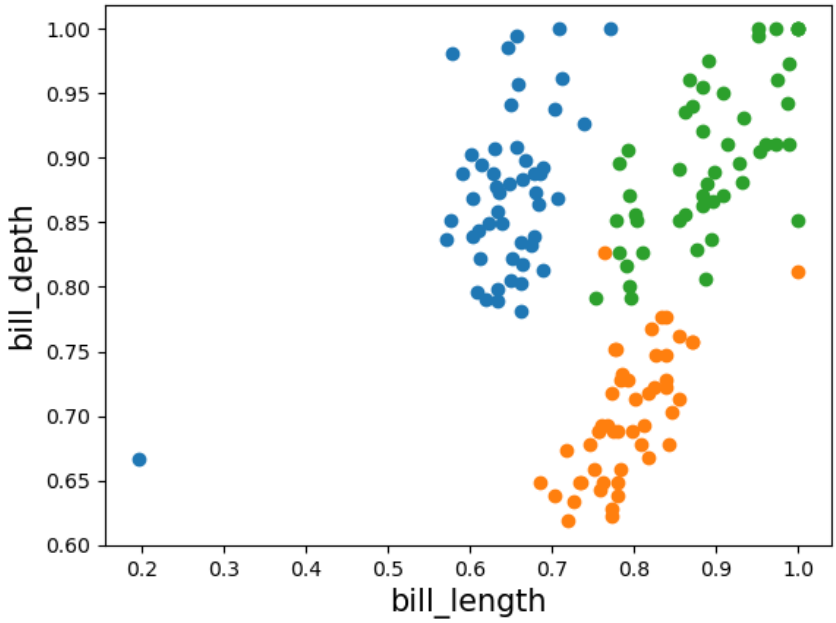
Data Visualization:

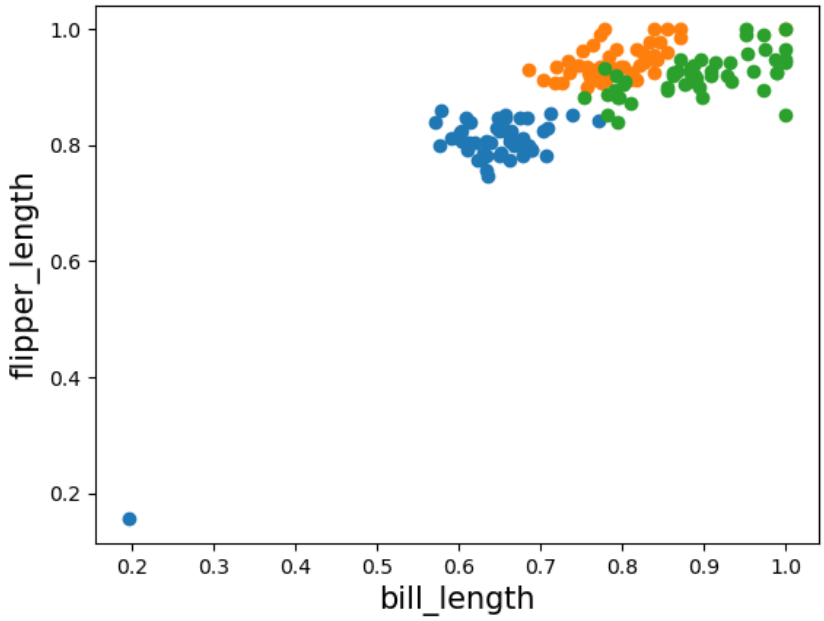
First visualize between all Penguins species by:

Blue: Adelie Orange: Gentoo Green: Chinstrap

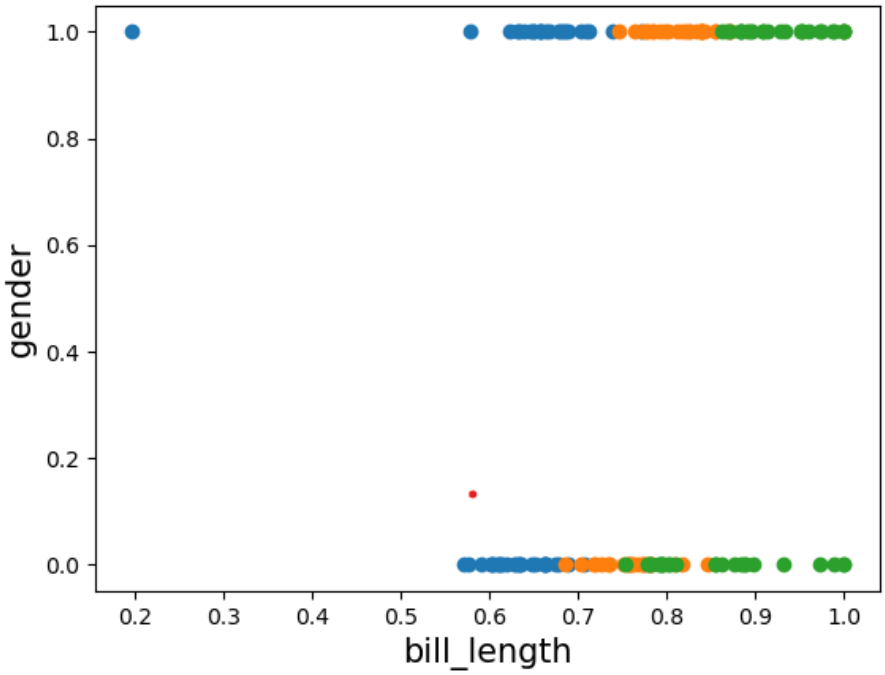
- Bill_length and bill_depth



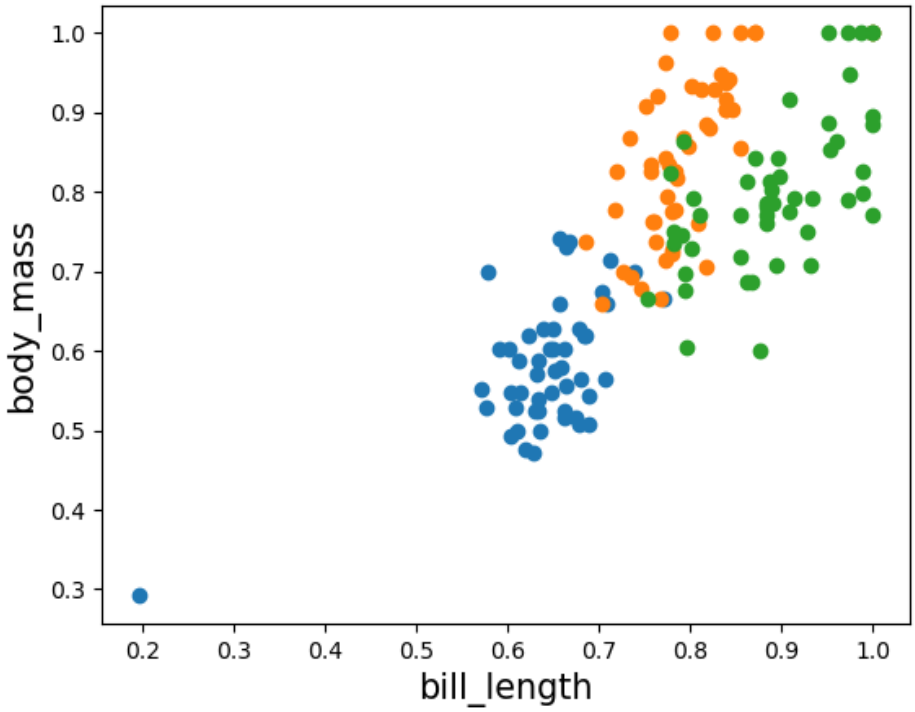
- Bill_length and flipper_length



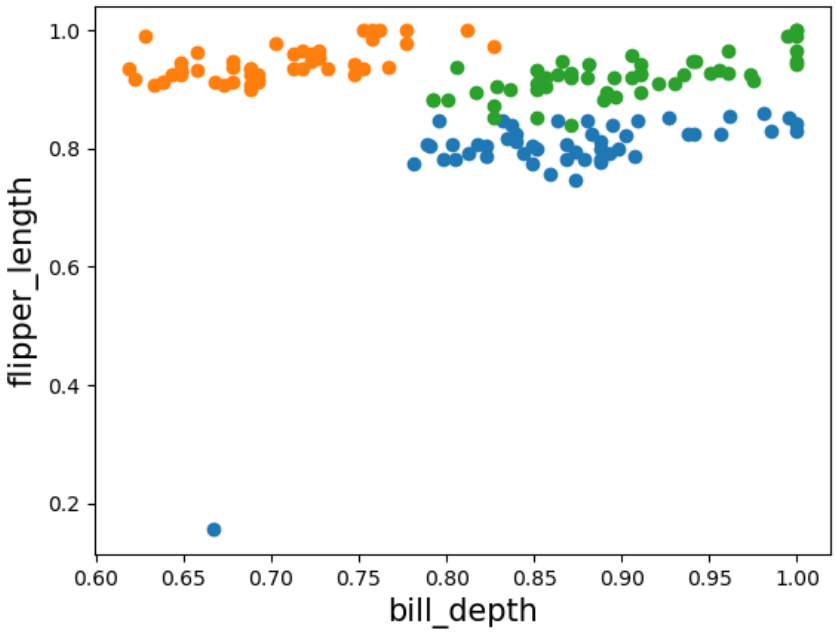
- Bill_length and gender



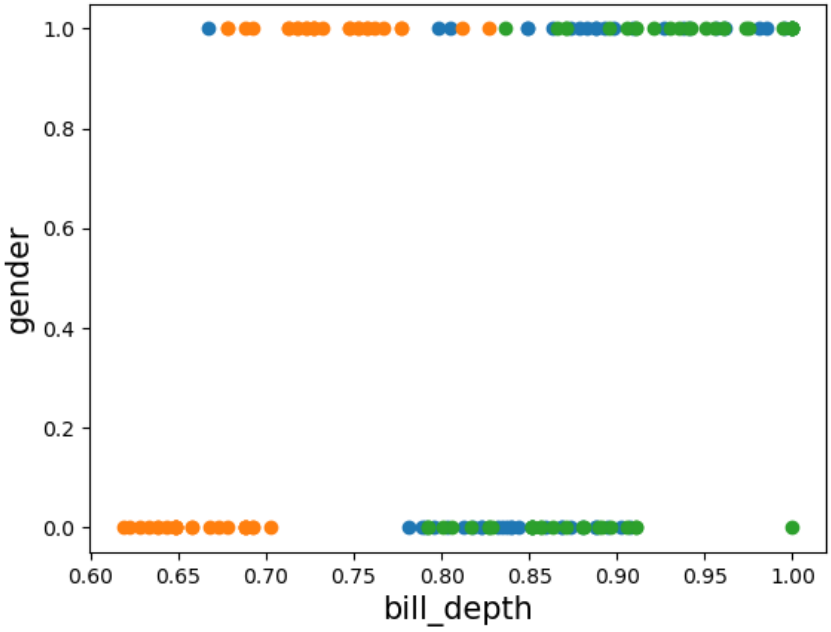
- Bill_length and body_mass



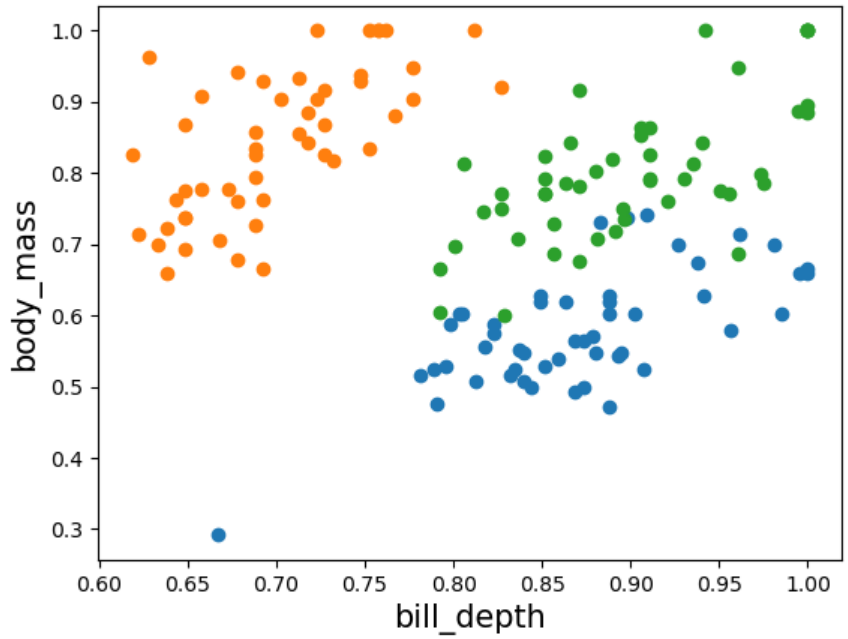
- Bill_depth and flipper_length



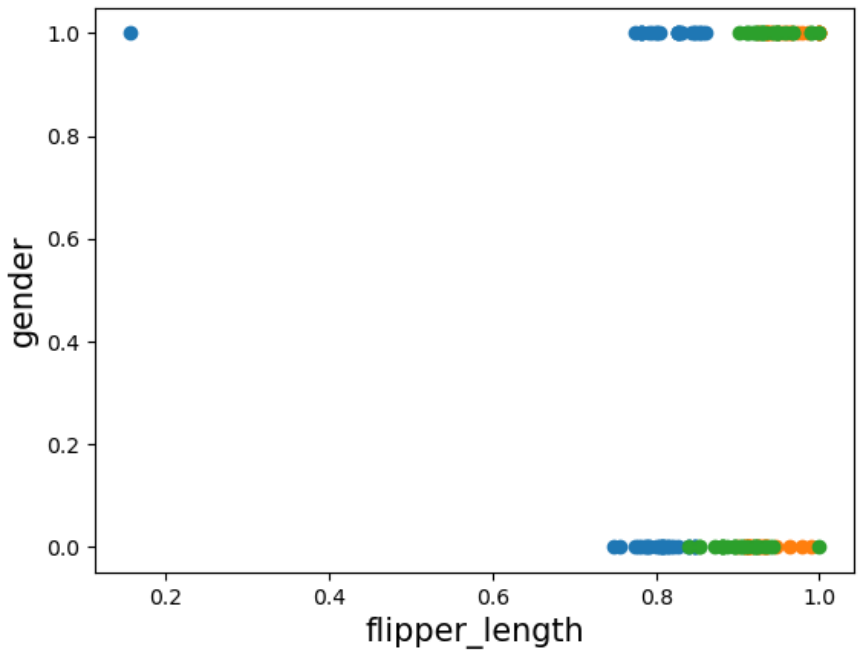
- Bill_depth and gender



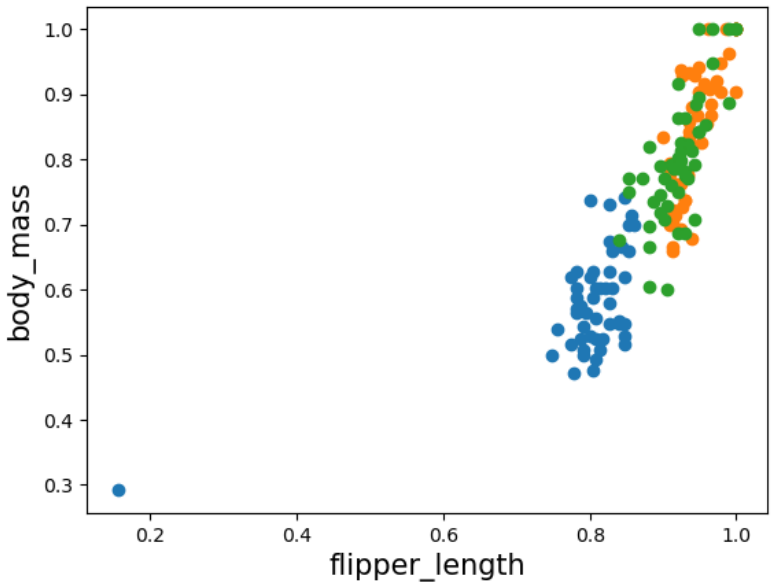
- Bill_depth and body_mass



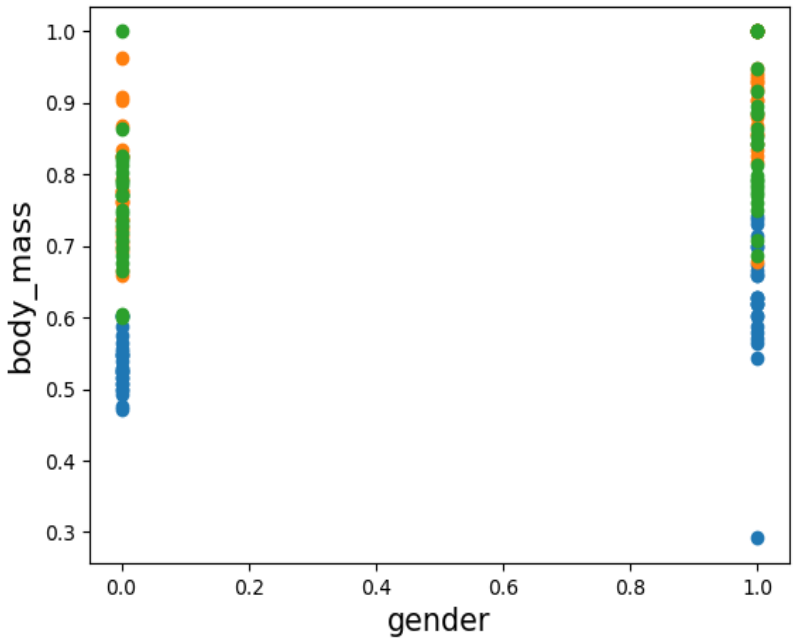
- flipper_length and gender



- flipper_length and body_mass



- gender and body_mass



- when using Bill_length and bill_depth
  we find that the 3 classes are linearly separable
- when using Bill_length and flipper_length
  we find that we can separate between class Adelie and class Chinstrap with line and we can separate between class Adelie and class Gentoo with line
- when using Bill_length and gender
  we can not separate 3 classes with each other
- when using Bill_length and body_mass
  we can separate class Adelie and class Chinstrap
- when use Bill_depth and flipper_length
  we can separate 3 classes
- when using Bill_depth and gender
  we can not separate 3 classes because they are not linearly separable
- when using Bill_depth and body_mass
  we can separate 3 classes because they are linearly separable
- when using flipper_length and gender
  we can hard separate between 3 classes because they are not linearly separable
- when using flipper_length and body_mass
  we can separate class Adelie and class Chinstrap only
- when using gender and body_mass
  we can not separate 3 classes because they are not linearly separable

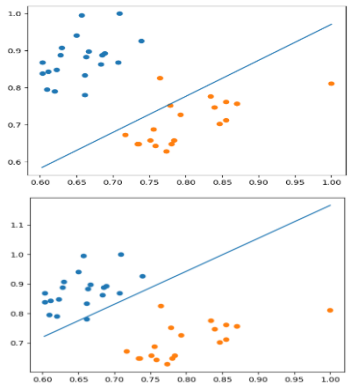
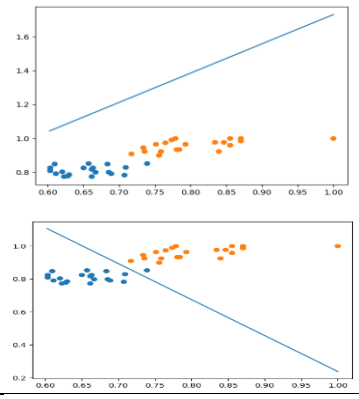
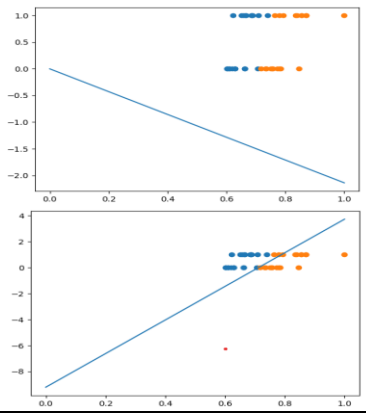
Preprocessing techniques:

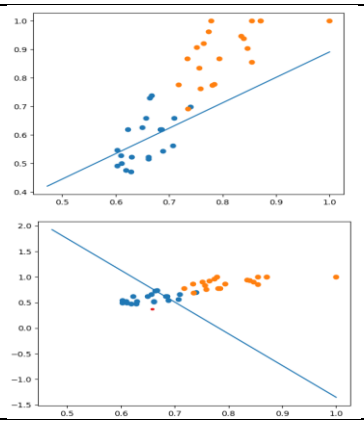
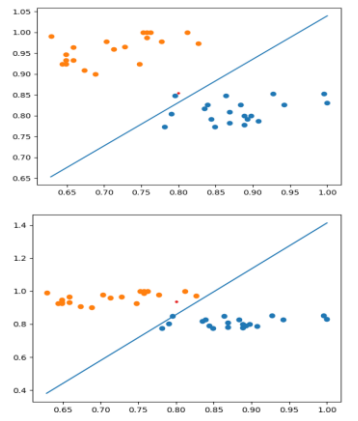
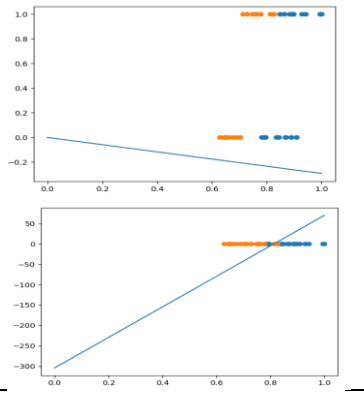
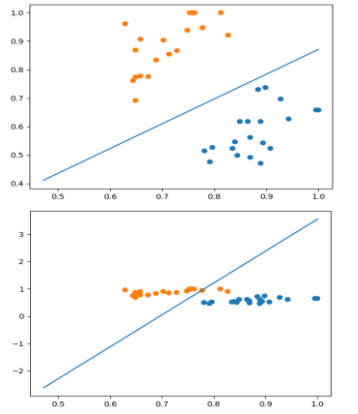
- Reading the features from the dataset and filling the NA.
- features in gender we used the normalize equation to normalize the data from 0 to 1.
- converted the three classes into 3 numbers from (1 to 3) to make it easier in the code.

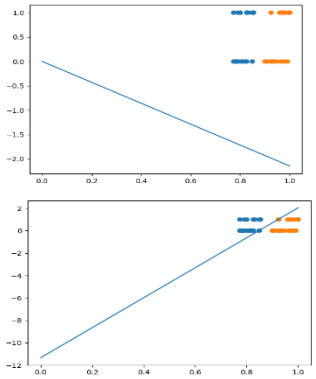
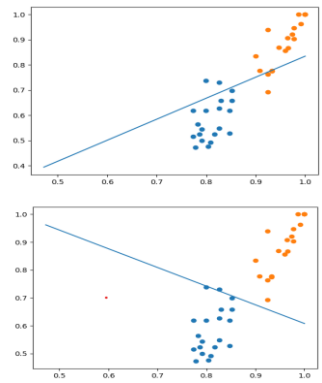
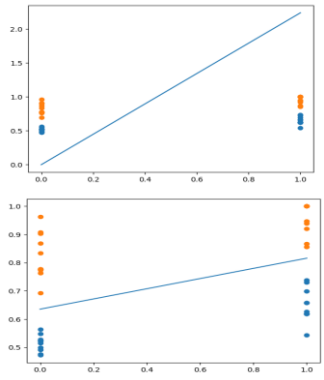
NOTE:
For all next result make epoch = 2000 and Learning Rate = 0.01

Visualization between each two Penguins:

“Adelie” and “Gentoo”:

Features	Accuracy	plot
bill_length and bill_depth:	Without bias:97.5% With bias: 97.5%	
bill_length and flipper lenght	Without bias:50.0% With bias: 97.5%	
bill_length and gender	Without bias:50.0% With bias:95.0%	

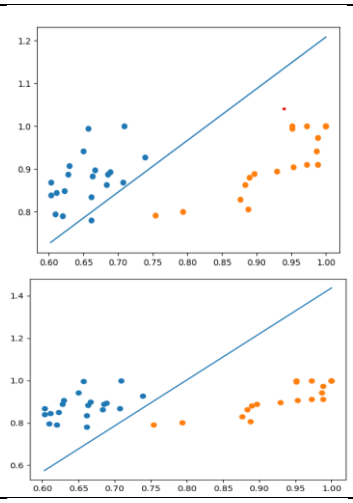
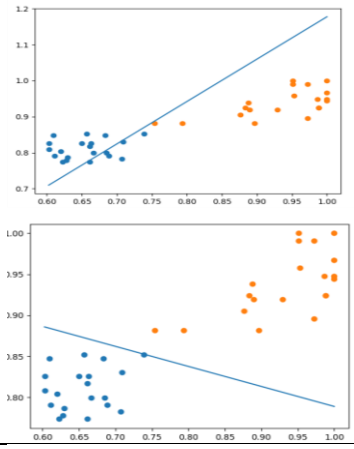
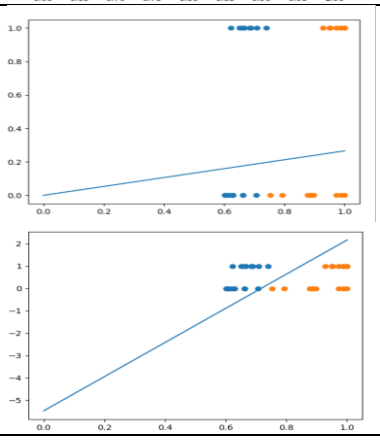
bill_length and body_mass	Without bias: 75.0% With bias:92.5%	
Bill_dipth and flipper_length	Without bias: 97.5% With bias:97.5%	
Bill_dipth and gender	Without bias:50.0% With bias: 90.0%	
Bill_dipth and body_mass	Without bias:100.0% With bias: 95.0%	

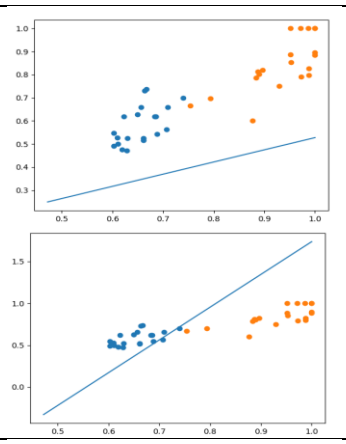
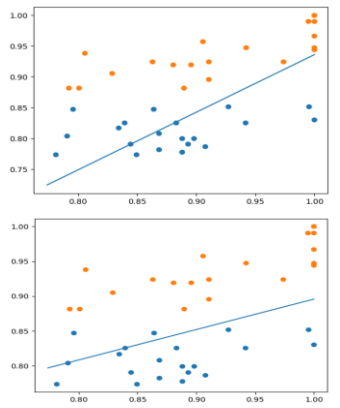
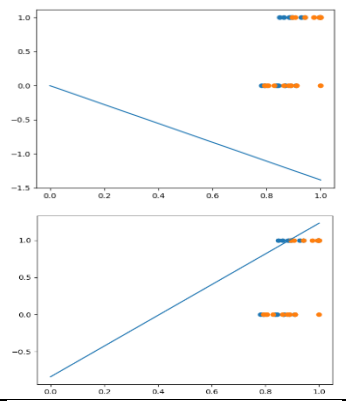
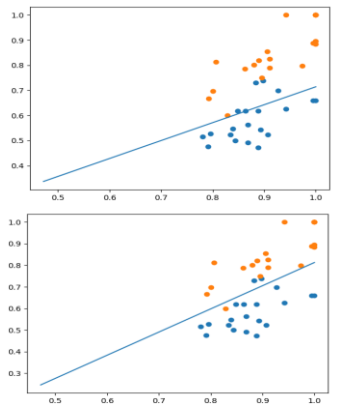
flipper_length and gender	Without bias:50.0% With bias: 100.0%	
flipper_length and body_mass	Without bias:85.0% With bias: 97.5%	
Gender and body_mass	Without bios:50.0% With bias: 100.0%	

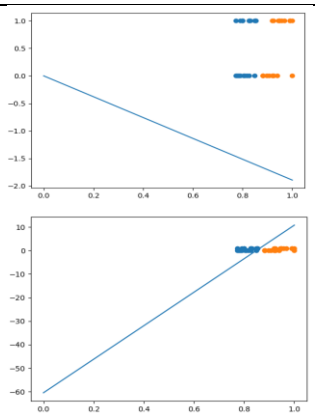
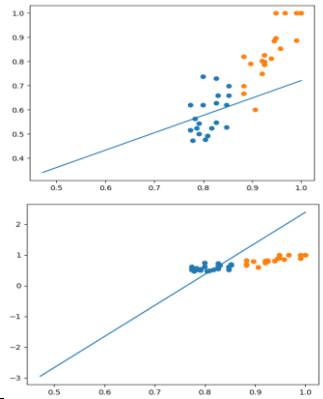
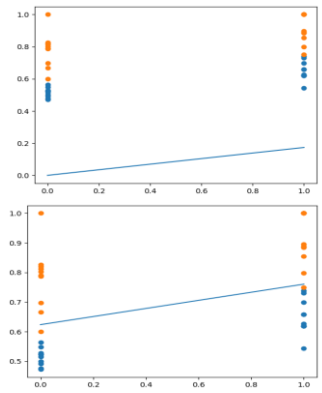
The best features to distinguish **between 'Adelie' and 'Gentoo' :**

- flipper_length and gender
- bill_length and bill_depth
- Bill_dipth and body_mass

between “Adelie” and “Chinstrap”:

Features	Accuracy	plot
bill_length and bill_depth	Without bias:97.5% With bias: 100%	
bill_length and flipper lenght	Without bias:85.0% With bias: 100%	
bill_length and gender	Without bias:50.0% With bias:100%	

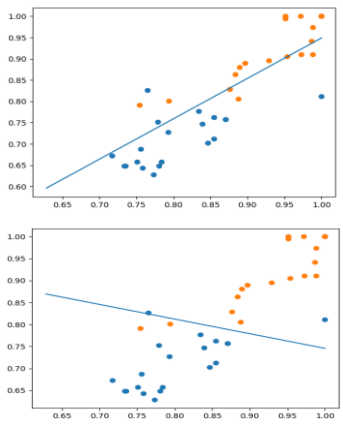
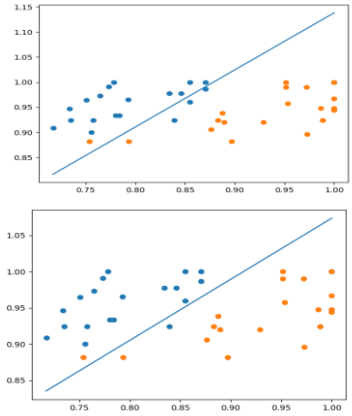
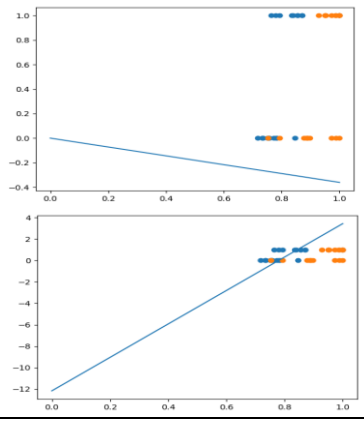
bill_length and body_mass	Without bias: 50.0% With bias:95.0%	
Bill_dipth and flipper_length	Without bias: 82.5% With bias:87.5%~92%	
Bill_dipth and gender	Without bias:50.0% With bias: 60.0%	
Bill_dipth and body_mass	Without bias:87.5% With bias: 92.5%	

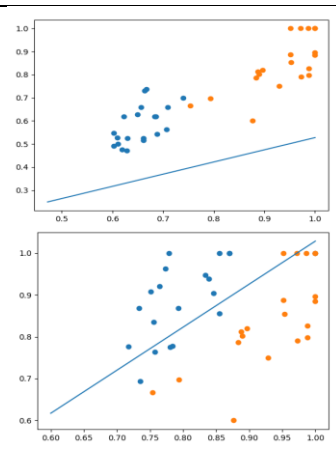
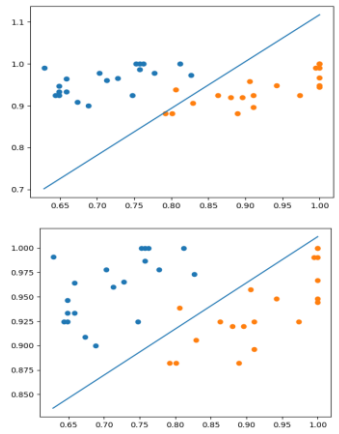
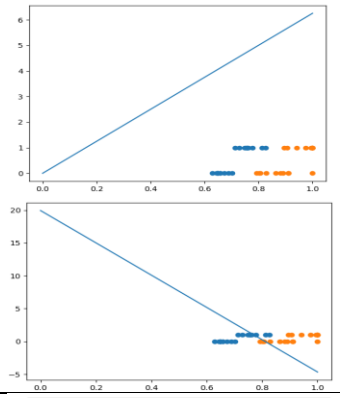
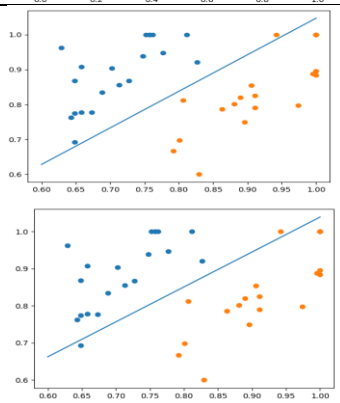
flipper_length and gender	Without bias:50.0% With bias: 100.0%	
flipper_length and body_mass	Without bias:75.0% With bias: 80.0%	
Gender and body_mass	Without bias:50.0% With bias: 97.5%	

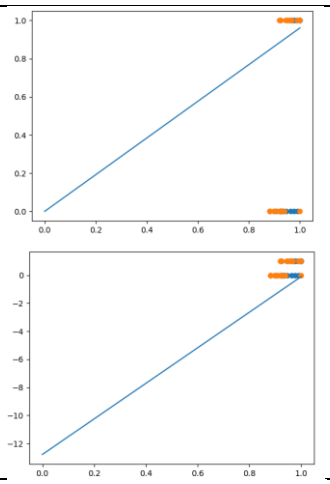
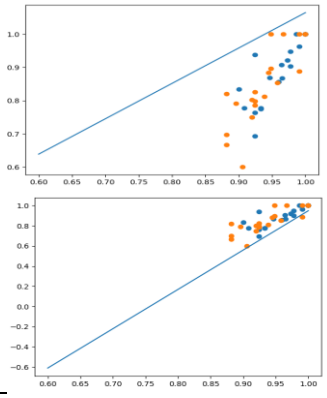
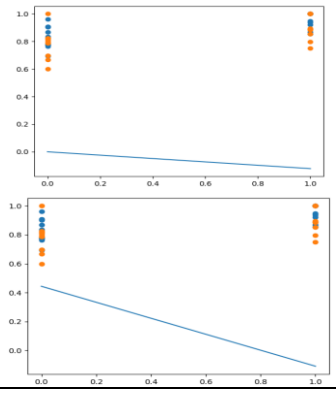
The best features to distinguish **between "Adelie" and "Chinstrap":**

- flipper_length and gender
- bill_length and bill_depth
- Gender and body_mass

between “Gentoo” and “Chinstrap”:

Features	Accuracy	plot
bill_length and bill_depth:	Without bias:85.0% With bias: 90%	
bill_length and flipper lenght	Without bias:87.5% With bias: 92.5%	
bill_length and gender	Without bias:50.0% With bias:77.5%	

bill_length and body_mass	Without bias: 50.0% With bias:80.0%	
Bill_dipth and flipper_length	Without bias: 97.5% With bias:92.5%	
Bill_dipth and gender	Without bias:50.0% With bias: 85.0%	
Bill_dipth and body_mass	Without bias:87.5% With bias: 95%	

flipper_length and gender	Without bios:50.0% With bias: 50.0%	
flipper_length and body_mass	Without bias:50.0% With bias: 47.5%	
Gender and body_mass	Without bias:50.0% With bias: 97.5%	

The best features to distinguish **between “Adelie” and “Chinstrap”:**

- Bill_dipth and flipper_length
- Bill_dipth and body_mass
- Gender and body_mass