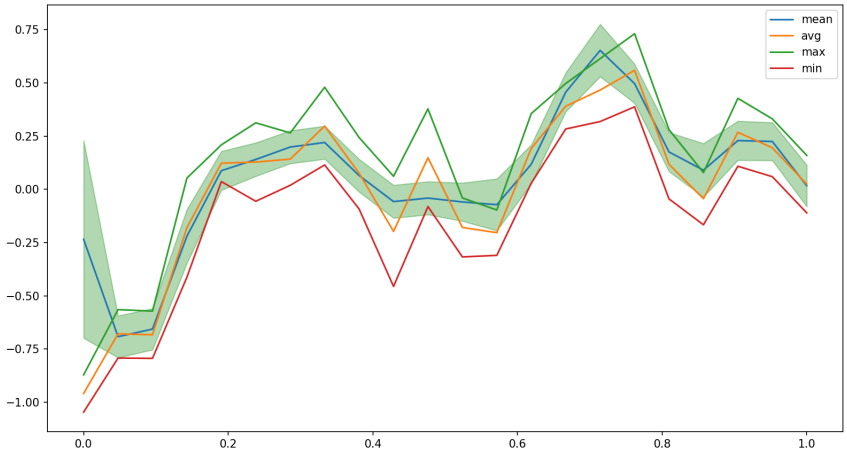

Figure 10: Result plot using RBF kernel

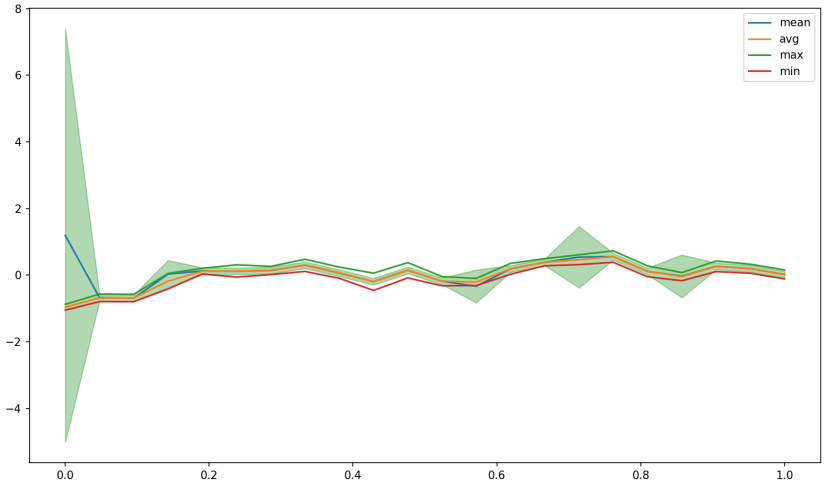

Figure 11: Result plot using exponential_sine_squared kernel

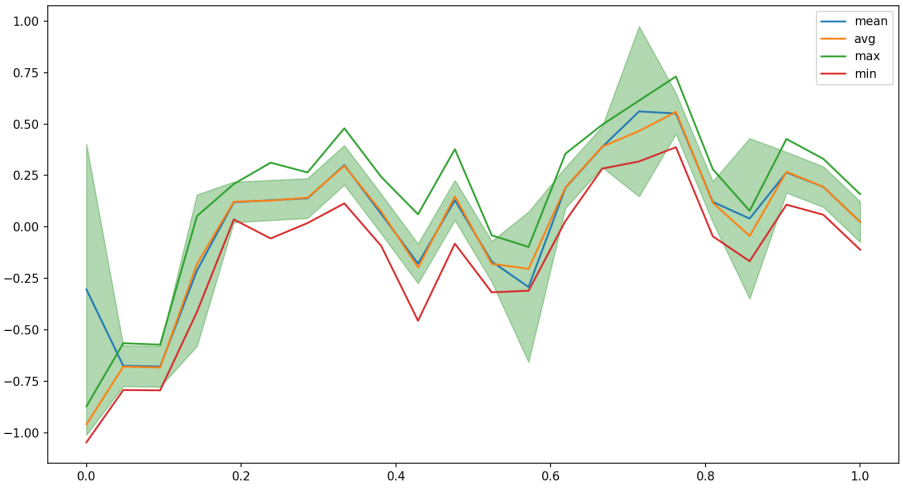

Figure 12: Result plot using combined kernel

3 Gaussian Processes for Sensors

3.1 MSE on Training Data

MSE_train = 0.0025033282351671895

3.2 MSE on Testing Data

MSE_test = 0.008519195648037572

3.3 Visualization

The areas of high uncertainty locate in the right corner and the hollow area which matched with my expectations.

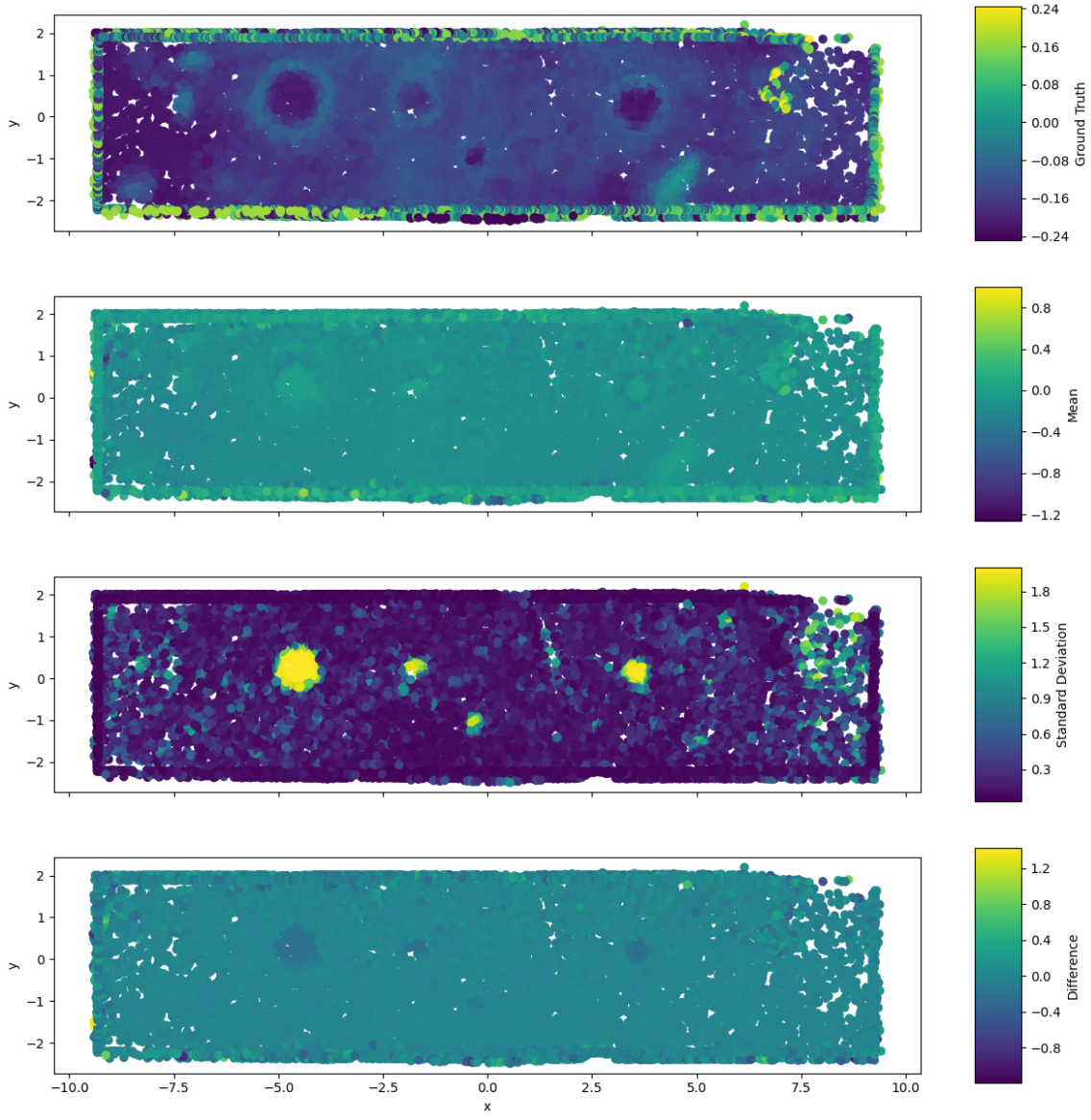

Figure 13: Visualization of the spatial variability of the GP outputs