Faculty of Computer & Information Sciences
Ain Shams University
Subject: Neural Networks and Deep Learning
Year: 4th-year undergraduate (CS)

Task 1-Penguins Classification

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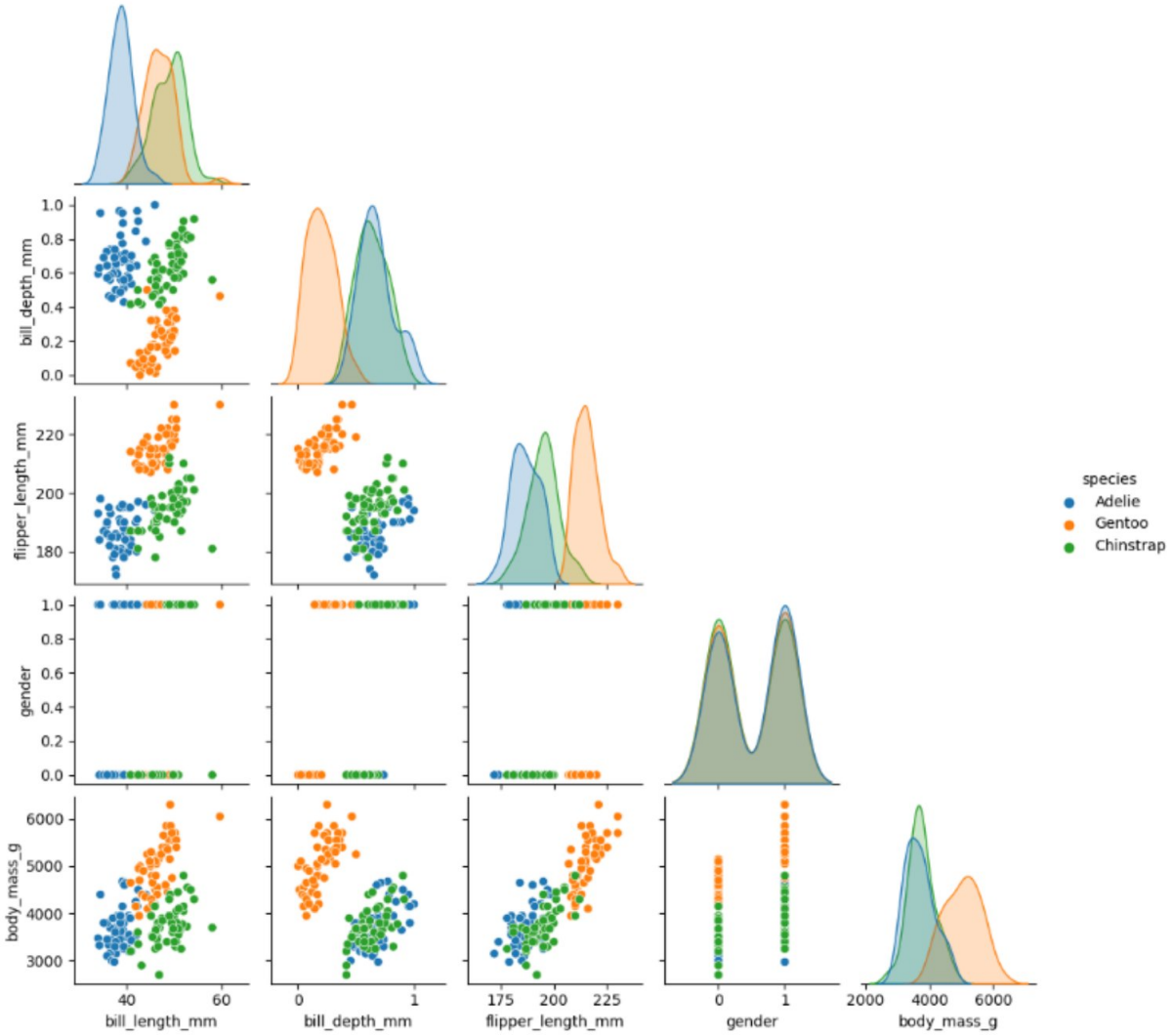
Content:

- A Plotted graph for all possible combinations of features.
- Plotted graphs for combinations of two features between test samples of each two classes.
- Confusion matrices for these relations.

Before Training:

We have plotted a graph to show all the possible combination of features and determine which features are discriminative between which classes.



- **<u>Bill_depth_mm & bill_length_mm:</u>**

The relation between the mentioned two features; “bill_depth_mm” and “bill_length_mm” shows that:

  - The samples of Adelie & Gentoo classes are linearly separable

- The samples of Adelie & Chinstrap are not linearly separable.
- The samples of Gentoo & Chinstrap are not linearly separable.

- **Flipper_length_mm & bill_length_mm:**

The relation between the mentioned two features; "flipper_length_mm" and "bill_length_mm" shows that:

- The samples of Adelie & Gentoo classes are linearly separable
- The samples of Adelie & Chinstrap are not linearly separable.
- The samples of Gentoo & Chinstrap are not linearly separable.

- **Flipper_length_mm & bill_depth_mm:**

The relation between the mentioned two features; "flipper_length_mm" and "bill_depth_mm" shows that:

- The samples of Adelie & Gentoo classes are linearly separable
- The samples of Adelie & Chinstrap are not linearly separable.
- The samples of Gentoo & Chinstrap are linearly separable.

- **Gender & bill_length_mm:**

The relation between the mentioned two features; "bill_length_mm" and "gender" shows that:

- The samples of Adelie & Gentoo classes are linearly separable
- The samples of Adelie & Chinstrap are not linearly separable.
- The samples of Gentoo & Chinstrap are not linearly separable.

- **Gender & bill_depth_mm:**

The relation between the mentioned two features; "bill_depth_mm" and "gender" shows that:

- The samples of Adelie & Gentoo classes are linearly separable
- The samples of Adelie & Chinstrap are not linearly separable.
- The samples of Gentoo & Chinstrap are not linearly separable.

- **Flipper_length_mm & Gender:**

The relation between the mentioned two features; “flipper_length_mm” and “gender” shows that:

  - The samples of Adelie & Gentoo classes are linearly separable
  - The samples of Adelie & Chinstrap are not linearly separable.
  - The samples of Gentoo & Chinstrap are not linearly separable.

- **Body_mass_g & bill_length_mm:**

The relation between the mentioned two features; “bill_length_mm” and “body_mass_g” shows that:

  - The samples of Adelie & Gentoo classes are not linearly separable
  - The samples of Adelie & Chinstrap are not linearly separable.
  - The samples of Gentoo & Chinstrap are not linearly separable.

- **Body_mass_g & bill_depth_mm:**

The relation between the mentioned two features; “bill_depth_mm” and “body_mass_g” shows that:

  - The samples of Adelie & Gentoo classes are linearly separable
  - The samples of Adelie & Chinstrap are not linearly separable.
  - The samples of Gentoo & Chinstrap are linearly separable.

- **Body_mass_g & flipper_length_mm:**

The relation between the mentioned two features; “flipper_length_mm” and “body_mass_g” shows that:

  - The samples of Adelie & Gentoo classes are linearly separable
  - The samples of Adelie & Chinstrap are not linearly separable.
  - The samples of Gentoo & Chinstrap are not linearly separable.

- **Body_mass_g & gender:**

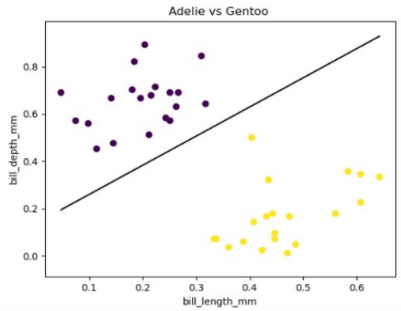
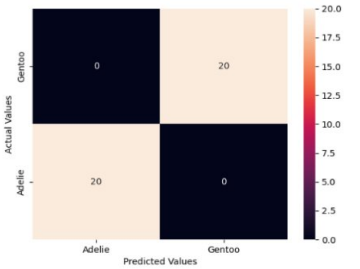
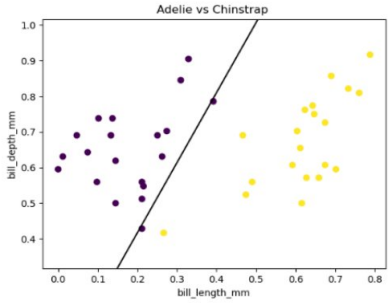
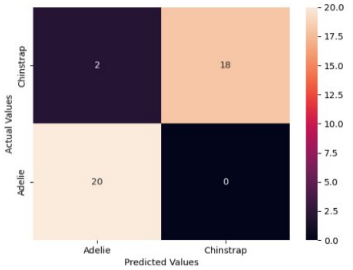
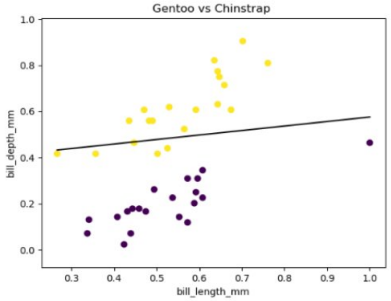
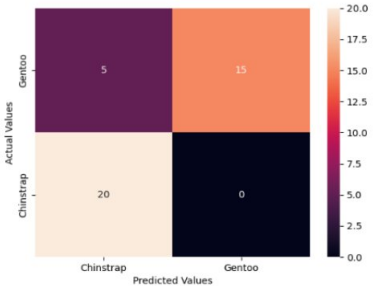
The relation between the mentioned two features; “gender” and “body_mass_g” shows that:

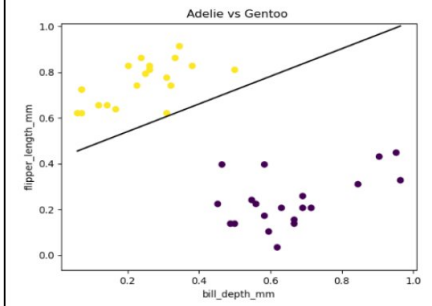
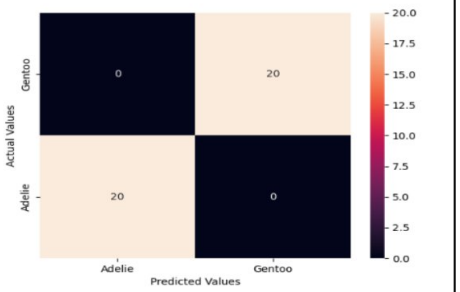
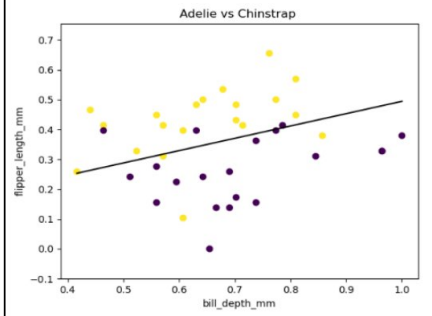
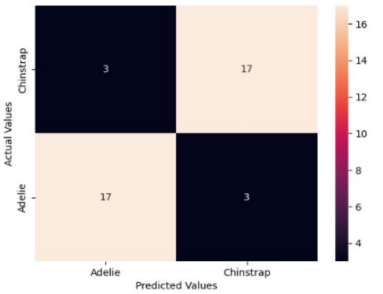
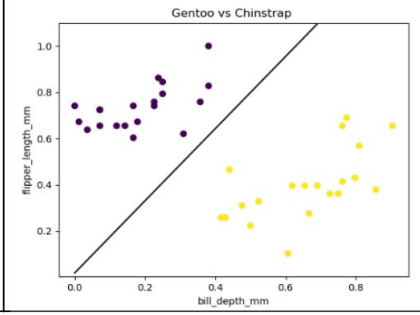
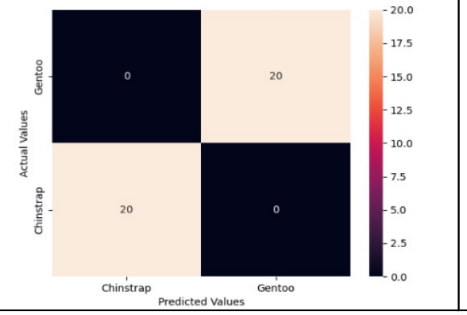
  - The samples of Adelie & Gentoo classes are not linearly separable
  - The samples of Adelie & Chinstrap are not linearly separable.
  - The samples of Gentoo & Chinstrap are not linearly separable.

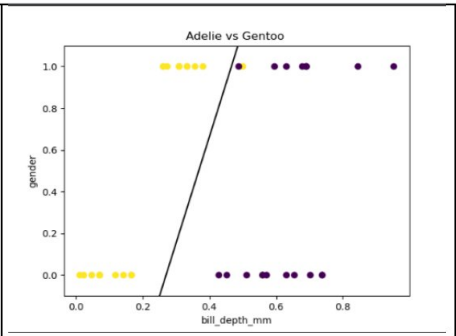
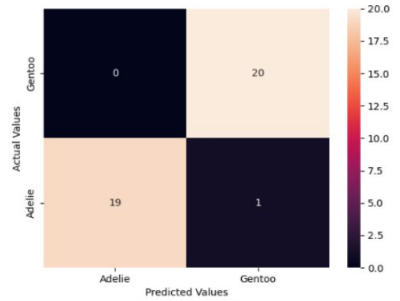
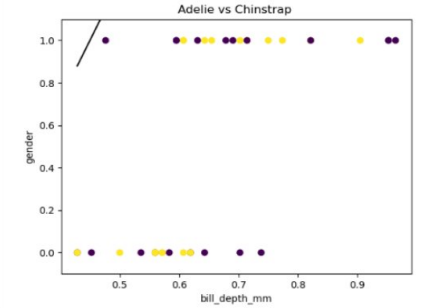
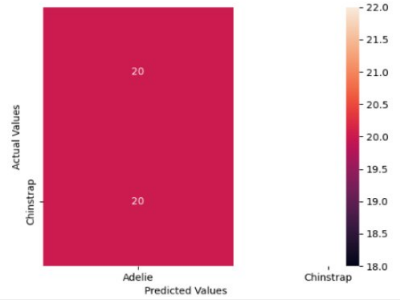
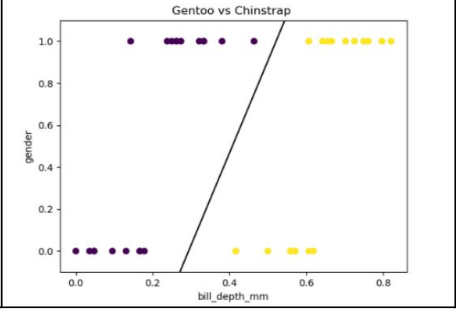
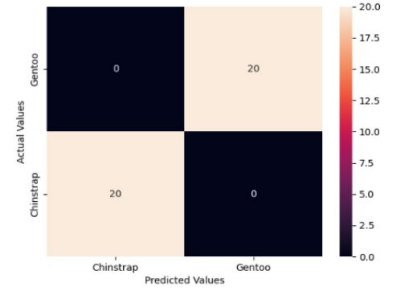
Conclusion:

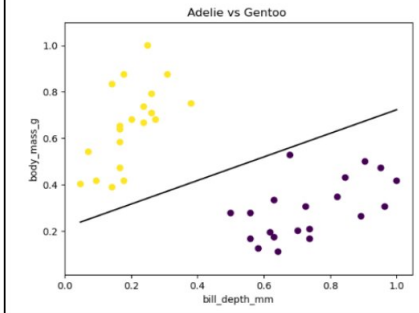
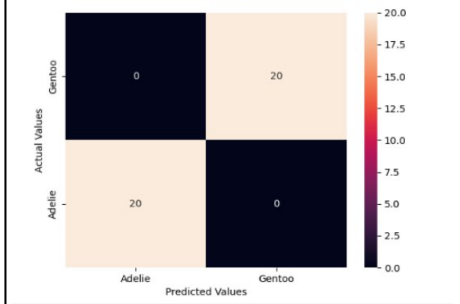
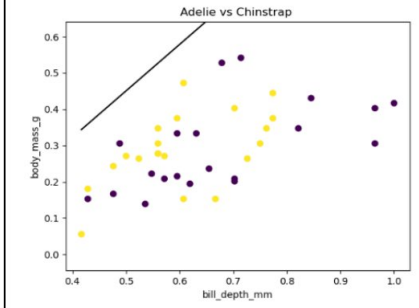
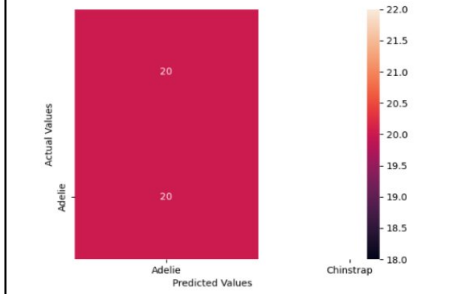
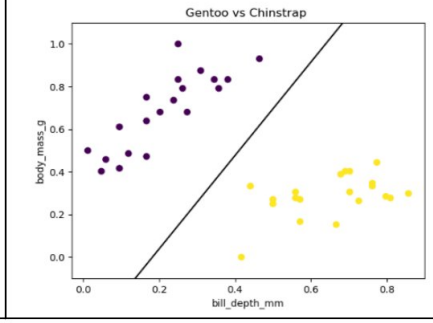
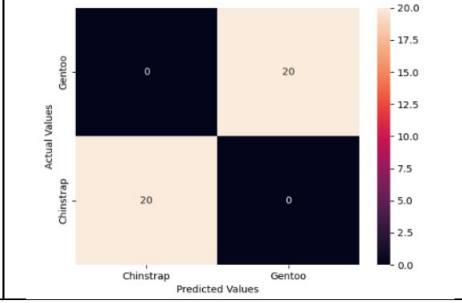
- To classify between Gentoo & Chinstrap, the best features to use are “flipper_length_mm” with “bill_depth_mm” or “body_mass_g” with “bill_depth_mm” and in both cases the accuracy is 100%.
- To classify between Adelie & Chinstrap, the best features to use are “gender” and “bill_length_mm” with accuracy 100%.
- To classify between Adelie & Gentoo, the worst features to use together are “bill_length_mm” and “body_mass_g” and all “gender” combinations are not completely accurate. Otherwise, all features’ combinations are accurate 100%.

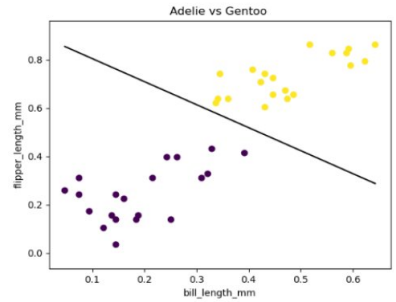
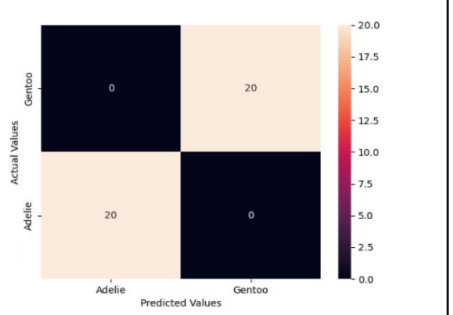
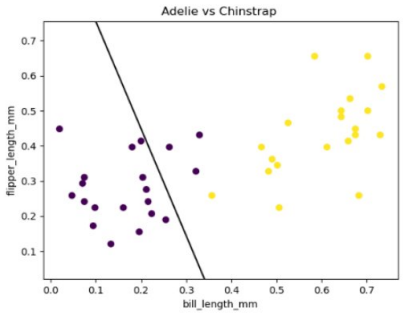
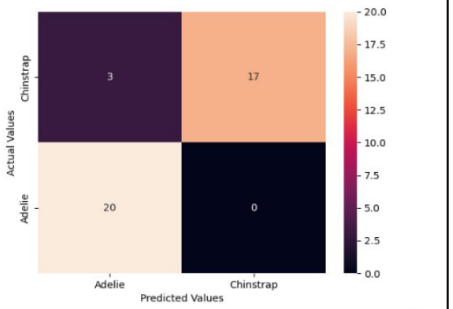
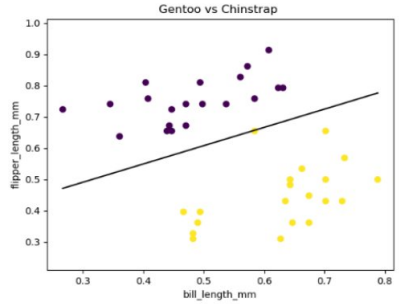
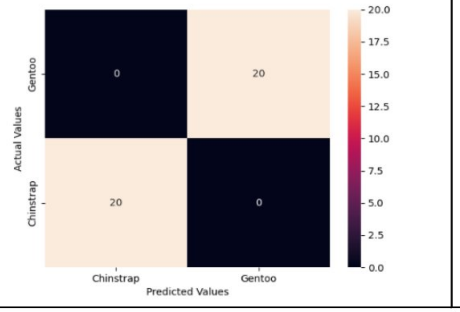
After training the model we will run the GUI to test the relation between samples when the features at learning rate=0.1, epochs=100, and bias is checked.

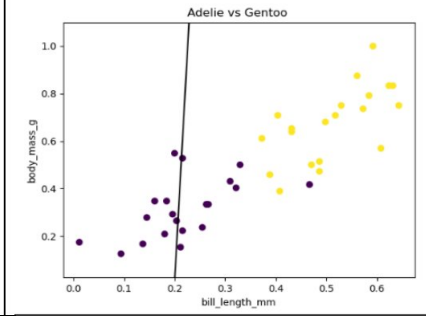
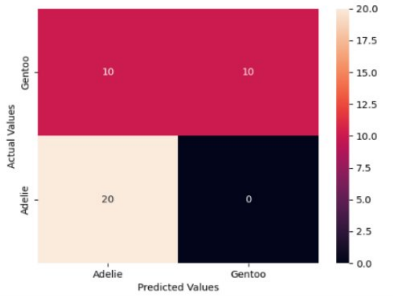
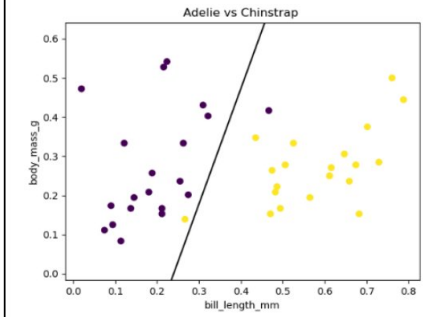
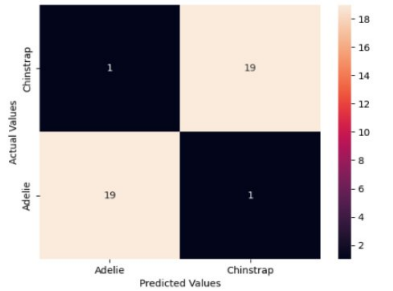
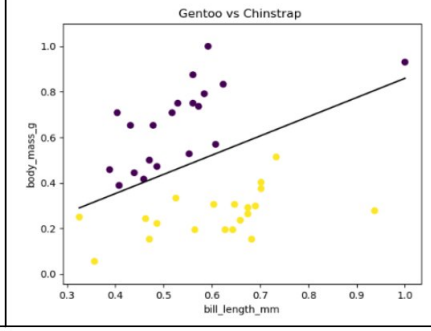
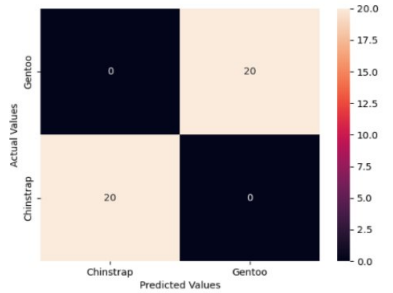
Feature 1	Feature 2	Class 1	Class 2	plot	confusion matrix	accuracy
bill_depth_mm	bill_length_mm	Adelie	Gentoo			100%
		Adelie	Chinstrap			95%
		Gentoo	Chinstrap			85%

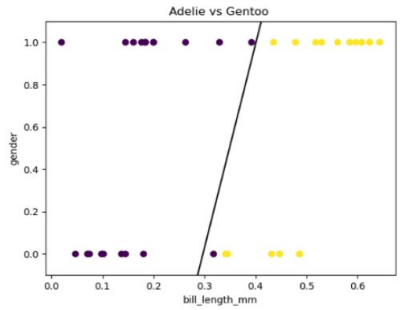
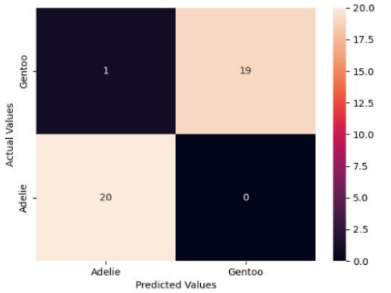
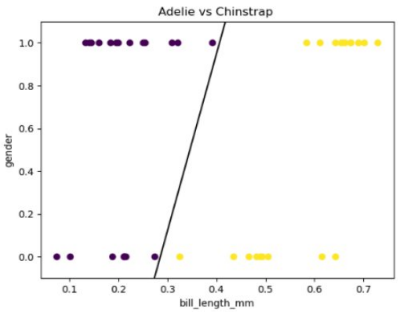
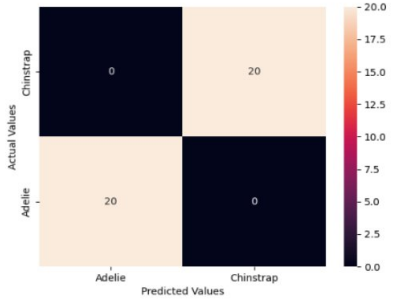
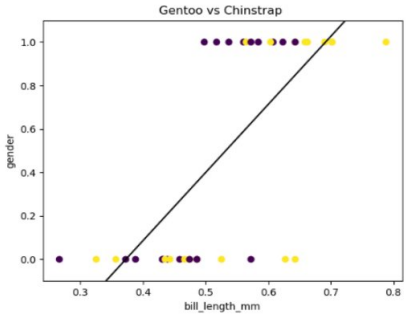
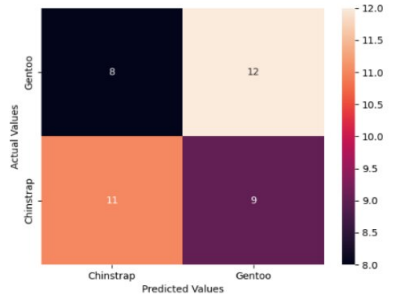
bill_depth_mm	flipper_length_mm	Adelie	Gentoo			100%
		Adelie	Chinstrap			85%
		Gentoo	Chinstrap			100%

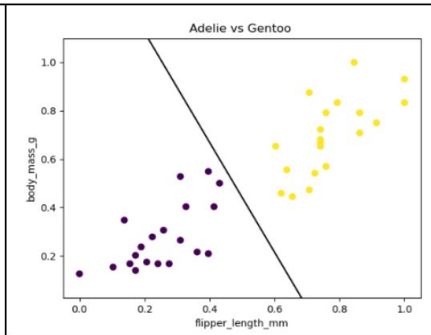
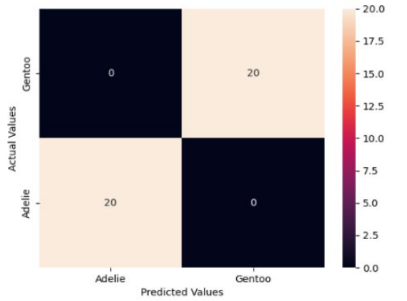
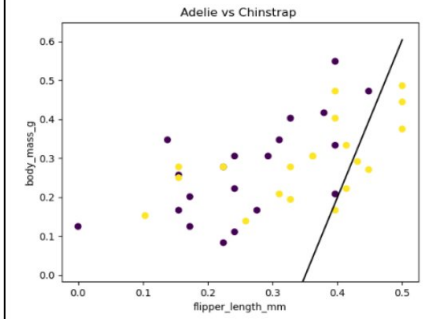
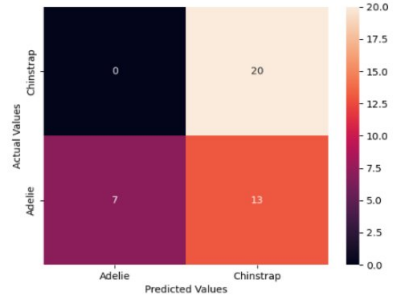
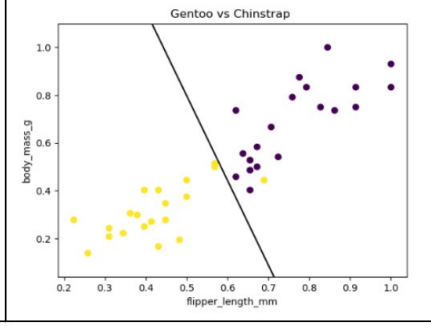
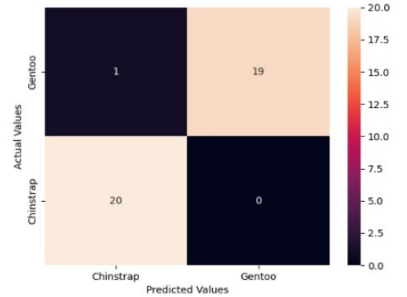
bill_depth_mm	gender	Adelie	Gentoo			97.50%
		Adelie	Chinstrap			50%
		Gentoo	Chinstrap			100%

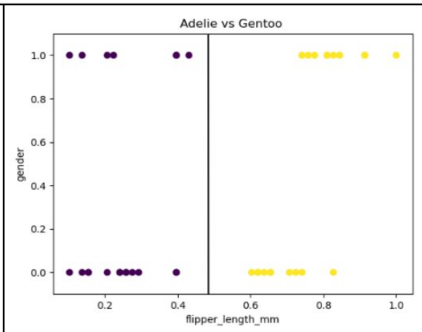
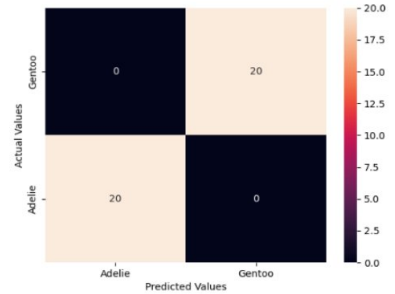
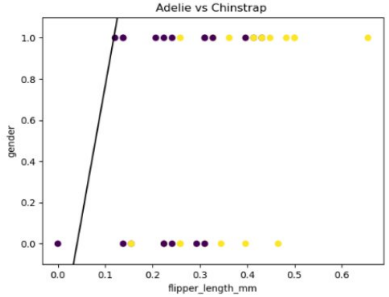
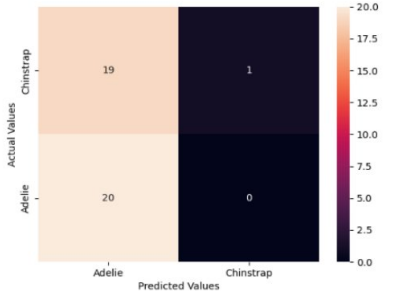
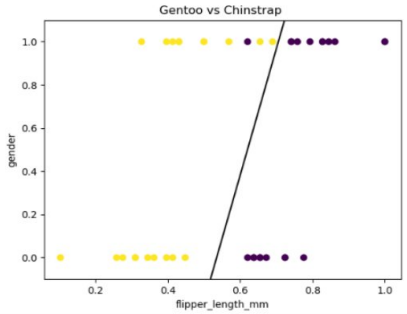
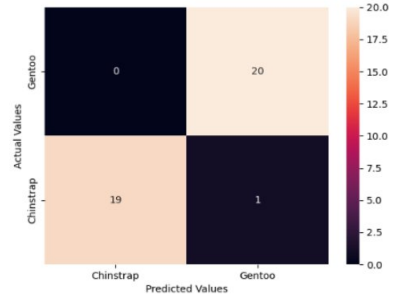
bill_depth_mm	body_mass_g	Adelie	Gentoo			100%
		Adelie	Chinstrap			50%
		Gentoo	Chinstrap			100%

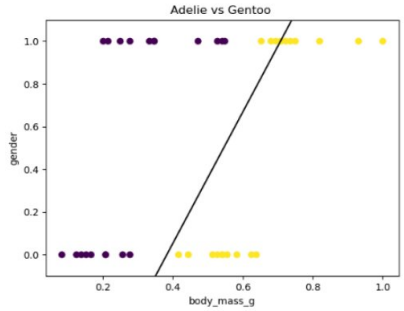
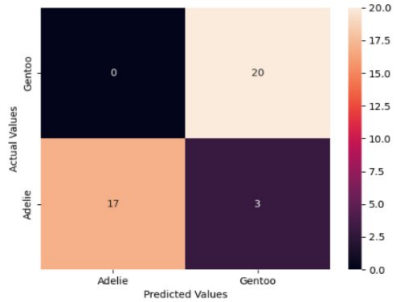
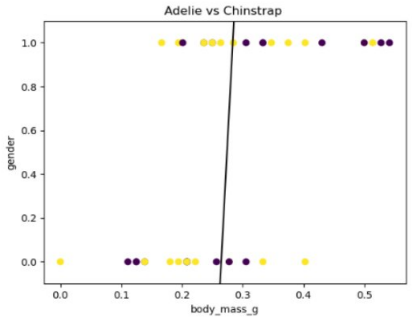
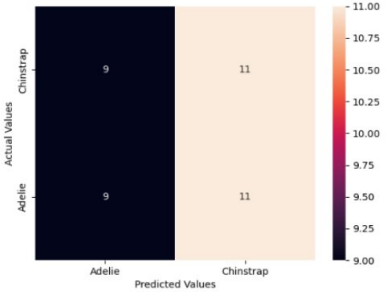
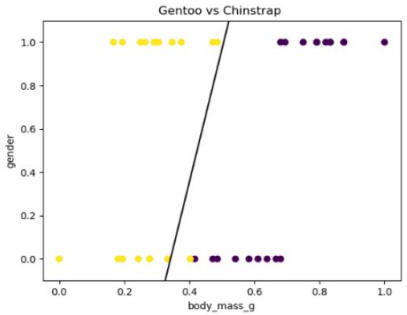
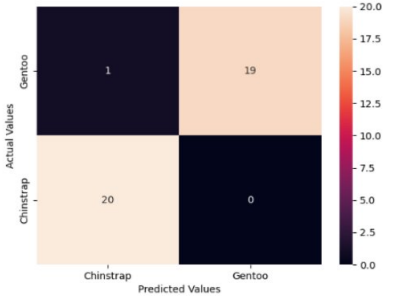
bill_length_mm	flipper_length_mm	Adelie	Gentoo			100%
		Adelie	Chinstrap			92.50%
		Gentoo	Chinstrap			100%

bill_length_mm	body_mass_g	Adelie	Gentoo			75%
		Adelie	Chinstrap			95%
		Gentoo	Chinstrap			100%

bill_length_mm	gender	Adelie	Gentoo			97.50%
		Adelie	Chinstrap			100%
		Gentoo	Chinstrap			57.50%

flipper_length_mm	body_mass_g	Adelie	Gentoo			100%
		Adelie	Chinstrap			67.50%
		Gentoo	Chinstrap			97.50%

flipper_length_mm	gender	Adelie	Gentoo			100%
		Adelie	Chinstrap			52.50%
		Gentoo	Chinstrap			97.50%

body_mass_g	gender	Adelie	Gentoo			92.50%
		Adelie	Chinstrap			50%
		Gentoo	Chinstrap			97.50%