

Neural Network Task 1

No	Name	ID
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5	مايكيل نادر عماد الدين	2021170442
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Perceptron 1st Combination

Bird Species Classification

Select Two Features:

- gender
- body_mass
- beak_length
- beak_depth
- fin_length

Select Two Classes (C1 & C2 or C1 & C3 or C2 & C3):

- A & B
- A & C
- B & C

Enter Learning Rate (eta):
0.01

Enter Number of Epochs (m):
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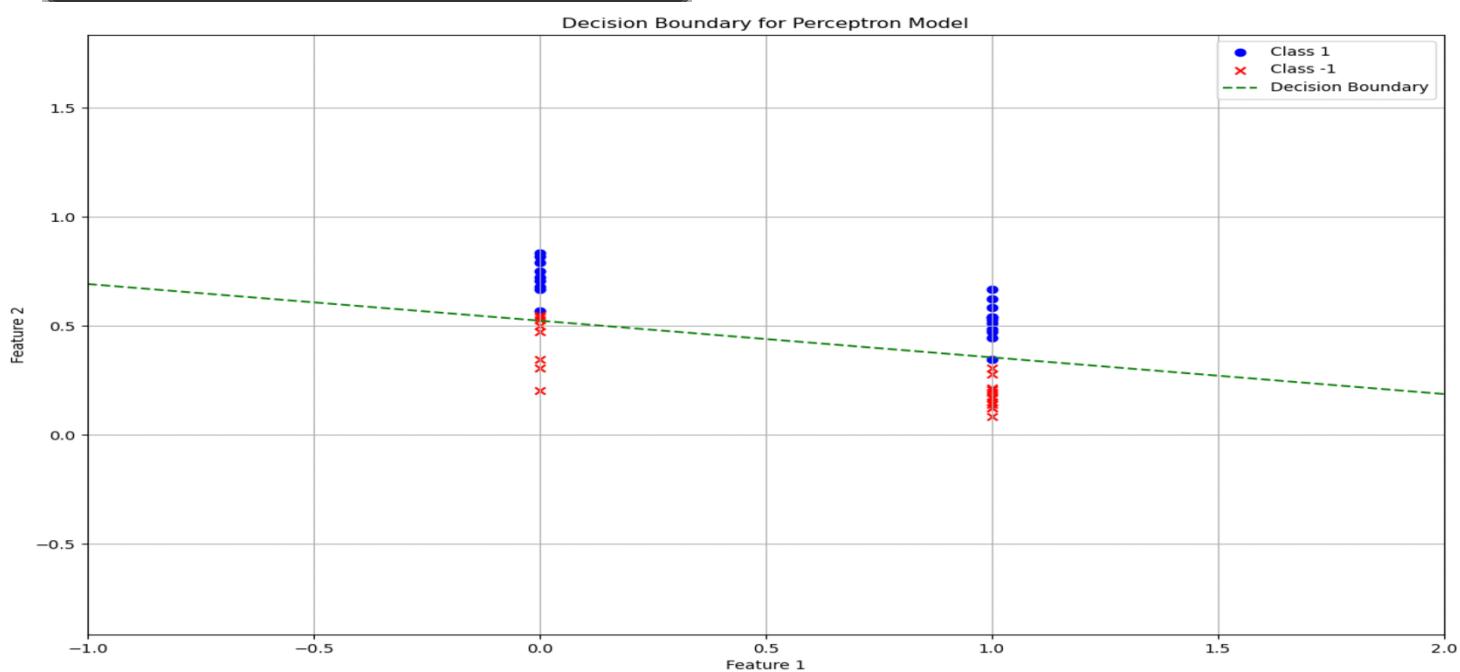
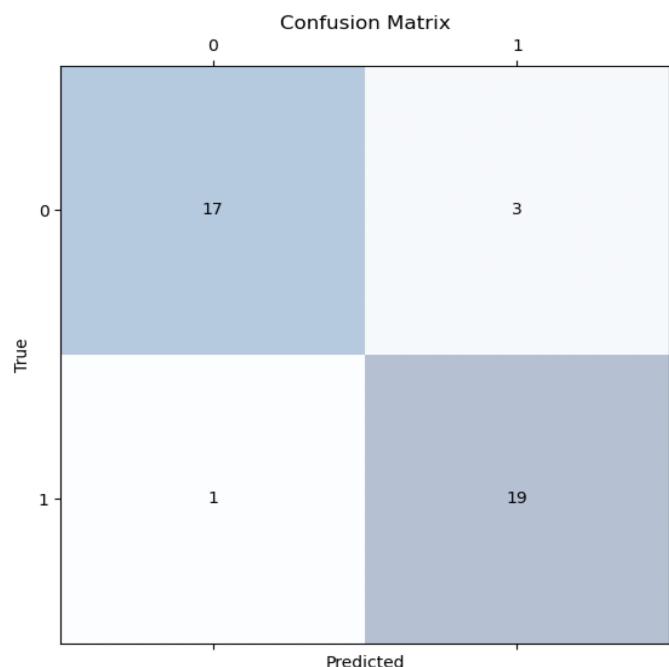
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0.01

Add Bias

Choose Algorithm:

- Perceptron
- Adaline

Submit



Preception 2nd Combination

Bird Species Classification

Select Two Features:

- gender
- body_mass
- beak_length
- beak_depth
- fin_length

Select Two Classes (C1 & C2 or C1 & C3 or C2 & C3):

- A & B
- A & C
- B & C

Enter Learning Rate (eta):
0.01

Enter Number of Epochs (m):
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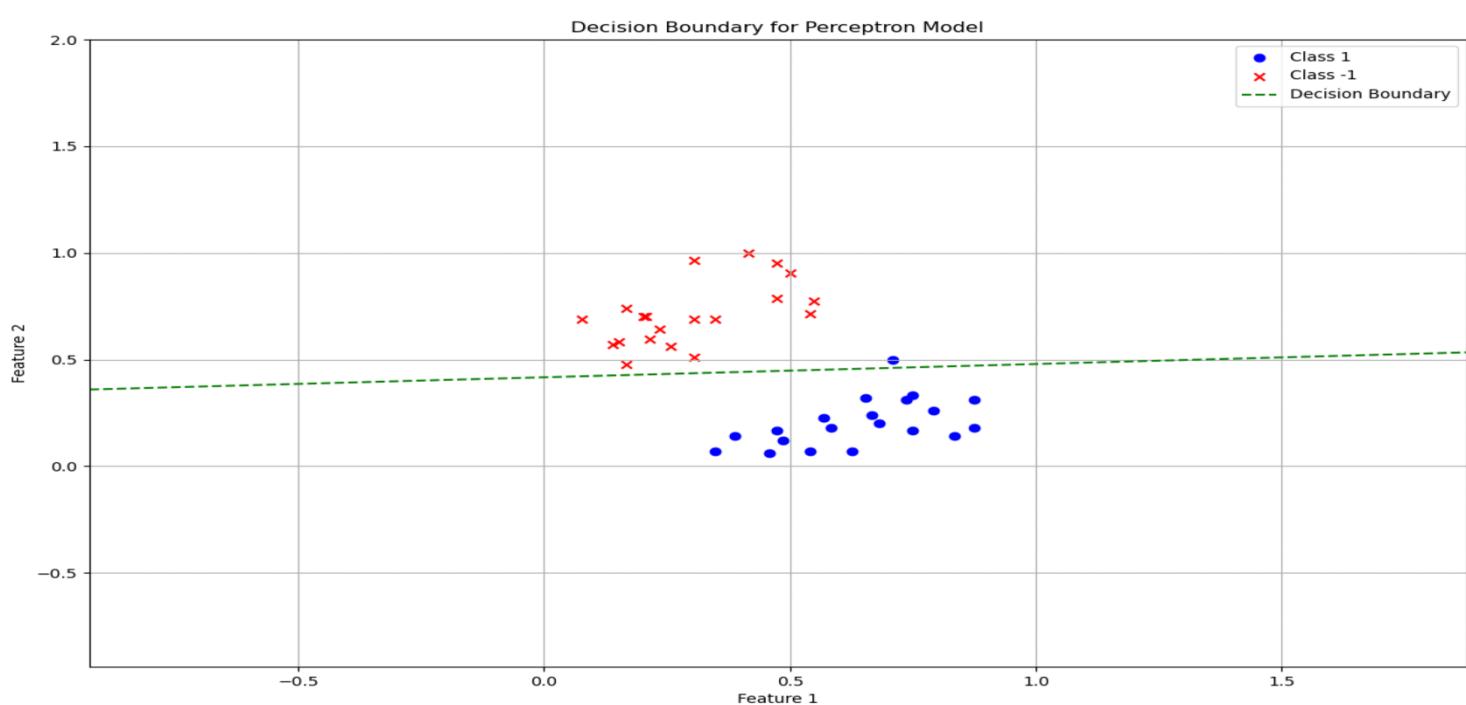
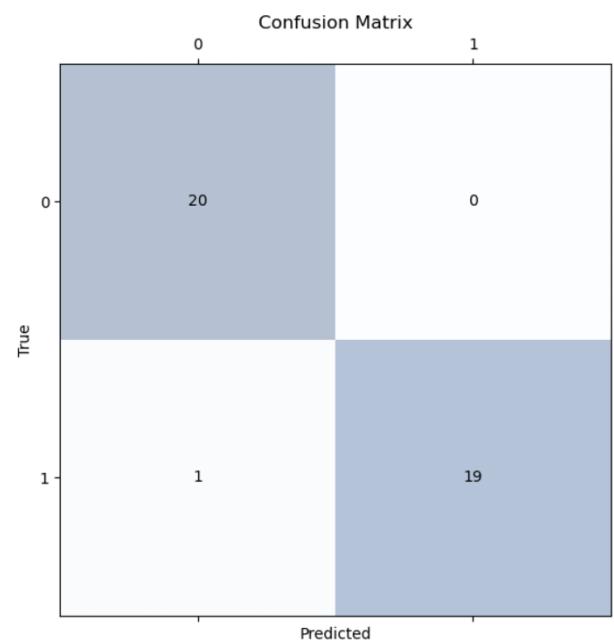
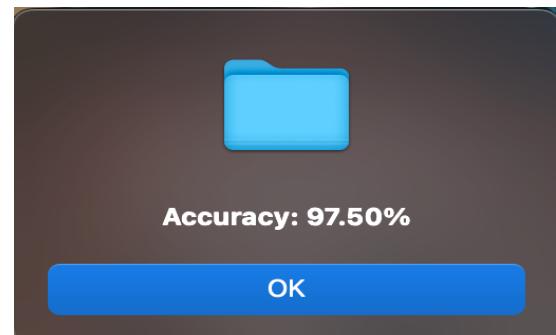
Enter MSE Threshold:
0.01

Add Bias

Choose Algorithm:

- Perceptron
- Adaline

Submit



Preceptron 3rd Combination

Bird Species Classification

Select Two Features:

- gender
- body_mass
- beak_length
- beak_depth
- fin_length

Select Two Classes (C1 & C2 or C1 & C3 or C2 & C3):

- A & B
- A & C
- B & C

Enter Learning Rate (eta):
0.01

Enter Number of Epochs (m):
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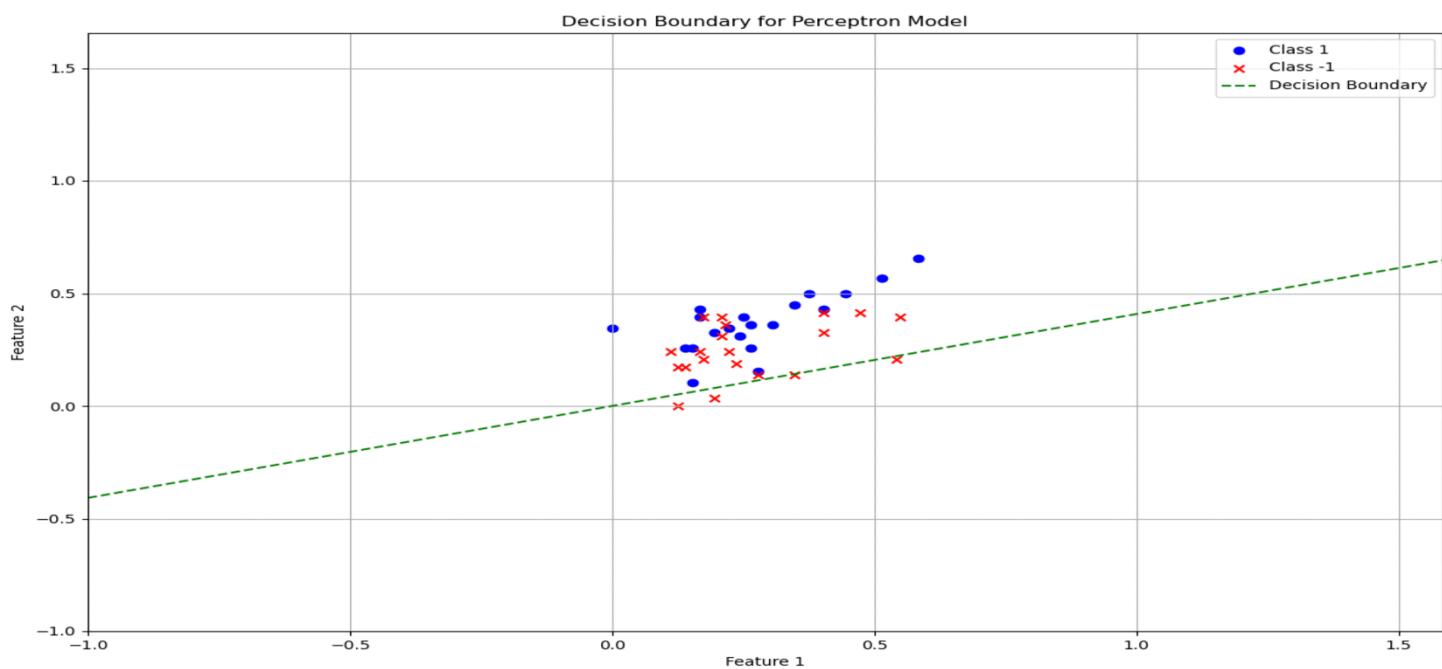
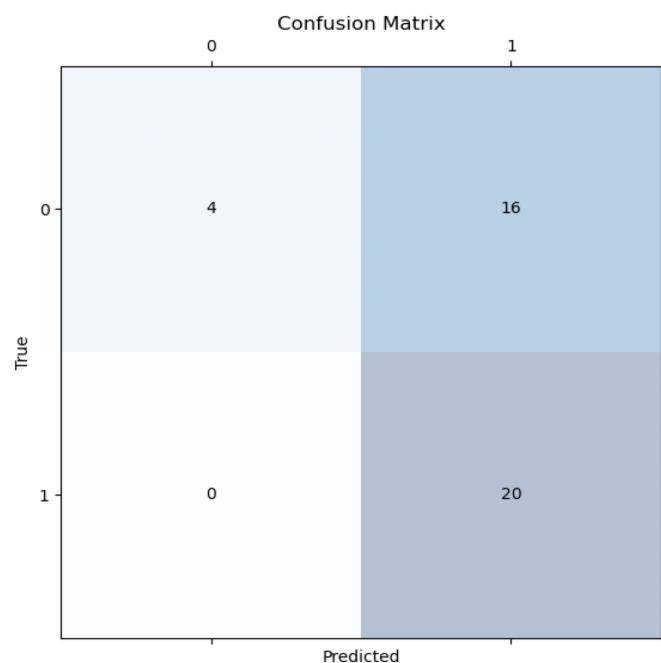
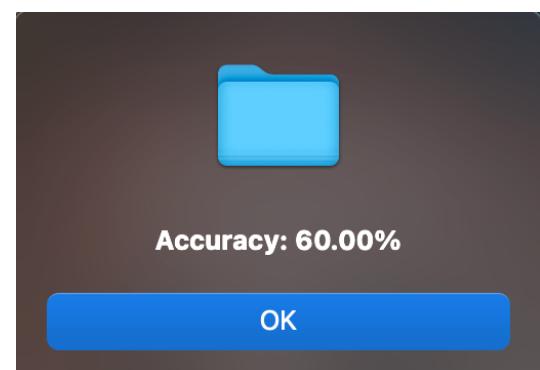
Enter MSE Threshold:
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Add Bias

Choose Algorithm:

- Perceptron
- Adaline

Submit



Preceptron 4th Combination

Bird Species Classification

Select Two Features:

- gender
- body_mass
- beak_length
- beak_depth
- fin_length

Select Two Classes (C1 & C2 or C1 & C3 or C2 & C3):

- A & B
- A & C
- B & C

Enter Learning Rate (eta):
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Enter Number of Epochs (m):
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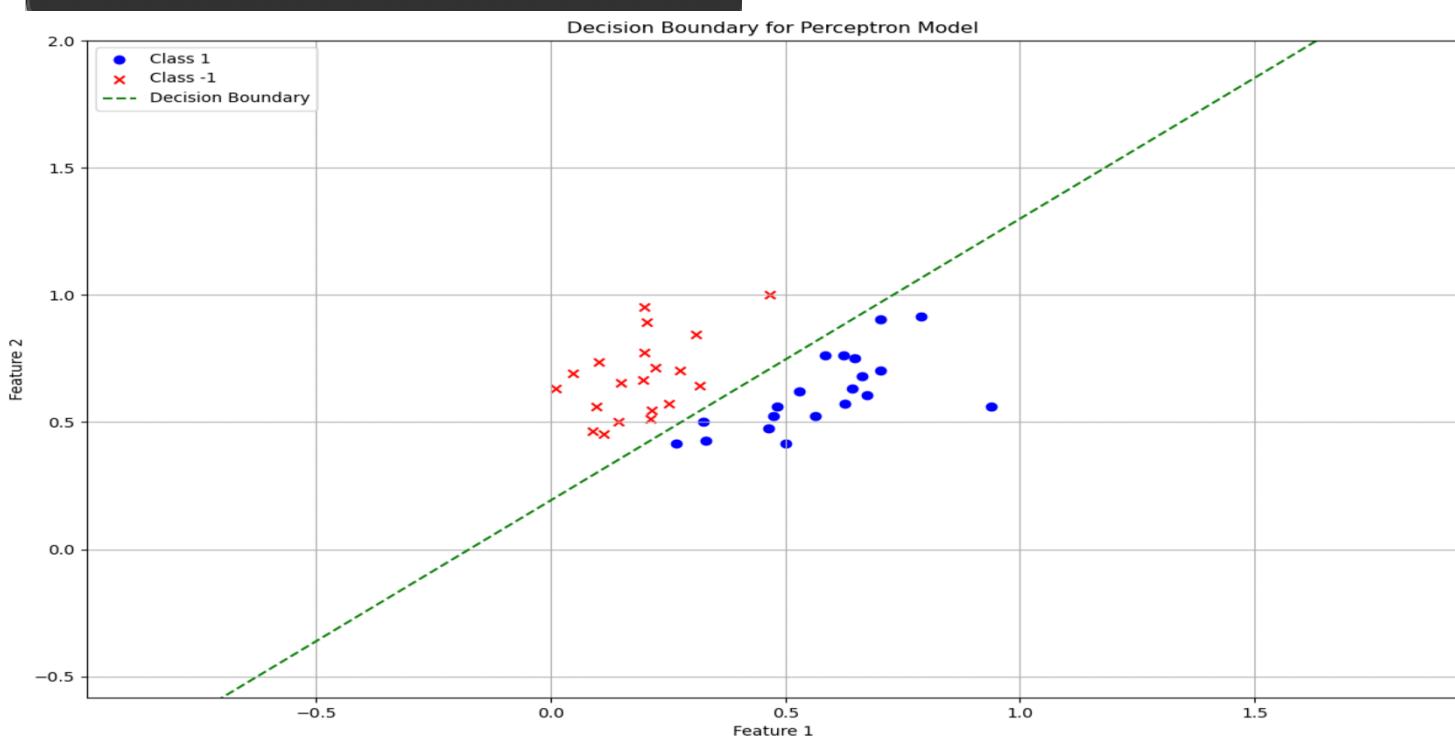
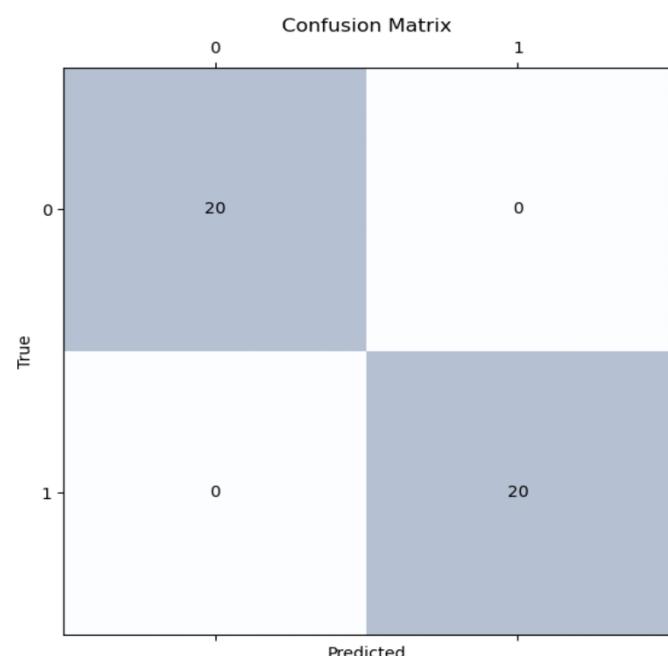
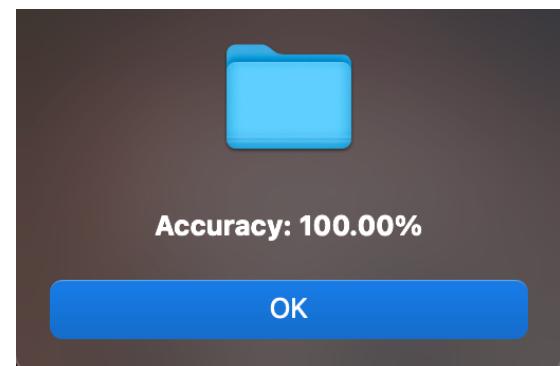
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Add Bias

Choose Algorithm:

- Perceptron
- Adaline

Submit



Preception 5th Combination

Bird Species Classification

Select Two Features:

- gender
- body_mass
- beak_length
- beak_depth
- fin_length

Select Two Classes (C1 & C2 or C1 & C3 or C2 & C3):

- A & B
- A & C
- B & C

Enter Learning Rate (eta):
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Enter Number of Epochs (m):
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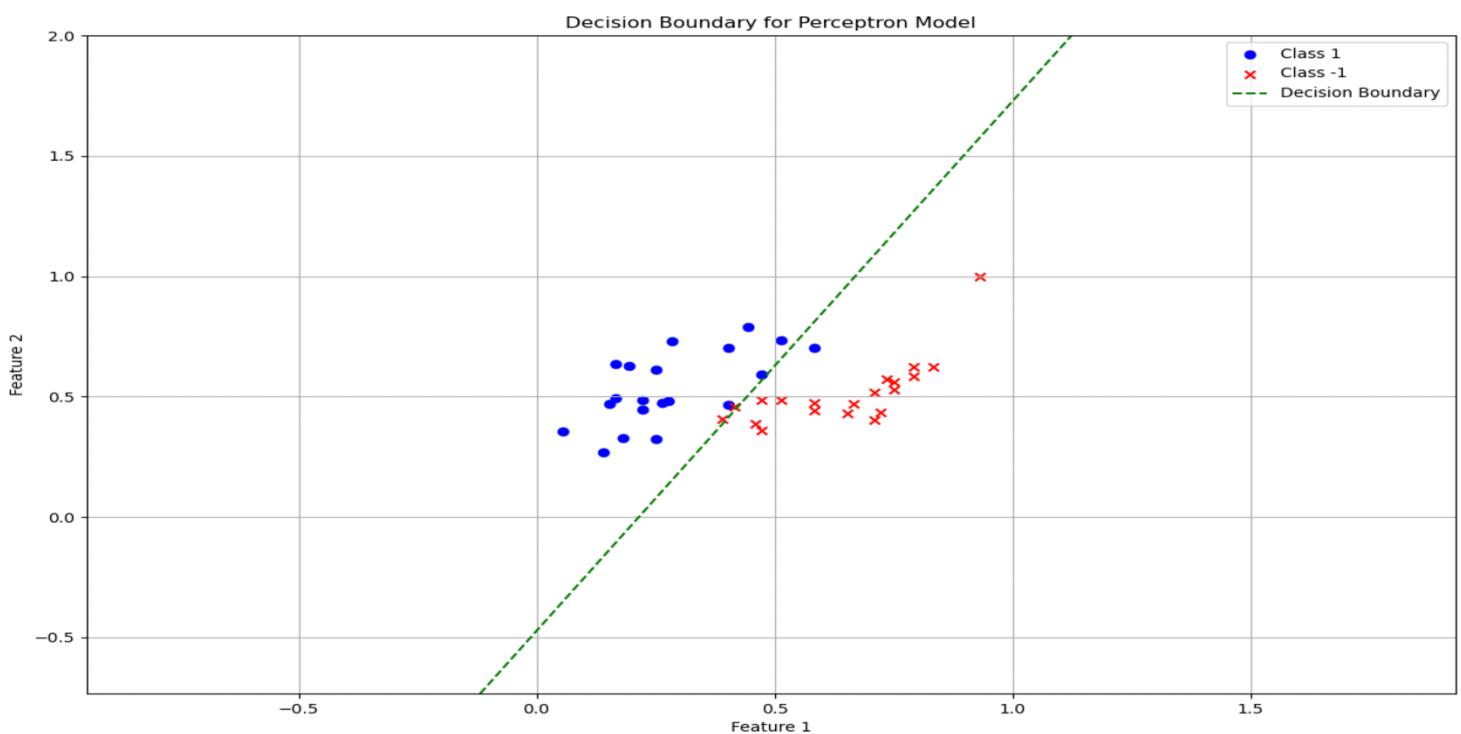
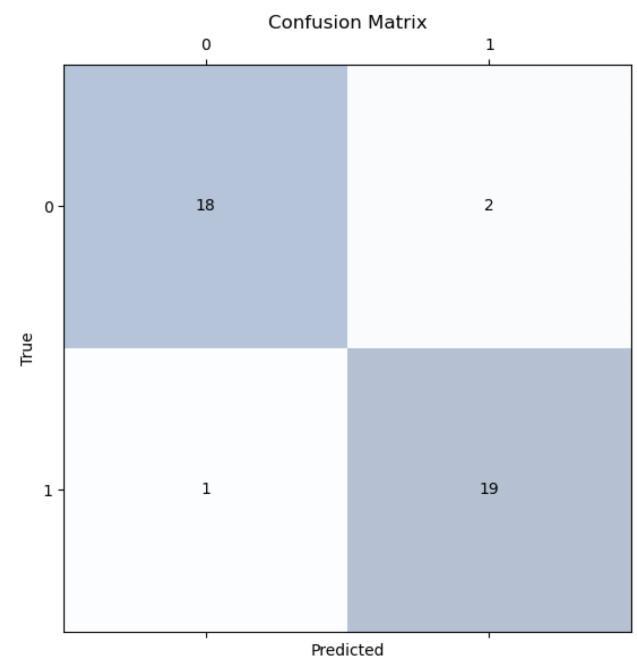
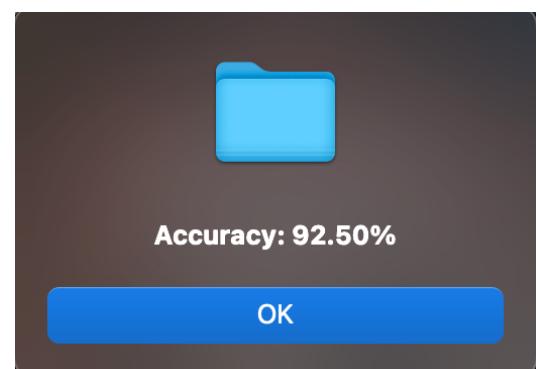
Enter MSE Threshold:
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Add Bias

Choose Algorithm:

- Perceptron
- Adaline

Submit



Preception 6th Combination

Bird Species Classification

Select Two Features:

- gender
- body_mass
- beak_length
- beak_depth
- fin_length

Select Two Classes (C1 & C2 or C1 & C3 or C2 & C3):

- A & B
- A & C
- B & C

Enter Learning Rate (eta):
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Enter Number of Epochs (m):
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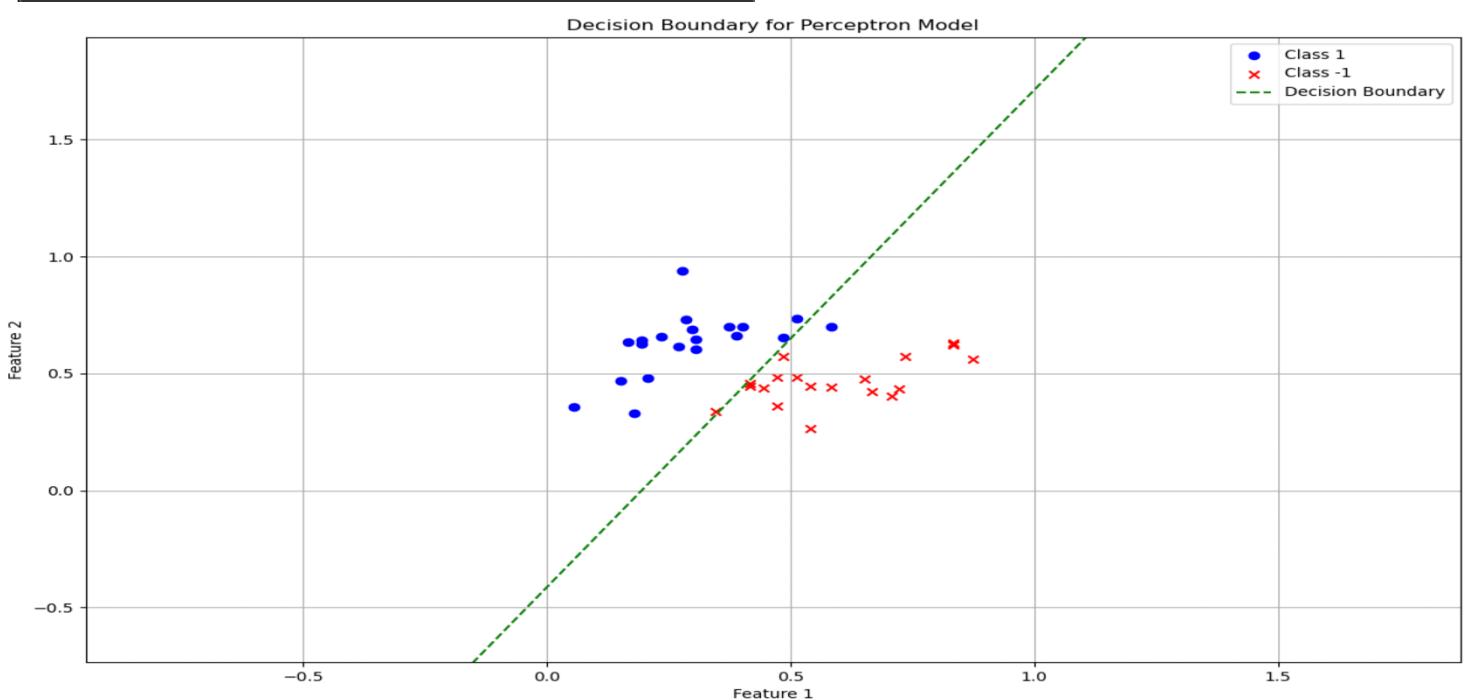
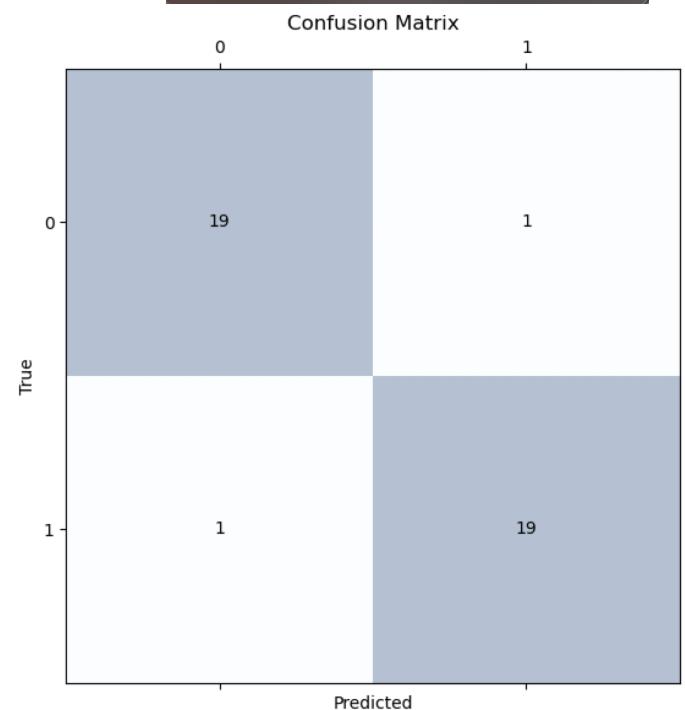
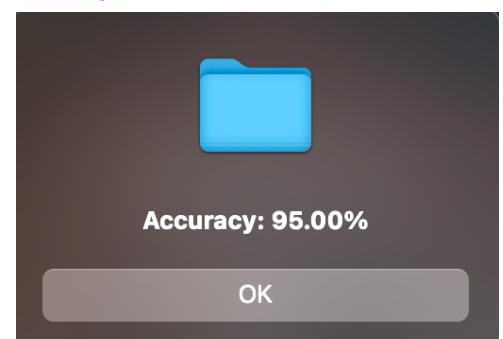
Enter MSE Threshold:
0.01

Add Bias

Choose Algorithm:

- Perceptron
- Adaline

Submit



Conclusions on Feature Selection and Model Performance Using Perceptron

Class Comparisons:

1. **For Class A & B:**
 - **Best Feature Combination:** Selecting the features **body_mass** and **beak_depth** resulted in **97.5% accuracy**. The decision boundary derived from this combination almost completely separates the two classes.
 - **Less Effective Combination:** The combination of **gender** and **body_mass** was less effective, highlighting the critical role of feature selection in maximizing model performance.
2. **For Class A & C:**
 - **Impact of Feature Choice:** Utilizing **fin_length** led to a significant drop in accuracy, resulting in no clear decision boundary between the two classes.
 - **Optimal Features:** The combination of **beak_length** and **beak_depth** achieved **100% accuracy**, indicating a well-defined decision boundary that effectively separates the two classes.
3. **For Class B & C:**
 - **Improved Performance with Bias:** Including a bias term enhanced accuracy from **92.5% to 95%**, demonstrating that the incorporation of a bias is essential for improving the Perceptron's predictive capabilities.

General Conclusion on Model Efficacy:

- The **Perceptron algorithm** exhibits strong performance in classifying the selected features, as shown by:
 - High accuracy levels achieved through careful feature selection.
 - The establishment of clear decision boundaries for effective class separation.
 - The importance of bias in enhancing accuracy and improving model predictions.

Final Thoughts:

- These findings emphasize the necessity of thoughtful feature selection and bias inclusion when training machine learning models like the Perceptron. The results demonstrate how specific features can significantly impact the accuracy and robustness of classification tasks.

Adaline 1st Combination

Bird Species Classification

Select Two Features:

gender
 body_mass
 beak_length
 beak_depth
 fin_length

Select Two Classes (C1 & C2 or C1 & C3 or C2 & C3):

A & B
 A & C
 B & C

Enter Learning Rate (eta):
0.01

Enter Number of Epochs (m):
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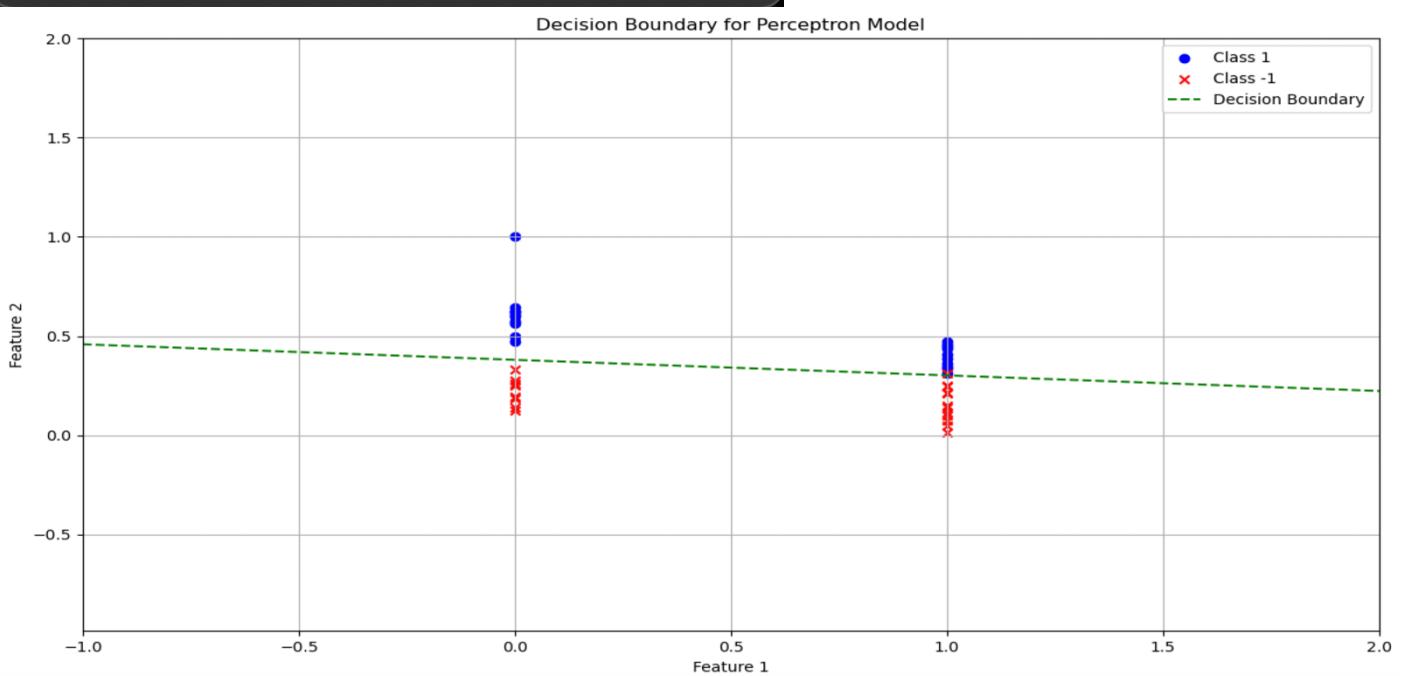
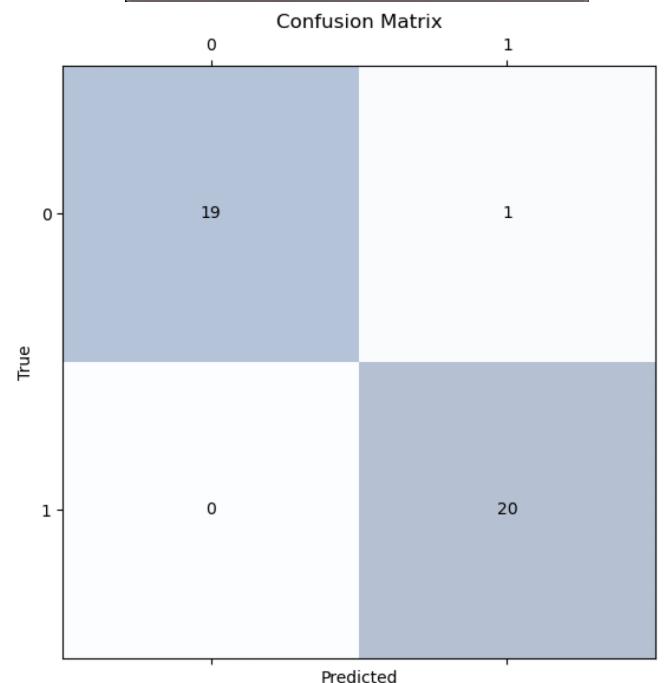
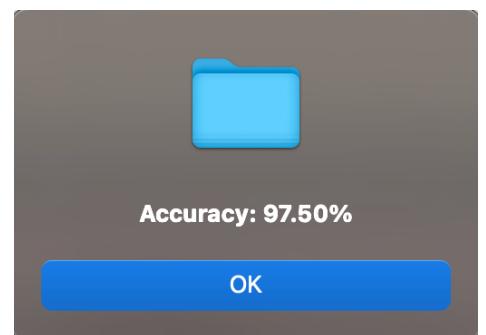
Enter MSE Threshold:
0.01

Add Bias

Choose Algorithm:

Perceptron
 Adaline

Submit



Adaline 2nd Combination

Bird Species Classification

Select Two Features:

- gender
- body_mass
- beak_length
- beak_depth
- fin_length

Select Two Classes (C1 & C2 or C1 & C3 or C2 & C3):

- A & B
- A & C
- B & C

Enter Learning Rate (eta):
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Enter Number of Epochs (m):
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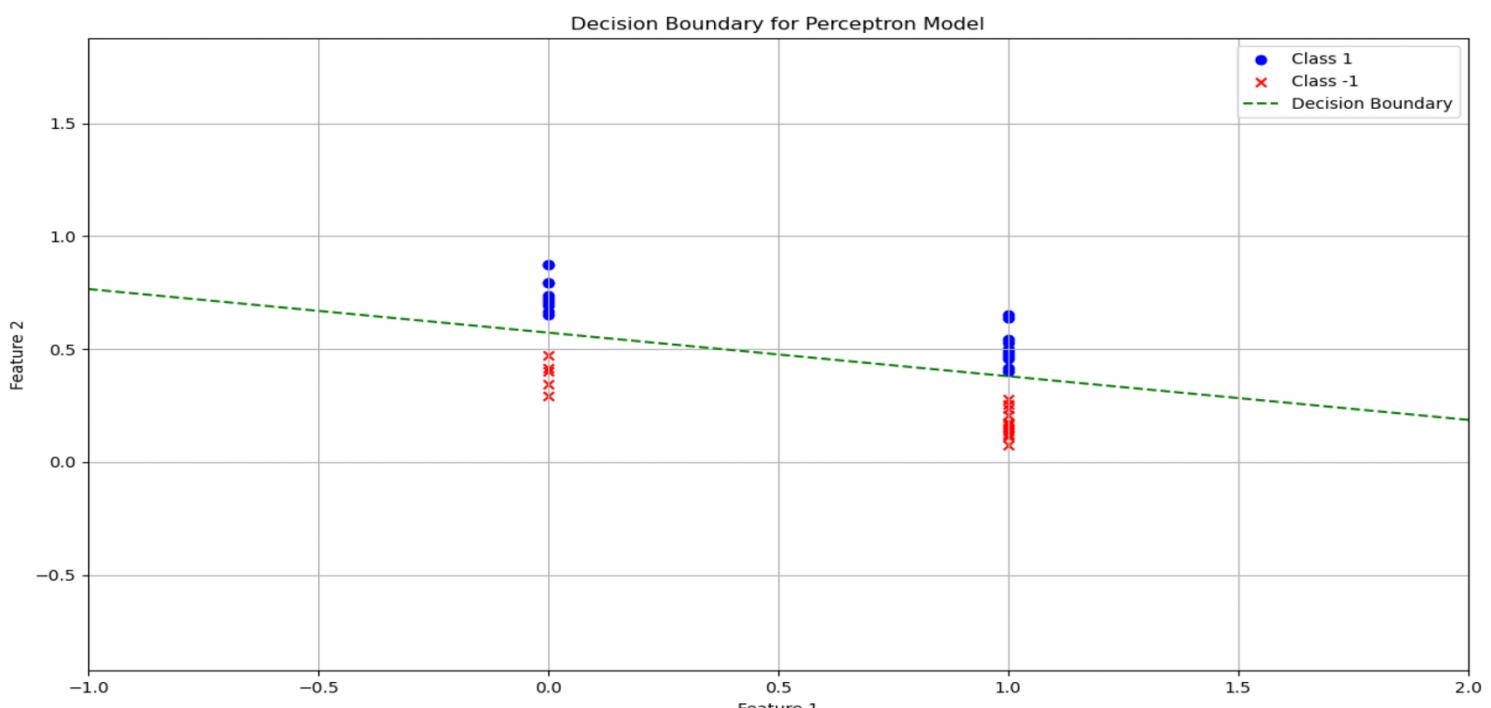
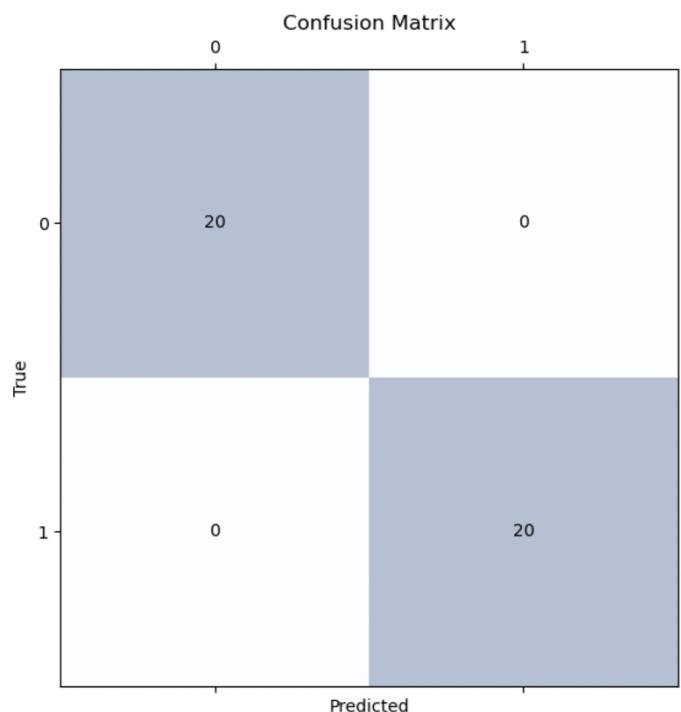
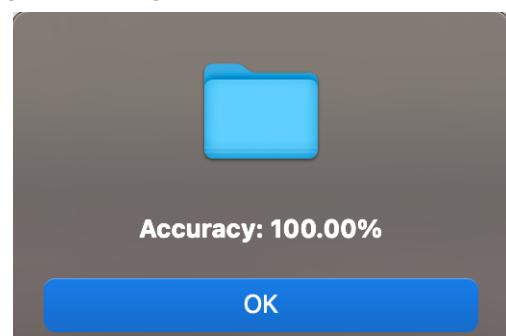
Enter MSE Threshold:
0.01

Add Bias

Choose Algorithm:

-
- Adaline

Submit



Adaline 3rd Combination

Bird Species Classification

Select Two Features:

- gender
- body_mass
- beak_length
- beak_depth
- fin_length

Select Two Classes (C1 & C2 or C1 & C3 or C2 & C3):

- A & B
- A & C
- B & C

Enter Learning Rate (eta):
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Enter Number of Epochs (m):
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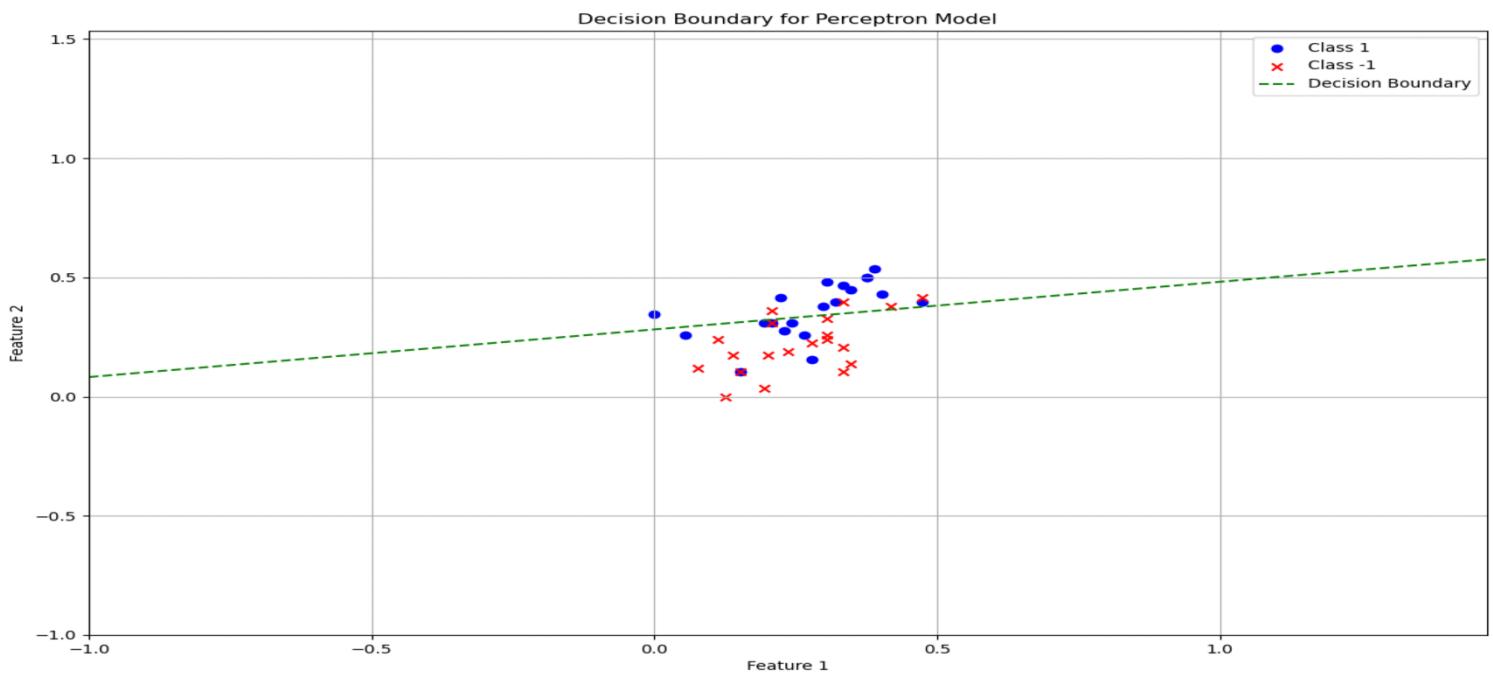
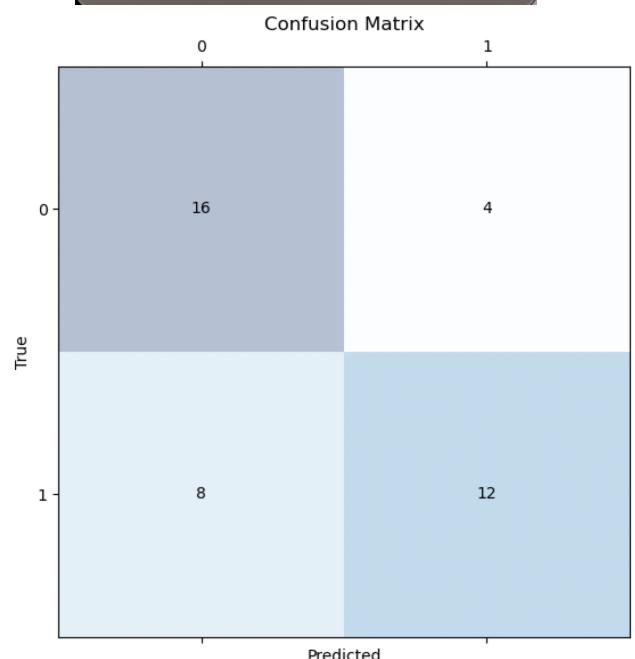
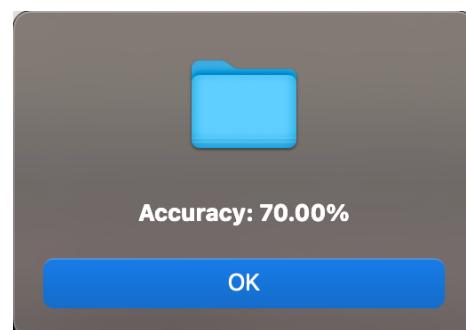
Enter MSE Threshold:
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Add Bias

Choose Algorithm:

- Perceptron
- Adaline

Submit



Adaline 4th Combination

Bird Species Classification

Select Two Features:

- gender
- body_mass
- beak_length
- beak_depth
- fin_length

Select Two Classes (C1 & C2 or C1 & C3 or C2 & C3):

- A & B
- A & C
- B & C

Enter Learning Rate (eta):
0.01

Enter Number of Epochs (m):
100

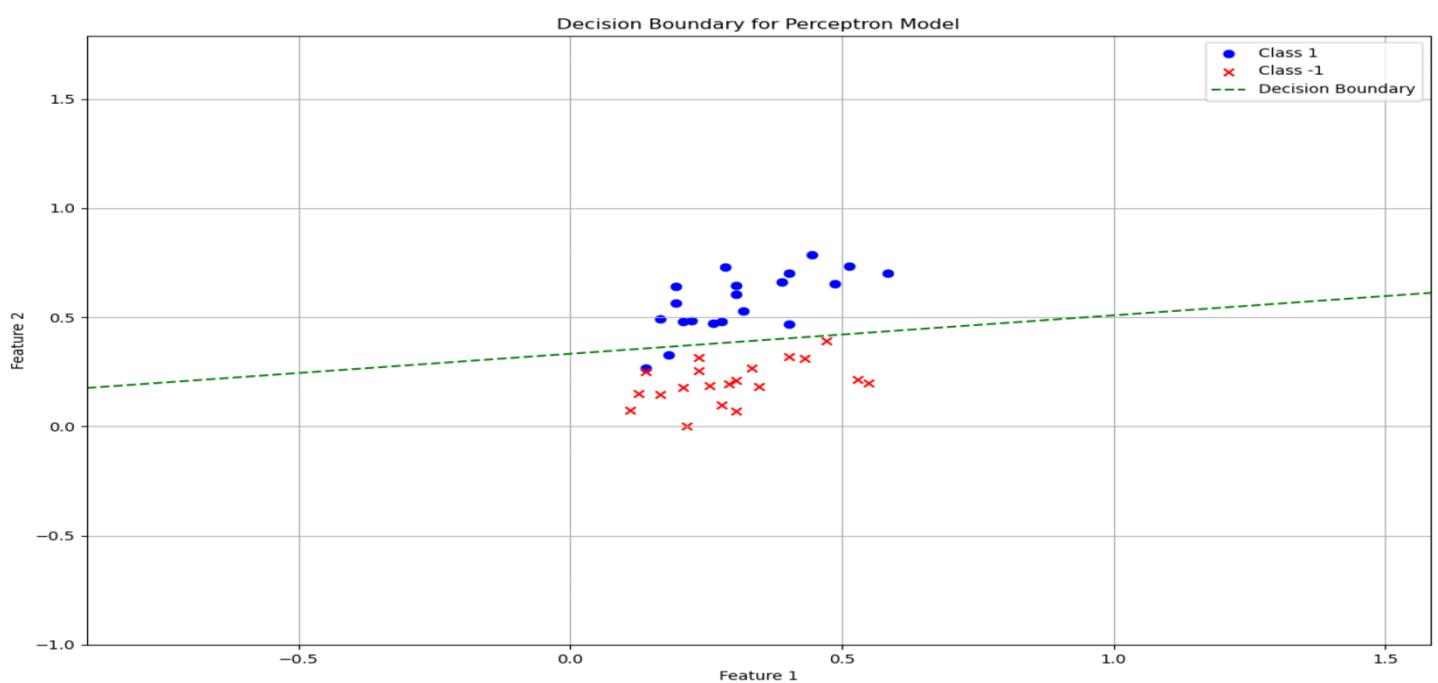
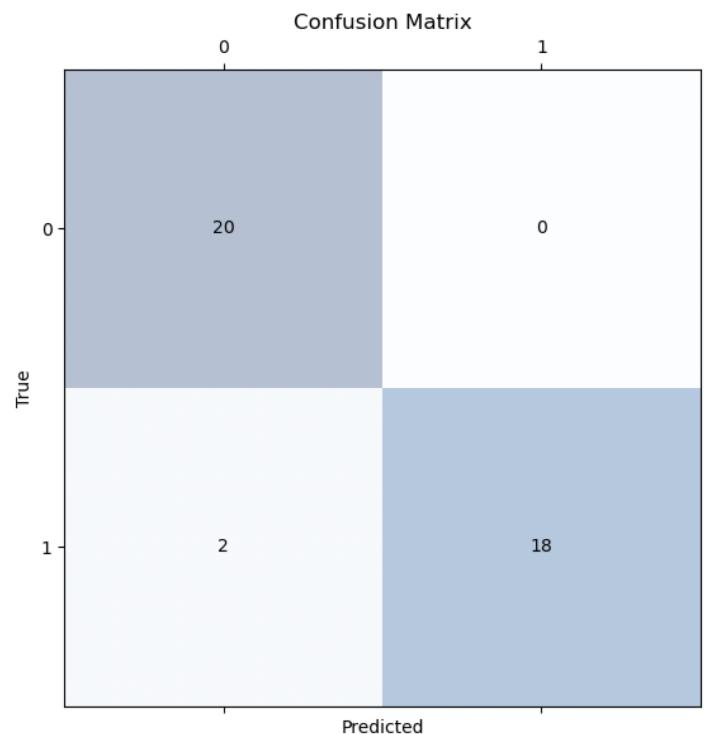
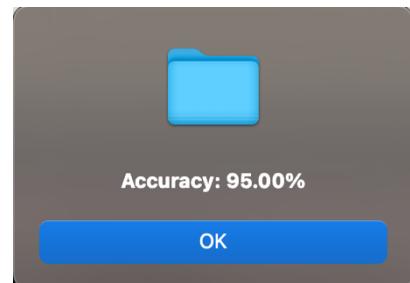
Enter MSE Threshold:
0.01

Add Bias

Choose Algorithm:

- Perceptron
- Adaline

Submit



Adaline 5th Combination

Bird Species Classification

Select Two Features:

- gender
- body_mass
- beak_length
- beak_depth
- fin_length

Select Two Classes (C1 & C2 or C1 & C3 or C2 & C3):

- A & B
- A & C
- B & C

Enter Learning Rate (eta):
0.01

Enter Number of Epochs (m):
100

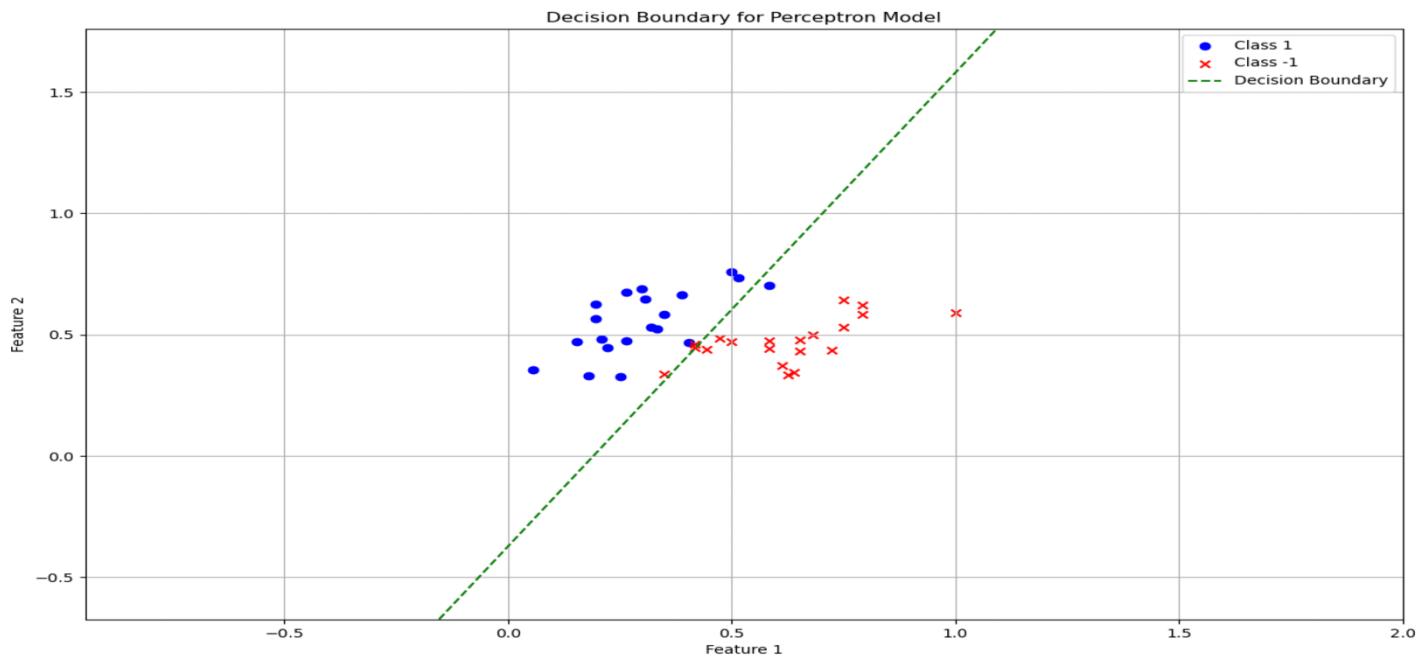
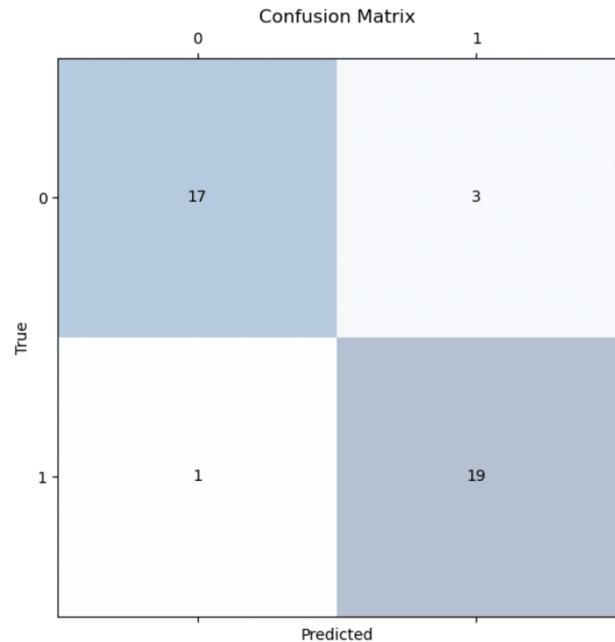
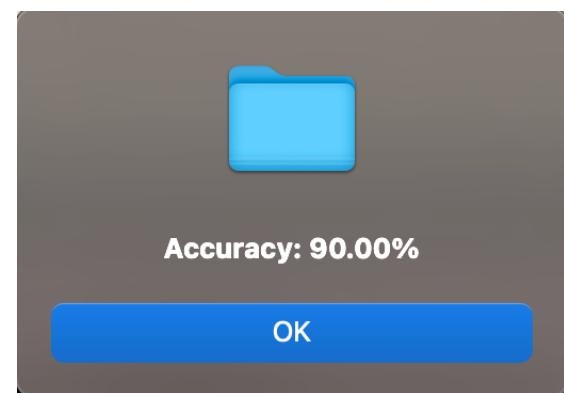
Enter MSE Threshold:
0.01

Add Bias

Choose Algorithm:

- Perceptron
- Adaline

Submit



Adaline 6th Combination

Bird Species Classification

Select Two Features:

gender
 body_mass
 beak_length
 beak_depth
 fin_length

Select Two Classes (C1 & C2 or C1 & C3 or C2 & C3):

A & B
 A & C
 B & C

Enter Learning Rate (eta):
0.01

Enter Number of Epochs (m):
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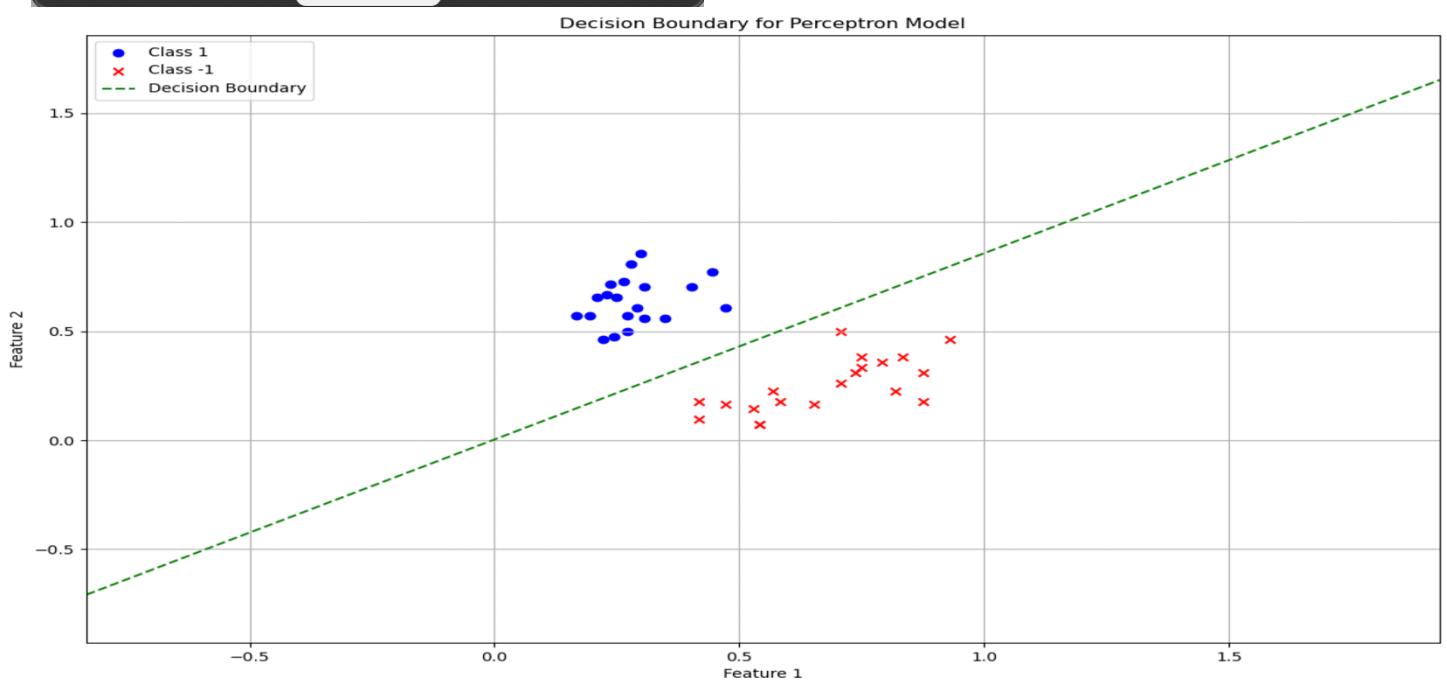
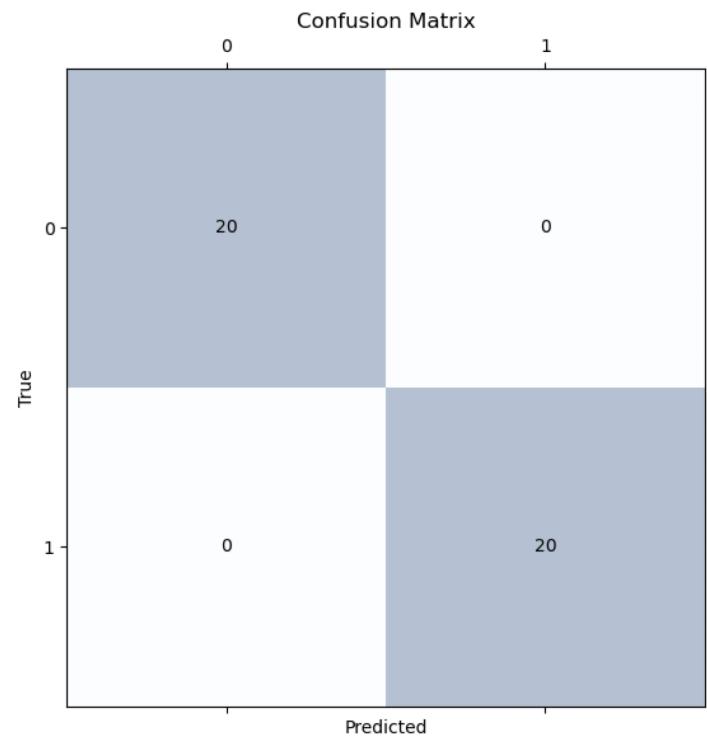
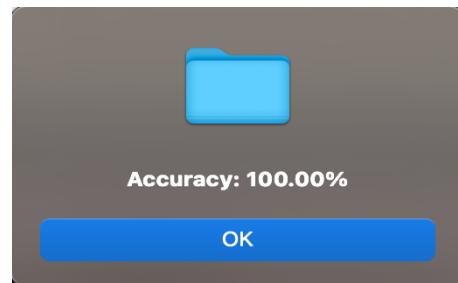
Enter MSE Threshold:
0.01

Add Bias

Choose Algorithm:

Perceptron
 Adaline

Submit



Conclusions on Feature Selection and Model Performance

Class Comparisons:

1. For Class A & B:

- **Best Feature Combination:** The combination of body_mass and gender resulted in 100% accuracy. The decision boundary derived from this feature set was able to perfectly separate the two classes.
- **Less Effective Combination:** The combination of gender and beak_length did not yield the same level of performance, highlighting the importance of feature selection in model accuracy.

2. For Class A & C:

- **Impact of Feature Choice:** Utilizing fin_length significantly decreased accuracy, with no clear decision boundary present between the two classes.
- **Optimal Features:** The combination of beak_length and body_mass resulted in 95% accuracy, demonstrating a well-defined decision boundary that effectively separates the two classes.

3. For Class B & C:

- **Improved Performance with New Features:** Changing the feature set to include body_mass and beak_depth, along with incorporating a bias term, enhanced accuracy from 90% to 100%.

General Conclusion on Model Efficacy:

- The **ADALINE algorithm** demonstrates superior performance and generalization capabilities over the Perceptron. This is evidenced by its ability to:
 - Achieve higher accuracy rates across various class combinations.
 - Produce clear and effective decision boundaries for separating classes.
 - Utilize continuous output values to refine predictions, rather than relying solely on binary outputs, which enhances the model's sensitivity to variations in data.

Final Thoughts:

- The findings emphasize the significance of selecting appropriate features for training machine learning models, as well as the advantages of using algorithms like ADALINE, which leverage continuous prediction mechanisms to achieve greater accuracy and robustness in classification tasks.