Neural Networks Task 1

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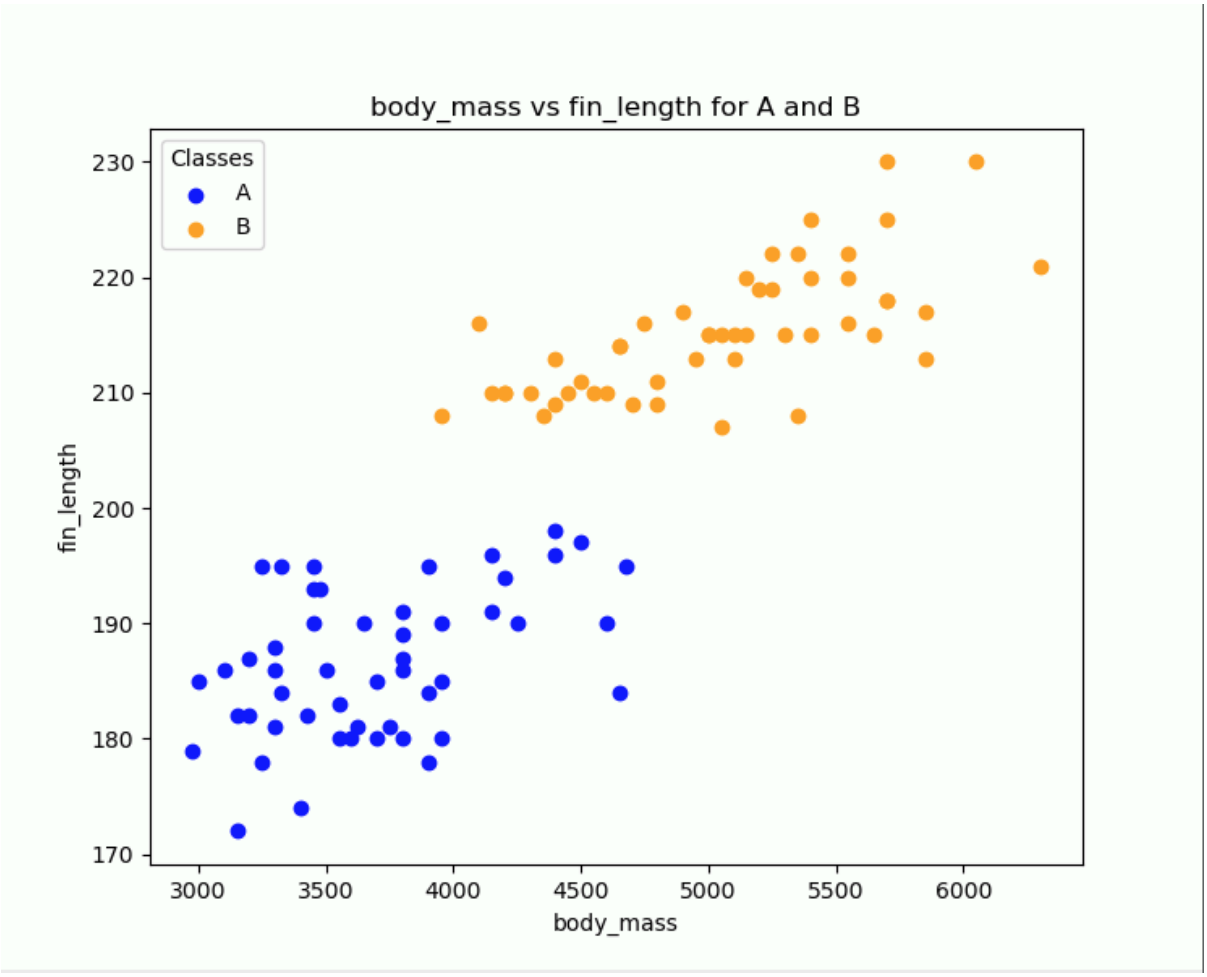
Analysis

All the tests taken were performed with a learning rate=0.01, 50 epochs and 0.01 MSE threshold.

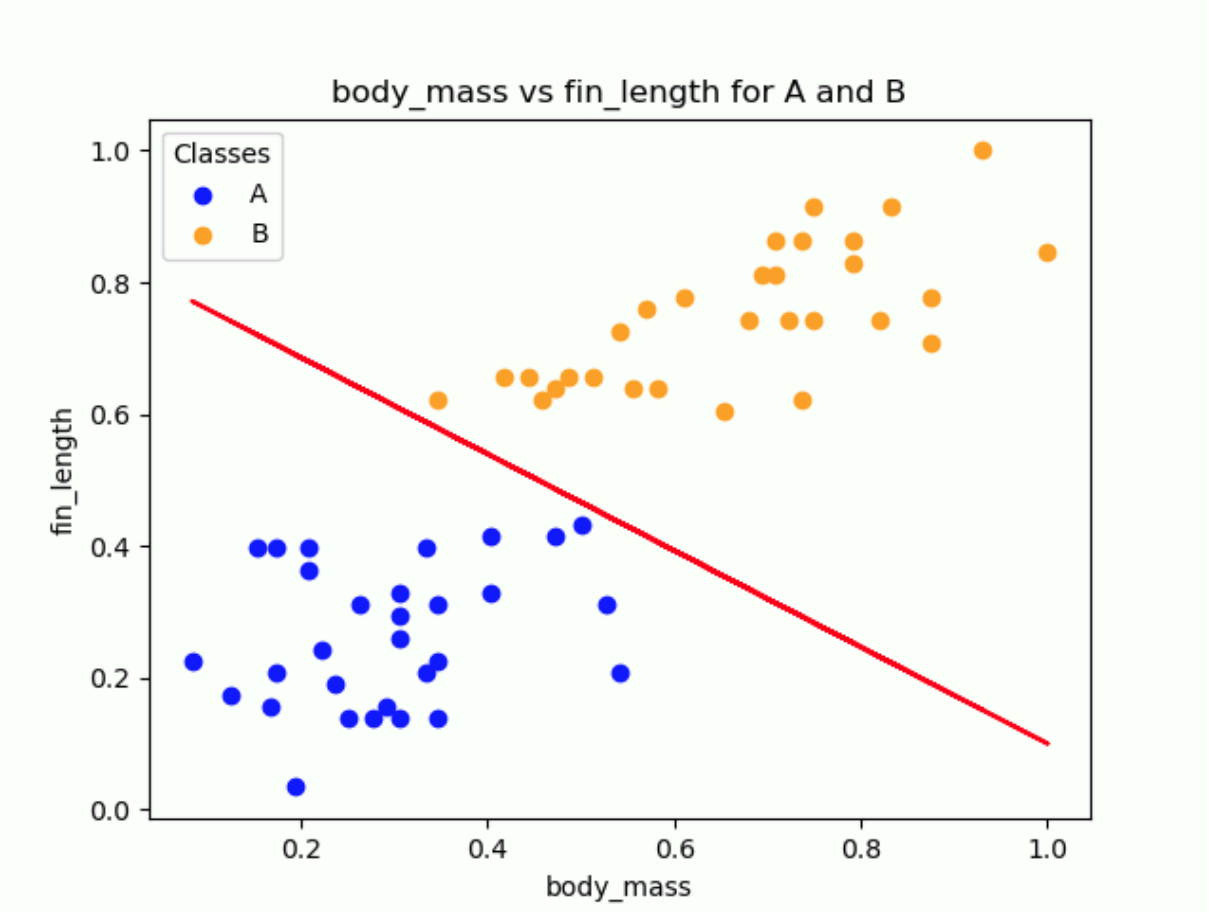
Classes: A & B Features: Fin length & Body mass:



the figure shows that fin length and body mass can discriminate well between classes A and B. Generally, Class B tends to have longer fin length than Class A. Some cases of Class B can have a body mass that's similar to Class A but most cases of Class B have a larger body mass.

Adaline:

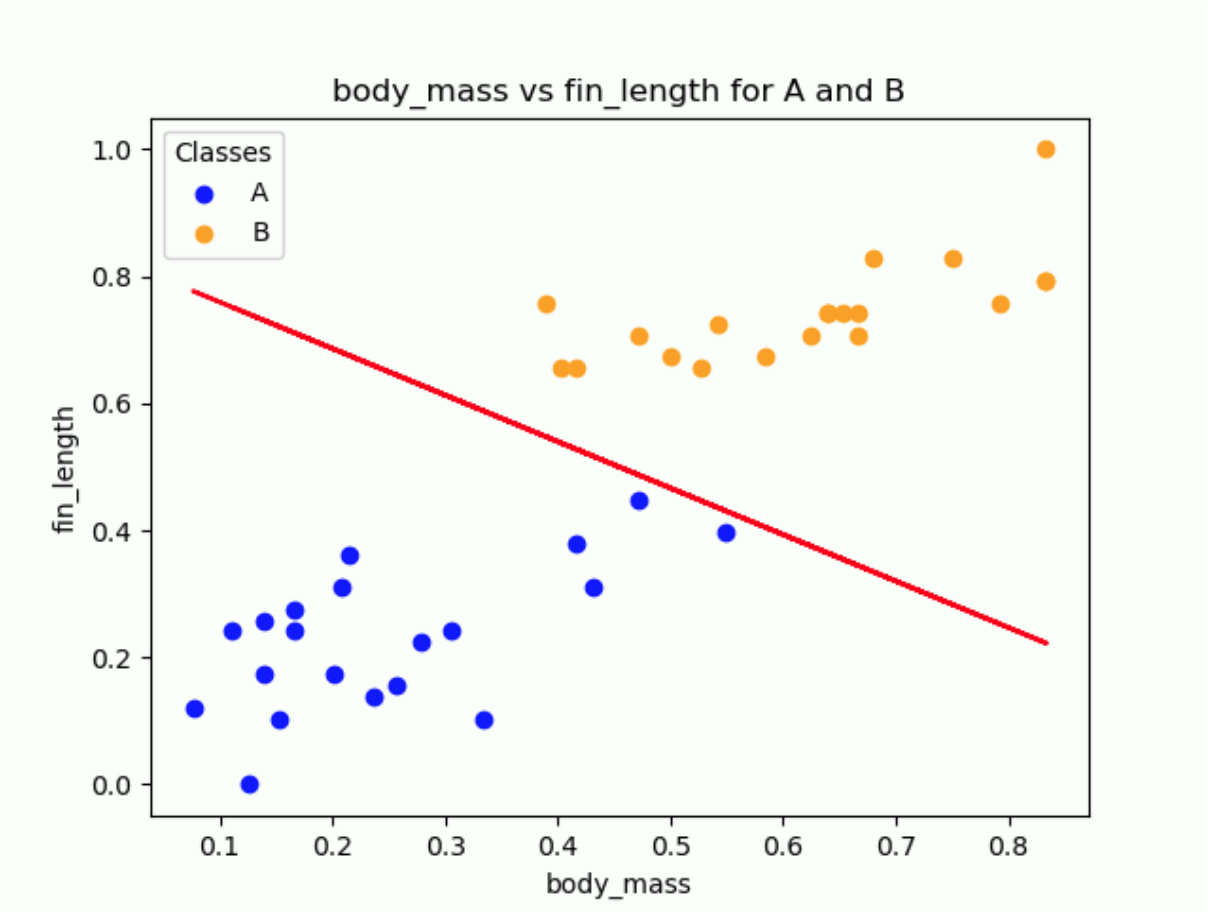
Train



30	0
0	30

Accuracy: 100%. Precision: 1.0. Recall:1.0. F1:1.0.

Test

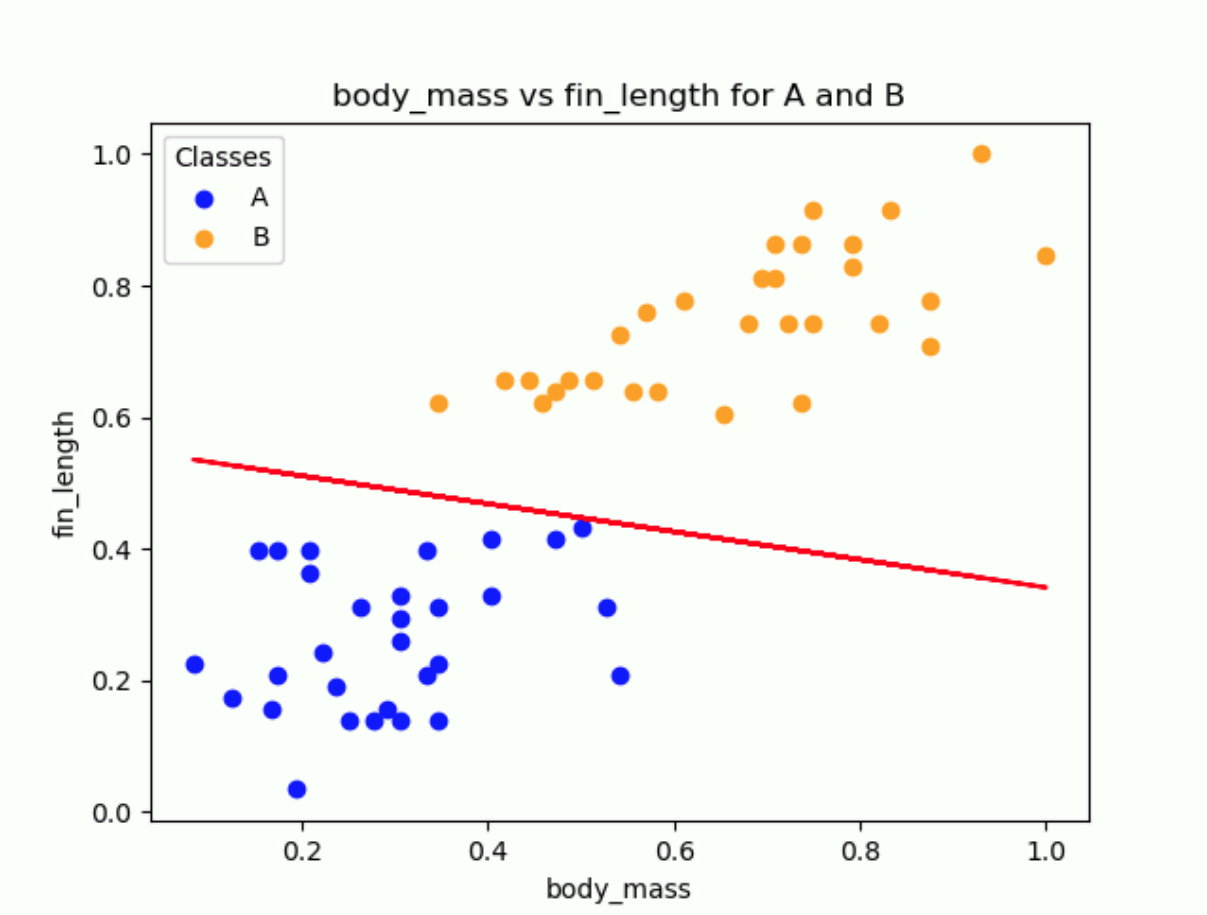


20	0
0	20

Accuracy: 100%. Precision: 1.0. Recall:1.0. F1:1.0.

Perceptron:

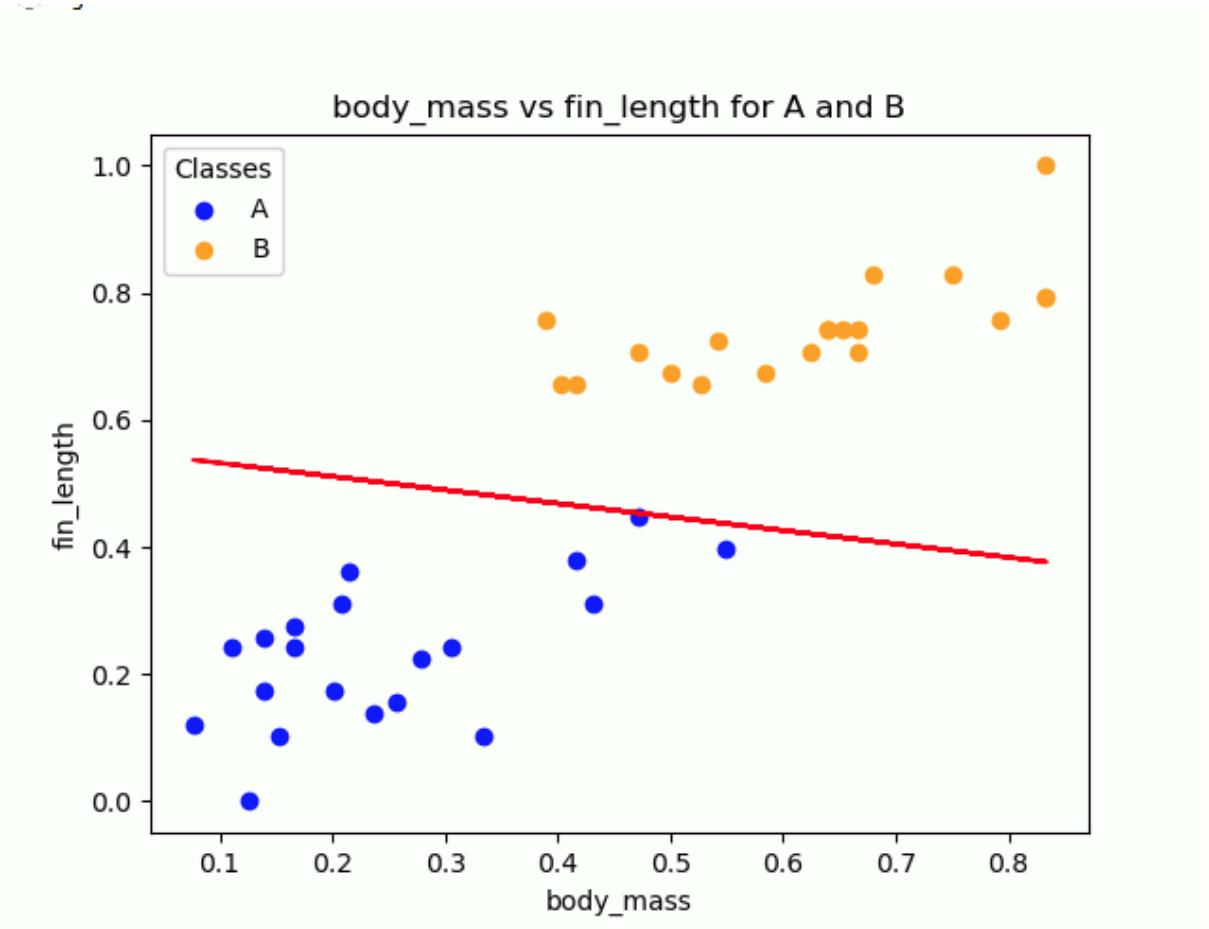
Train



30	0
0	30

Accuracy: 100%. Precision: 1.0. Recall:1.0. F1:1.0.

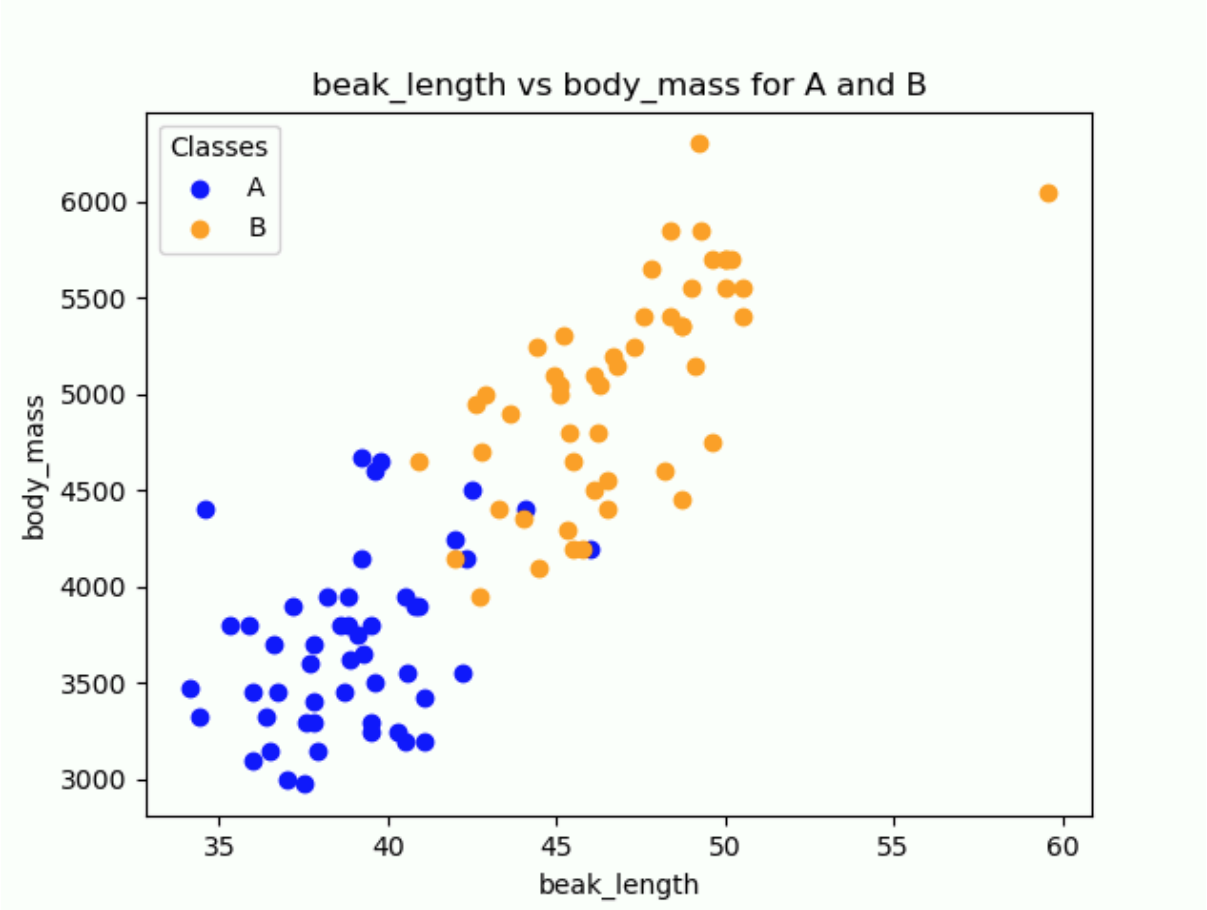
Test



20	0
0	20

Accuracy: 100%. Precision: 1.0. Recall:1.0. F1:1.0.

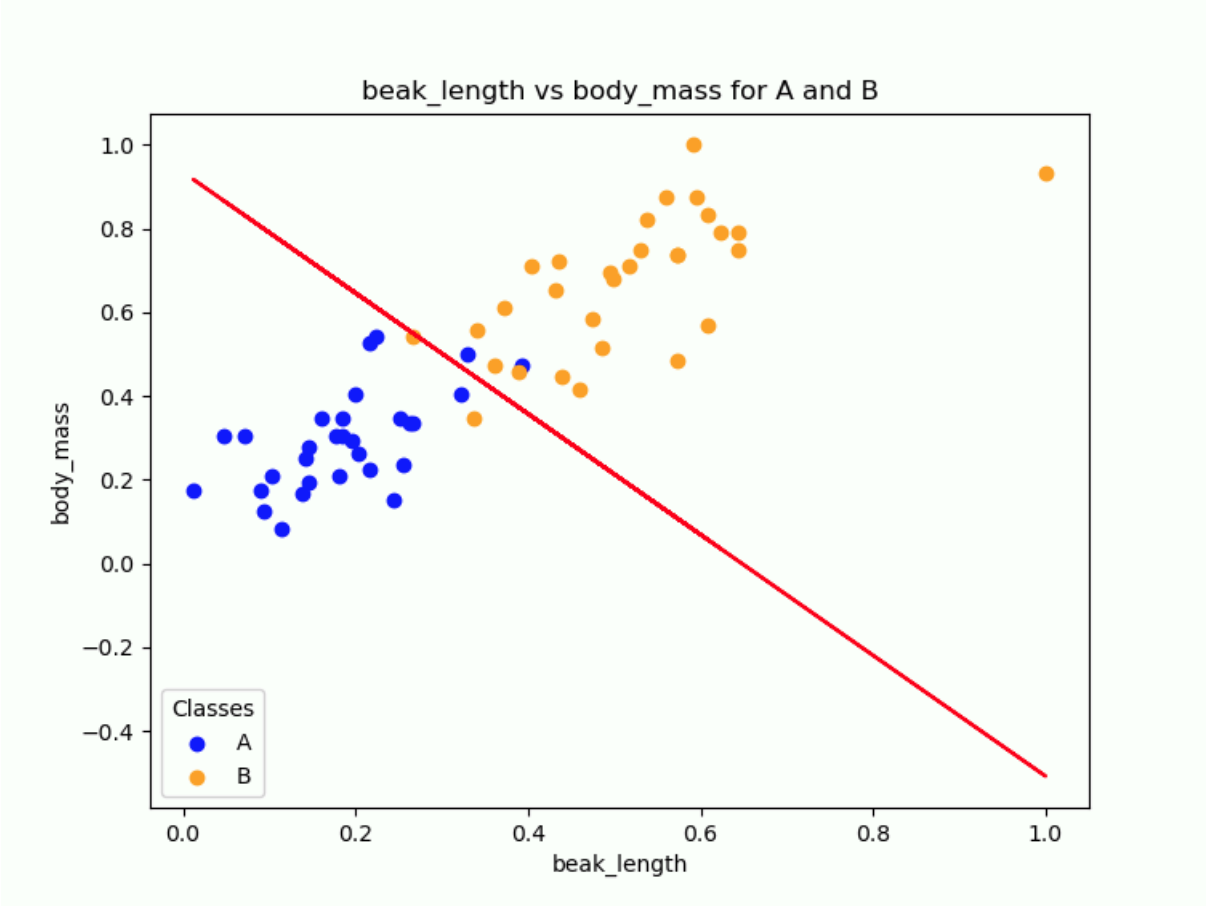
Classes: A & B Features: Beak length & Body mass:



The figure shows that this data is harder to separate linearly since some points from both classes are intertwined. It is expected that both learning algorithms to be less accurate than the previous test.

Adaline:

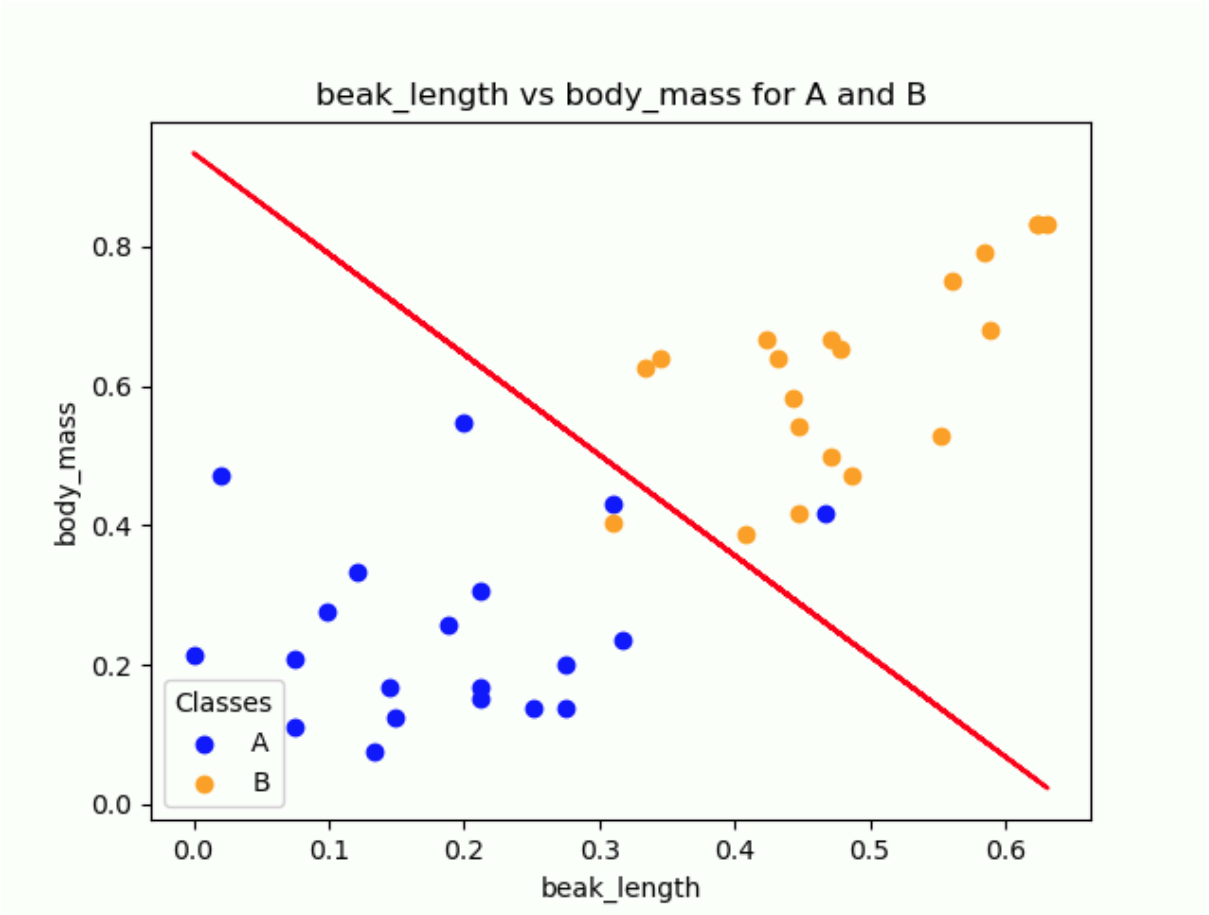
Train



28	2
2	28

Accuracy: 93%. Precision: 0.93. Recall:0.93. F1:0.93.

Test

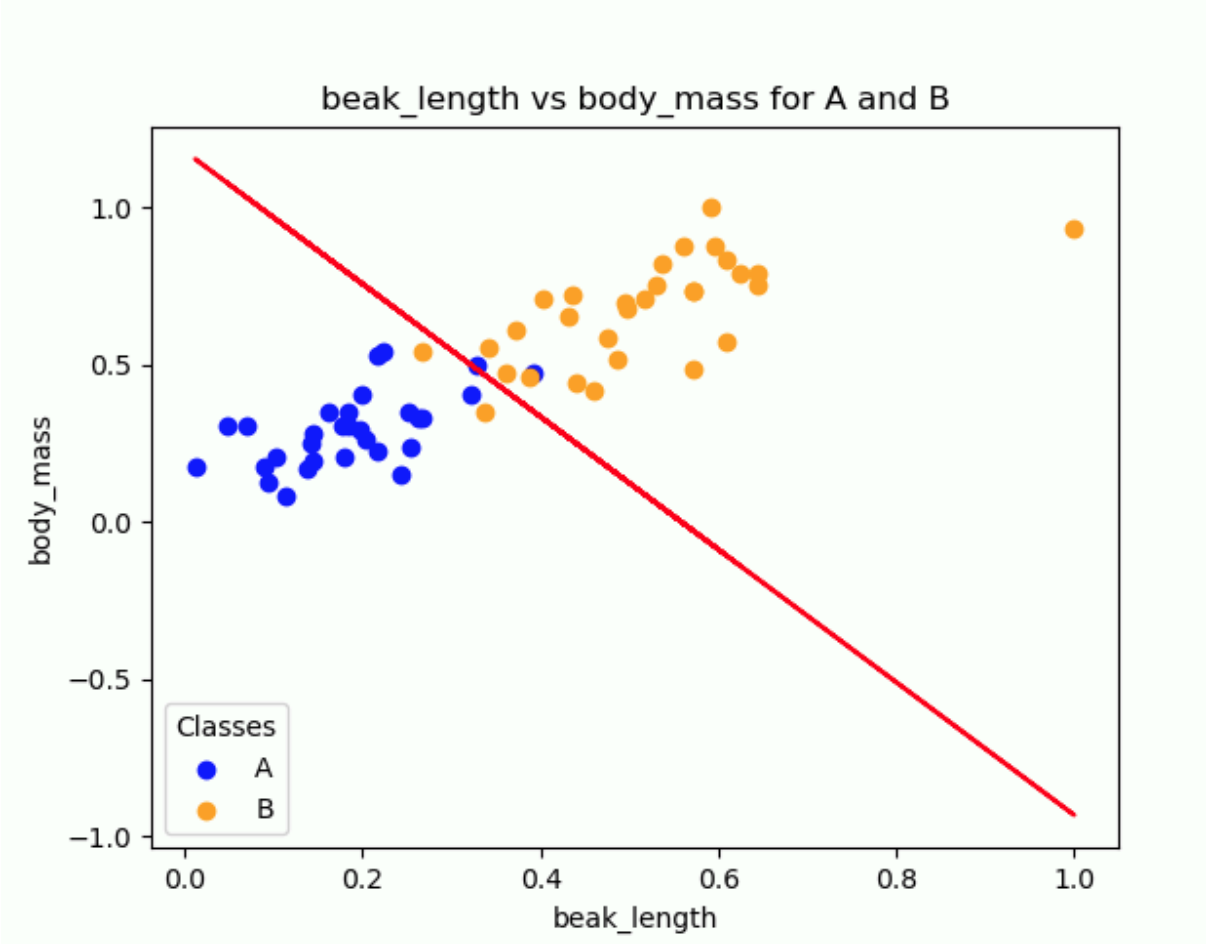


19	1
1	19

Accuracy: 95%. Precision: 0.95. Recall:0.95. F1:0.95.

Perceptron:

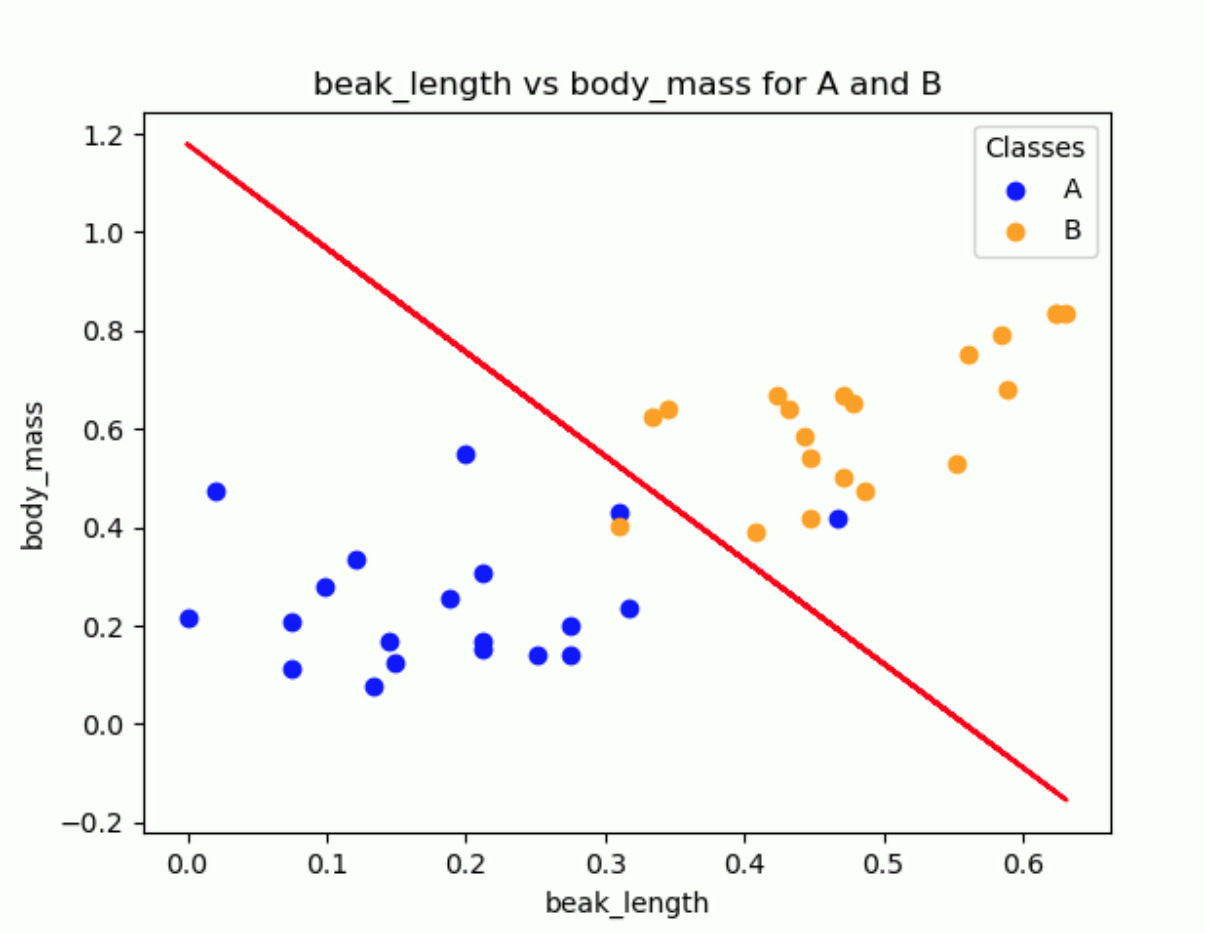
Train



28	2
2	28

Accuracy: 93%. Precision: 0.93. Recall:0.93. F1:0.93.

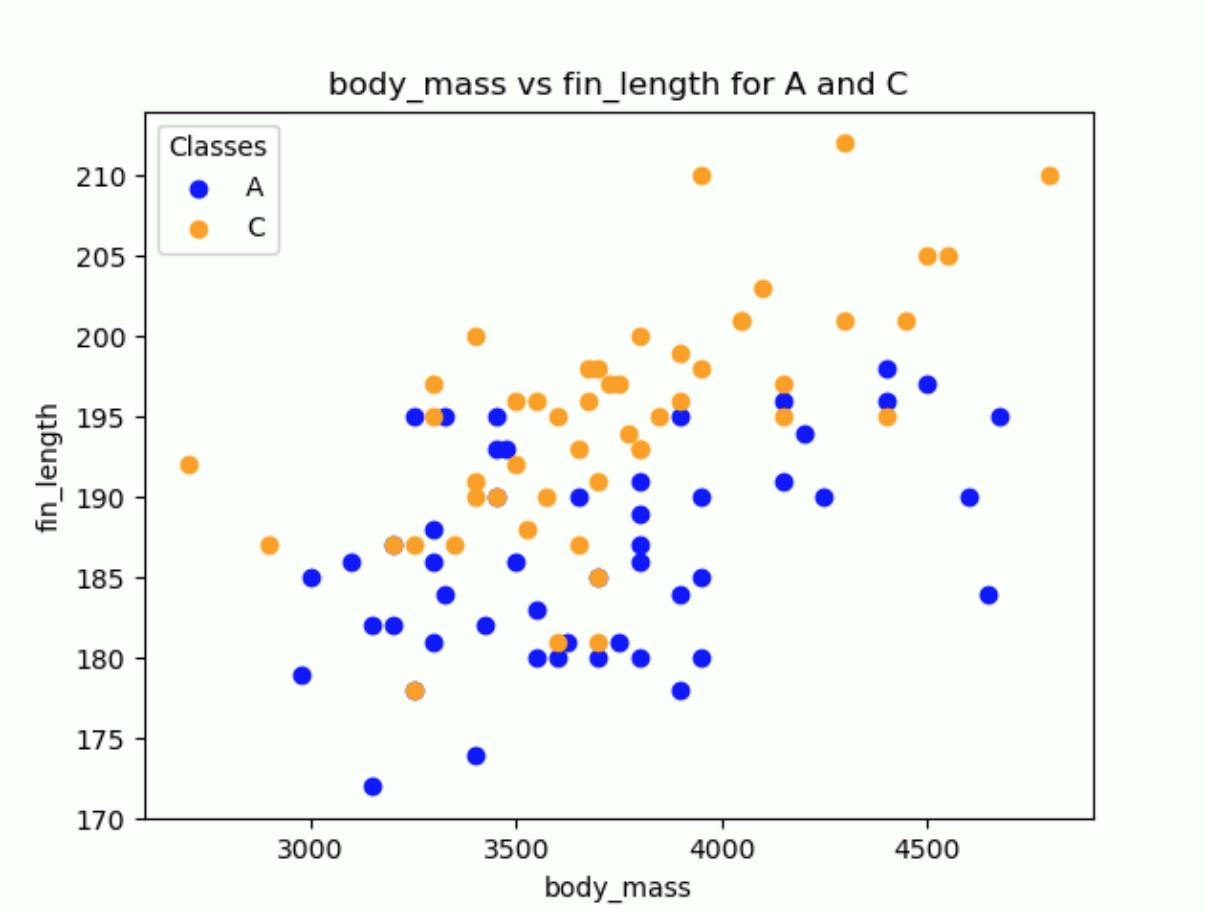
Test



19	1
1	19

Accuracy: 95%. Precision: 0.95. Recall:0.95. F1:0.95.

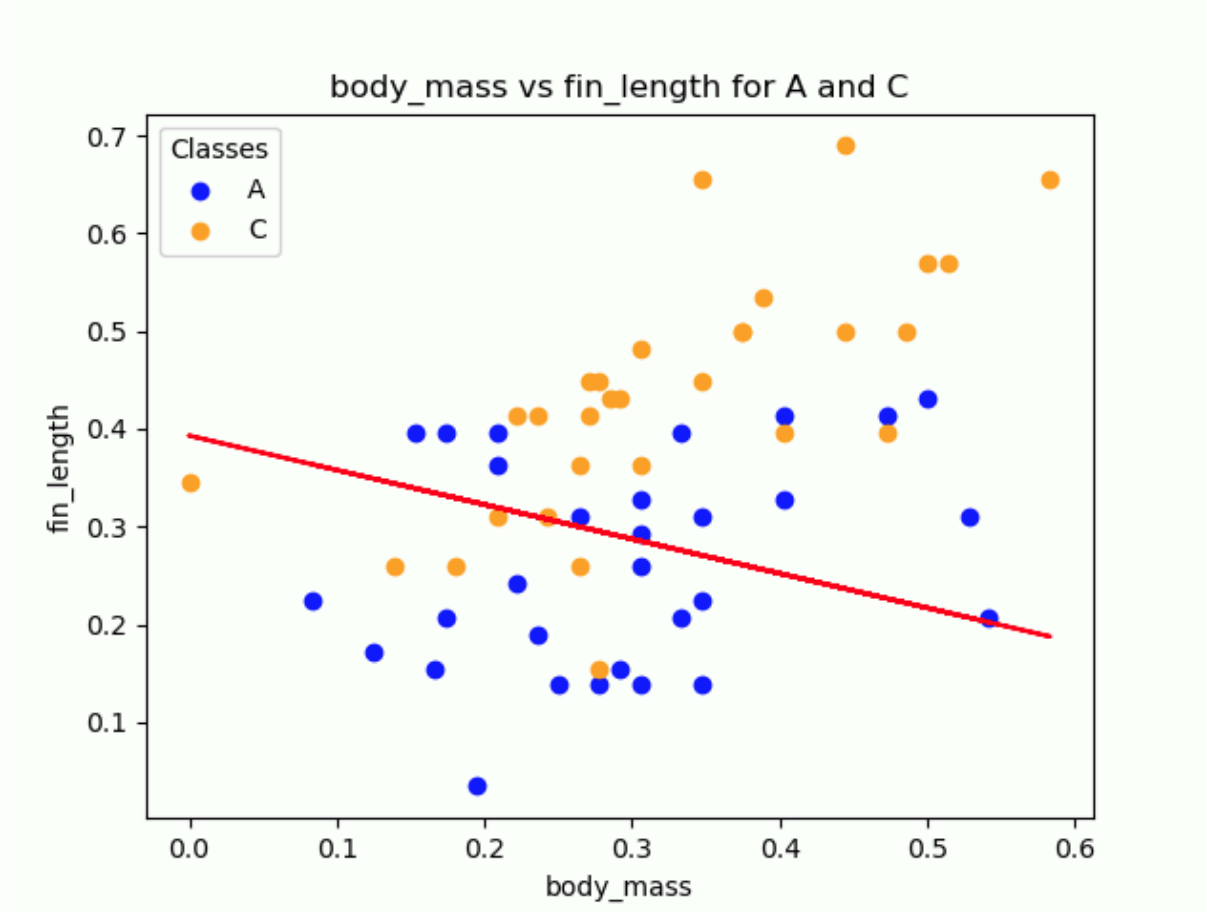
Classes: C & A Features: Fin length & Body mass:



As the figure shows, this data can not be separated linearly. As a matter of fact, these 2 features can not discriminate between Classes A and C. Both algorithms should have a hard time separating between them, with no good accuracy.

Adaline:

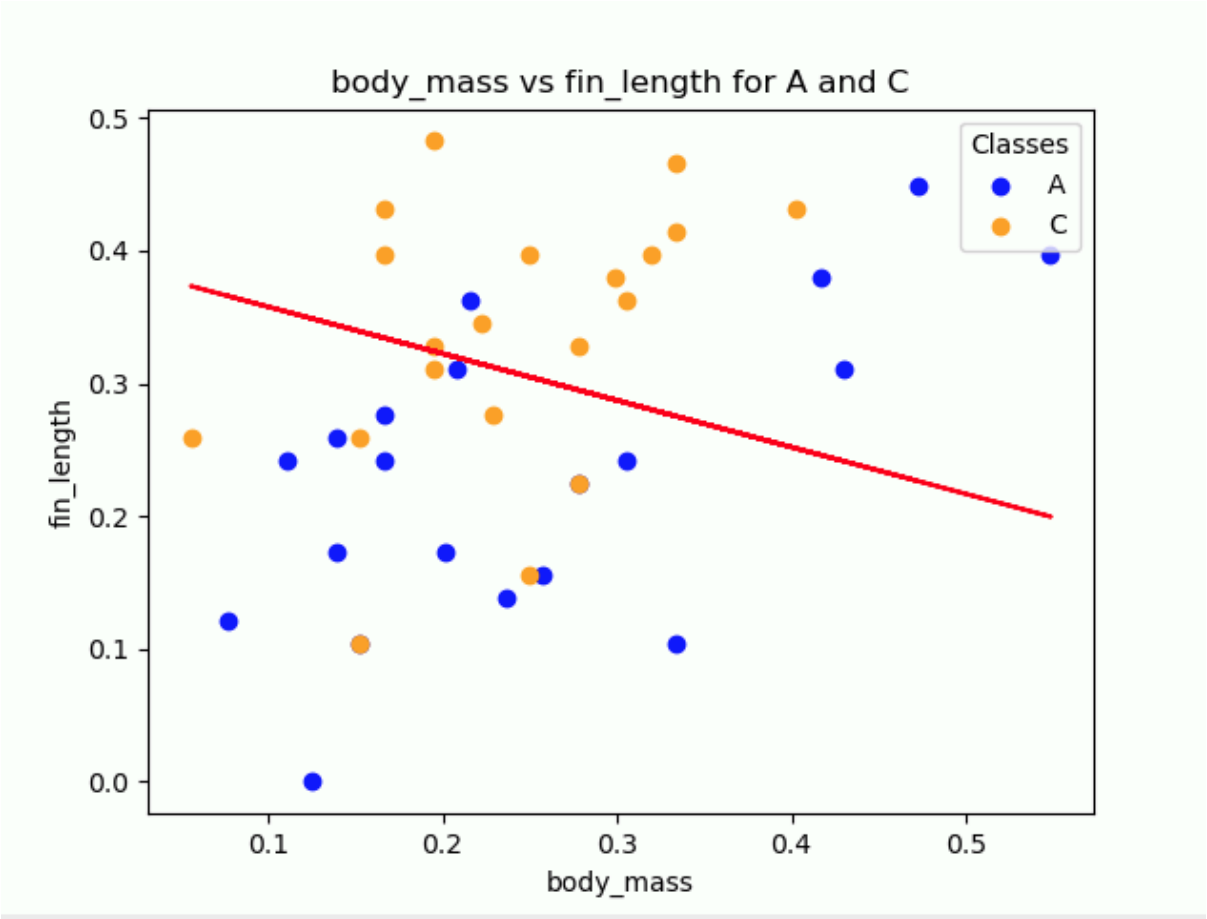
Train



24	15
6	15

Accuracy: 65%. Precision: 0.61. Recall:0.8. F1:0.69.

Test

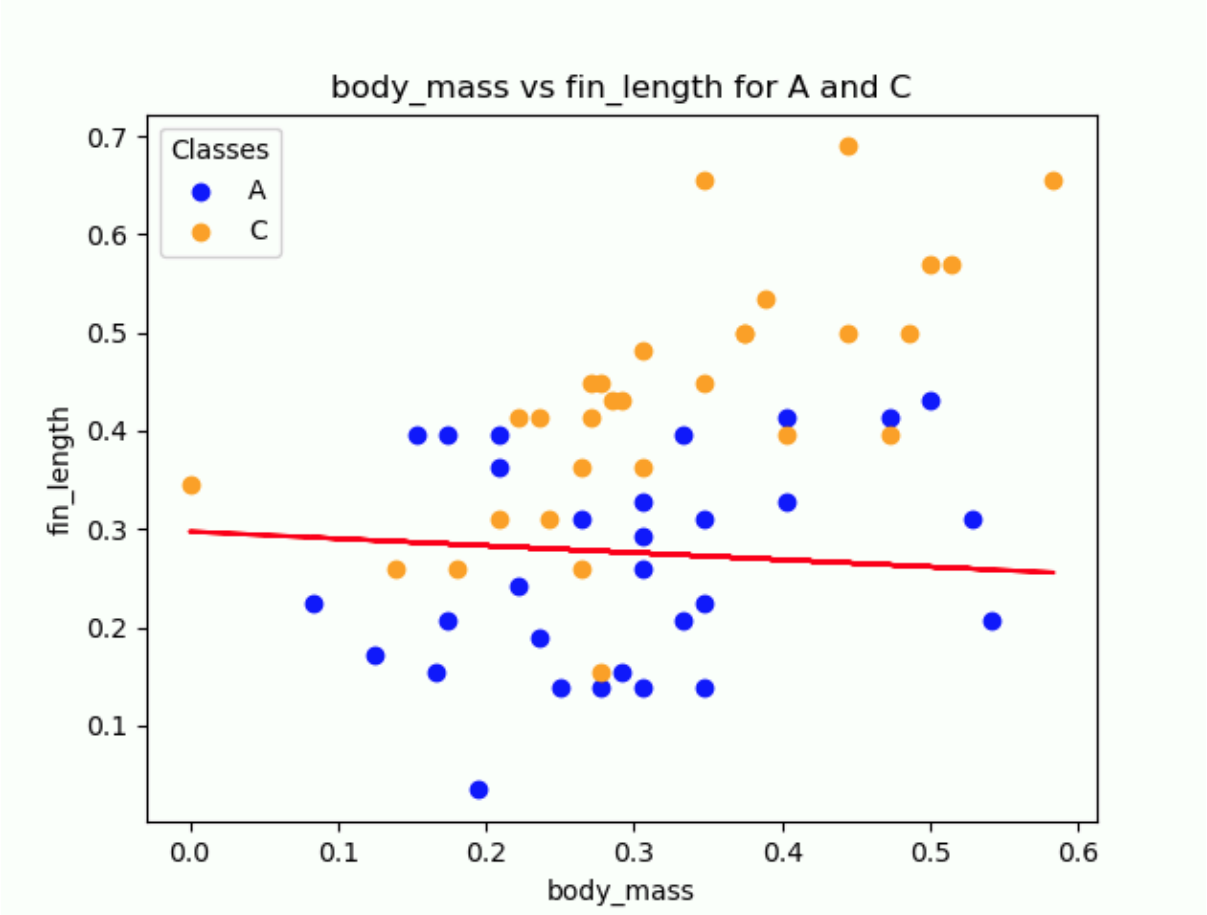


13	5
7	15

Accuracy: 70%. Precision: 0.72. Recall:0.65. F1:0.68.

Perceptron:

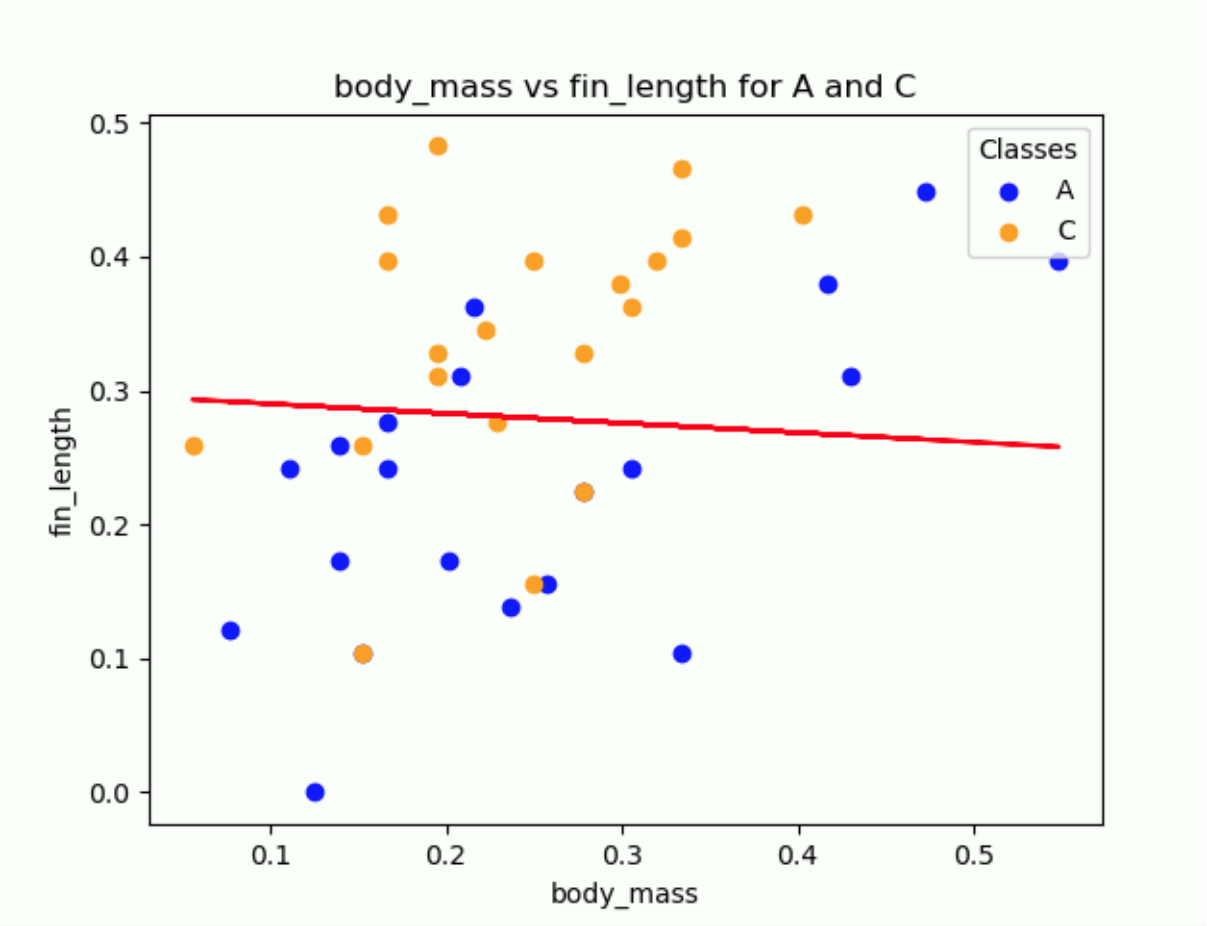
Train



26	14
4	16

Accuracy: 70%. Precision: 0.65. Recall:0.86. F1:0.74.

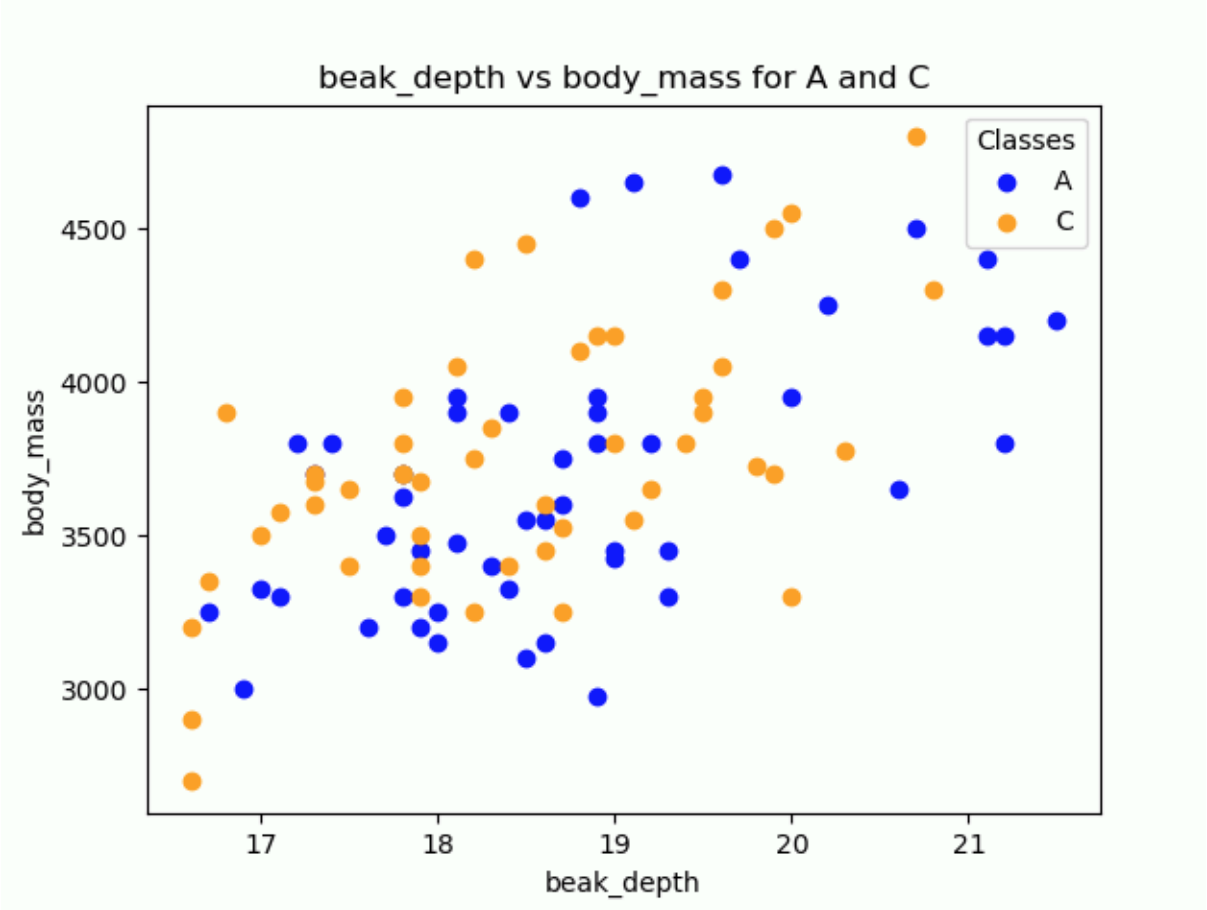
Test



14	6
6	14

Accuracy: 70%. Precision: 0.7. Recall:0.7. F1:0.7.

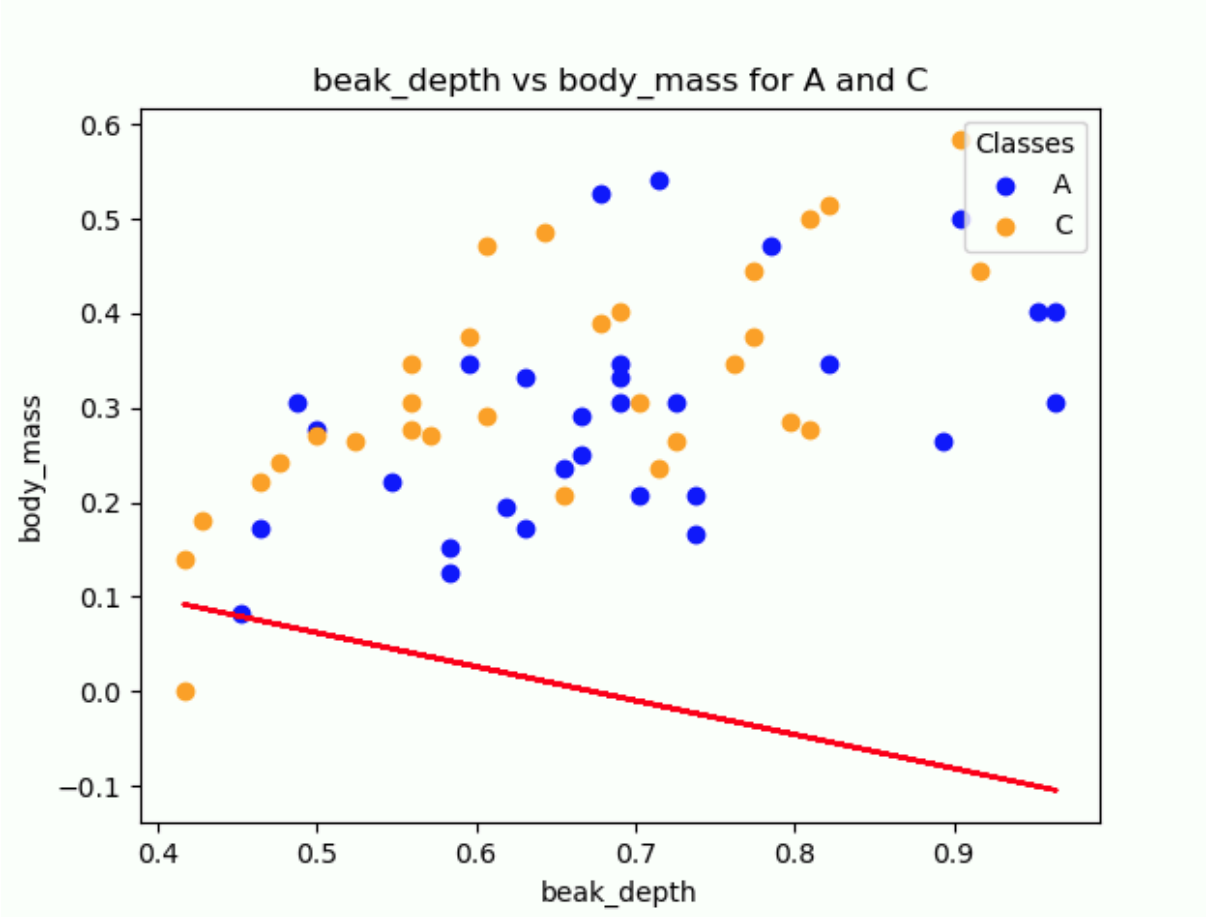
Classes: C & A Features: Beak depth & Body mass:



As the figure shows, these 2 features can not discriminate between Classes A and C. Low accuracy is expected from both algorithms.

Adaline:

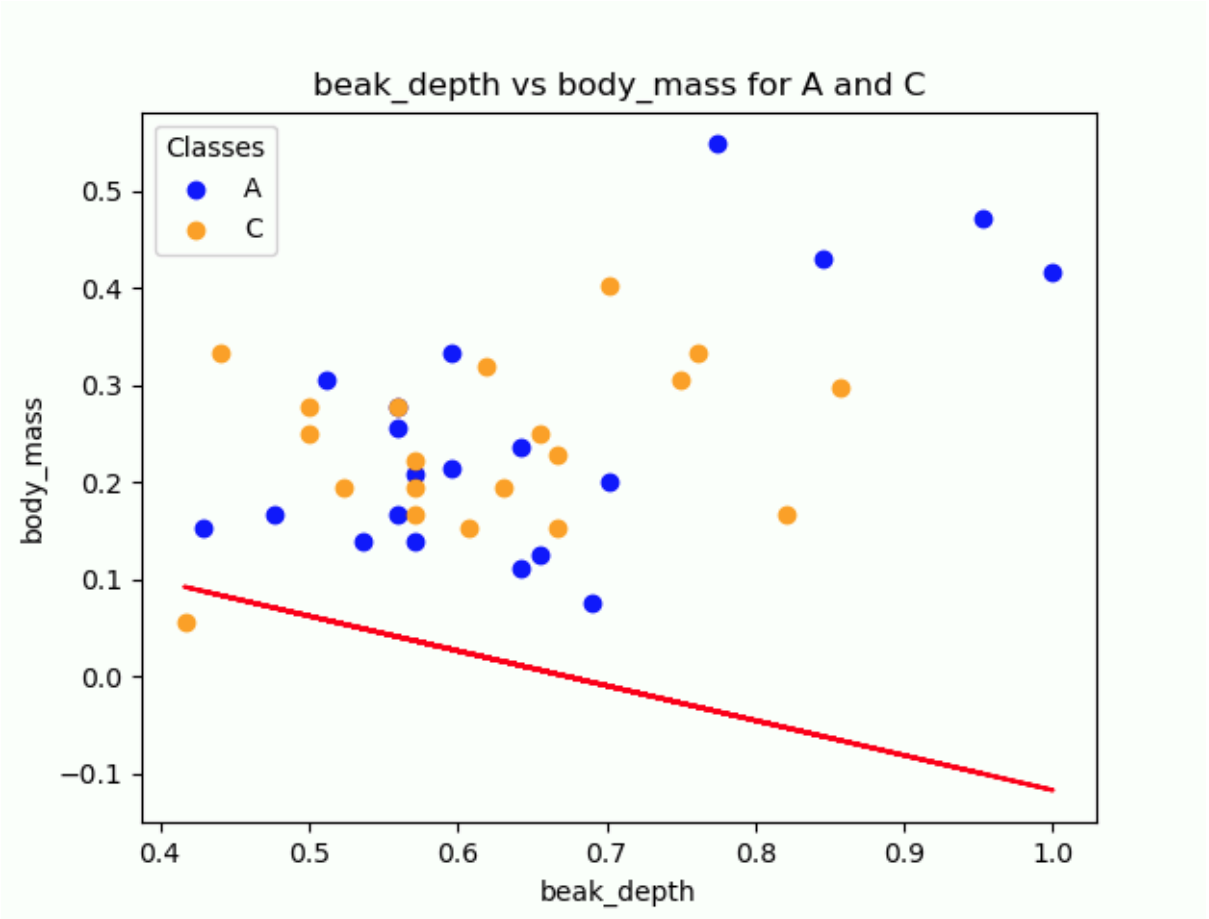
Train



29	30
1	0

Accuracy: 48%. Precision: 0.49. Recall:0.96. F1:0.65.

Test

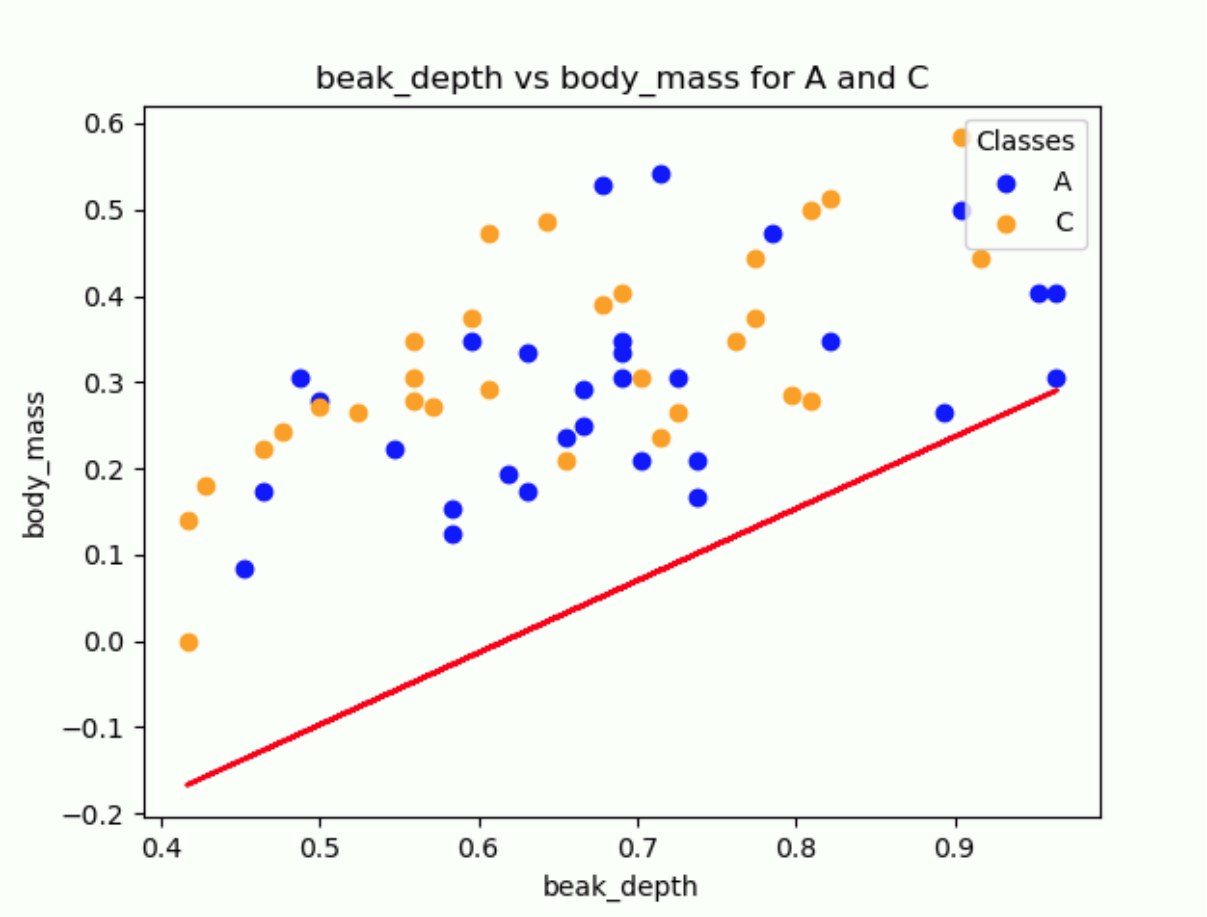


19	20
1	0

Accuracy: 47.5%. Precision: 0.48. Recall:0.95. F1:0.64.

Perceptron:

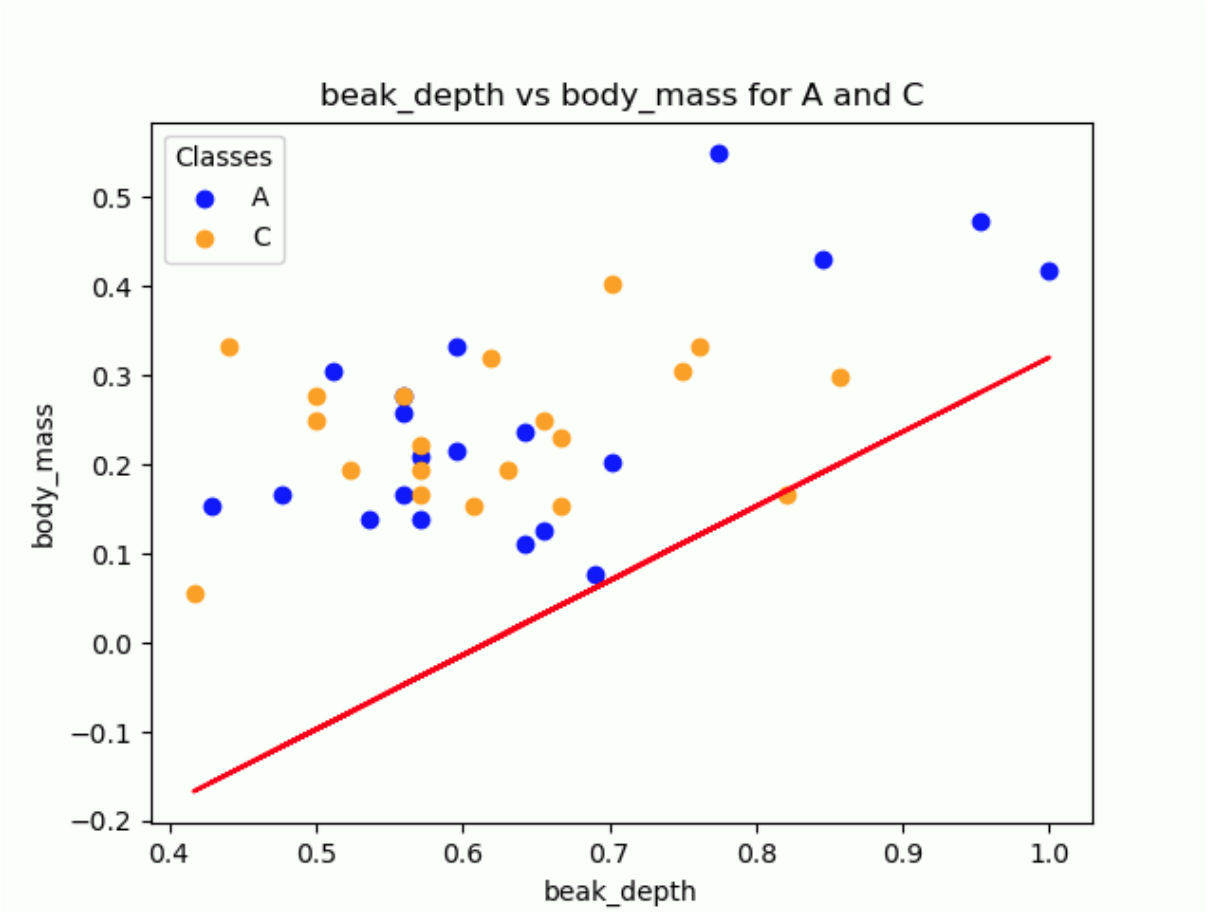
Train



30	30
0	0

Accuracy: 50%. Precision: 0.5. Recall:1.0. F1:0.66.

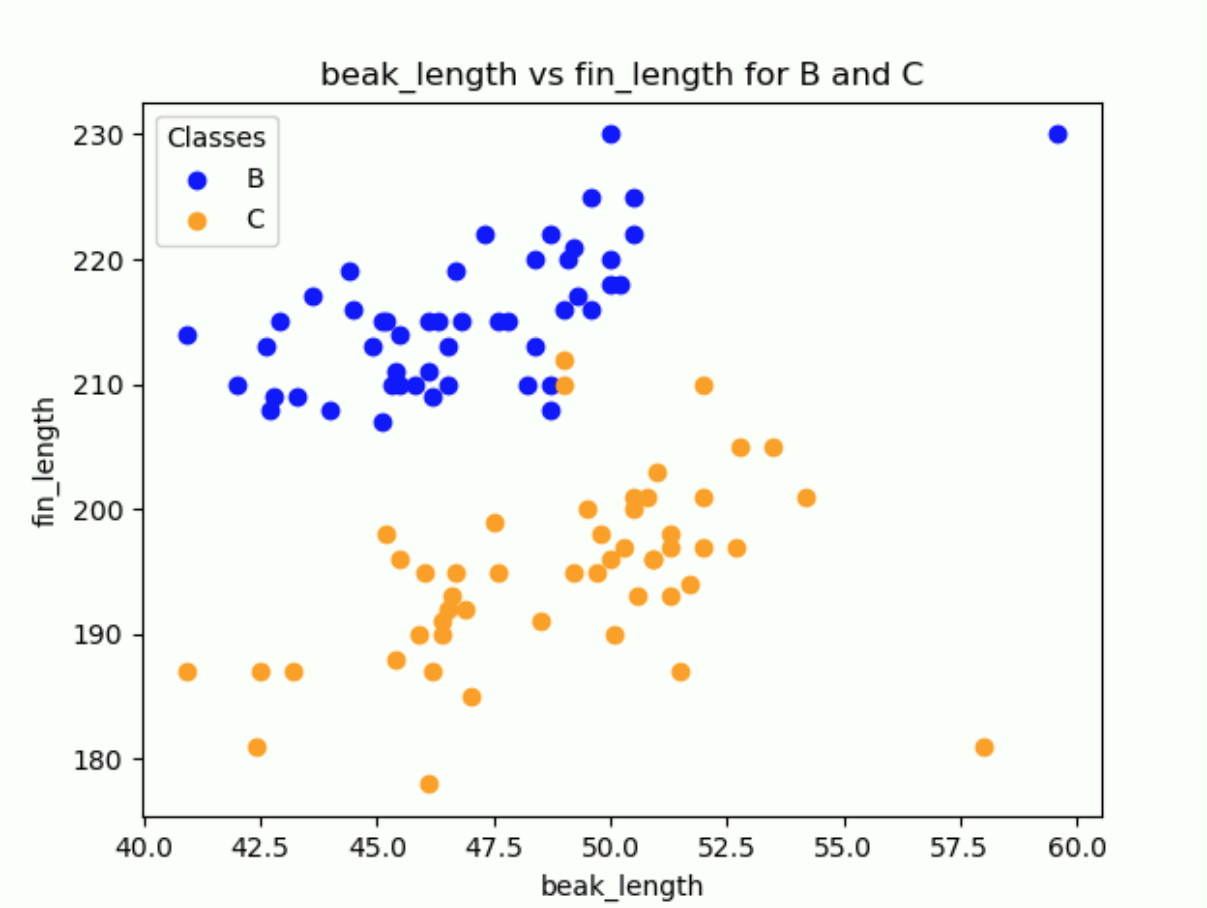
Test



19	20
1	0

Accuracy: 47.5%. Precision: 0.48. Recall:0.95. F1:0.64.

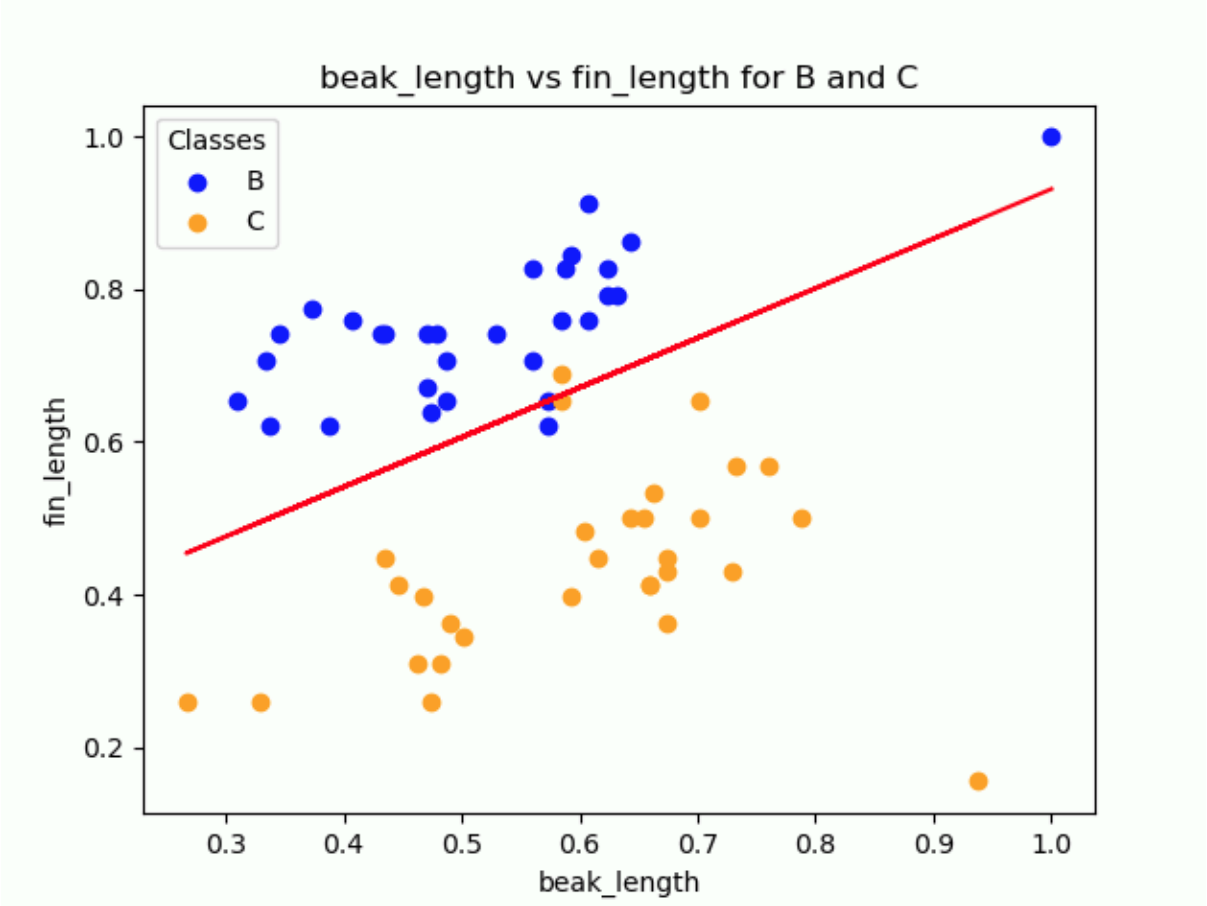
Classes: C & B Features: Beak length & Fin length:



The two features can somewhat discriminate between the two classes, with some examples from Class C that are similar to Class B. Good accuracy is expected.

Adaline:

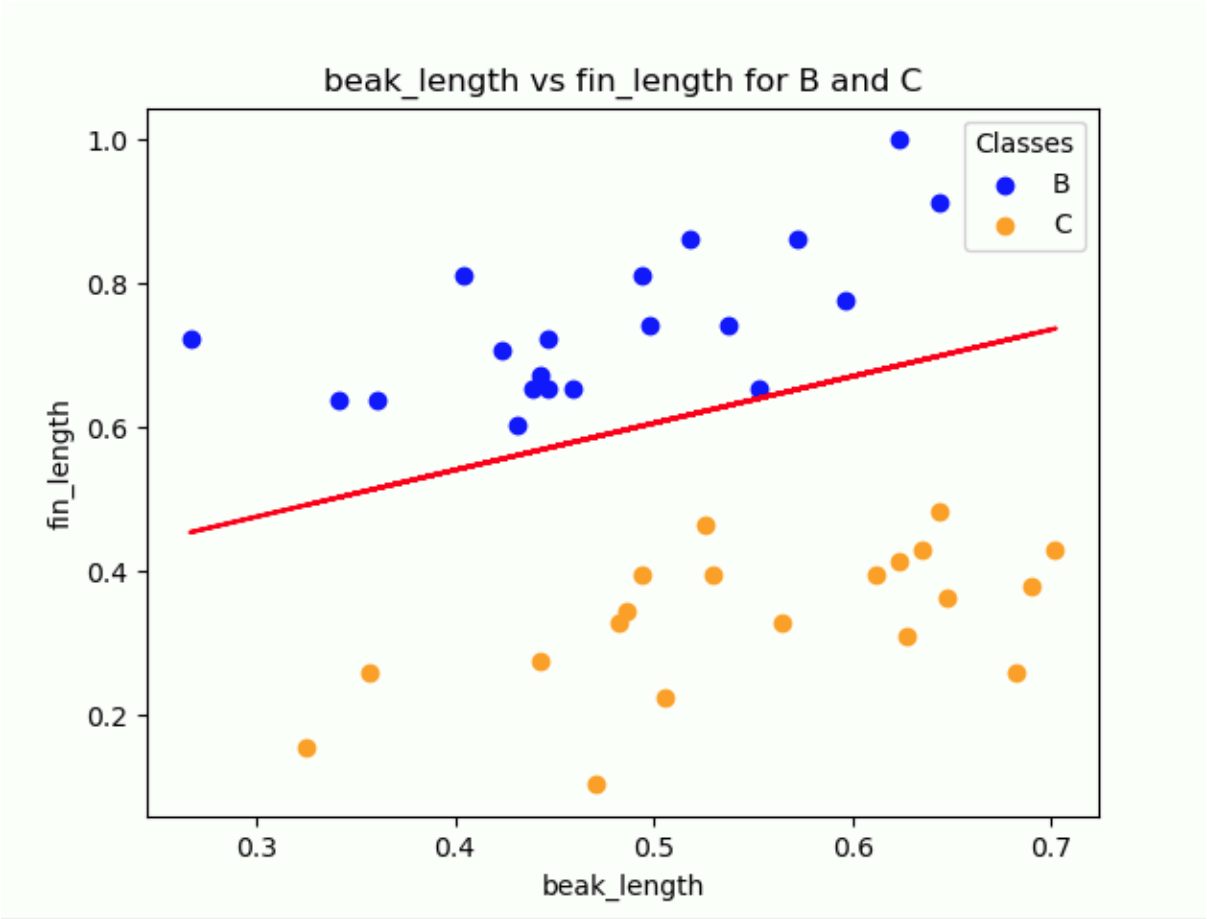
Train



29	1
1	29

Accuracy: 96%. Precision: 0.96. Recall:0.96. F1:0.96.

Test

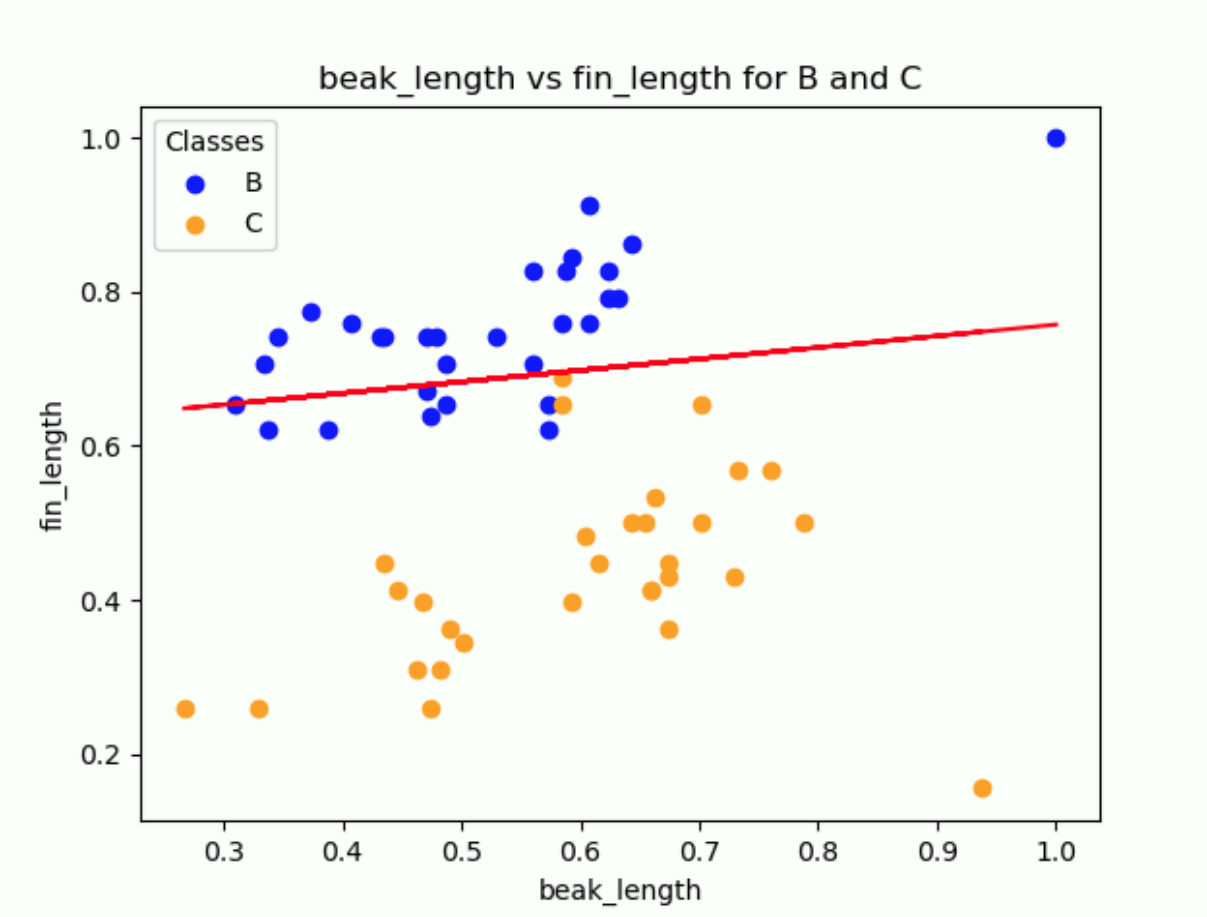


20	0
0	20

Accuracy: 100%. Precision: 1.0. Recall: 1.0. F1: 1.0.

Perceptron:

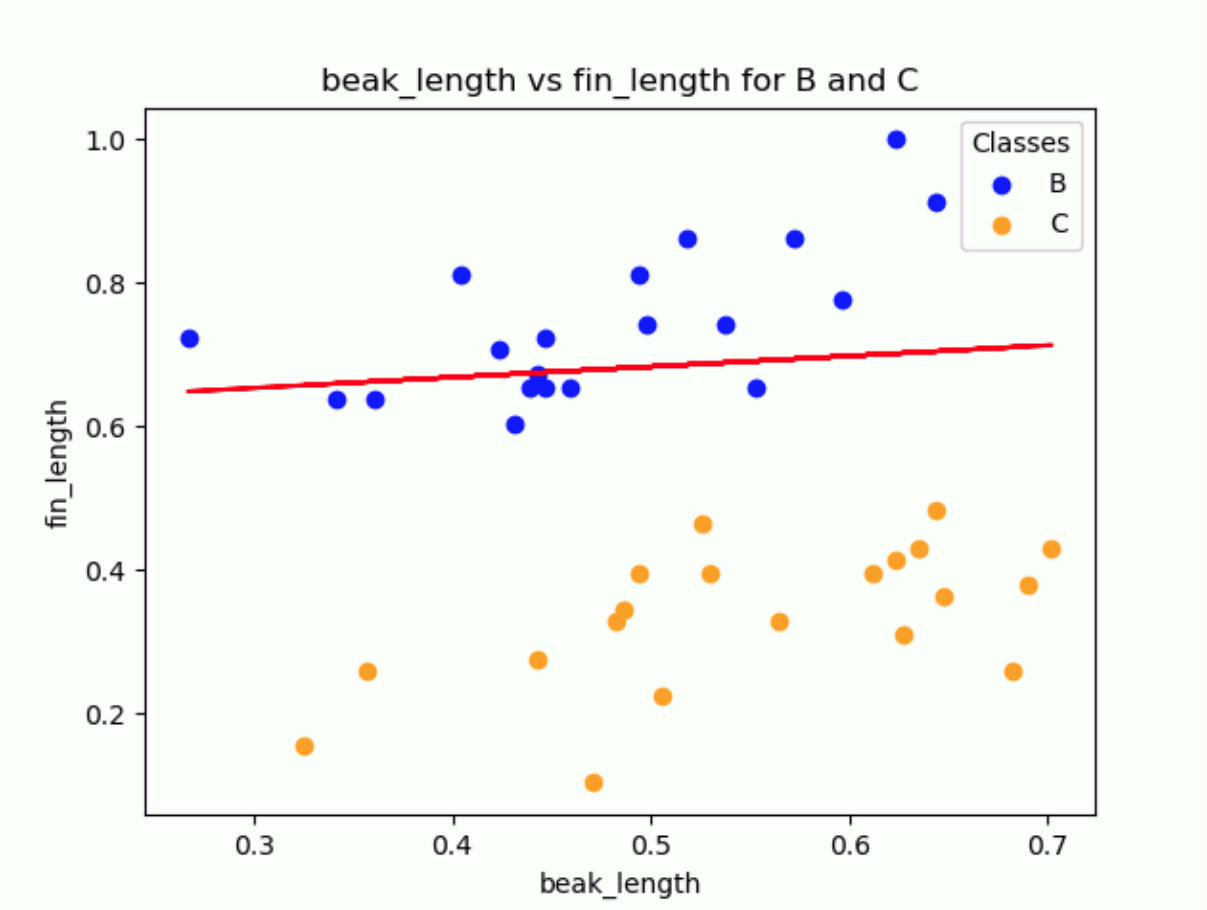
Train



30	8
0	22

Accuracy: 86%. Precision: 0.78. Recall: 1.0. F1: 0.88.

Test

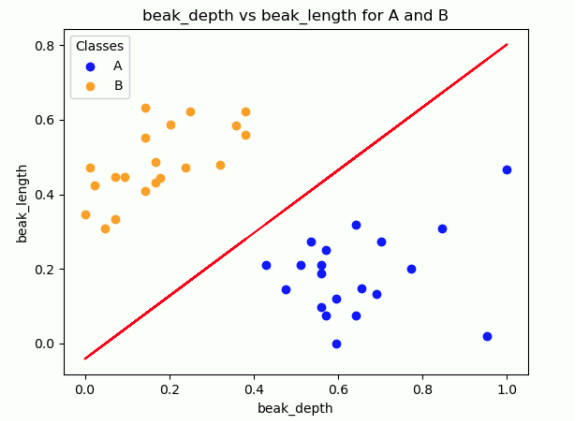
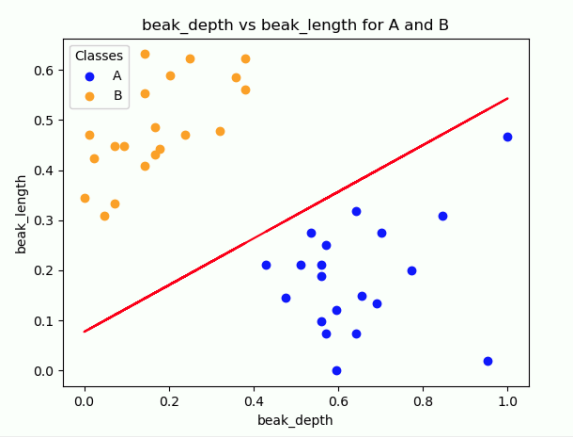
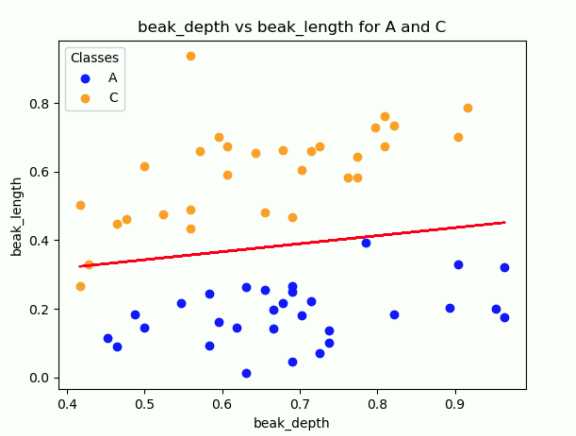
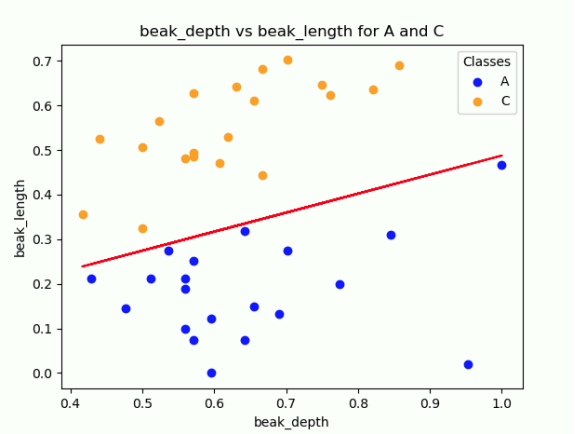
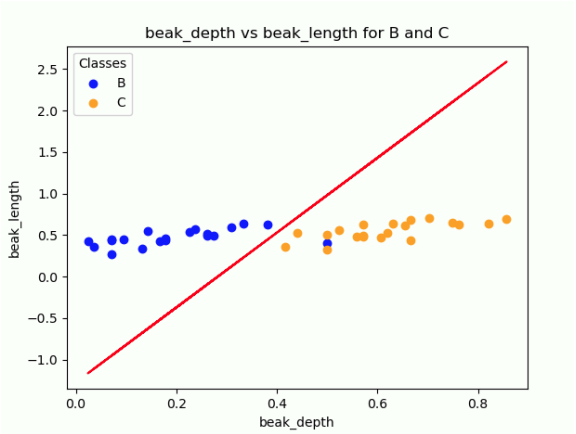
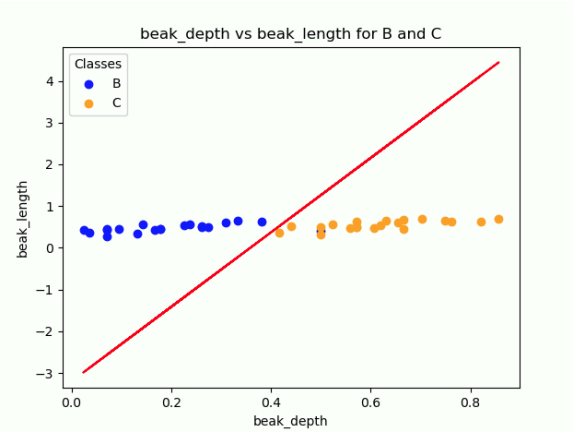


20	8
0	12

Accuracy: 80%. Precision: 0.71. Recall: 1.0. F1: 0.83. However, increasing the number of epochs from 50 to 80 results in better performance, with test accuracy = 100%.

Verdict

The best 2 features that can discriminate between all the combinations of the 3 classes are **Beak depth and Beak length.** The following table shows the performance of these two features on the test set with both algorithms and all combinations of classes.

Adaline	Perceptron
	
Accuracy= 100%	Accuracy= 100%
	
Accuracy= 98%	Accuracy = 100%
	
Accuracy = 97.5%	Accuracy = 97.5%