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

**Task 1-Penguins Classification**

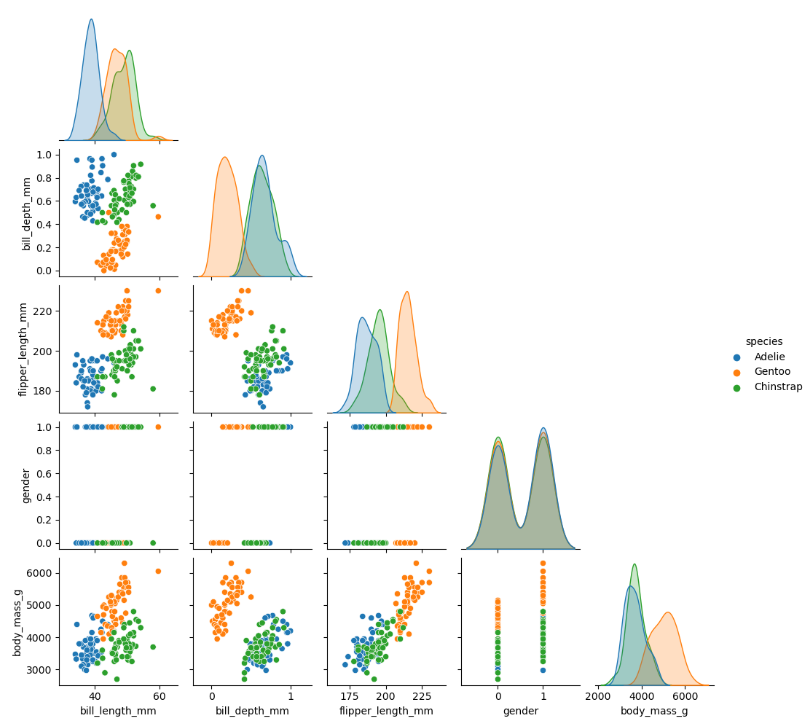
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Content:

* 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.



* **Bill\_depth\_mm & bill\_length\_mm:**

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.