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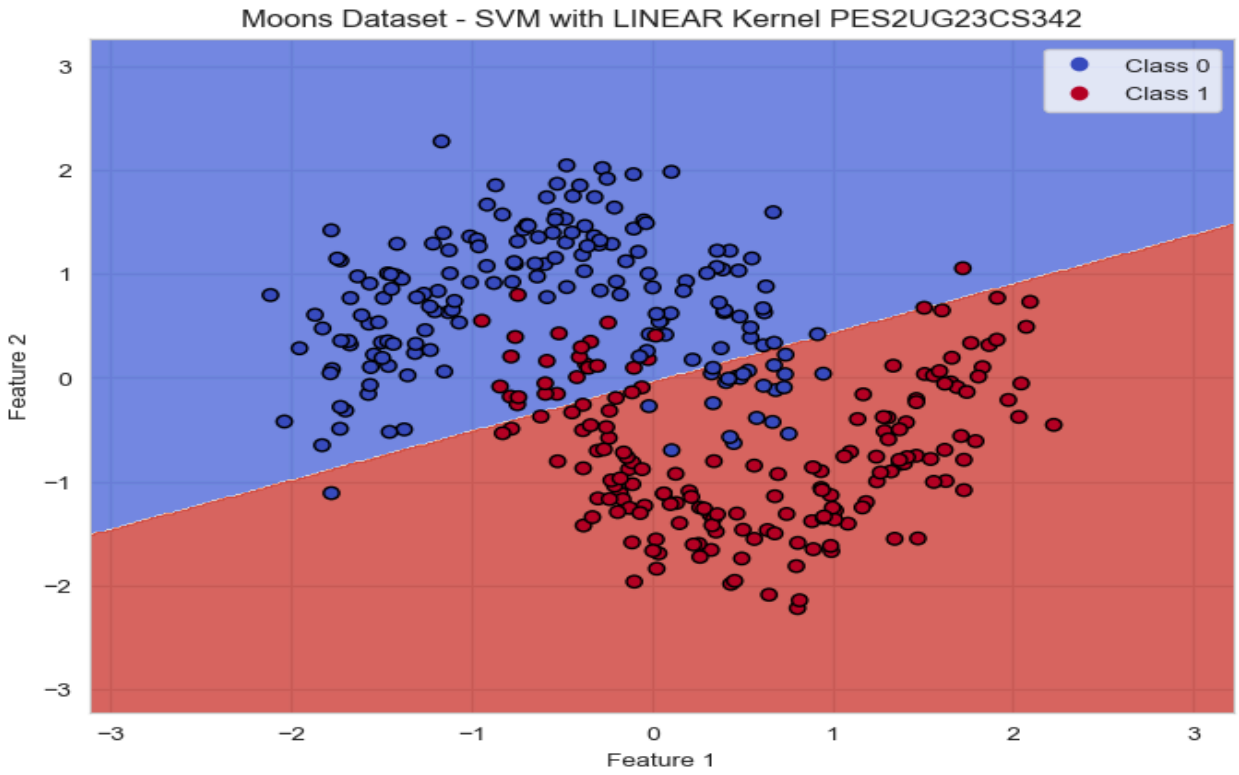
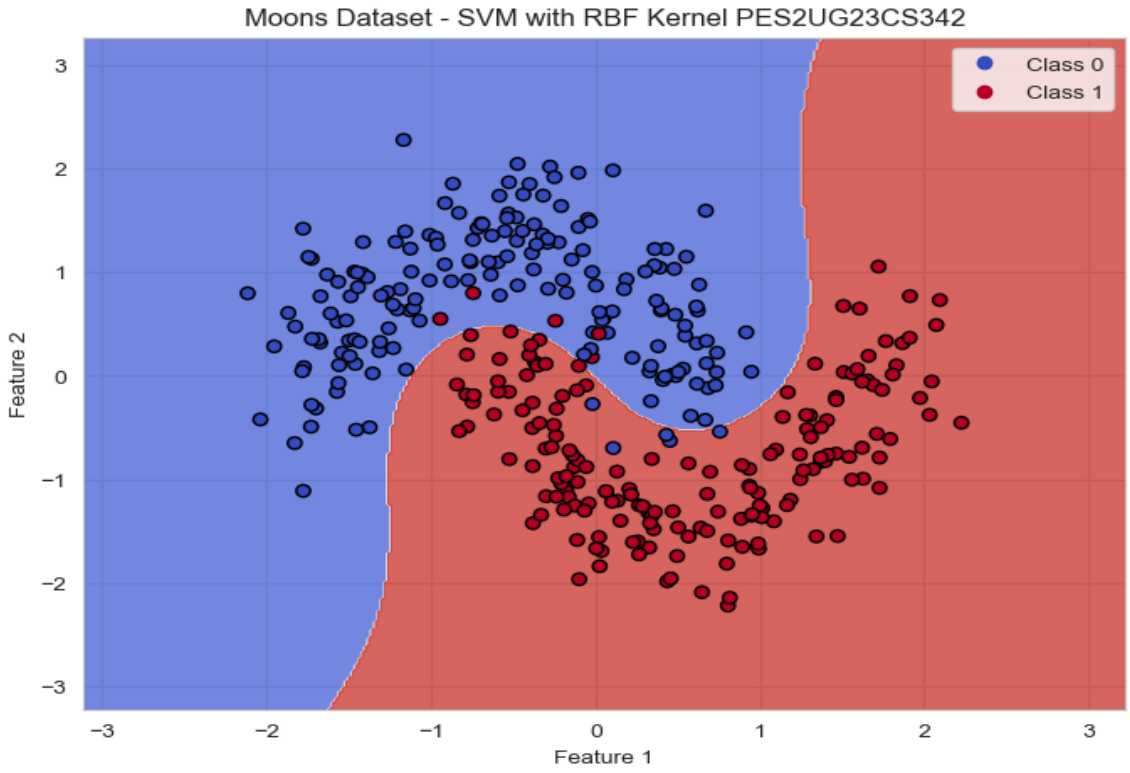
Section: F

Moons Dataset:

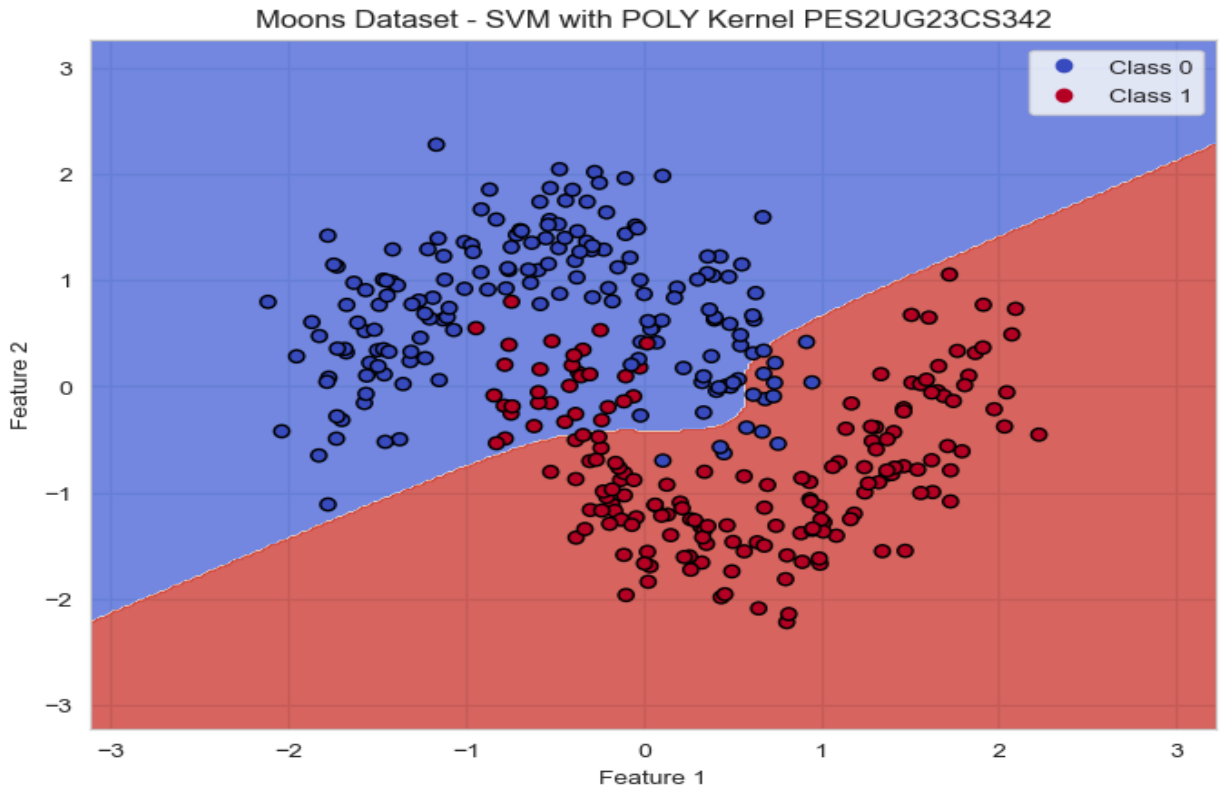
1. Classification Report for SVM with LINEAR Kernel



2. Classification Report for SVM with RBF Kernel



3. Classification Report for SVM with POLY Kernel



Classification Report for Moons Dataset:

SVM with LINEAR Kernel PES2UG23CS342

	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

SVM with RBF Kernel PES2UG23CS342

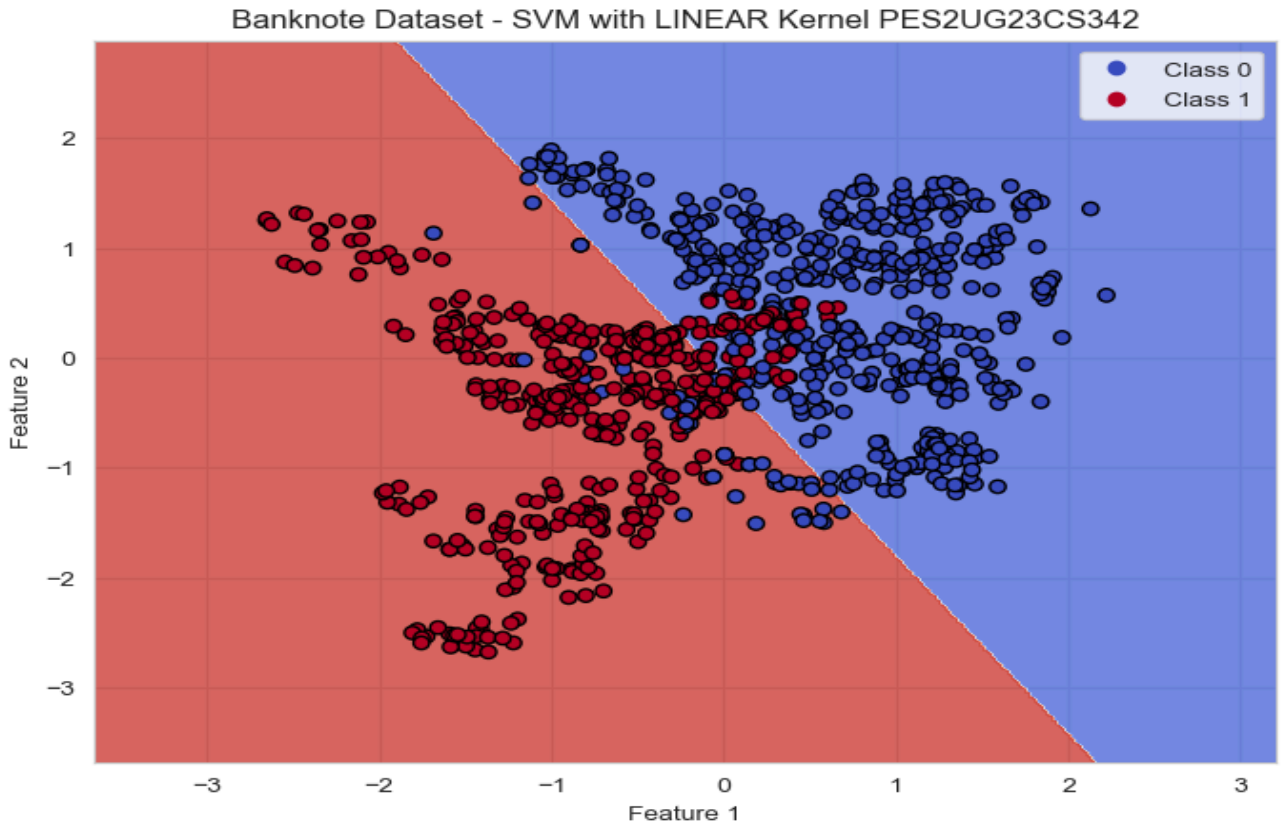
	precision	recall	f1-score	support
0	0.95	1.00	0.97	75
1	1.00	0.95	0.97	75
accuracy			0.97	150
macro avg	0.97	0.97	0.97	150
weighted avg	0.97	0.97	0.97	150

SVM with POLY Kernel PES2UG23CS342

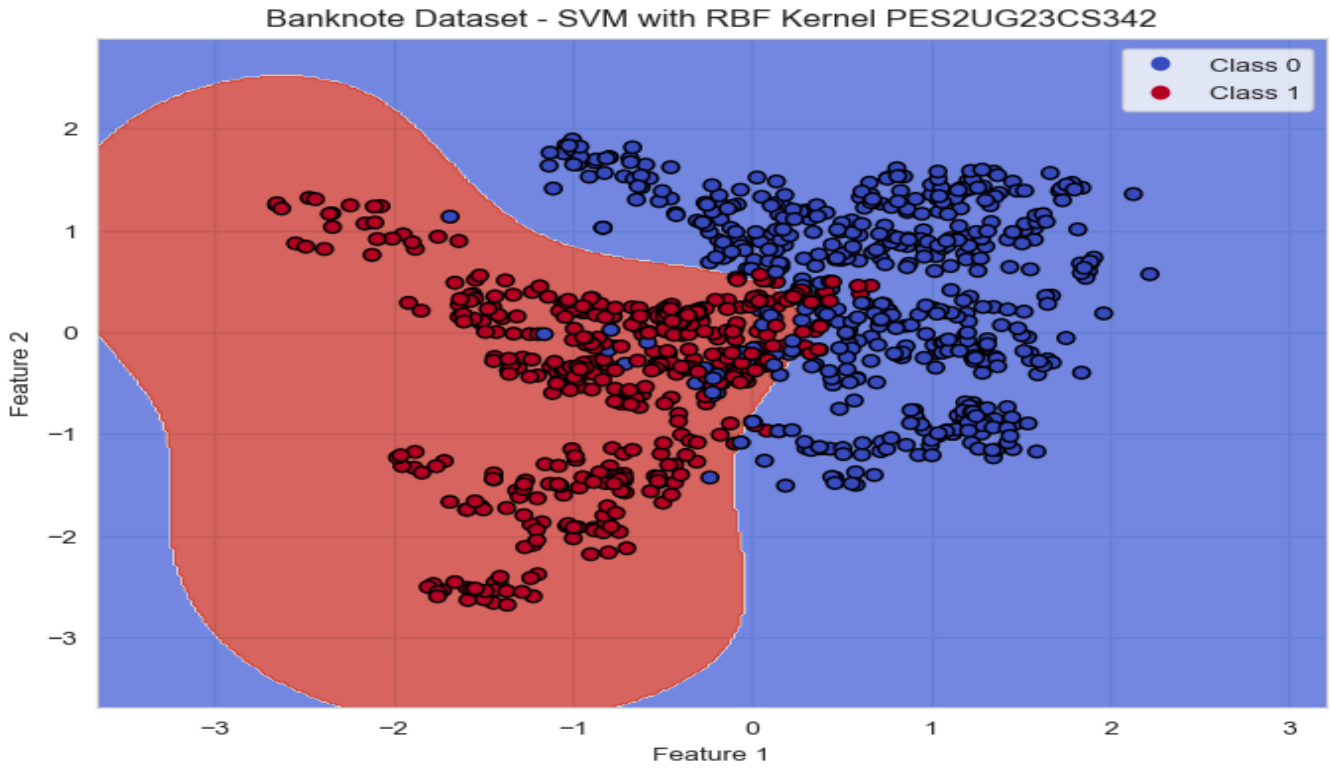
	precision	recall	f1-score	support
0	0.85	0.95	0.89	75
1	0.94	0.83	0.88	75
accuracy			0.89	150
macro avg	0.89	0.89	0.89	150
weighted avg	0.89	0.89	0.89	150

Bank Authentication Dataset:

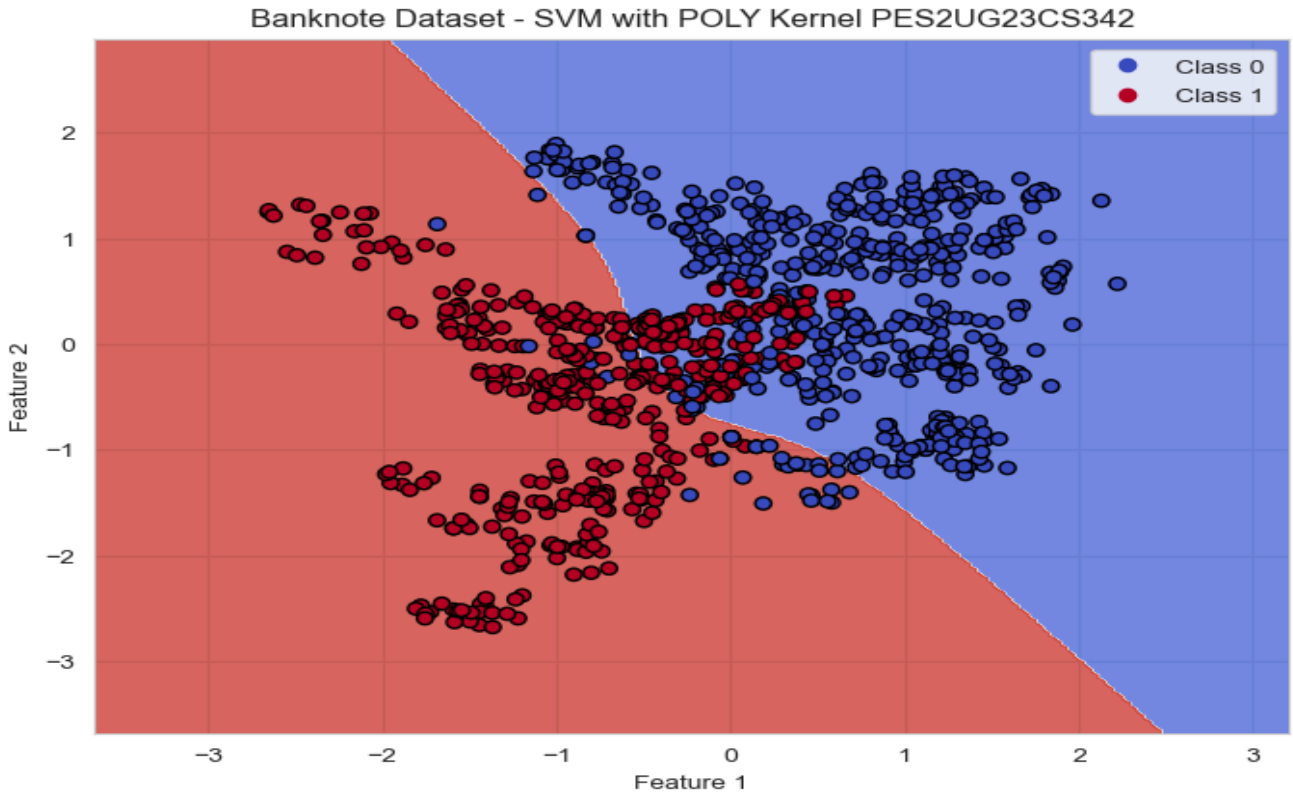
1. Classification Report for SVM with LINEAR Kernel



2. Classification Report for SVM with RBF Kernel



3. Classification Report for SVM with POLY Kernel



Classification Report for Bank Authentication Dataset:

SVM with LINEAR Kernel PES2UG23CS342

	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

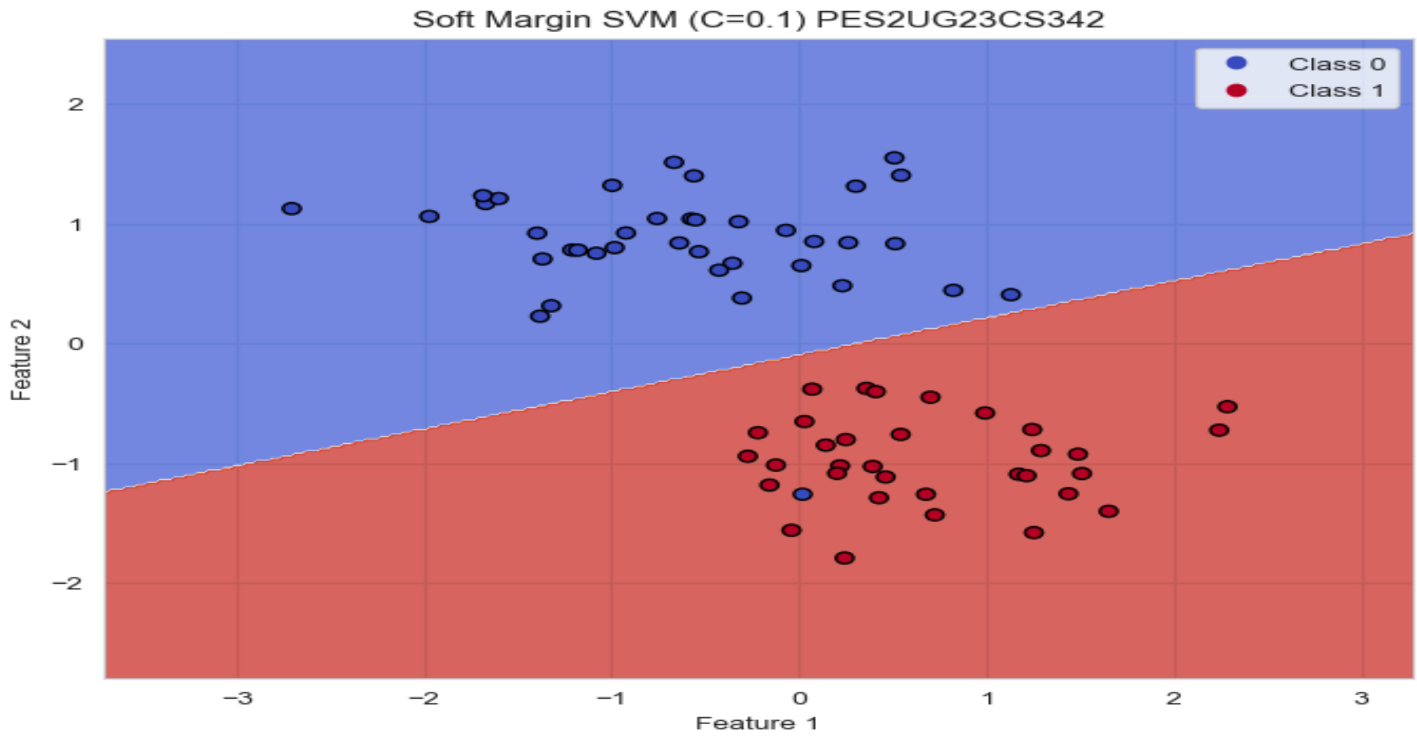
SVM with RBF Kernel PES2UG23CS342

	precision	recall	f1-score	support
Forged	0.96	0.91	0.94	229
Genuine	0.90	0.96	0.93	183
accuracy			0.93	412
macro avg	0.93	0.93	0.93	412
weighted avg	0.93	0.93	0.93	412

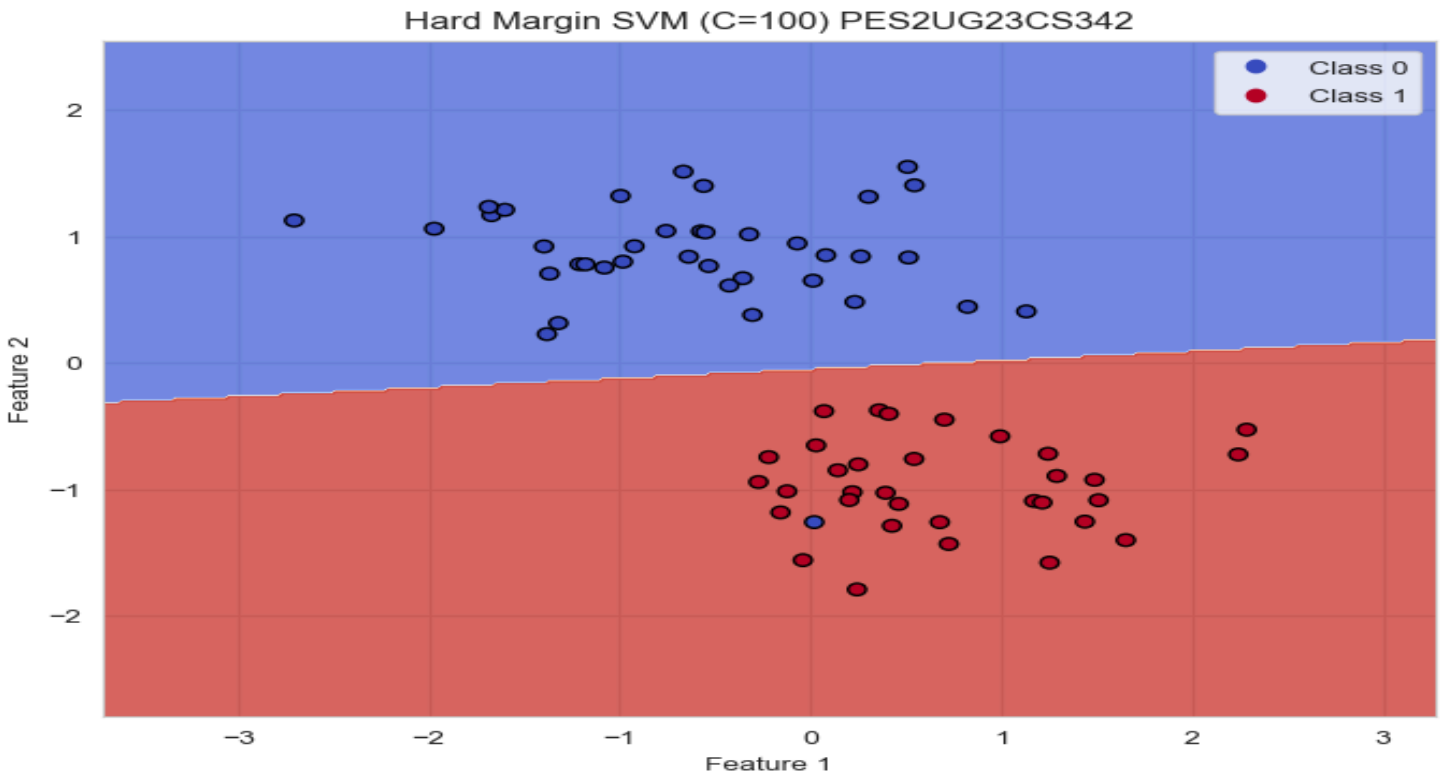
SVM with POLY Kernel PES2UG23CS342

	precision	recall	f1-score	support
Forged	0.82	0.91	0.87	229
Genuine	0.87	0.75	0.81	183
accuracy			0.84	412
macro avg	0.85	0.83	0.84	412
weighted avg	0.85	0.84	0.84	412

Soft-Margin SVM:



Hard-Margin SVM:



Questions to be answered:

Moons Dataset Questions:

1. Inferences about the Linear Kernel's performance

Ans: Linear kernel achieved 87% accuracy, the lowest of the three kernels. This is expected because the Moons dataset has curved, non-linear boundaries that cannot be separated well by a straight line.

2. Comparison between RBF and Polynomial kernel decision boundaries

Ans: RBF performed better (97% accuracy) than Polynomial (89% accuracy). RBF creates smoother curved boundaries that better fit the crescent shape, while Polynomial shows some class imbalance.

Banknote Dataset Questions:

1. Which kernel was most effective for this dataset?

Ans: RBF kernel was most effective with 93% accuracy, compared to Linear (88%) and Polynomial (84%). RBF showed the best balance between precision and recall for both classes.

2. Why might the Polynomial kernel have underperformed here?

Ans: The polynomial kernel achieved only 84% accuracy because the banknote features may not align well with polynomial transformations, and it showed poor class balance (Forged: 0.87 F1 vs Genuine: 0.81 F1).

Hard vs. Soft Margin Questions:

1. Which margin (soft or hard) is wider?

Ans: Soft Margin (C=0.1) has a wider margin than Hard Margin (C=100). Lower C values create wider margins by allowing more flexibility.

2. Why does the soft margin model allow "mistakes"?

Ans: Soft margin uses slack variables to permit some misclassification in exchange for a wider margin. This trades perfect training accuracy for better generalization.

3. Which model is more likely to be overfitting and why?

Ans: Hard Margin (C=100) is more likely to overfit because high C values force the model to fit training data very closely, creating complex boundaries that may not generalize well.

4. Which model would you trust more for new data and why?

Ans: Soft Margin (C=0.1) is more trustworthy because it has better generalization ability due to its wider margin and tolerance for noise, making it more robust on unseen data.