NAME: CHERUKURI VENKATA KARTIK

SRN: PES2UG23CS148

SECTION: C

Inferences about the Linear Kernel's performance ?
Based on the classification report from cell , the Linear Kernel on the Moons dataset achieved an accuracy of `0.87`.
Comparison between RBF and Polynomial kernel decision boundaries?
the RBF kernel seems to capture the shape of the data more naturally for the Moons dataset

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Which kernel was most effective for this dataset?
RBF was the most effective with an accuracy of 0.94
Why might the Polynomial kernel have underperformed here?
The relationship between the variance and skewness might not be the best captured by the polynomial kernel

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Which margin (soft or hard) is wider?
The plot for the "Soft Margin SVM (C=0.1)" clearly shows a wider margin compared to the "Hard Margin SVM (C=100)"
Why does the soft margin model allow "mistakes"?
The soft margin SVM allows "mistakes" because its primary goal is to find a balance between maximizing the margin and minimizing the errors.
Which model is more likely to be overfitting and why?
The Hard Margin is more likely to be overfitting to the training data. With a large C value, the model heavily penalizes misclassifications and tries to classify every training point correctly
Which model would you trust more for new data and why?
Soft margin can be trusted more for newer data because the wider margin leads to better generalization performance.

Training result of moons dataset

```
SVM with LINEAR Kernel <PES2UG23CS148>
              precision    recall  f1-score   support

           0       0.85      0.89      0.87        75
           1       0.89      0.84      0.86        75

    accuracy                           0.87       150
   macro avg       0.87      0.87      0.87       150
weighted avg       0.87      0.87      0.87       150

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    SVM with RBF Kernel <PES2UG23CS148>
                  precision    recall  f1-score   support

               0       0.95      1.00      0.97        75
               1       1.00      0.95      0.97        75

        accuracy                           0.97       150
       macro avg       0.97      0.97      0.97       150
    weighted avg       0.97      0.97      0.97       150

    ----------------------------------------

    SVM with POLY Kernel <PES2UG23CS148>
                  precision    recall  f1-score   support

               0       0.82      0.91      0.86        75
               1       0.90      0.80      0.85        75

        accuracy                           0.85       150
       macro avg       0.86      0.85      0.85       150
    weighted avg       0.86      0.85      0.85       150

    ----------------------------------------
```
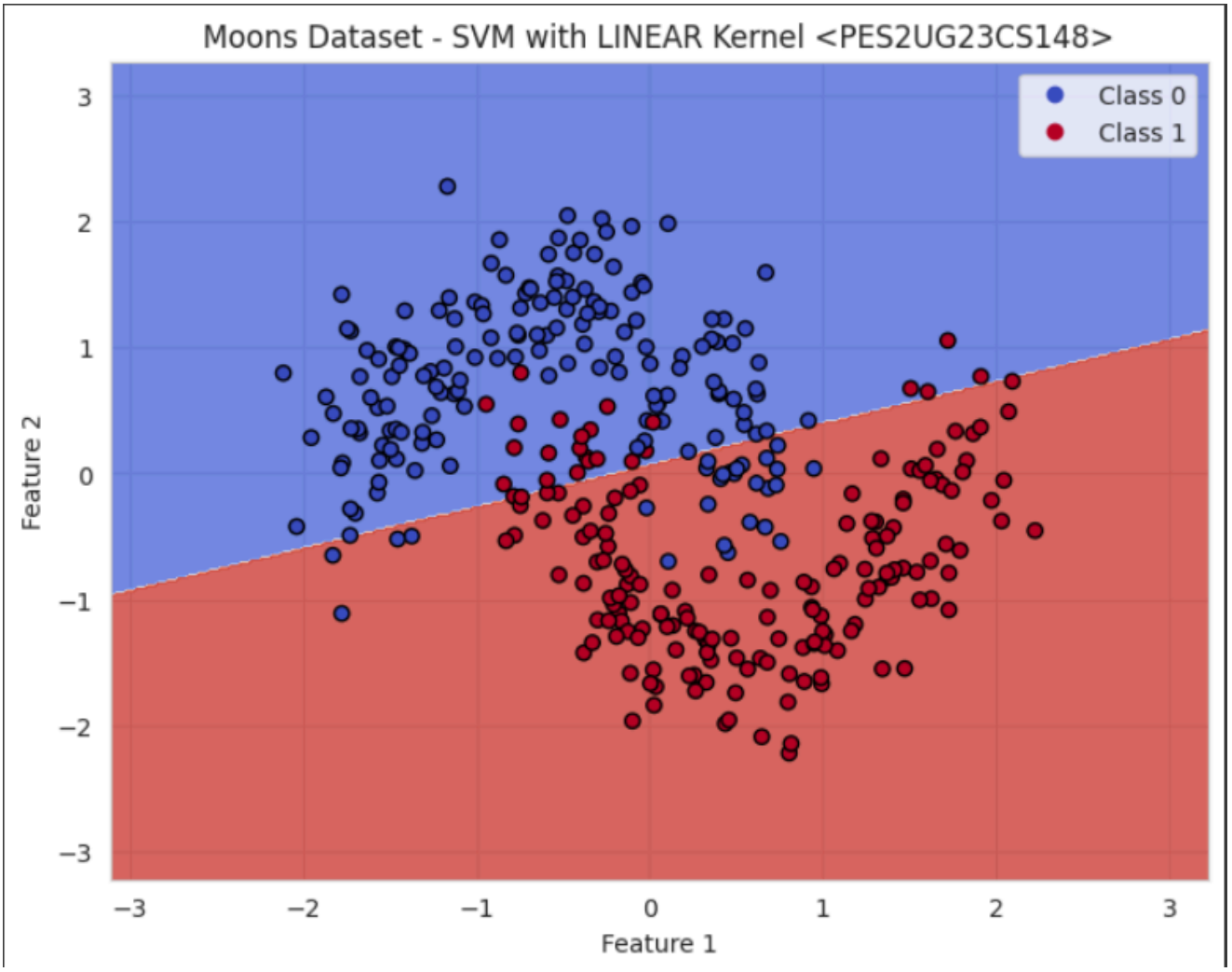

Training result of banknotes dataset

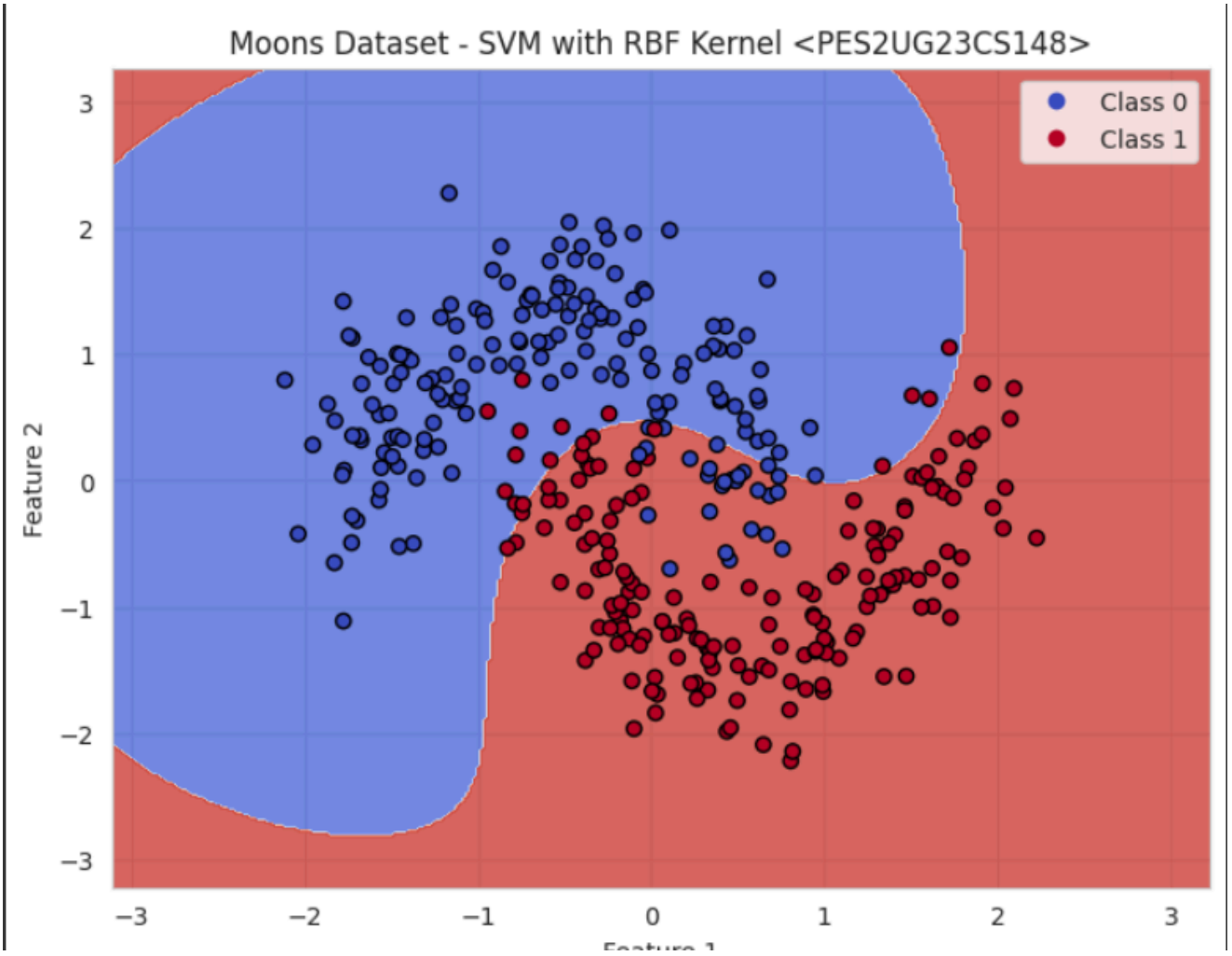
```
SVM with LINEAR Kernel <PES2UG23CS148>
              precision    recall  f1-score   support

      Forged       0.90      0.88      0.89       229
     Genuine       0.86      0.88      0.87       183

    accuracy                           0.88       412
   macro avg       0.88      0.88      0.88       412
weighted avg       0.88      0.88      0.88       412

----------------------------------------
```

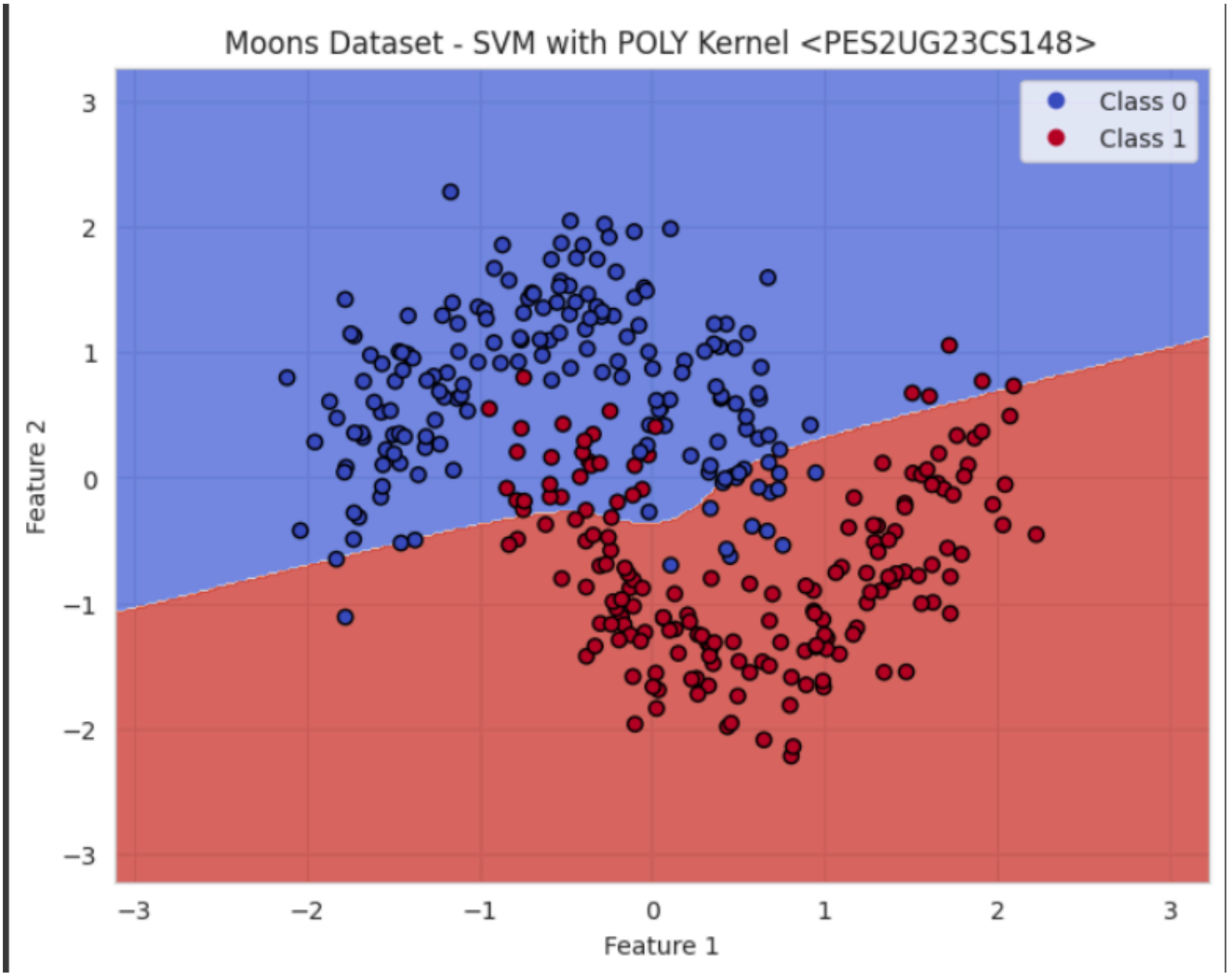
```
SVM with RBF Kernel <PES2UG23CS148>
              precision    recall  f1-score   support

      Forged       0.98      0.90      0.94       229
     Genuine       0.89      0.98      0.93       183

    accuracy                           0.94       412
   macro avg       0.94      0.94      0.94       412
weighted avg       0.94      0.94      0.94       412

----------------------------------------
```

```
SVM with POLY Kernel <PES2UG23CS148>
              precision    recall  f1-score   support

      Forged       0.97      0.85      0.90       229
     Genuine       0.83      0.97      0.90       183

    accuracy                           0.90       412
   macro avg       0.90      0.91      0.90       412
weighted avg       0.91      0.90      0.90       412

----------------------------------------
```

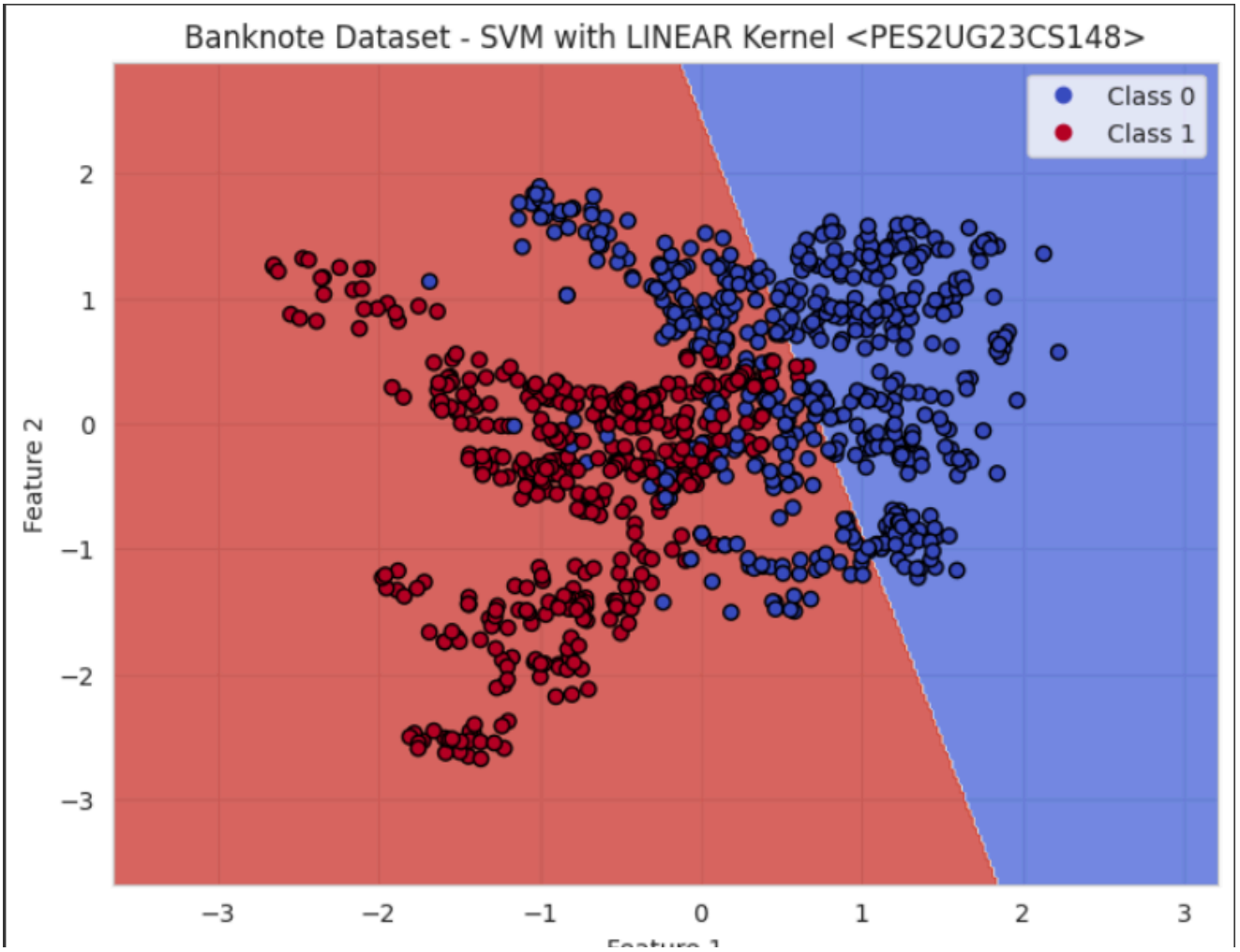
Moons dataset plots

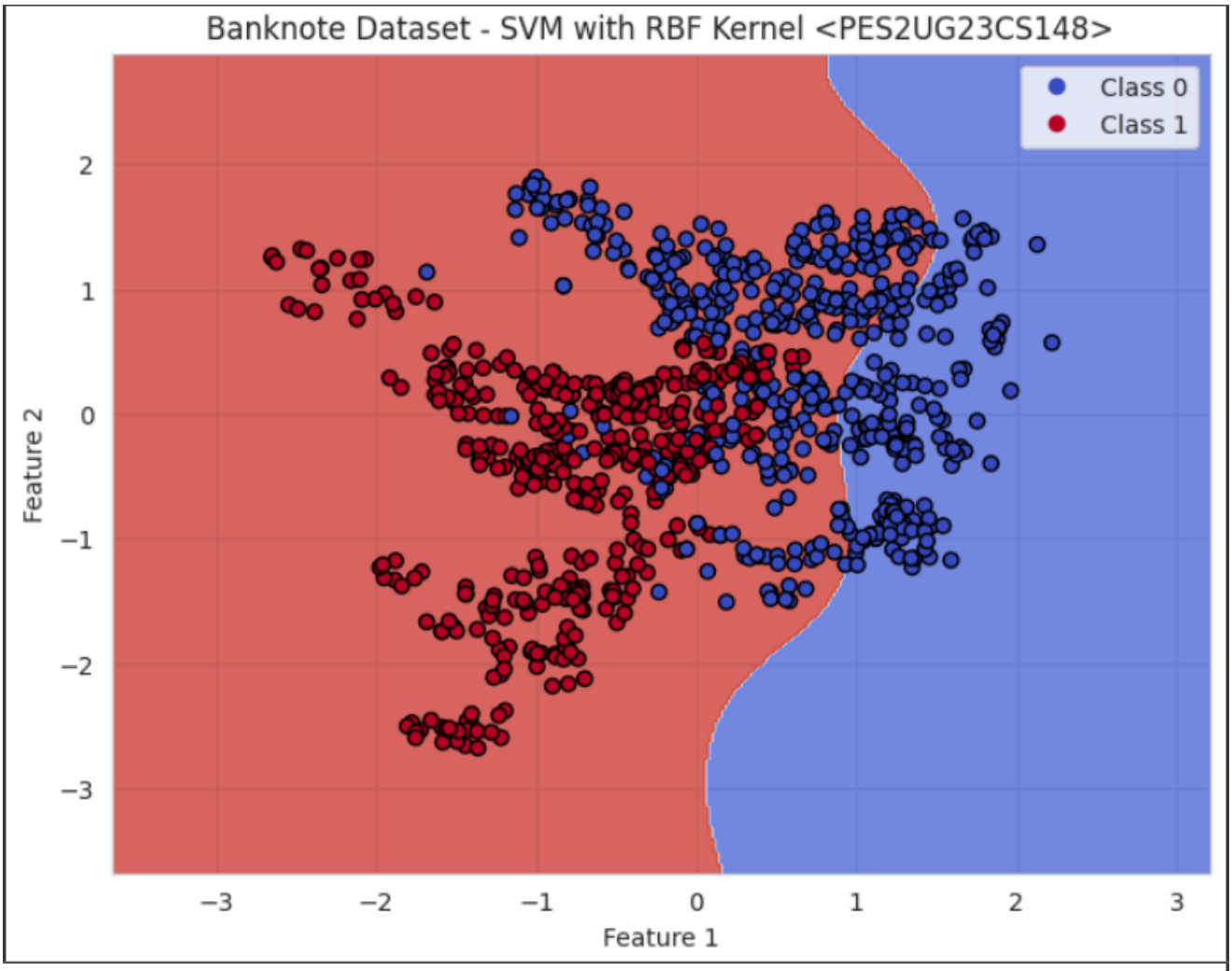


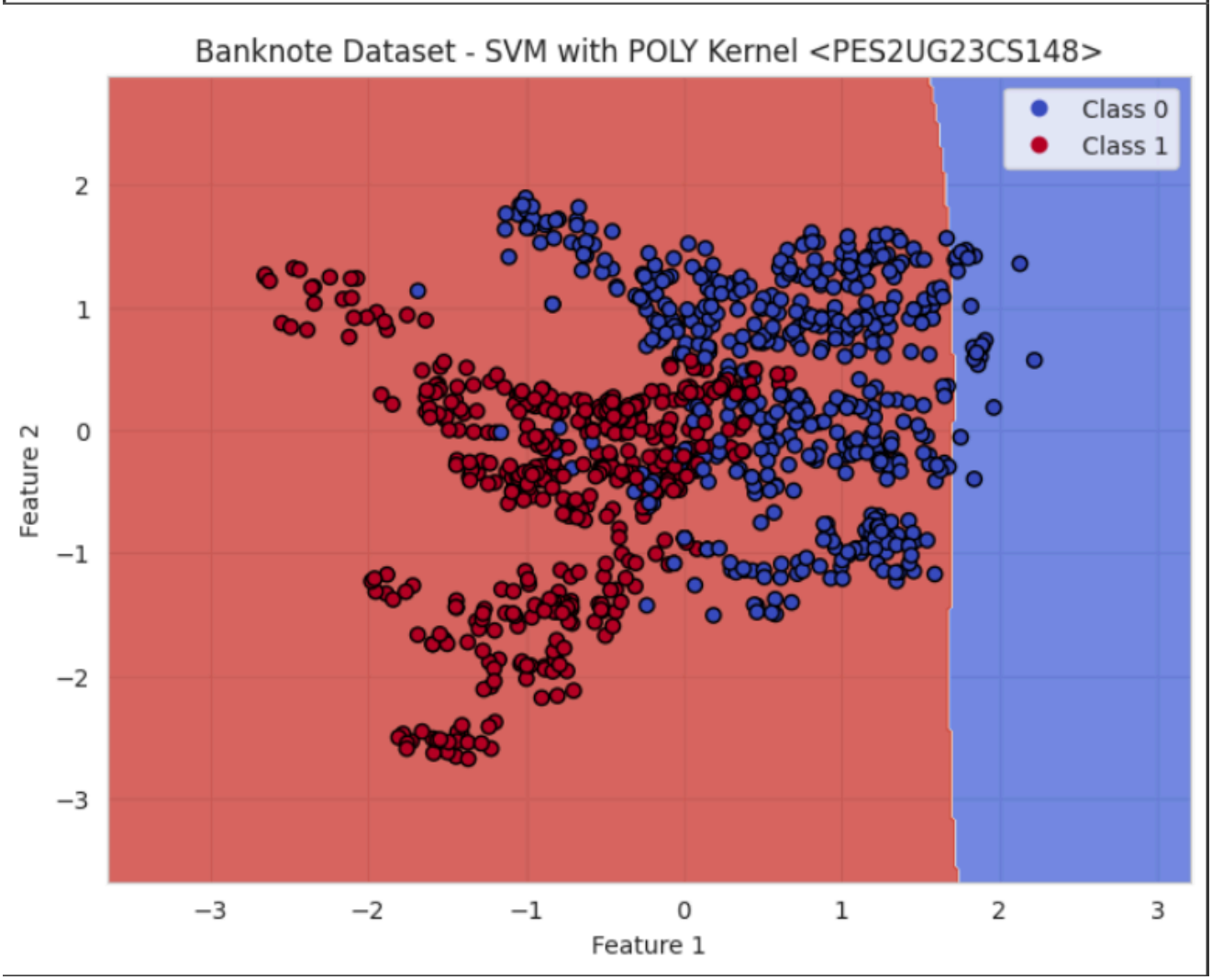

Moons Dataset - SVM with RBF Kernel <PES2UG23CS148>
Class 0
Class 1
Feature 2
3
2
1
0
−1
−2
−3
−3
−2
−1
0
1
2
3


Moons Dataset - SVM with POLY Kernel <PES2UG23CS148>
Class 0
Class 1
Feature 2
3
2
1
0
−1
−2
−3
−3
−2
−1
0
1
2
3
Feature 1

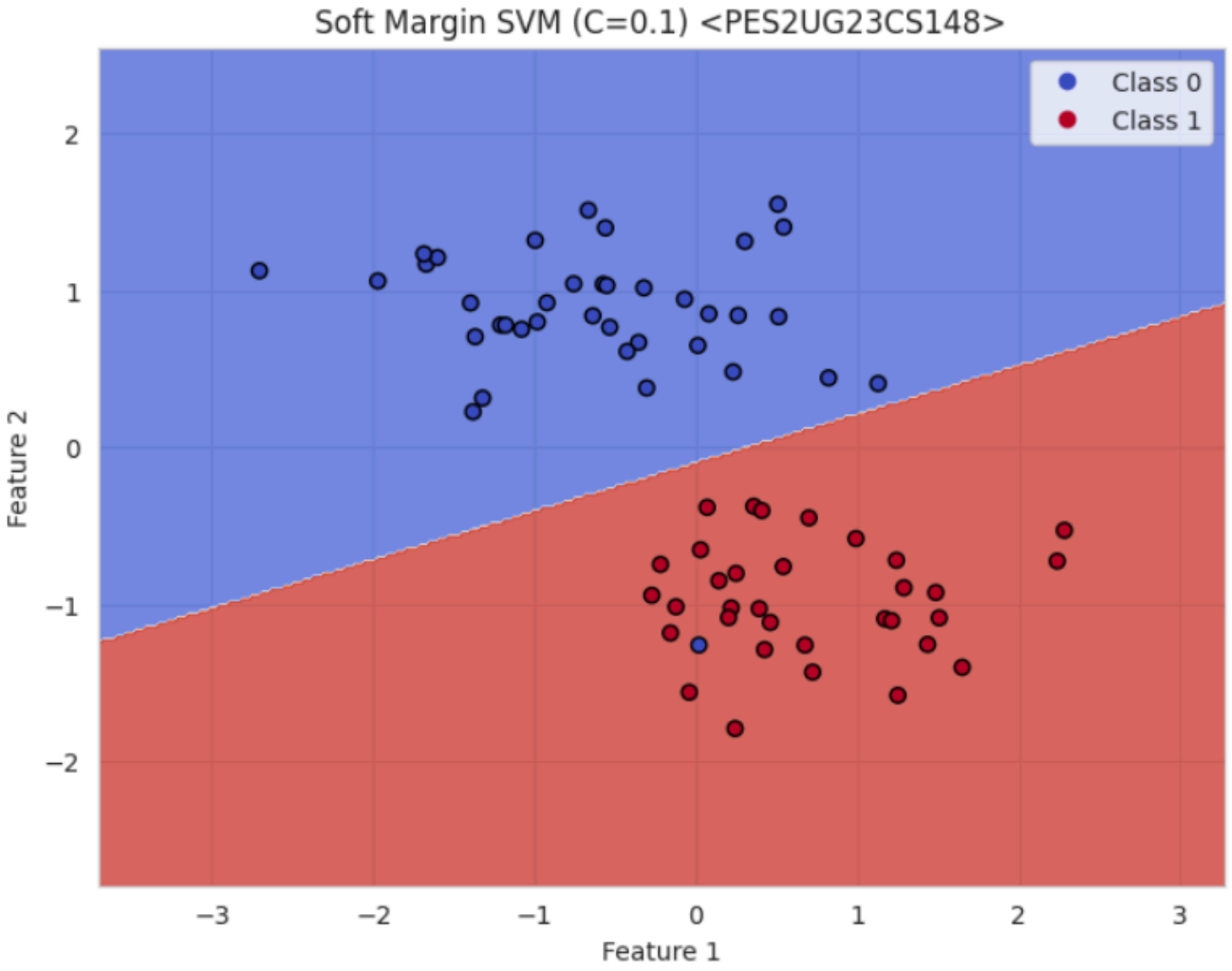
Banknote Dataset plots

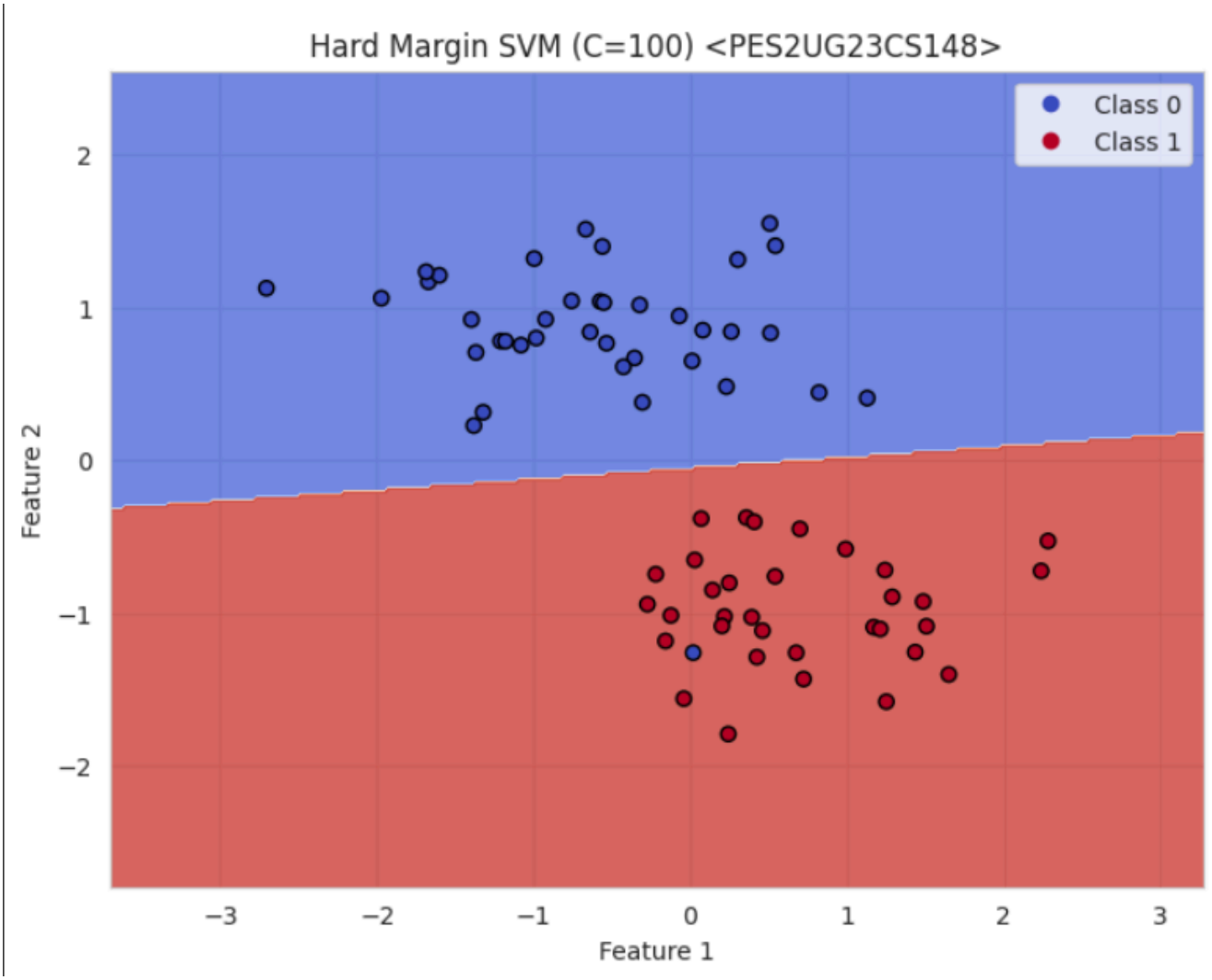



Banknote Dataset - SVM with RBF Kernel <PES2UG23CS148>
Class 0
Class 1
Feature 2
Feature 1
2
1
0
−1
−2
−3
−3
−2
−1
0
1
2
3


Banknote Dataset - SVM with POLY Kernel <PES2UG23CS148>
Class 0
Class 1
Feature 2
Feature 1
2
1
0
−1
−2
−3
−3
−2
−1
0
1
2
3

Margin Analysis




Hard Margin SVM (C=100) <PES2UG23CS148>
Class 0
Class 1
Feature 2
Feature 1
2
1
0
−1
−2
−3
−2
−1
0
1
2
3