Probability HW 4: Programming

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Problem 3b

Visible Result

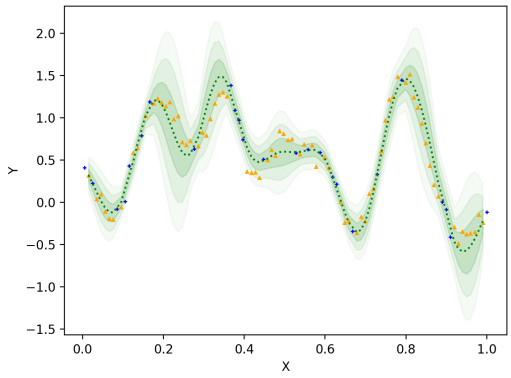

Figure 1: Result with l = 0.06

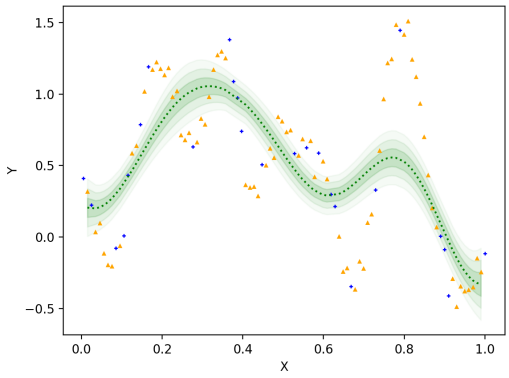

Figure 2: Result with l = 0.2

Discussion

- 從上圖觀察可以發現當 length scale 的值較小時預測出來的值也會比較接近 training data 的分佈
- length scale 較大時雖然沒有很貼近但也有符合大致上的趨勢

Problem 4a

Result

```
n = 1000
0.6133180078141631
0.5913871954328415
0.6434925751928088
0.6058258607919874
0.5956535658635271
0.5973054137687839
0.6393233123526773
```

```
n = 100000
0.6050122965509694
0.6037731696255065
0.6020554264486477
0.6101525116474245
0.6061534166114468
0.6015266711925347
0.6039288083114491
```

```
0.5802650806422411
0.6375293311482652
0.5567821087436734
0.5608090872555922
0.620784107204537
0.5681178029149777
0.5769977984401469
0.579495641494023
0.6028944076783146
0.5861387792343558
0.5509381594851043
0.5995129213108215
0.6275515804774061
```

```
0.6090480146212429
0.6071474864639189
0.6067321754206961
0.6033291651093283
0.6062315935066845
0.604352899383245
0.6048460062677966
0.6058021546716923
0.6053428957782203
0.60819851837954
0.6063757581998733
0.6052664333595846
0.6056327747388892
```

Discussion

- 當取樣的點數（n）為 1000 時，那 20 個測試的結果的距大約是 0.07，而 n = 100,000 時，全距大約為 0.01
- 可見取樣的點數愈高， 估計的誤差會愈小

Problem 4b

Result

```
n = 1000
2.3

n = 100000
2.21648

n = 10000000
2.22192
```

Discussion

- 該橢圓的實際面積大約是 2.22，而在這次實驗我們可以看到當取樣的點數 n 愈大，用蒙地卡羅法估計出來的面積會愈接近正確的值