Leafs

Kaisa Roggeveen, Scott Graham

March 22nd 2018

Addressed to: Steven Vamosi University of Calgary

Introduction

Background information about pear and cherry tree leaves. Midrib is the central vein of a leaf.

Data

Measurement Process

The first step taken in the measurement of the leaves was to give each leaf an identification number based on the species. The method used to meausre the dimensions was to create a box with the minimum length and width in which the entire leaf would be encompassed in the box.

To begin creating the sides of the box, a ruler was aligned parallel to the midrib, which is the central vein in the leaf and moved towards the left and the right of the picture until only one point on the leaf remained [reference]. From the single point on the side of the leaf, a line was drawn parallel to the midrib of the leaf.

Next, the base and point of the leaf were measured, a ruler was placed perpendicular to the midrib and the ruler was moved towards to tip of the leaf until a single point remained, a line was draw perpendicular to the midrib at this point. At the base of the leaves the length of the leaf was set as the point where the leaf ends and the stem begins, at this point a line was drawn perpendicular to the midrib.

After all the boxes were created, the width (lines parallel to midrib) and the length (lines perpendicular to midrib) were measured and the results were recorded in a spread sheet.

Data Creation

Type	Length	Width
Cherry	11.5	5.9
Cherry	16.7	9.1
Cherry	10.4	4.9
Cherry	18.1	8.4
Cherry	19.3	6.5
Cherry	12.2	8.0
Cherry	10.3	5.3
Cherry	9.9	4.3
Cherry	9.6	6.8
Cherry	19.2	10.4
Cherry	12.8	6.2
Cherry	12.1	8.3
Cherry	12.5	6.2
Cherry	8.3	4.3

Type	Length	Width
Cherry	6.9	4.5
Cherry	9.2	5.5
Pear	5.3	3.1
Pear	6.9	6.2
Pear	9.2	8.9
Pear	8.5	7.5
Pear	8.2	4.1
Pear	5.7	4.0
Pear	5.8	5.1
Pear	16.8	9.9
Pear	6.1	5.9
Pear	8.9	4.1
Pear	6.4	4.4
Pear	18.8	15.2

Type	Length	Width
Cherry:16	Min. : 5.300	Min. : 3.100
Pear :12	1st Qu.: 7.875	1st Qu.: 4.475
NA	Median : 9.750	Median : 6.050
NA	Mean :10.914	Mean : 6.536
NA	3rd Qu.:12.575	3rd Qu.: 8.075
NA	Max. :19.300	Max. :15.200

Classification Procedure

Training Data

New Data

Observation Space

Figure XX: Length vs Width Scatter Plot

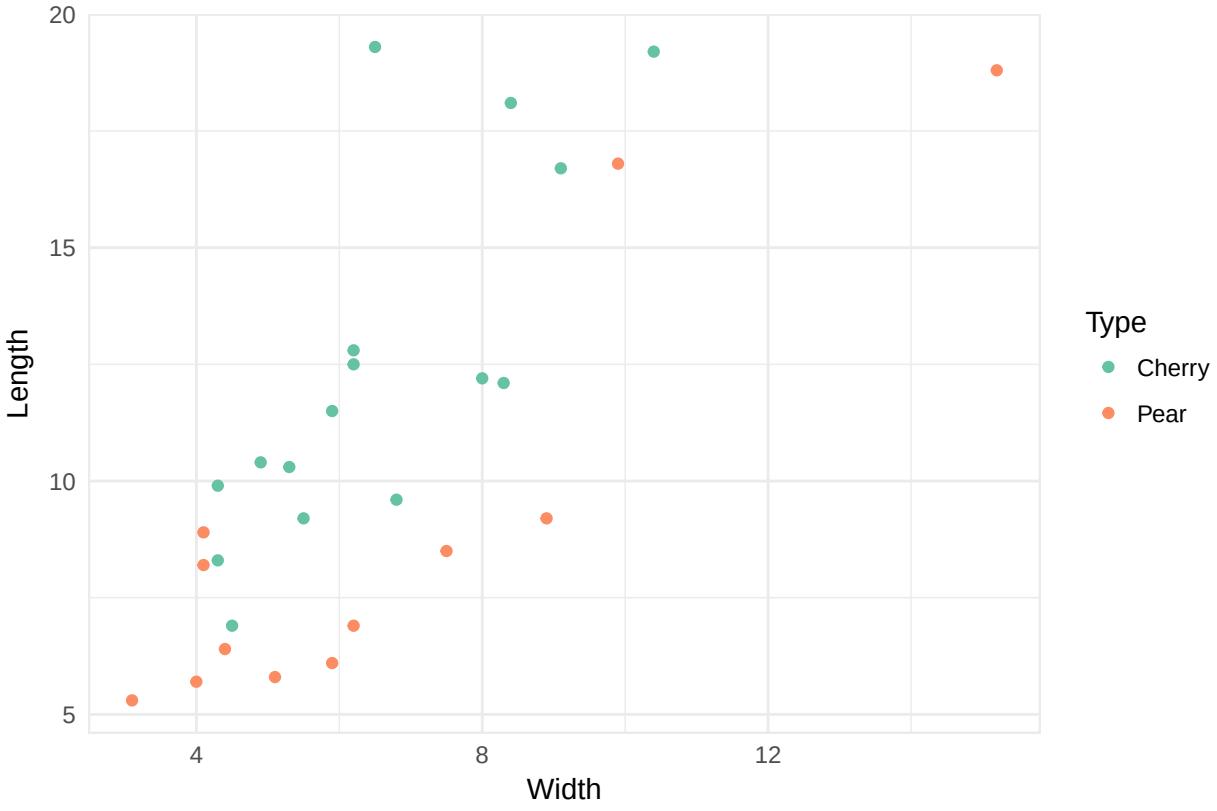


Figure XX: Length vs Width Scatter Plot

Overlayed with the Contour Plot

Figure XX: Length vs Width Scatter Plot

Overlayed with a Contour Plot of that Type

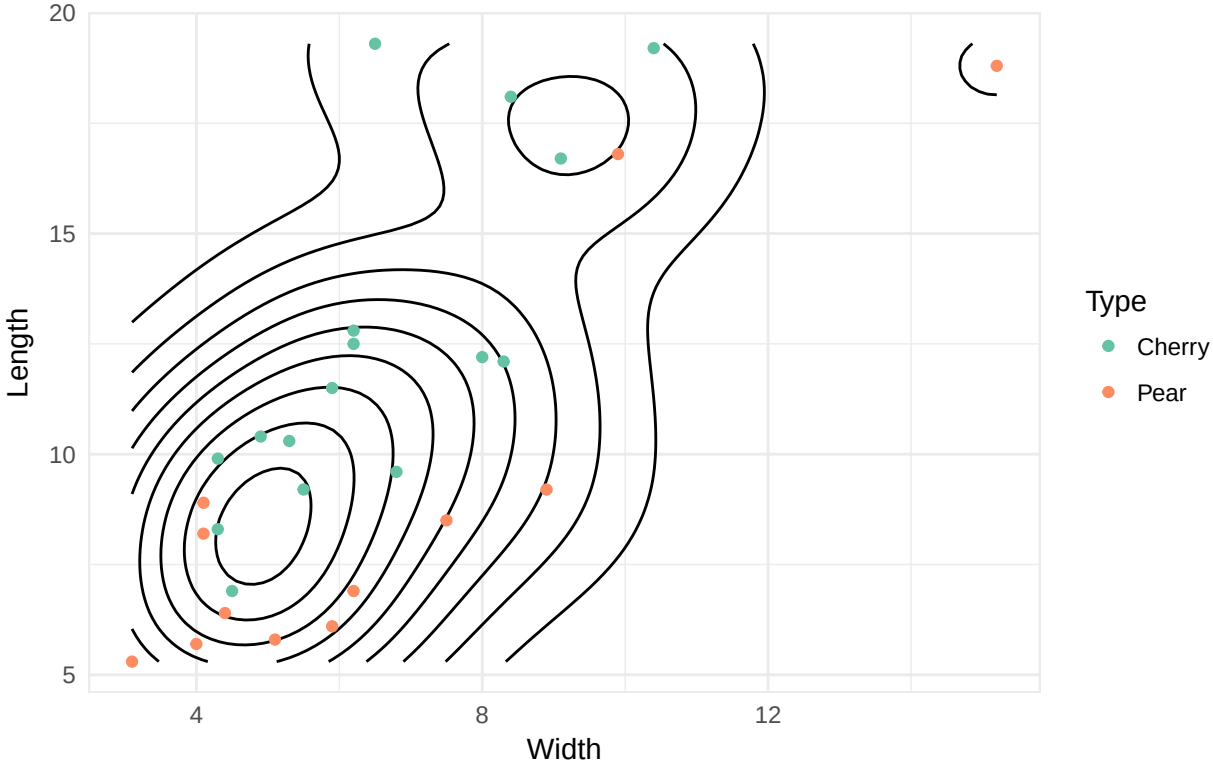
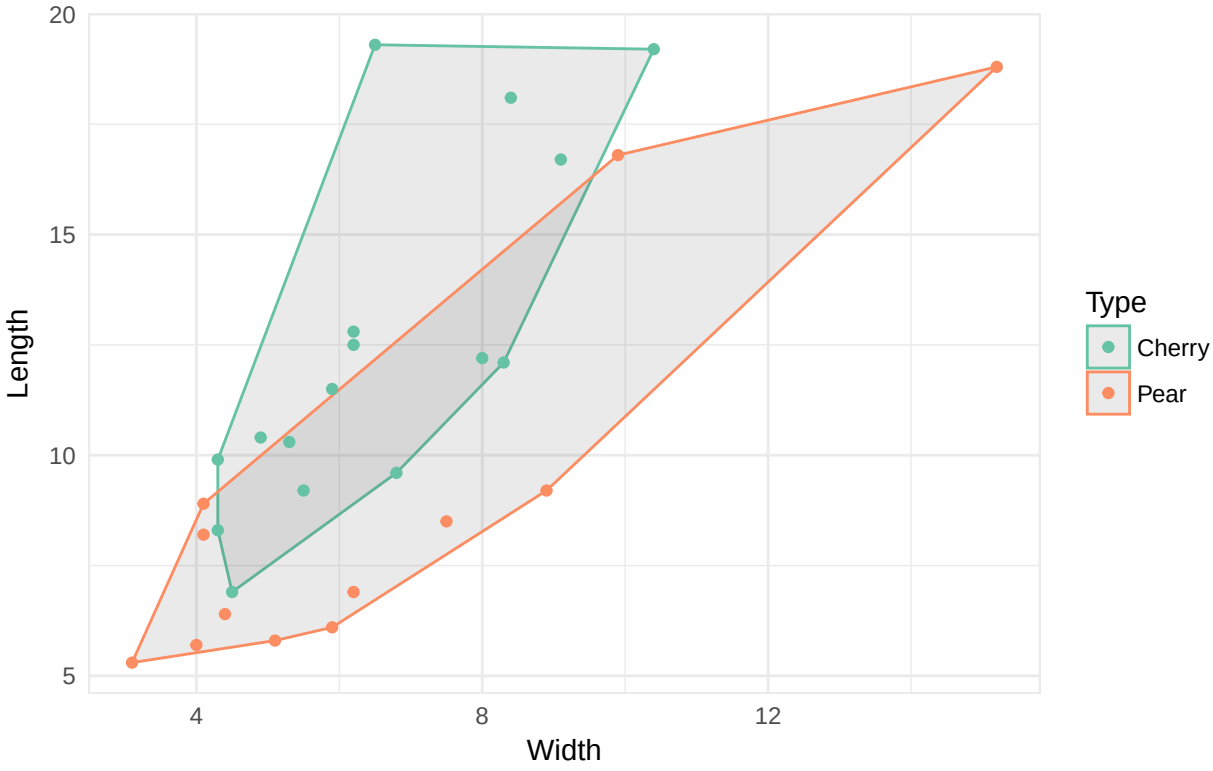


Figure XX: Length vs Width Scatter Plot

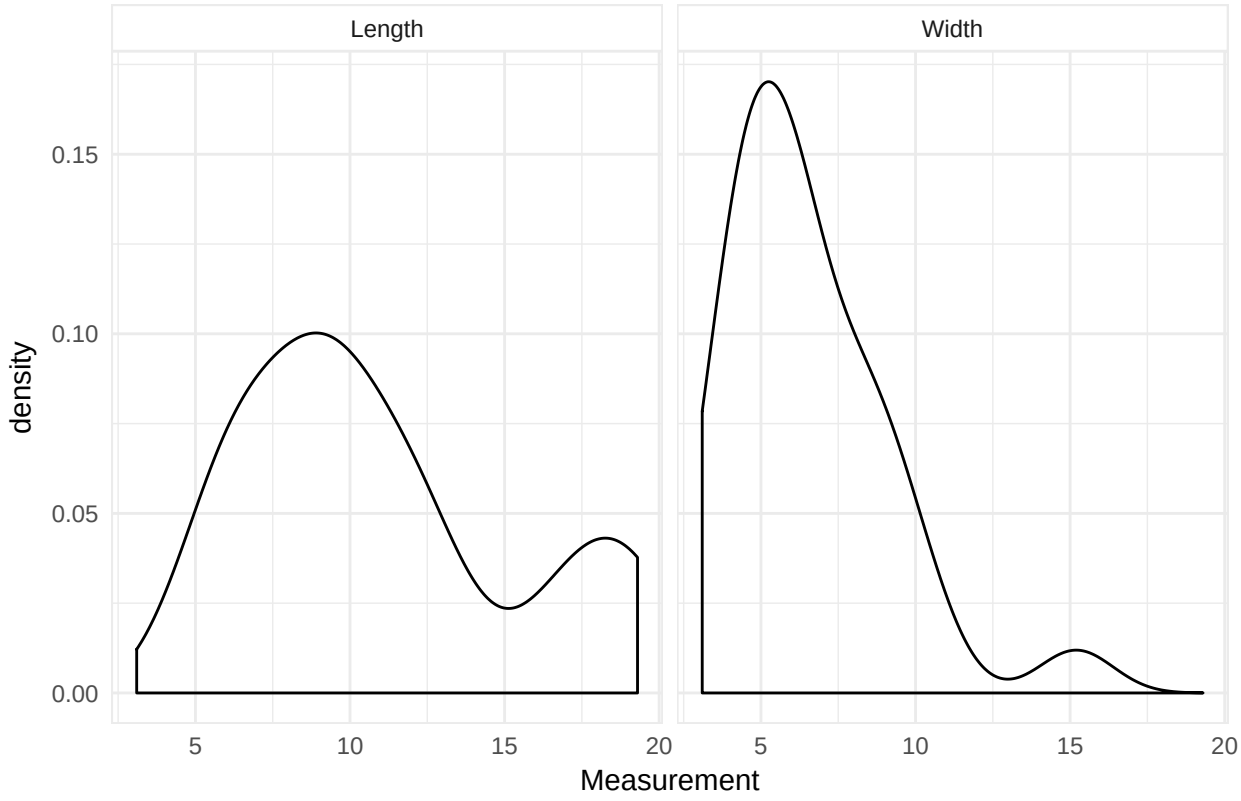
Overlayed with the Convex Hull of that Type




```
## Warning: Computation failed in `stat_bin()`:
## is.numeric(width) is not TRUE

## Warning: Computation failed in `stat_bin()`:
## is.numeric(width) is not TRUE
```

Figure XX: Density Plot



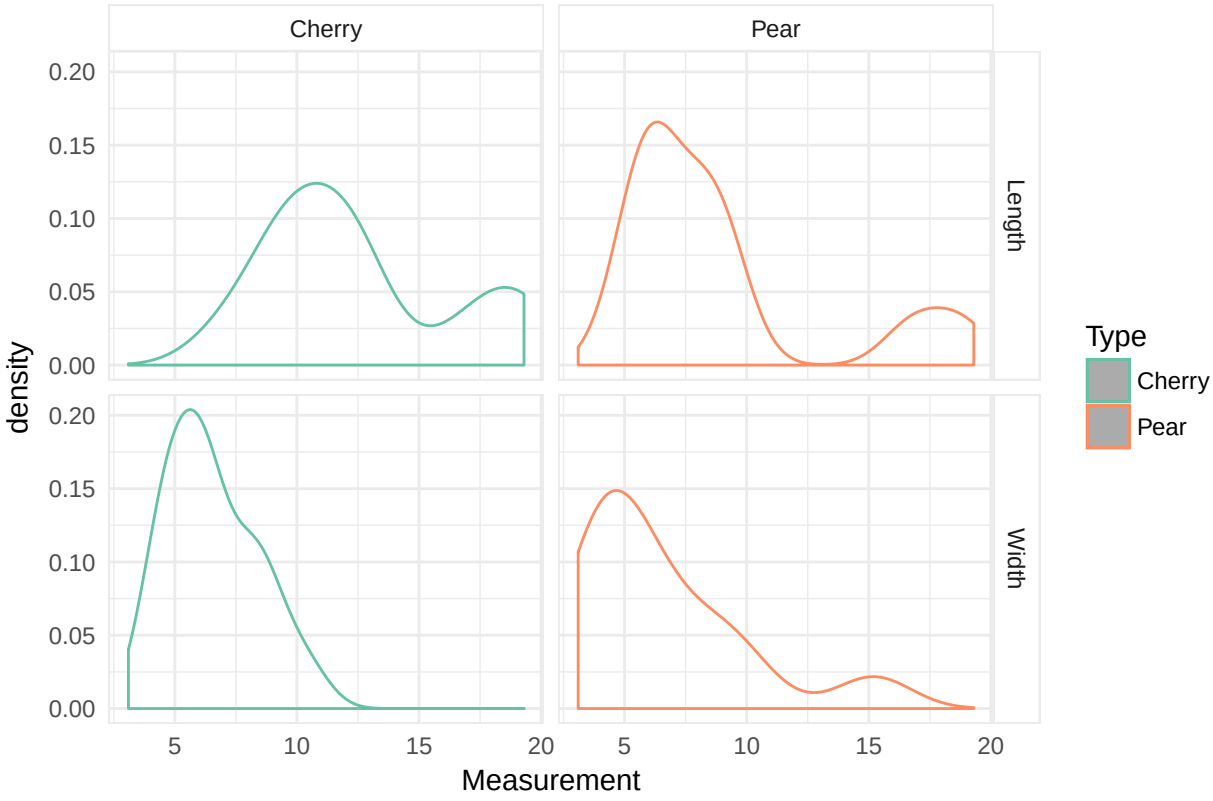

```
## Warning: Computation failed in `stat_bin()`:
## is.numeric(width) is not TRUE

## Warning: Computation failed in `stat_bin()`:
## is.numeric(width) is not TRUE

## Warning: Computation failed in `stat_bin()`:
## is.numeric(width) is not TRUE

## Warning: Computation failed in `stat_bin()`:
## is.numeric(width) is not TRUE
```

Figure XX: Density Plot by Type



Covariance Matrix

Table 3: Shared Covariance Matrix

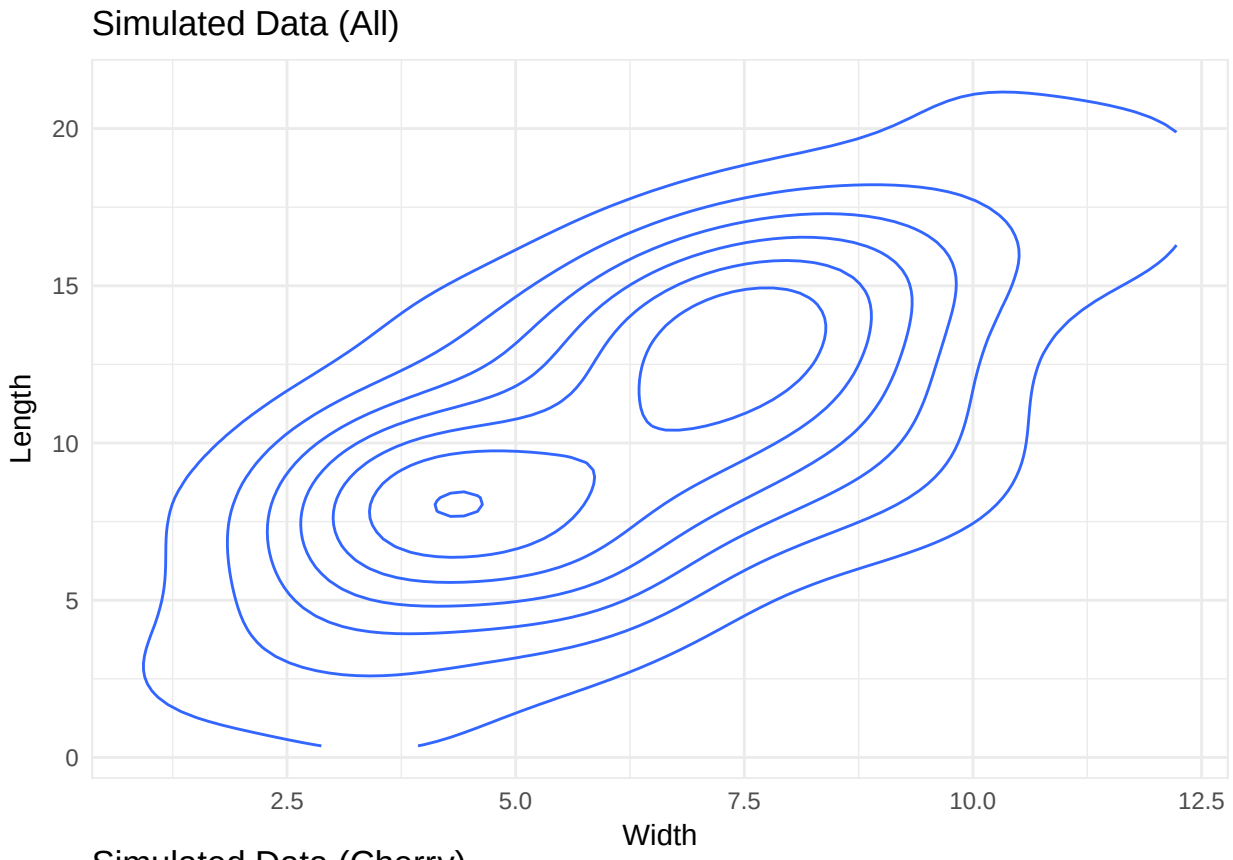
	Length	Width
Length	19.422011	8.476508
Width	8.476508	6.685344

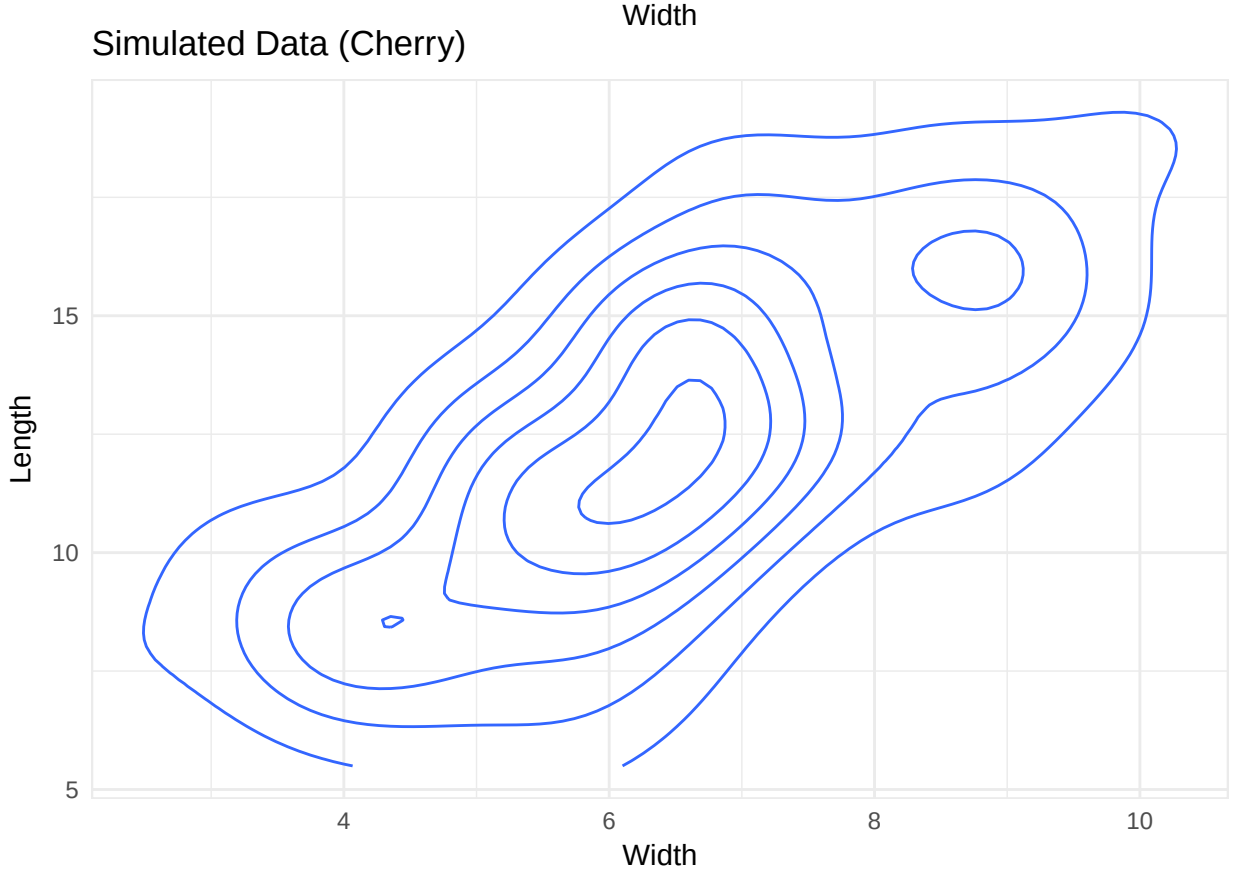
Table 4: Cherry Covariance Matrix

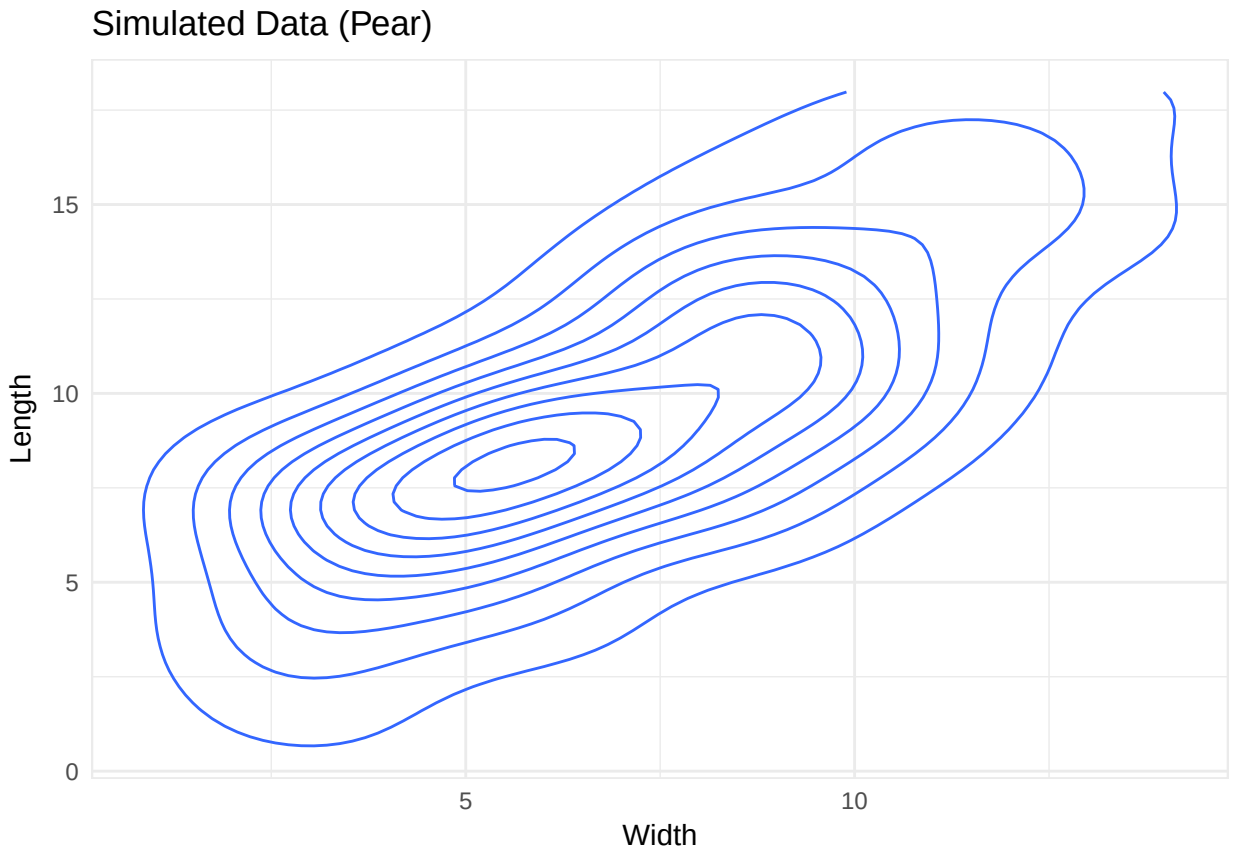
	Length	Width
Length	15.047833	5.443833
Width	5.443833	3.357167

Table 5: Pear Covariance Matrix

	Length	Width
Length	19.27788	13.37333
Width	13.37333	11.83152


Simulated Data (All)
Length
Width
0
5
10
15
20
2.5
5.0
7.5
10.0
12.5


Simulated Data (Cherry)
Length
Width
5
10
15
4
6
8
10



Number	Length	Width
1	8.2	3.2
2	5.2	3.8
3	7.6	4.0

Length	Width	Density
6.9000	4.3	0.0124
7.6592	4.3	0.0163
8.1653	4.3	0.0186

Length	Width	Density
5.3000	3.1000	0.0179
7.5041	3.1000	0.0168
8.3306	3.1000	0.0135
5.3000	3.8408	0.0216
7.5041	3.8408	0.0213
8.3306	3.8408	0.0169
5.3000	4.0878	0.0223
7.5041	4.0878	0.0224
8.3306	4.0878	0.0177

Conclusion