Perceptron Using IRIS Data Set

in JULIA

In [1]:
```
using CSV, Plots, Random
```

In [ ]:
```
iris = CSV.read("iris_data.csv")
```

Range all rows into a Data Frame of 5 columns

In [18]:
```
iris = iris[:,1:5];
```

In [19]:
```
iris
```

Out[19]: 100 rows × 5 columns

	SepalLength	SepalWidth	PetalLength	PetalWidth	Species
	Float64⍰	Float64⍰	Float64⍰	Float64⍰	String⍰
1	5.1	3.5	1.4	0.2	setosa
2	4.9	3.0	1.4	0.2	setosa
3	4.7	3.2	1.3	0.2	setosa
4	4.6	3.1	1.5	0.2	setosa
5	5.0	3.6	1.4	0.2	setosa
6	5.4	3.9	1.7	0.4	setosa
7	4.6	3.4	1.4	0.3	setosa
8	5.0	3.4	1.5	0.2	setosa
9	4.4	2.9	1.4	0.2	setosa
10	4.9	3.1	1.5	0.1	setosa
11	5.4	3.7	1.5	0.2	setosa
12	4.8	3.4	1.6	0.2	setosa
13	4.8	3.0	1.4	0.1	setosa
14	4.3	3.0	1.1	0.1	setosa
15	5.8	4.0	1.2	0.2	setosa
16	5.7	4.4	1.5	0.4	setosa
17	5.4	3.9	1.3	0.4	setosa
18	5.1	3.5	1.4	0.3	setosa
19	5.7	3.8	1.7	0.3	setosa
20	5.1	3.8	1.5	0.3	setosa
21	5.4	3.4	1.7	0.2	setosa
22	5.1	3.7	1.5	0.4	setosa
23	4.6	3.6	1.0	0.2	setosa
24	5.1	3.3	1.7	0.5	setosa
25	4.8	3.4	1.9	0.2	setosa
26	5.0	3.0	1.6	0.2	setosa
27	5.0	3.4	1.6	0.4	setosa
28	5.2	3.5	1.5	0.2	setosa
29	5.2	3.4	1.4	0.2	setosa
30	4.7	3.2	1.6	0.2	setosa
⋮	⋮	⋮	⋮	⋮	⋮

In this model we are only allowed to use two of the measurements to make our model: SepalLength SepalWidth PetalLength PetalWidth. The possible combinations are:

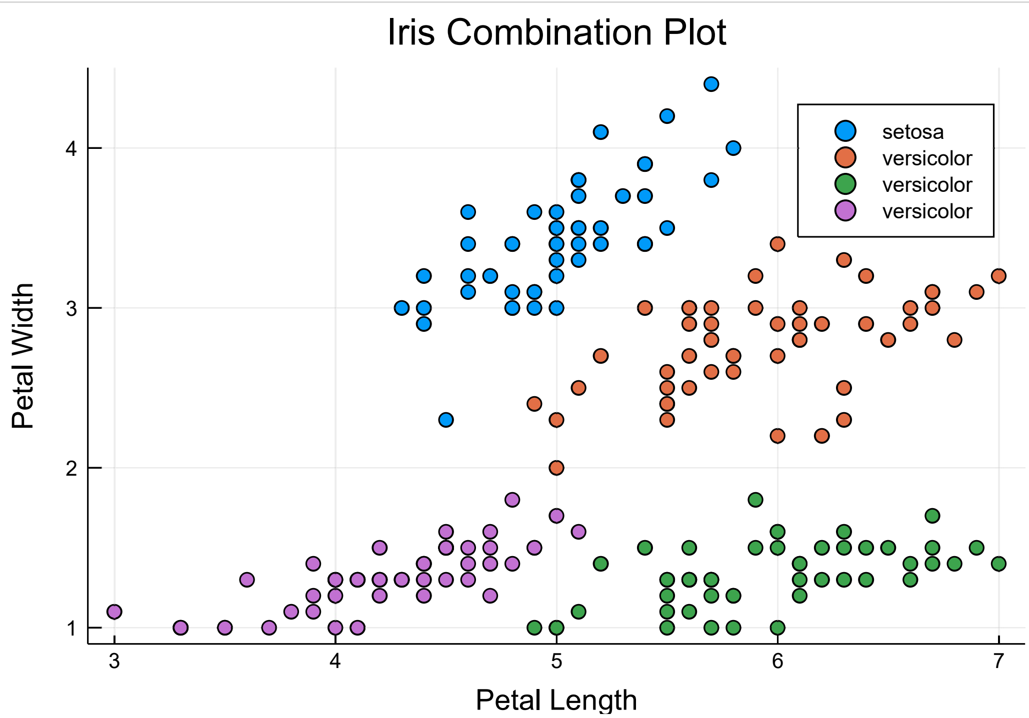
1. col(1) and col(2)
2. col(1) and col(3)
3. col(1) and col(4)
4. col(2) and col(3)
5. col(2) and col(4)
6. col(3) and col(4)

In [57]:
```
SepalLength_SepalWidth       = [x for x in zip(iris[1], iris[2], iris[5])]
SepalLength_PetalLength      = [x for x in zip(iris[1], iris[3], iris[5])]
SepalLength_PetalWidth       = [x for x in zip(iris[1], iris[4], iris[5])]
SepalWidth_PetalLength       = [x for x in zip(iris[2], iris[3], iris[5])]
SepalWidth_PetalWidth        = [x for x in zip(iris[2], iris[4], iris[5])]
PetalLength_PetalWidth       = [x for x in zip(iris[3], iris[4], iris[5])];
```

Plotting the combination of IRIS Data Set. Notice the Second Plot Lenght and Width interchange.

In [90]:
```
scatter([x[1:2] for x in SepalLength_SepalWidth if x[3] == "setosa"], label = "seto
sa")
scatter!([x[1:2] for x in SepalLength_SepalWidth if x[3] != "setosa"], label = "ver
sicolor")
scatter!([x[1:2] for x in SepalLength_PetalWidth if x[3] != "setosa"], label = "ver
sicolor")
scatter!([x[1:2] for x in PetalLength_PetalWidth if x[3] != "setosa"], label = "ver
sicolor")
plot!(title = "Iris Combination Plot", xlabel = "Petal Length", ylabel = "Petal Wid
th")
```

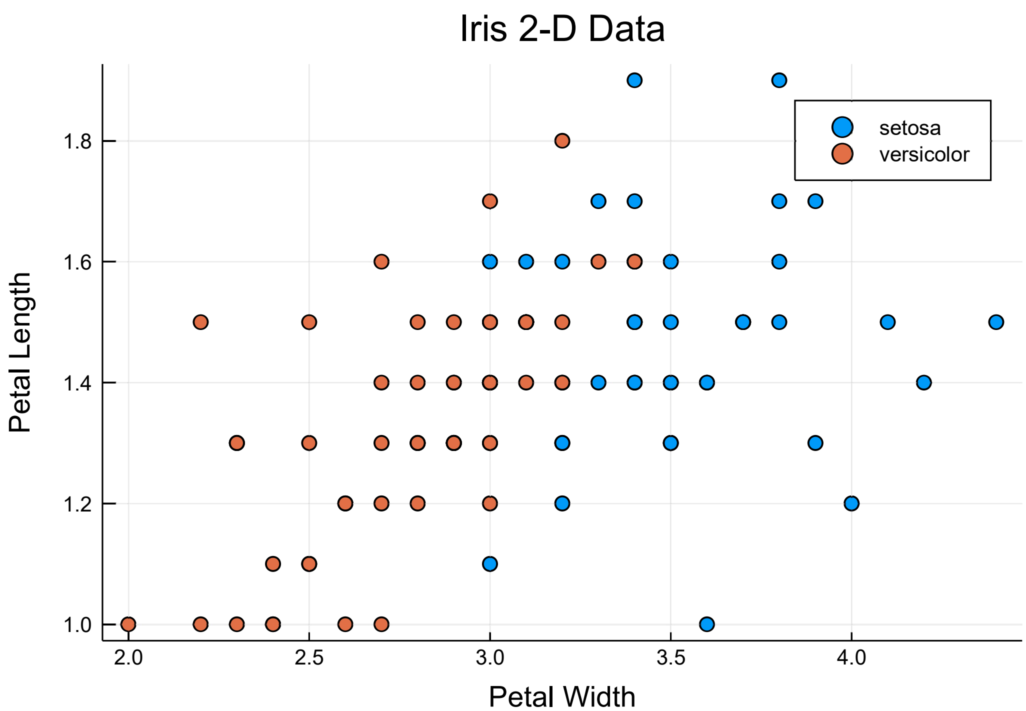
Out[90]:



Here we see that the two combinations are not separable.

In [108]:
```
scatter([x[1:2] for x in SepalWidth_PetalLength if x[3] == "setosa"], label = "setosa")
scatter!([x[1:2] for x in SepalWidth_PetalWidth if x[3] != "setosa"], label = "versicolor")
plot!(title = "Iris 2-D Data", xlabel = "Petal Width", ylabel = "Petal Length")
```

Out[108]:



Hypothesis, Learning Algorith and Predictor Functions. (ref: [https://serhanaya.github.io/neural-networks-julia-implementation/ (https://serhanaya.github.io/neural-networks-julia-implementation/)](https://serhanaya.github.io/neural-networks-julia-implementation/))

In [101]:
```
wt = rand(3)
function h(wt, x)
    x_new = [1.0, x[1], x[2]]
    return wt'x_new > 0 ? 1 : -1
end

function PLA(wt, x, y)
    if h(wt, x) != y
        wt += y*[1.0, x[1], x[2]]
    end
    return w
end

function predictor(n, wt, test)
    return h(wt, test[n]) == 1 ? "setosa" : "versicolor"
end
```

Out[101]: `predictor (generic function with 1 method)`

Takes in a data set and number of iterations. It will split the data into training and testing, train the data and make predictions. The output will be the percentage of correct predictions of your testing set.

In [104]:
```
function final_predict(data, iter)
    wt = rand(3)

    shuffled = data = data[shuffle(1:end), :]
    train = shuffled[1:80,:]
    test = shuffled[81:100,:]
    X, Y = [[x[1], x[2]] for x in train], [x[3] == "setosa" ? 1 : -1 for x in trai
n]
    for i = 1:100
        j = rand(1:80)
        wt = PLA(wt, X[j], Y[j])
    end

    accuracy_count = []
    for i = 1:iter
        n = rand(1:20)
        if predictor(n, wt, test) == test[n][3]
            push!(accuracy_count, 1)
        end
    end
    accuracy = sum(accuracy_count) / iter * 100
    return accuracy, wt
end
```

Out[104]:
```
final_predict (generic function with 1 method)
```

PREDICTION. Run each possible combination, evalute the accuracy, remember there are six of them:

Combination 1

In [105]:
```
predict , wt = final_predict(SepalLength_SepalWidth, 1000)
if predict > 90.0
    print("Comparing Sepal Length vs Sepal Width, the prediction is ", predict, "%
")
    else print("Comparing Sepal Length vs Sepal Width, the prediction is NOT good
enough")
end
```

```
Comparing Sepal Length vs Sepal Width, the prediction is NOT good enough
```

Combination 2

In [95]:
```
predict , wt = predict(SepalLength_PetalLength, 1000)
if predict > 90.0
    print("Comparing Sepal Length vs Petal Length, the prediction is ", predict, "%
")
    else print("Comparing Sepal Length vs Petal Length, the prediction is NOT good
enough")
end
```

```
Comparing Sepal Length vs Petal Length, the prediction is NOT good enough
```

Combination 3

In [96]:
```
predict , wt = predict(SepalLength_PetalWidth, 1000)
if predict > 90.0
    print("Comparing Sepal Length vs Petal Width, the prediction is ", predict, "%"
)
    else print("Comparing Sepal Length vs Petal Width, the prediction is NOT good e
nough")
end
```

```
Comparing Sepal Length vs Petal Width, the prediction is NOT good enough
```

Combination 4

In [97]:
```
predict , wt = predict(SepalWidth_PetalLength, 1000)
if predict > 90.0
    print("Comparing Sepal Width vs Petal Length, the prediction is ", predict, "%"
)
    else print("Comparing Sepal Width vs Petal Length, the prediction is NOT good e
nough")
end
```

```
Comparing Sepal Width vs Petal Length, the prediction is NOT good enough
```

Combination 5

In [98]:
```
predict , wt = predict(SepalWidth_PetalWidth, 1000)
if predict > 90.0
    print("Comparing Sepal Width vs Petal Width, the prediction is ", predict, "%")
    else print("Comparing Sepal Width vs Petal Width, the prediction is NOT good en
ough")
end
```

```
Comparing Sepal Width vs Petal Width, the prediction is NOT good enough
```

Combination 6

In [99]:
```
predict , wt = predict(PetalLength_PetalWidth, 1000)
if predict > 90.0
    print("Comparing Petal Length vs Petal Width, the prediction is ", predict, "%"
)
    else print("Comparing Petal Length vs Petal Width, the prediction is NOT good e
nough")
end
```

```
Comparing Petal Length vs Petal Width, the prediction is 100.0%
```

The hypothesis conclusion is that PetalLenght vs PetalWidth gives the best linearly separated data as shown in the plot below:

In [107]:

```
scatter([x[1:2] for x in PetalLength_PetalWidth if x[3] == "setosa"], label = "set
osa")
scatter!([x[1:2] for x in PetalLength_PetalWidth if x[3] != "setosa"], label = "ve
rsicolor")
plot!(title = "Iris 2-D Data", xlabel = "Petal Length", ylabel = "Petal Width")
plot!(x -> (-wt[1]-wt[2]*x)/wt[3], label= "learned seperator")
```

Out[107]: