機器學習HW4

系所:電控碩一 學號:313512022 姓名:呂靖樑  
**實驗結果:**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| C value  Sigma (log scale) | **1** | **5** | **10** | **50** | **100** | **500** | **1000** |
| **-100** | 54 | 54 | 54 | 54 | 54 | 54 | 54 |
| **-95** | 66.67 | 66.67 | 66.67 | 66.67 | 66.67 | 66.67 | 66.67 |
| **-90** | 72.67 | 72.67 | 72.67 | 72.67 | 72.67 | 72.67 | 72.67 |
| **-85** | 76.67 | 76.67 | 76.67 | 76.67 | 76.67 | 76.67 | 76.67 |
| **-80** | 78 | 78 | 78 | 78 | 78 | 78 | 78 |
| **-75** | 78.67 | 78.67 | 78.67 | 78.67 | 78.67 | 78.67 | 78.67 |
| **-70** | 51.33 | 51.33 | 51.33 | 51.33 | 51.33 | 51.33 | 51.33 |
| **-65** | 54 | 58.67 | 58.67 | 58.67 | 58.67 | 58.67 | 58.67 |
| **-60** | 62.67 | 64.67 | 64.67 | 64.67 | 64.67 | 64.67 | 64.67 |
| **-55** | 63.33 | 63.33 | 63.33 | 63.33 | 63.33 | 63.33 | 63.33 |
| **-50** | 66 | 66 | 66 | 66 | 66 | 66 | 66 |
| **-45** | 74 | 74.67 | 74.67 | 74.67 | 74.67 | 74.67 | 74.67 |
| **-40** | 84.67 | 85.33 | 85.33 | 85.33 | 85.33 | 85.33 | 85.33 |
| **-35** | 90.67 | 90 | 90 | 90 | 90 | 90 | 90 |
| **-30** | 94 | 92.67 | 92.67 | 92.67 | 92.67 | 92.67 | 92.67 |
| **-25** | 95.33 | 95.33 | 95.33 | 95.33 | 95.33 | 95.33 | 95.33 |
| **-20** | 95.33 | 94.67 | 95.33 | 95.33 | 95.33 | 95.33 | 95.33 |
| **-15** | 95.33 | 95.33 | 95.33 | 96.67 | 96.67 | 96.67 | 96.67 |
| **-10** | 94.67 | 95.33 | 95.33 | 96 | 96.67 | 96.67 | 96.67 |
| **-5** | 96 | 95.33 | 95.33 | 94.67 | 94.67 | 95.33 | 95.33 |
| **0** | 95.33 | 95.33 | 94.67 | 95.33 | 95.33 | 96 | 96 |
| **5** | 96 | 95.33 | 96.67 | 96 | 96.67 | 95.33 | 96 |
| **10** | 95.33 | 96 | 96 | 94.67 | 96 | 95.33 | 94 |
| **15** | 95.33 | 96 | 95.33 | 94 | 95.33 | 95.33 | 94.67 |
| **20** | 95.33 | 96 | 96 | 97.33 | 94.67 | 95.33 | 95.33 |
| **25** | 94.67 | 95.33 | 96 | 98 | 97.33 | 95.33 | 95.33 |
| **30** | 94.67 | 96.67 | 95.33 | 96 | 98 | 96 | 95.33 |
| **35** | 79.33 | 95.33 | 98 | 96.67 | 98.67 | 96.67 | 96 |
| **40** | 62 | 94.67 | 96 | 96.67 | 96.67 | 98 | 96 |
| **45** | 91.33 | 94.67 | 95.33 | 96 | 96.67 | 98 | 97.33 |
| **50** | 66.67 | 93.33 | 94.67 | 95.33 | 97.33 | 98.67 | 98 |
| **55** | 33.33 | 90.67 | 94 | 96.67 | 96 | 96.67 | 98.67 |
| **60** | 33.33 | 90.67 | 92.67 | 95.33 | 96.67 | 96.67 | 98.67 |
| **65** | 33.33 | 50 | 78.67 | 94.67 | 94.67 | 96.67 | 96.67 |
| **70** | 33.33 | 66.67 | 93.33 | 94.67 | 94.67 | 95.33 | 96 |
| **75** | 33.33 | 33.33 | 50 | 92.67 | 95.33 | 98 | 97.33 |
| **80** | 33.33 | 33.33 | 33.33 | 92 | 93.33 | 96 | 96.67 |
| **85** | 33.33 | 33.33 | 33.33 | 92 | 90.67 | 95.33 | 95.33 |
| **90** | 33.33 | 33.33 | 33.33 | 50 | 90 | 94.67 | 95.33 |
| **95** | 33.33 | 33.33 | 33.33 | 79.33 | 90 | 94.67 | 95.33 |
| **100** | 33.33 | 33.33 | 33.33 | 33.33 | 66.67 | 92.67 | 94.67 |

**討論:**

1. 小C更容忍錯誤，模型邊界平滑但泛化能力較弱；大C強調準確分類訓練數據，可能overfitting。適中的C能在邊界平滑與分類準確之間取得平衡，通常效果最佳。在實驗結果中，我認為C大於10表現較佳。
2. 當 sigma 過小，模型過於局部化，容易overfitting；當 sigma 過大，模型趨於線性，無法捕捉非線性特徵。適中的 sigma 能平衡全局與局部信息，通常分類效果最佳。特徵數值範圍也與sigma有關，建議進行特徵標準化，確保不同特徵對距離計算的影響一致。在實驗結果中，我認為sigma (log scale)介於-20~70表現較佳。
3. 我認為不採用two-fold cross validation 分類率會提高，因為模型直接在訓練數據上測試，其邊界已經針對這些數據調整過，分類率自然會較高，但是無法評估其泛化能力。