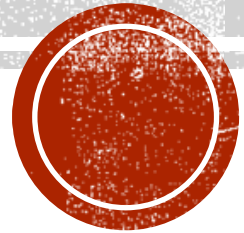
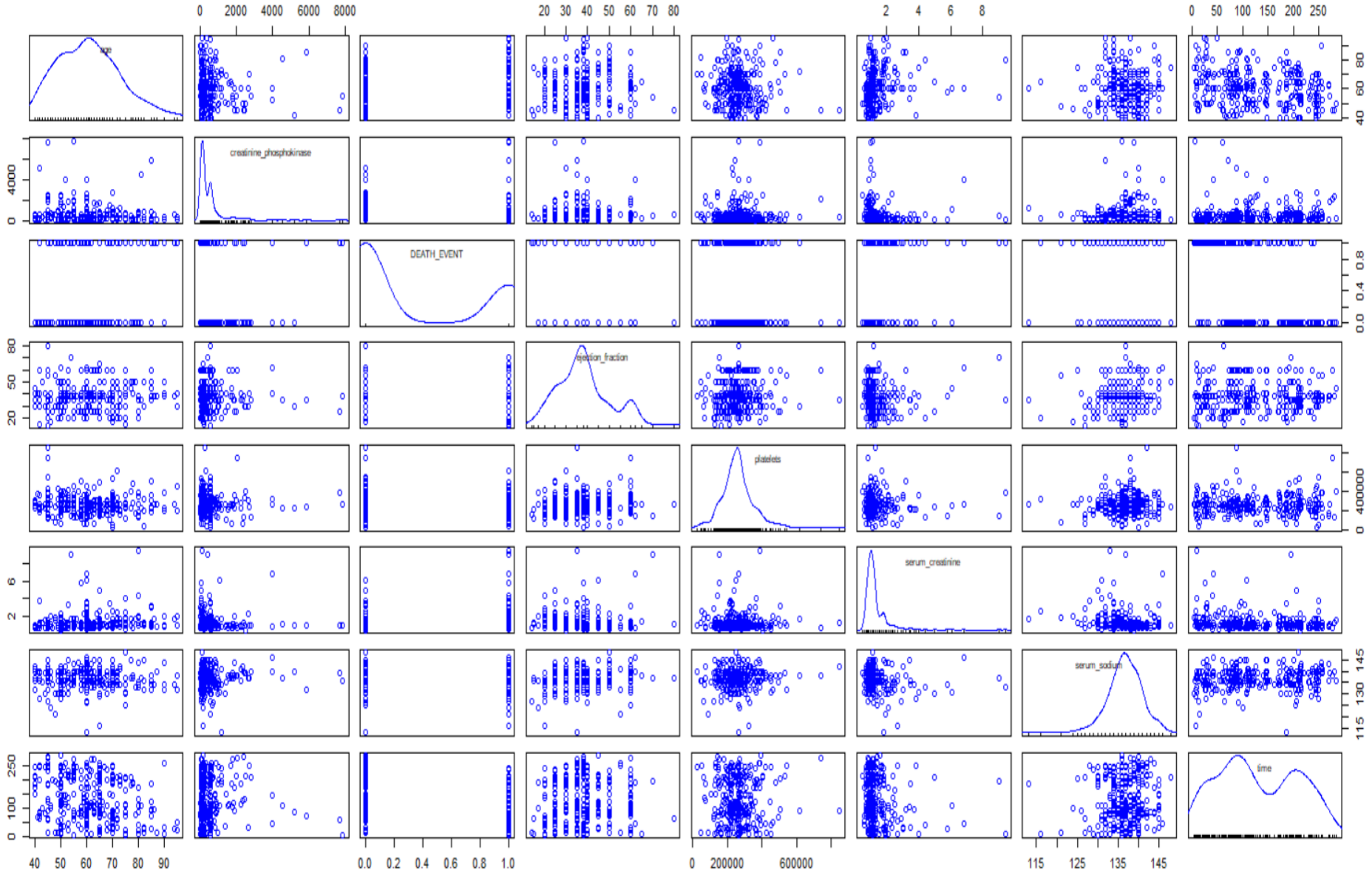
MACHINE LEARNING FOR BUSINESS

MEDICAL ANALYSIS

1.VISUALIZATIONS

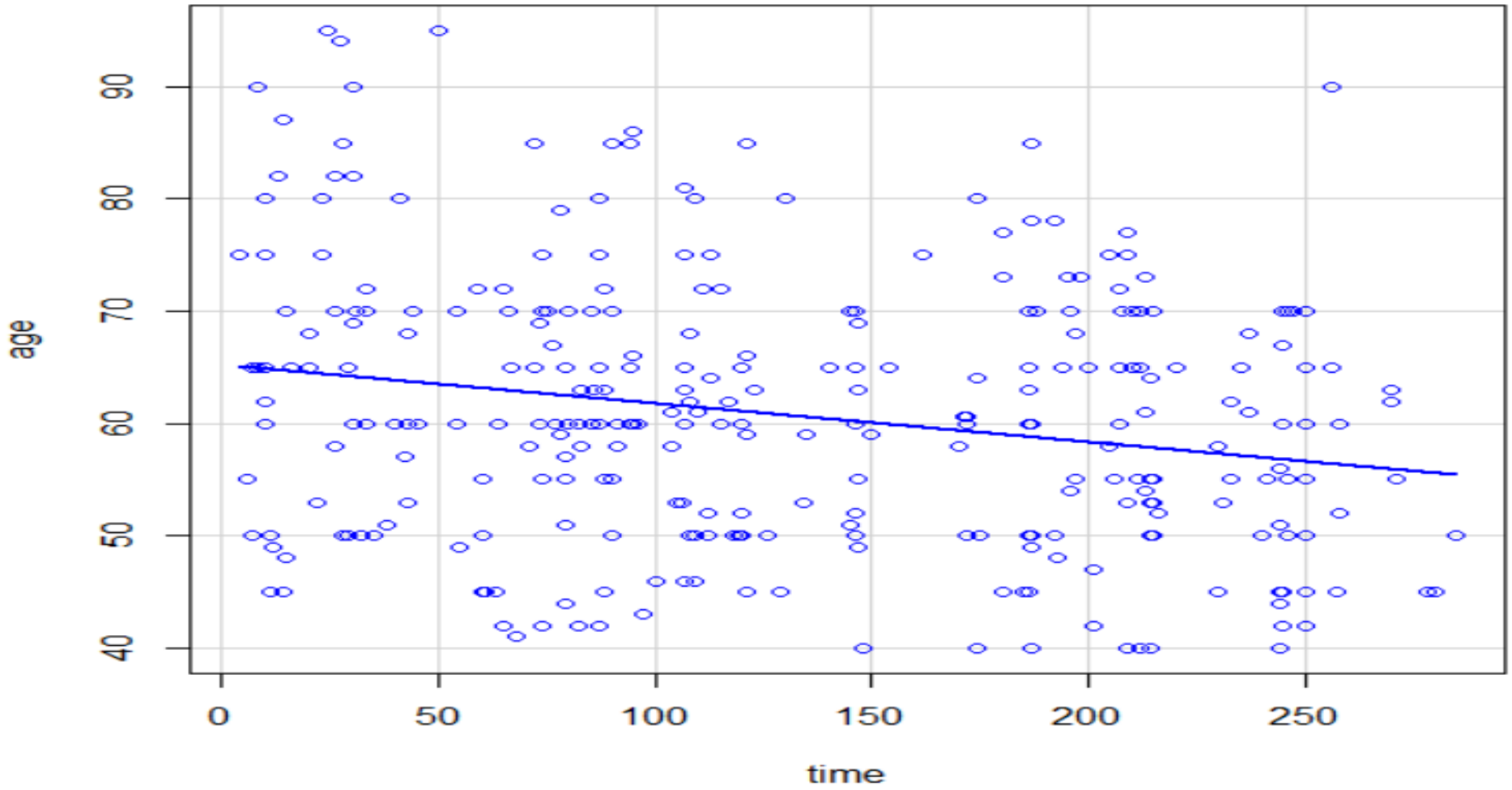


SCATTERPLOT MATRIX OF DEATH EVENT V/S CONTINUOUS VARIABLES

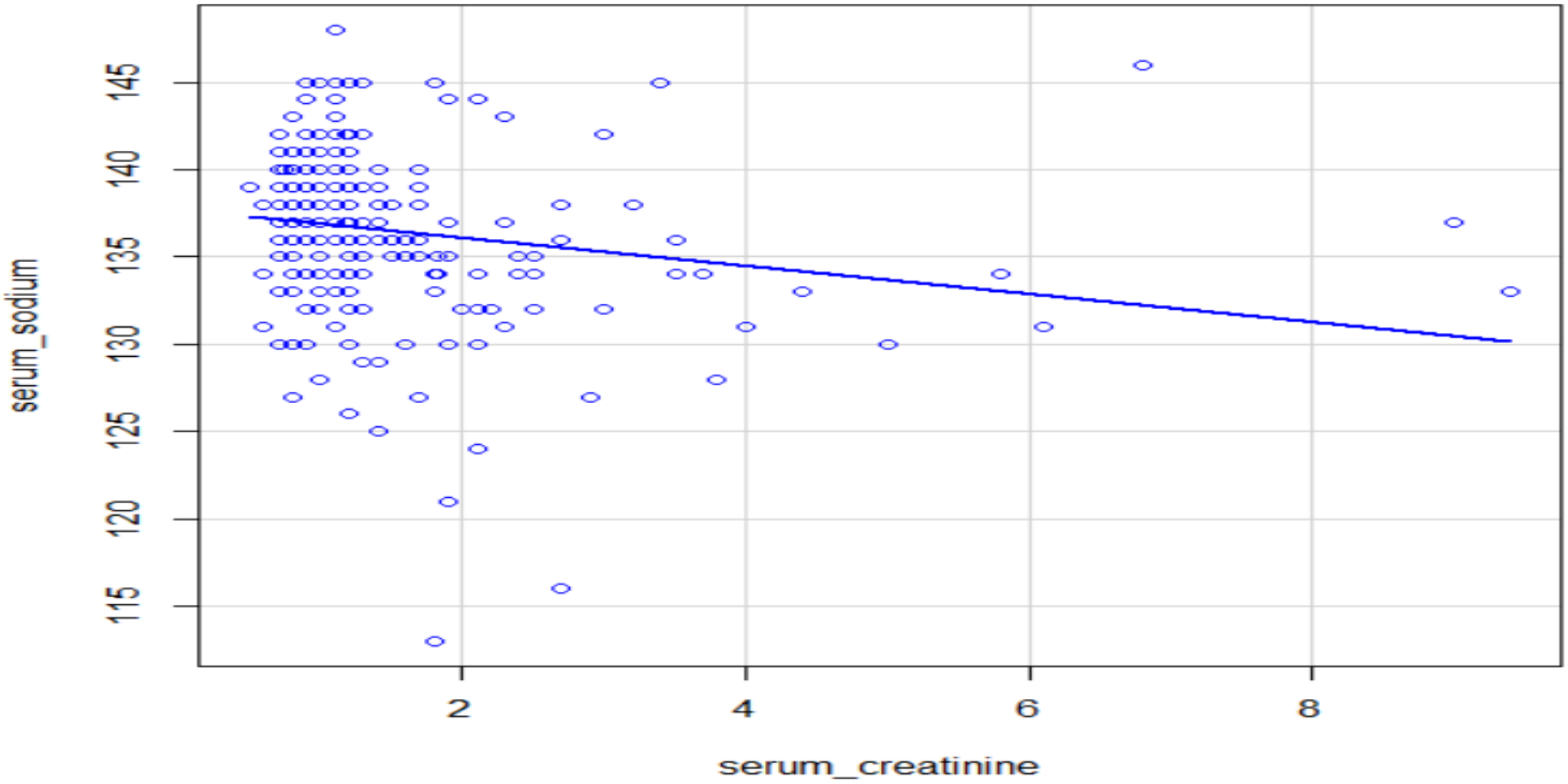


GRAPHS WITH STRONG RELATIONSHIP BETWEEN CONTINUOUS X VARIABLES

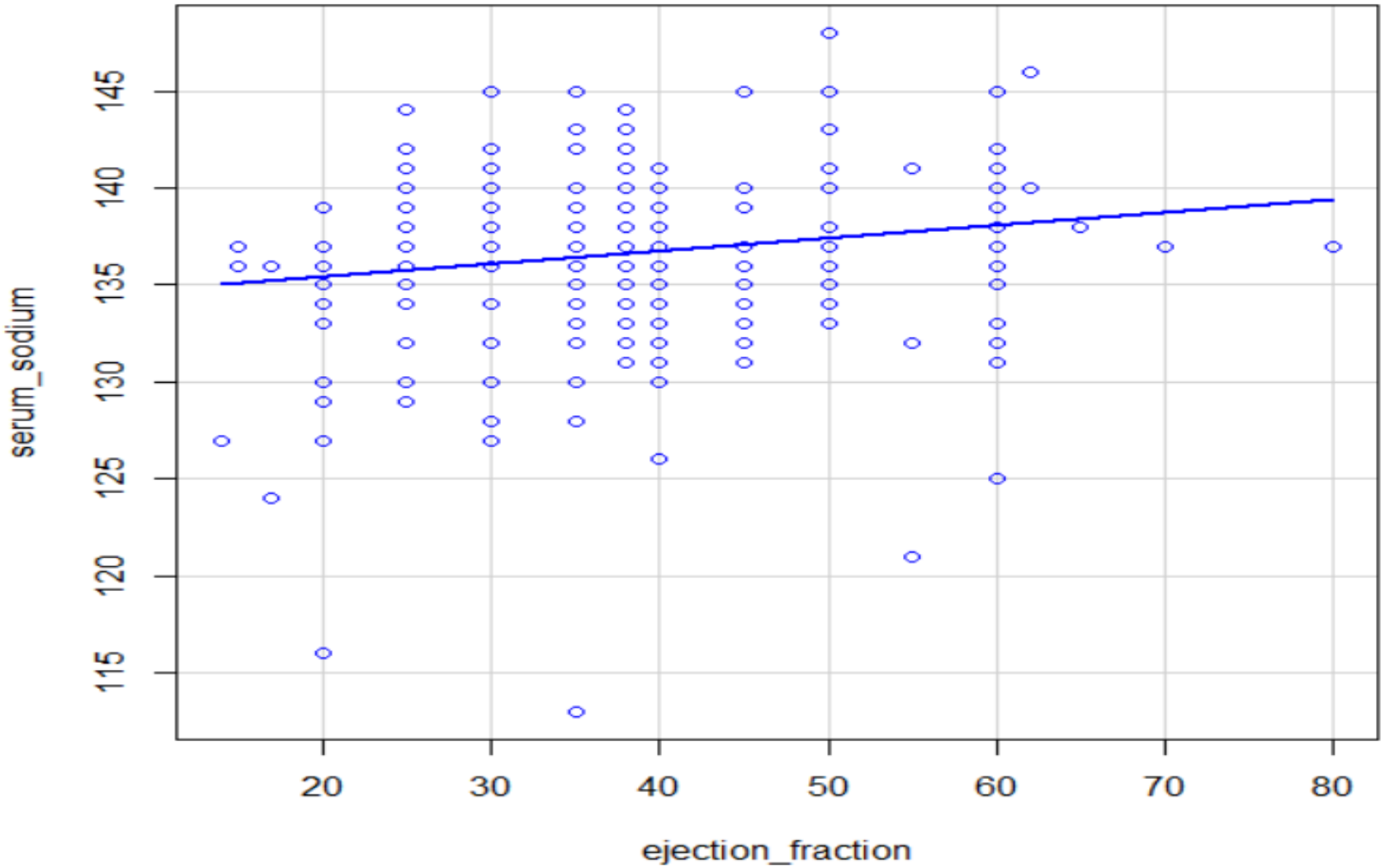
1.AGE V/S TIME



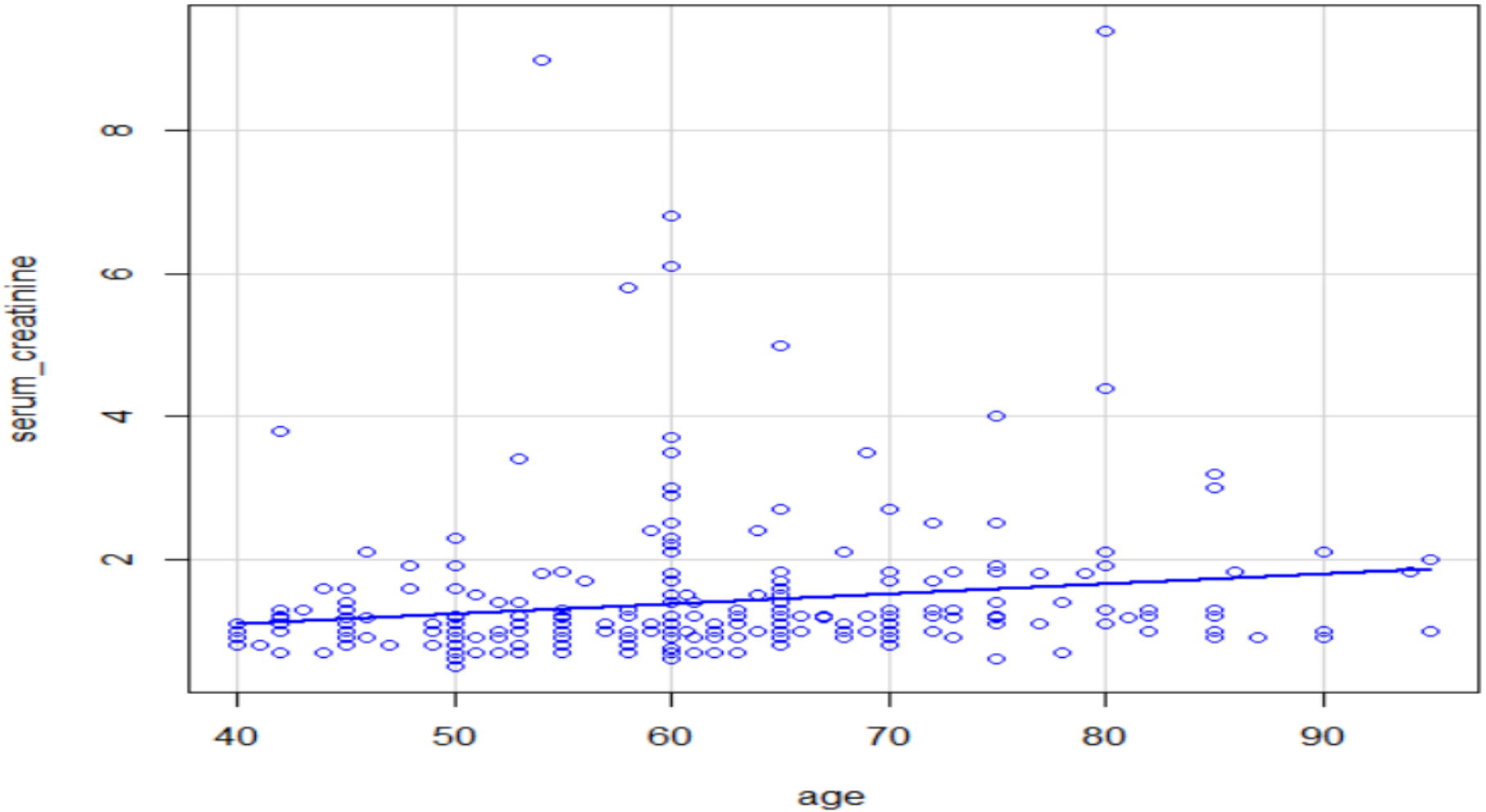
2.SERUM_CREATININE V/S SERUM_SODIUM



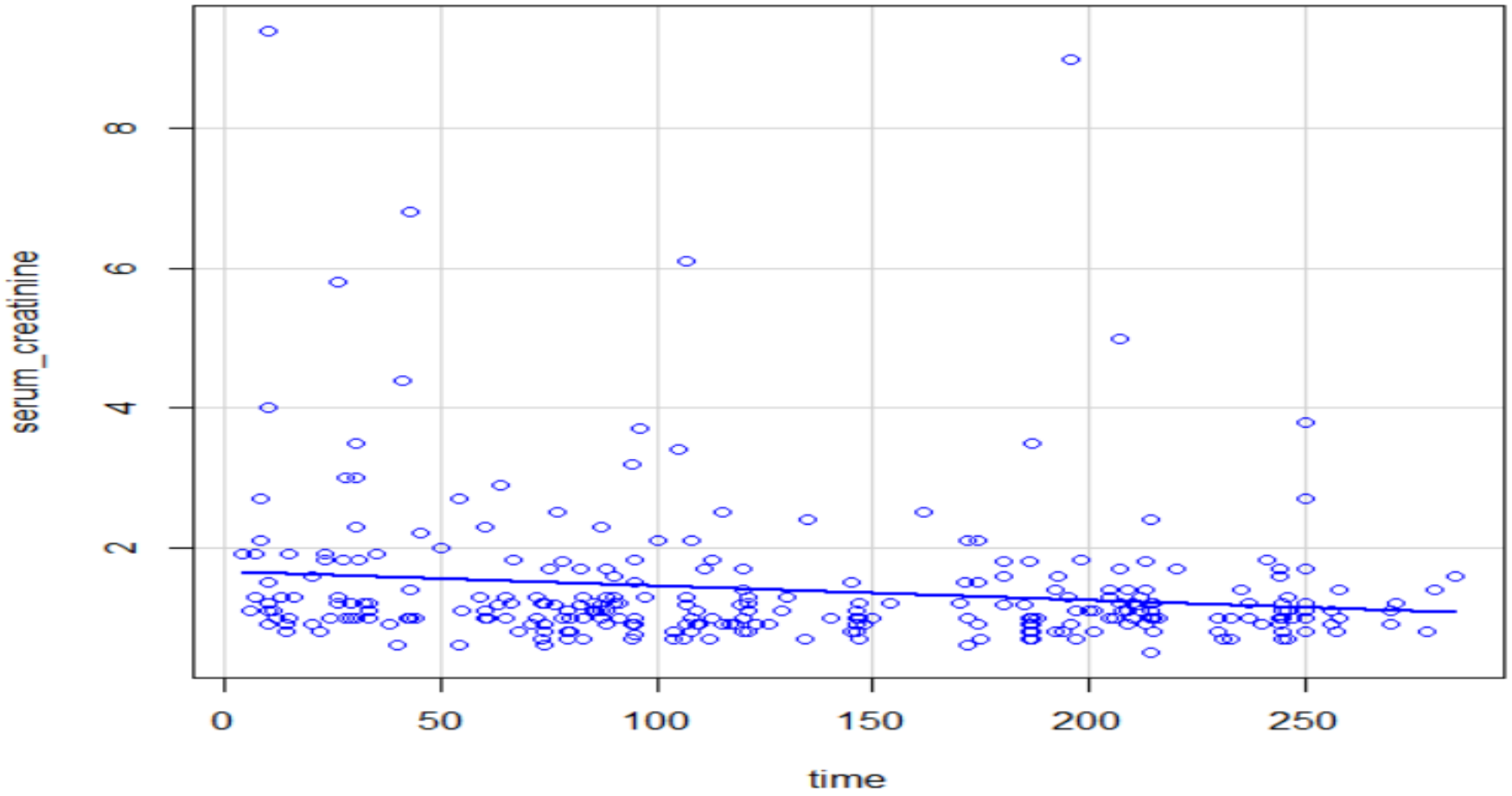
3.EJECTION_FRACTION V/S SERUM_SODIUM

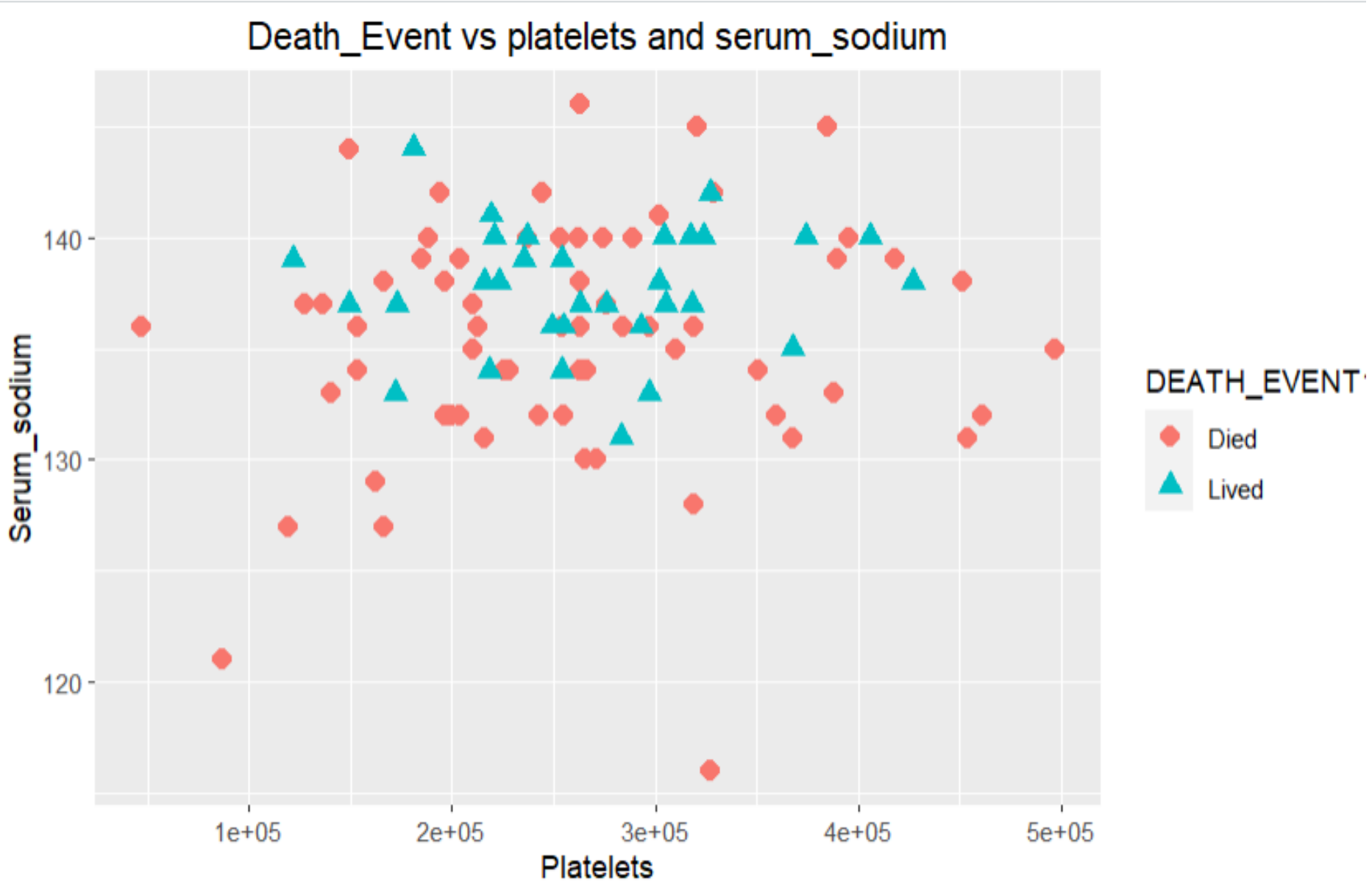


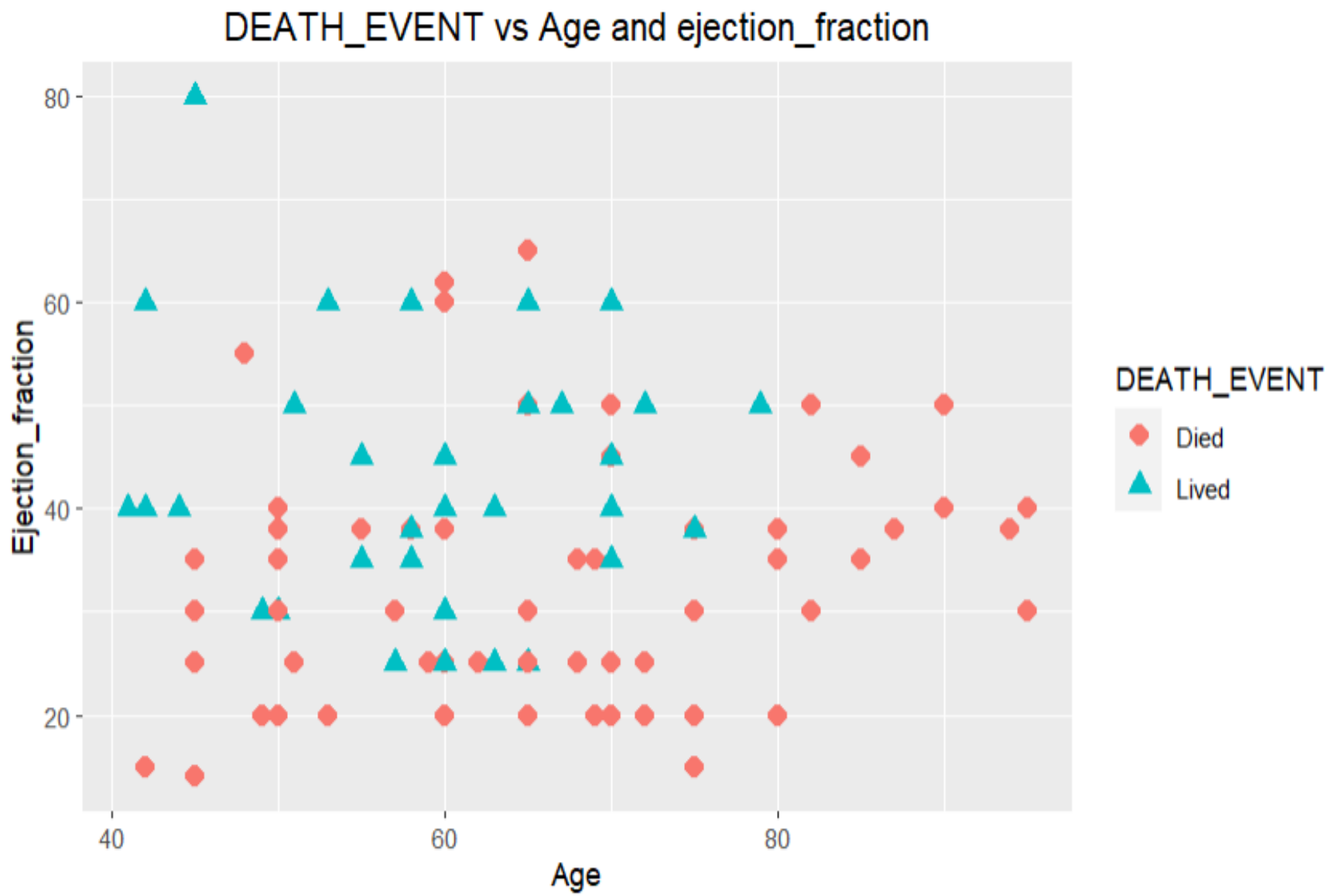
4.AGE V/S SERUM_CRETANINE

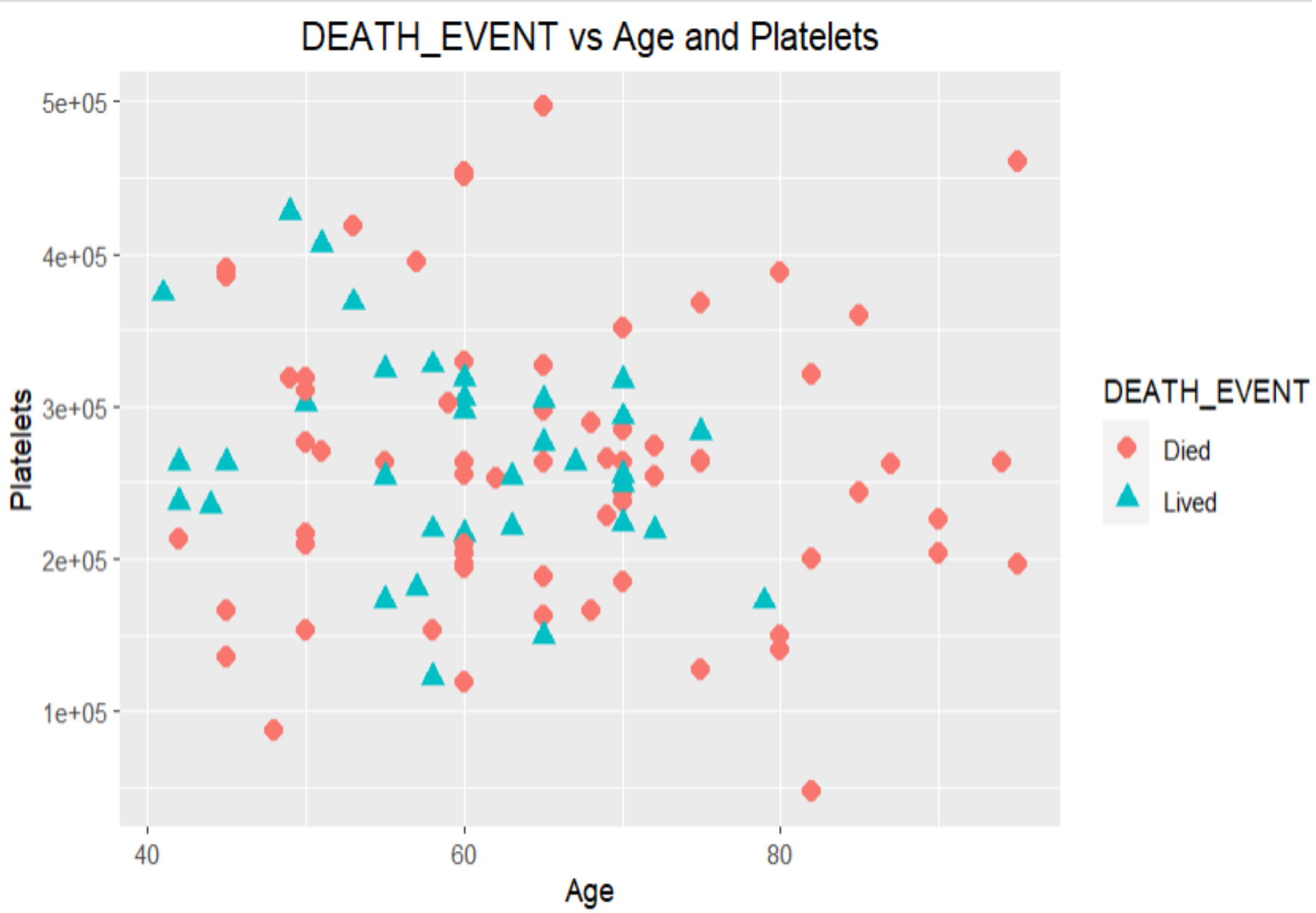


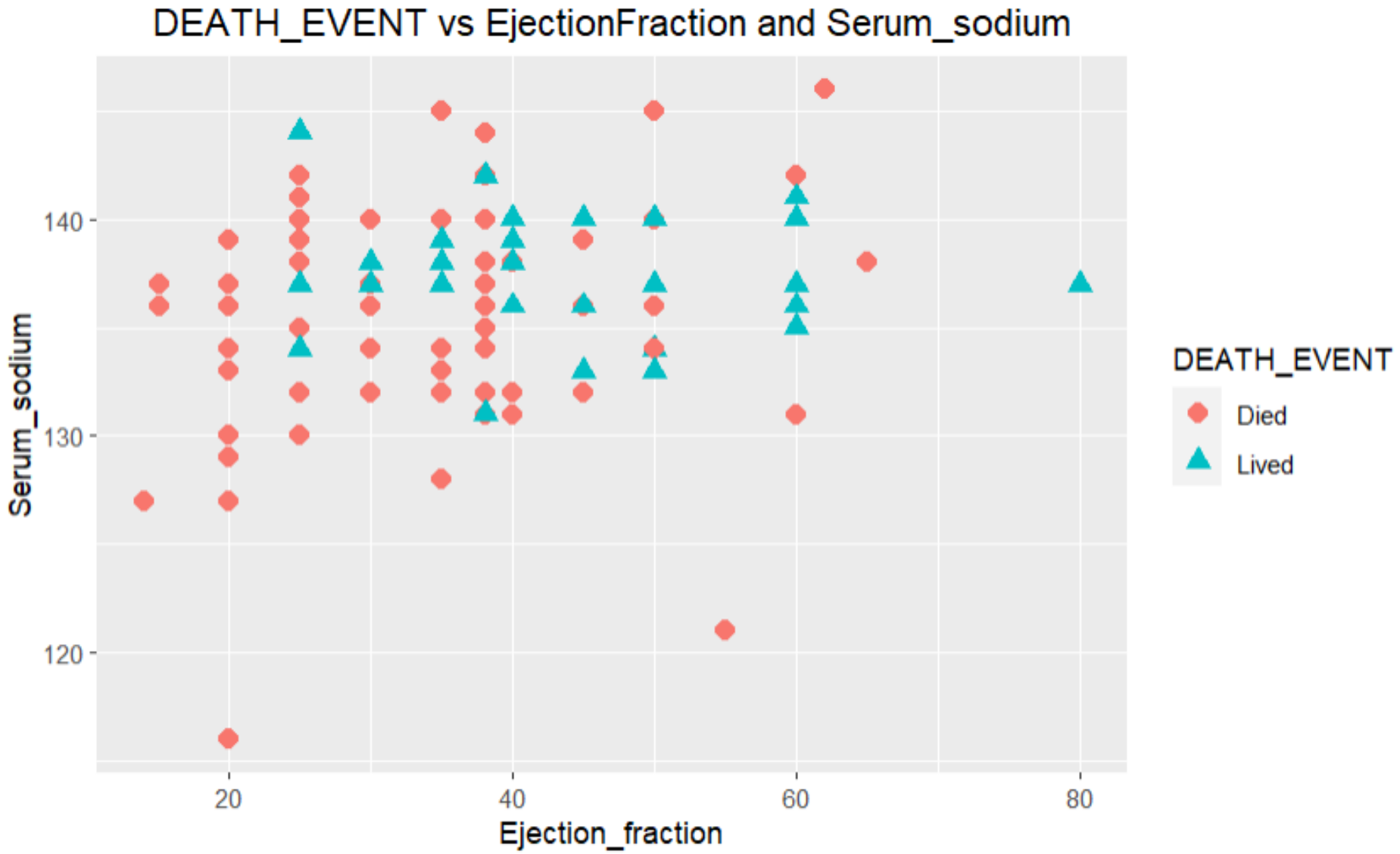
5.TIME V/S SERUM_CREATININE

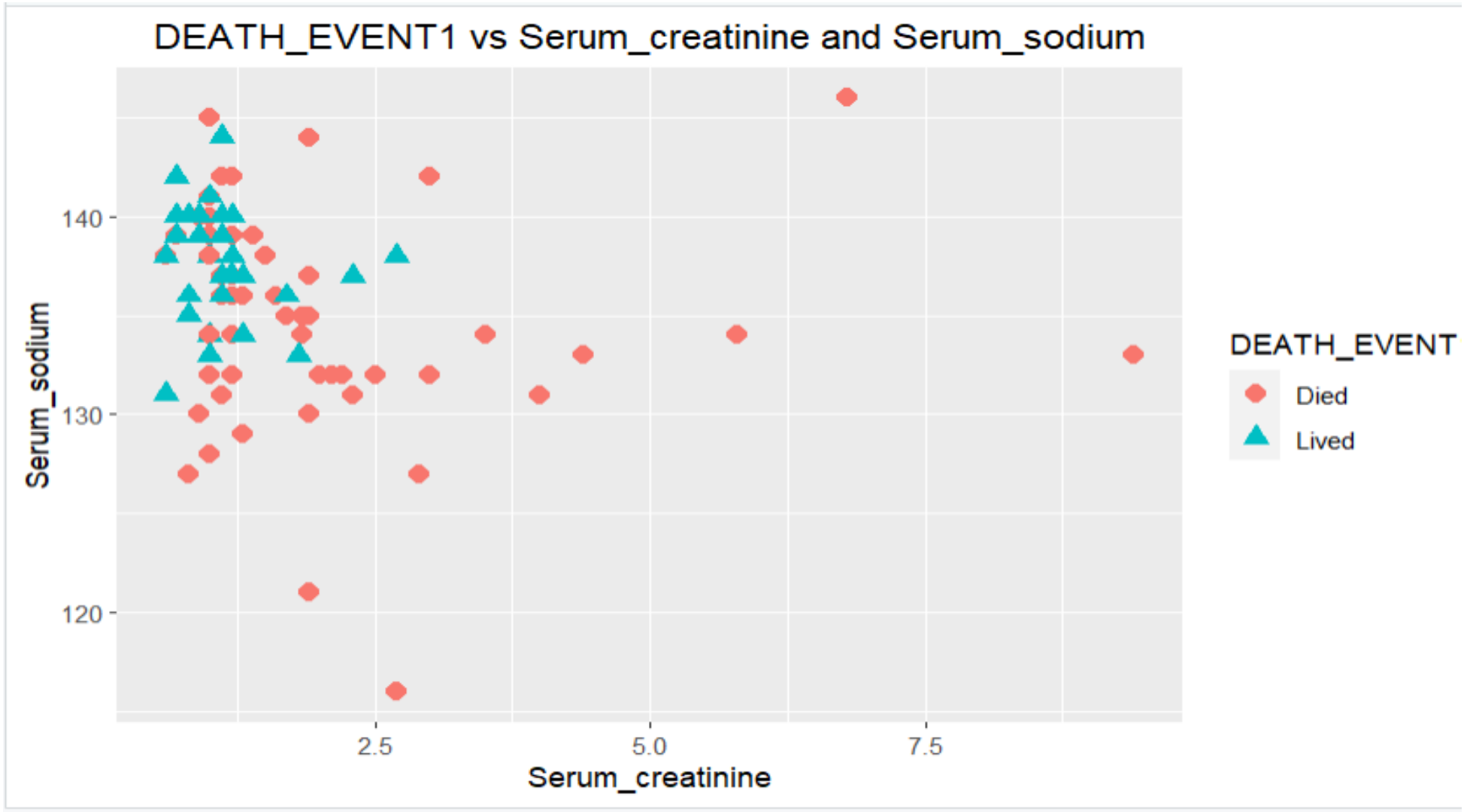


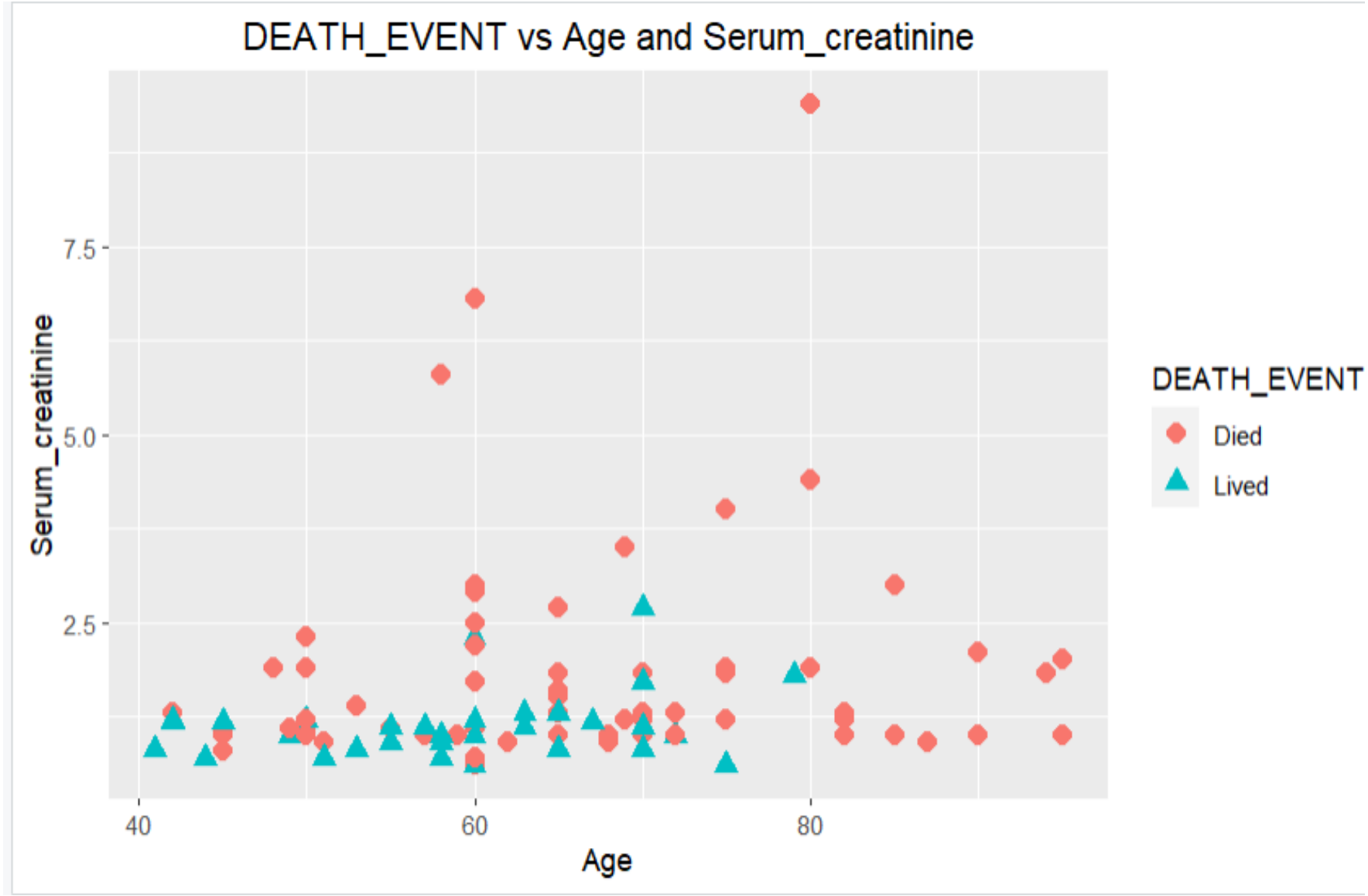

Death_Event vs platelets and serum_sodium
Serum_sodium
140
130
120
1e+05
2e+05
3e+05
4e+05
5e+05
Platelets
DEATH_EVENT
Died
Lived


DEATH_EVENT vs Age and ejection_fraction
Ejection_fraction
80
60
40
20
40
60
80
Age
DEATH_EVENT
Died
Lived

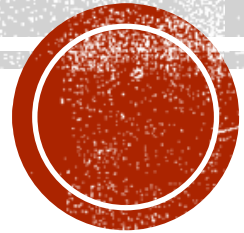

DEATH_EVENT vs Age and Platelets
5e+05
4e+05
3e+05
2e+05
1e+05
Platelets
40
60
80
Age
DEATH_EVENT
Died
Lived


DEATH_EVENT vs EjectionFraction and Serum_sodium
Serum_sodium
140
130
120
20
40
60
80
Ejection_fraction
DEATH_EVENT
Died
Lived


DEATH_EVENT1 vs Serum_creatinine and Serum_sodium
Serum_sodium
140
130
120
2.5
5.0
7.5
Serum_creatinine
DEATH_EVENT
Died
Lived


DEATH_EVENT vs Age and Serum_creatinine
Serum_creatinine
7.5
5.0
2.5
40
60
80
Age
DEATH_EVENT
Died
Lived

2.PERCEPTRONS

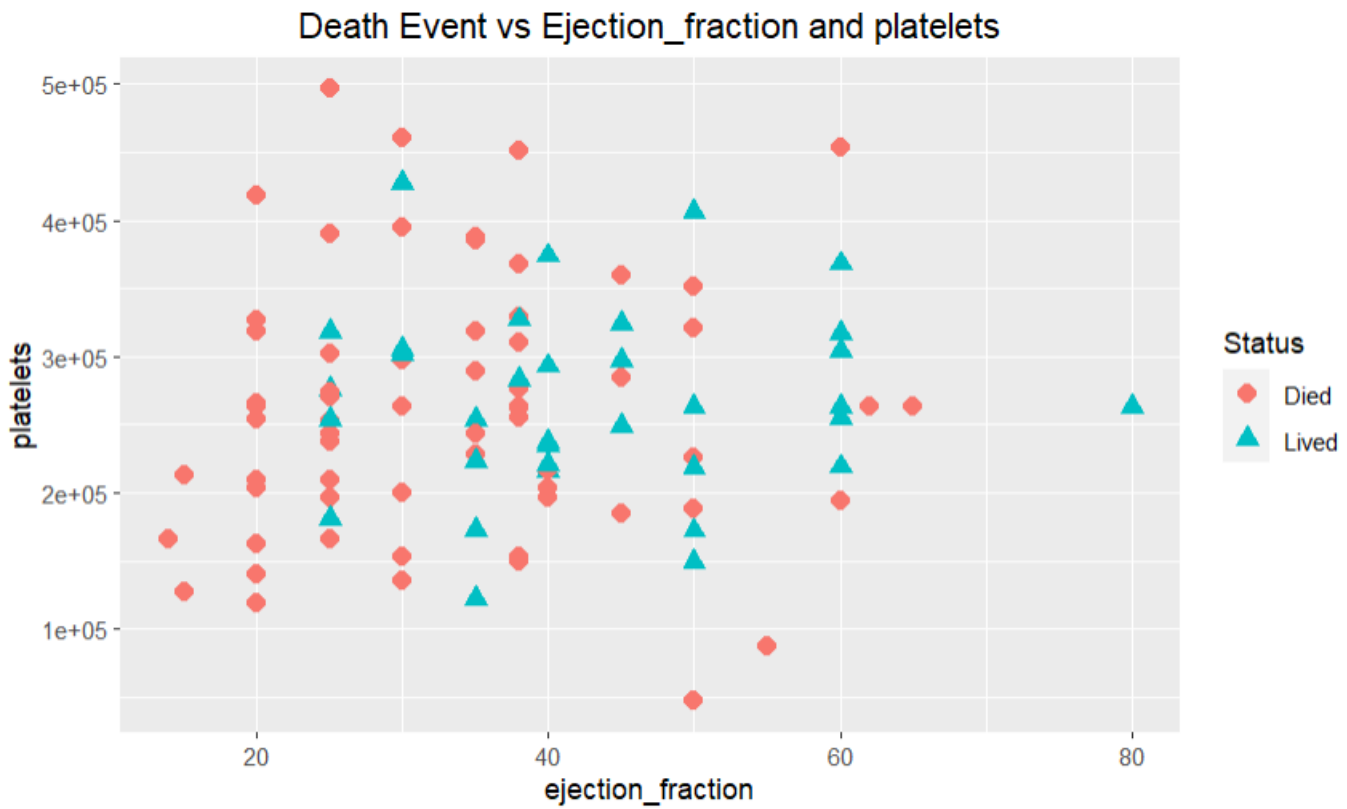


PERCEPTRONS WITH TWO X VARIABLES

1.(X-EJECTION_FRACTION, PLATELETS,Y- DEATH EVENT)

```
HFSubset2D <- HeartFailure[1:100, c("ejection_fraction", "platelets", "Status")]
ggplot(HFSubset2D, aes(x = ejection_fraction, y = platelets)) +
    geom_point(aes(colour = Status, shape= Status), size = 3) +
    xlab("ejection_fraction") +
    ylab("platelets") +
    ggtitle("Death Event vs Ejection_fraction and platelets") +
    theme(plot.title = element_text(hjust = 0.5))
HFSubset2D$class <- lapply(HFSubset2D$Status, function(x) {
    if(x == 'Died')
        HFSubset2D$class <- -1
    else if(x == 'Lived')
        HFSubset2D$class <- 1
    else
        HFSubset2D$class <- NULL
})
X <- HFSubset2D[, c("ejection_fraction", "platelets")] # Input Matrix
y <- HFSubset2D$class # Output Vector
perceptron <- function(X, y, numEpochs) {
```

1.PERCEPTRONS (X-EJECTION_FRACTION, PLATELETS,Y- DEATH EVENT)



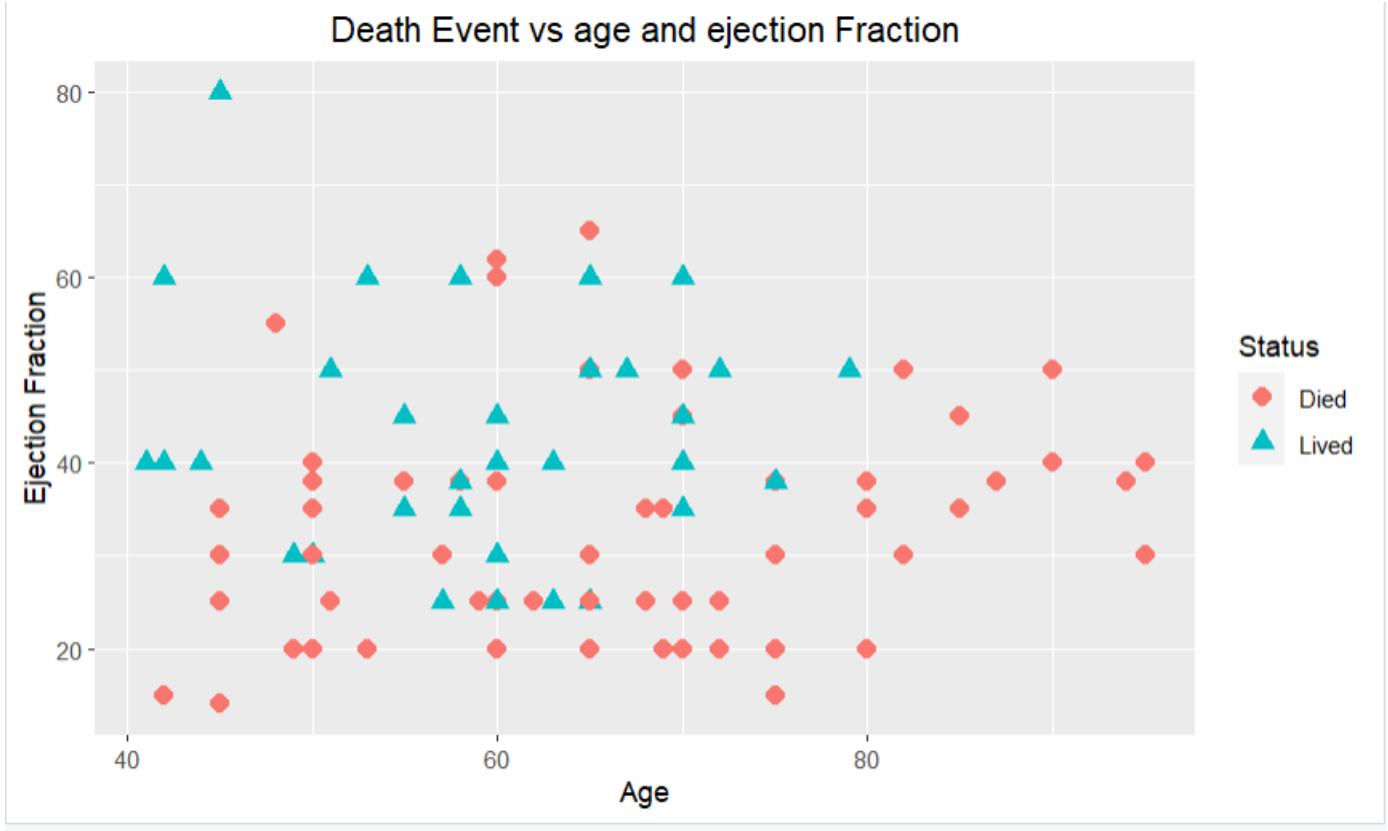
Showing 16 to 28 of 299 entries, 14 total columns

Console | Terminal | Background Jobs

R 4.2.1 · ~/

```
Number Incorrect:  32
Final Weight:  146.0479 293293.2
Epoch #:  4
Number Incorrect:  31
Final Weight:  185.0479 267935.2
Epoch #:  5
Number Incorrect:  32
Final Weight:  224.0479 295577.2
Epoch #:  6
Number Incorrect:  31
Final Weight:  263.0479 270219.1
Epoch #:  7
Number Incorrect:  32
Final Weight:  302.0479 297861.1
Epoch #:  8
Number Incorrect:  31
Final Weight:  341.0479 272503.1
> 
```

2.PERCEPTRONS (X-AGE,EJECTION FRACTION,Y- DEATH EVENT)




```
Number Incorrect:  24
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Epoch #:  4
Number Incorrect:  24
Final Weight:  17.14969 119.1507
Epoch #:  5
Number Incorrect:  20
Final Weight:  20.14969 123.1507
Epoch #:  6
Number Incorrect:  27
Final Weight:  -26.85031 170.1507
Epoch #:  7
Number Incorrect:  24
Final Weight:  -18.85031 157.1507
Epoch #:  8
Number Incorrect:  24
Final Weight:  -10.85031 144.1507
>
```
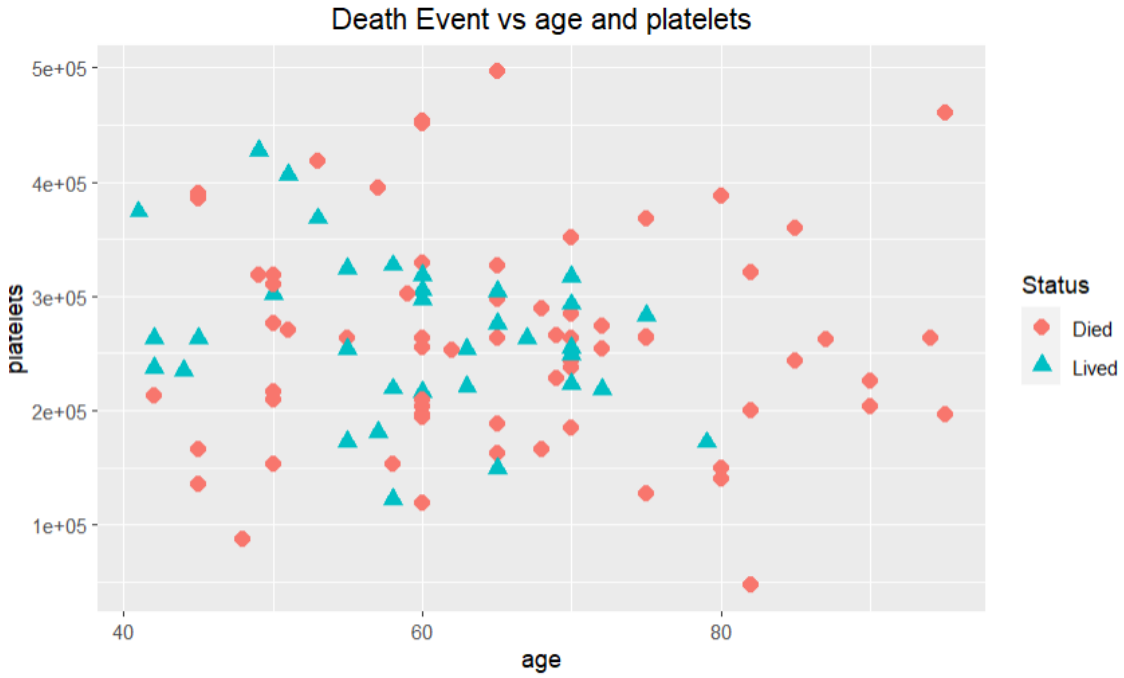
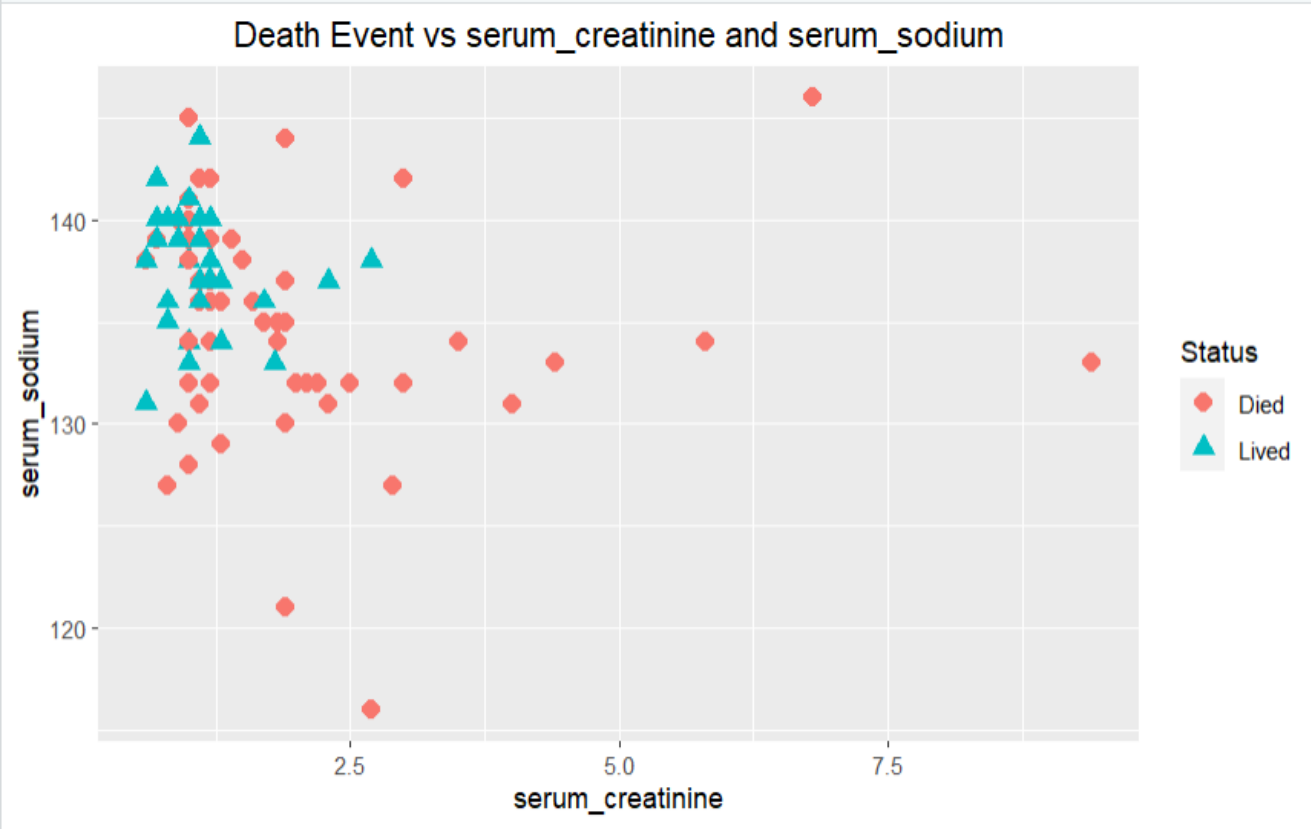

3.PERCEPTRONS (X-AGE,PLATELETS,Y- DEATH EVENT)



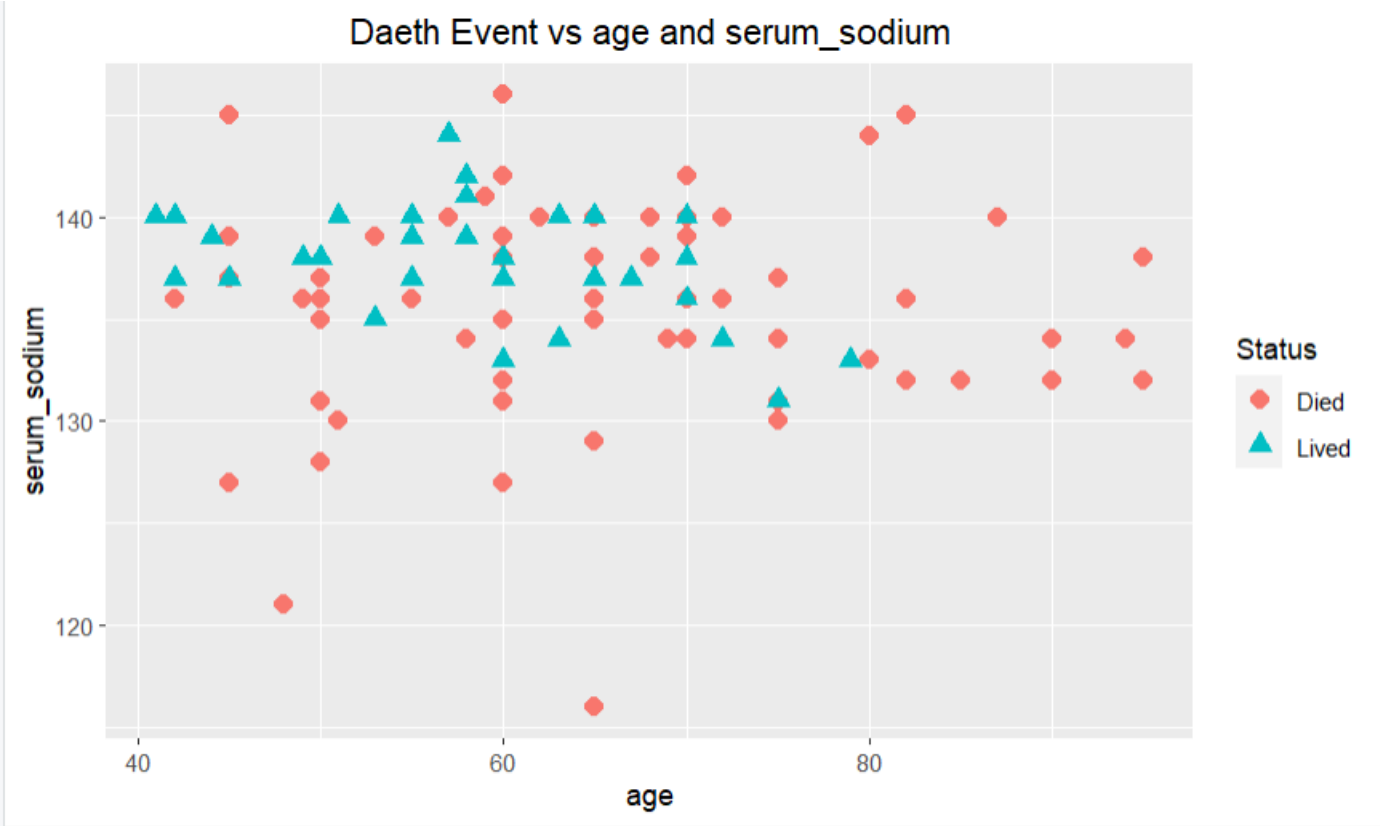

```
Epoch #:  4
Number Incorrect:  32
Final Weight:  -1323.775 297274.8
Epoch #:  5
Number Incorrect:  31
Final Weight:  -1625.775 271916.8
Epoch #:  6
Number Incorrect:  32
Final Weight:  -1984.775 299558.7
Epoch #:  7
Number Incorrect:  31
Final Weight:  -2286.775 274200.7
Epoch #:  8
```

4.PERCEPTRONS (X-SERUM_CREATININE, SERUM_SODIUM,Y- DEATH EVENT)




```
Number Incorrect:  30
Final Weight:  -26.01581 59.88719
Epoch #:  4
Number Incorrect:  30
Final Weight:  -31.46581 82.88719
Epoch #:  5
Number Incorrect:  30
Final Weight:  -36.91581 105.8872
Epoch #:  6
Number Incorrect:  30
Final Weight:  -42.36581 128.8872
Epoch #:  7
Number Incorrect:  31
Final Weight:  -47.81581 8.887185
Epoch #:  8
Number Incorrect:  30
Final Weight:  -51.66581 22.88719
> 
```

5.PERCEPTRONS (X-AGE, SERUM_SODIUM,Y- DEATH EVENT)




```
Number Incorrect:  28
Final Weight:  -98.74346 58.72048
Epoch #:  4
Number Incorrect:  28
Final Weight:  -127.7435 85.72048
Epoch #:  5
Number Incorrect:  28
Final Weight:  -125.7435 80.72048
Epoch #:  6
Number Incorrect:  28
Final Weight:  -154.7435 107.7205
Epoch #:  7
Number Incorrect:  28
Final Weight:  -182.7435 109.7205
Epoch #:  8
Number Incorrect:  28
Final Weight:  -211.7435 136.7205
>
```

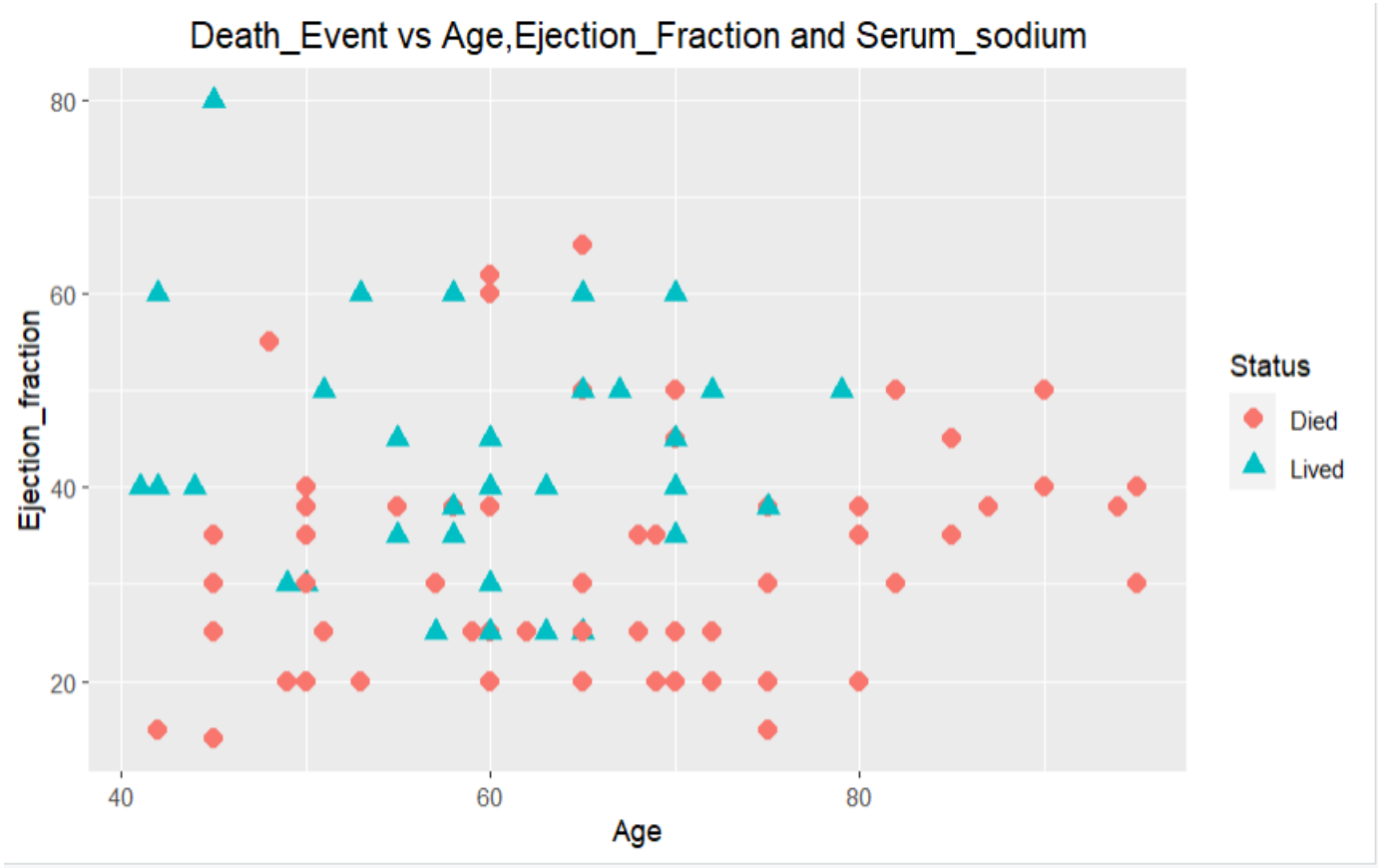
PERCEPTRONS WITH THREE X VARIABLES

1.(X-AGE, SERUM_SODIUM,EJECTION_FRACTION,Y- DEATH EVENT)

```
> library(ggplot2)
> HFSubset2D <- HeartFailure[1:100, c("age", "ejection_fraction","serum_sodium" ,"Status")]
> ggplot(HFSubset2D, aes(x = age, y = ejection_fraction)) +
+     geom_point(aes(colour = Status, shape= Status), size = 3) +
+     xlab("Age") +
+     ylab("Ejection_fraction") +
+     ggtitle("Death_Event vs Age,Ejection_Fraction and Serum_sodium") +
+     theme(plot.title = element_text(hjust = 0.5))
> HFSubset2D$class <- lapply(HFSubset2D$Status, function(x) {
+     if(x == 'Died')
+         HFSubset2D$class <- -1
+     else if(x == 'Lived')
+         HFSubset2D$class <- 1
+     else
+         HFSubset2D$class <- NULL
+ })
> X <- HFSubset2D[, c("age", "ejection_fraction","serum_sodium")] # Input Matrix
> y <- HFSubset2D$class # Output Vector
```

PERCEPTRONS WITH THREE X VARIABLES

1.(X-AGE, SERUM_SODIUM,EJECTION_FRACTION,Y- DEATH EVENT)



Showing 16 to 28 of 299 entries, 14 total columns

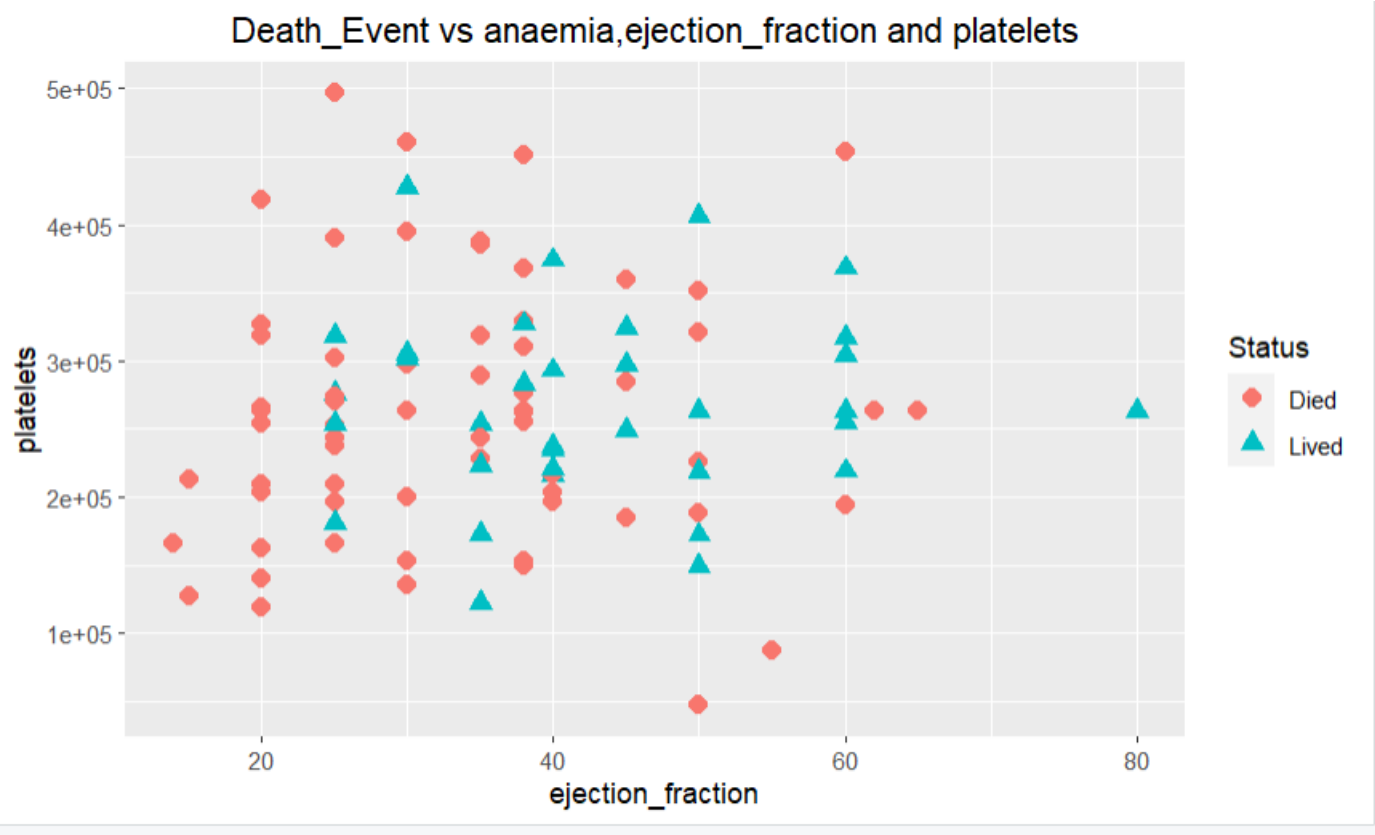
Console | Terminal | Background Jobs

R 4.2.1 · ~/

```
Number Incorrect:  30
Final Weight:  -179.814 428.9853 66.98404
Epoch #:  4
Number Incorrect:  26
Final Weight:  -185.814 468.9853 95.98404
Epoch #:  5
Number Incorrect:  28
Final Weight:  -191.814 486.9853 116.984
Epoch #:  6
Number Incorrect:  22
Final Weight:  -179.814 466.9853 143.984
Epoch #:  7
Number Incorrect:  24
Final Weight:  -179.814 463.9853 154.984
Epoch #:  8
Number Incorrect:  22
Final Weight:  -196.814 463.9853 158.984
> 
```

PERCEPTRONS WITH THREE X VARIABLES

2.(X-ANAEMIA, PLATELETS,EJECTION_FRACTION,Y- DEATH EVENT)



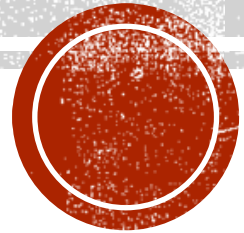
Showing 16 to 28 of 299 entries, 14 total columns

Console | Terminal | Background Jobs

R 4.2.1 · ~/

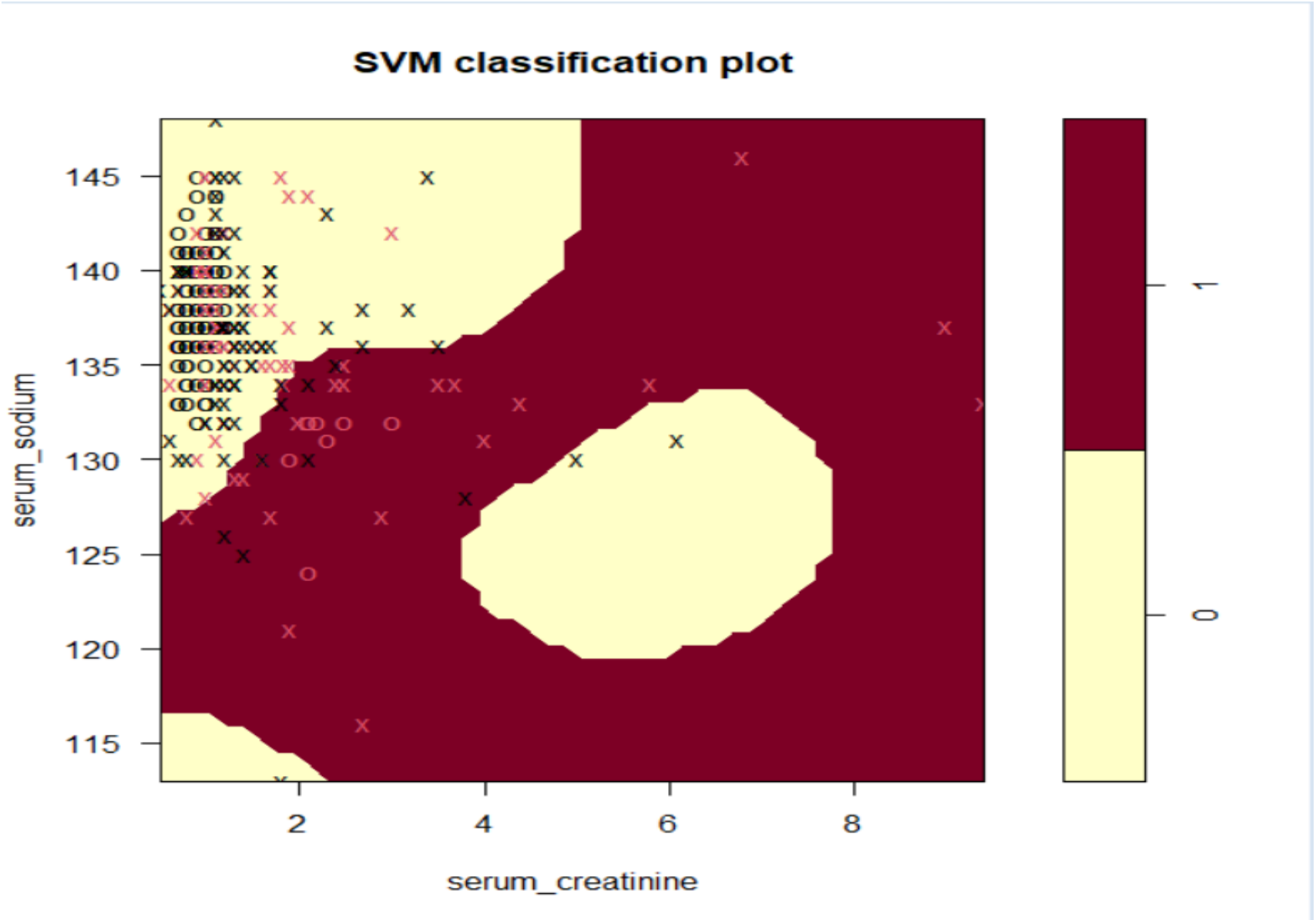
```
Number Incorrect:  31
Final Weight:  -12.95393 167.6333 269639.8
Epoch #:  4
Number Incorrect:  32
Final Weight:  -15.95393 206.6333 297281.7
Epoch #:  5
Number Incorrect:  31
Final Weight:  -17.95393 245.6333 271923.7
Epoch #:  6
Number Incorrect:  32
Final Weight:  -20.95393 284.6333 299565.7
Epoch #:  7
Number Incorrect:  31
Final Weight:  -22.95393 323.6333 274207.7
Epoch #:  8
Number Incorrect:  32
Final Weight:  -25.95393 362.6333 301849.6
> 
```

3.SUPPORT VECTOR MACHINES(SVM)

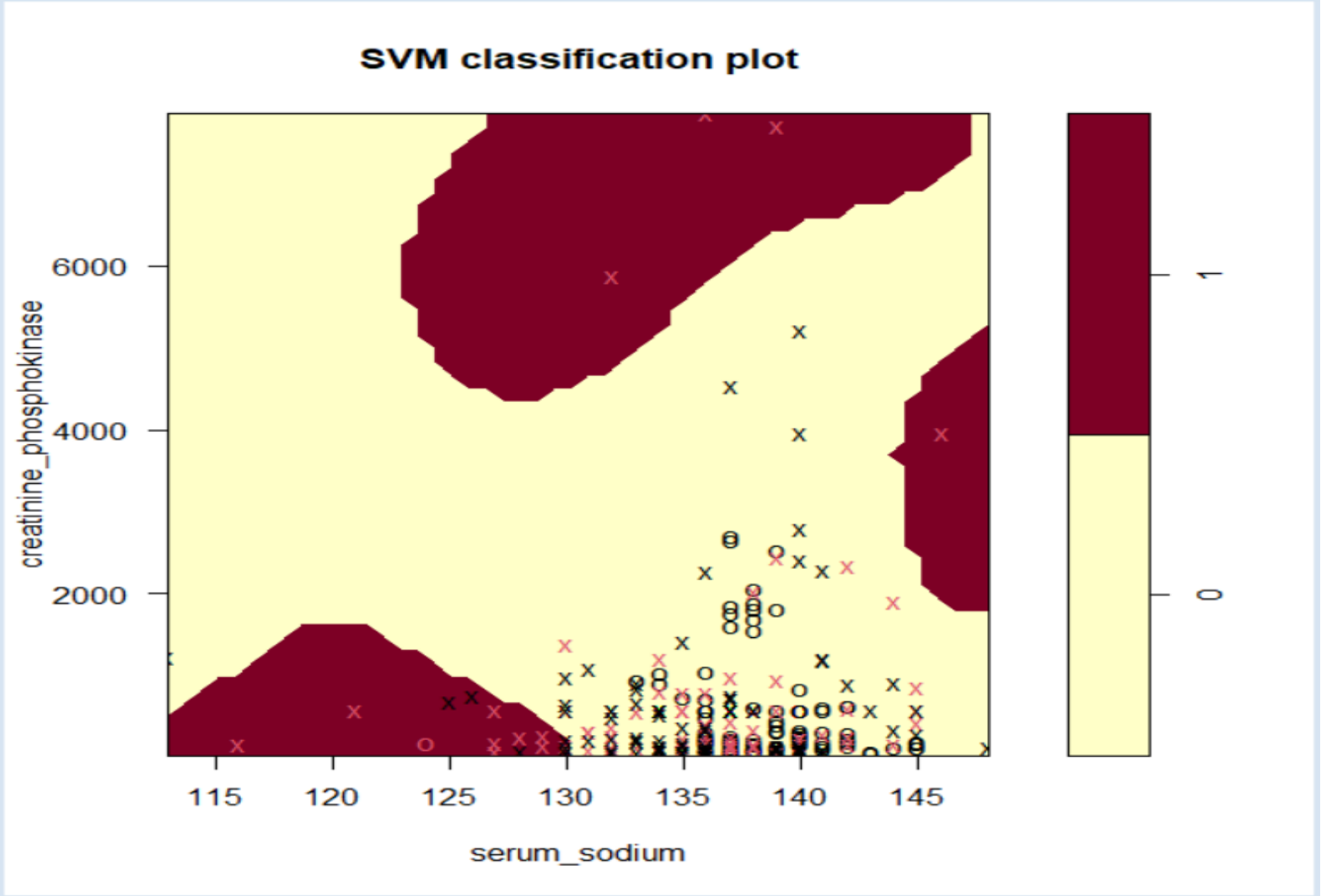


SVM WITH 2 X VARIABLES

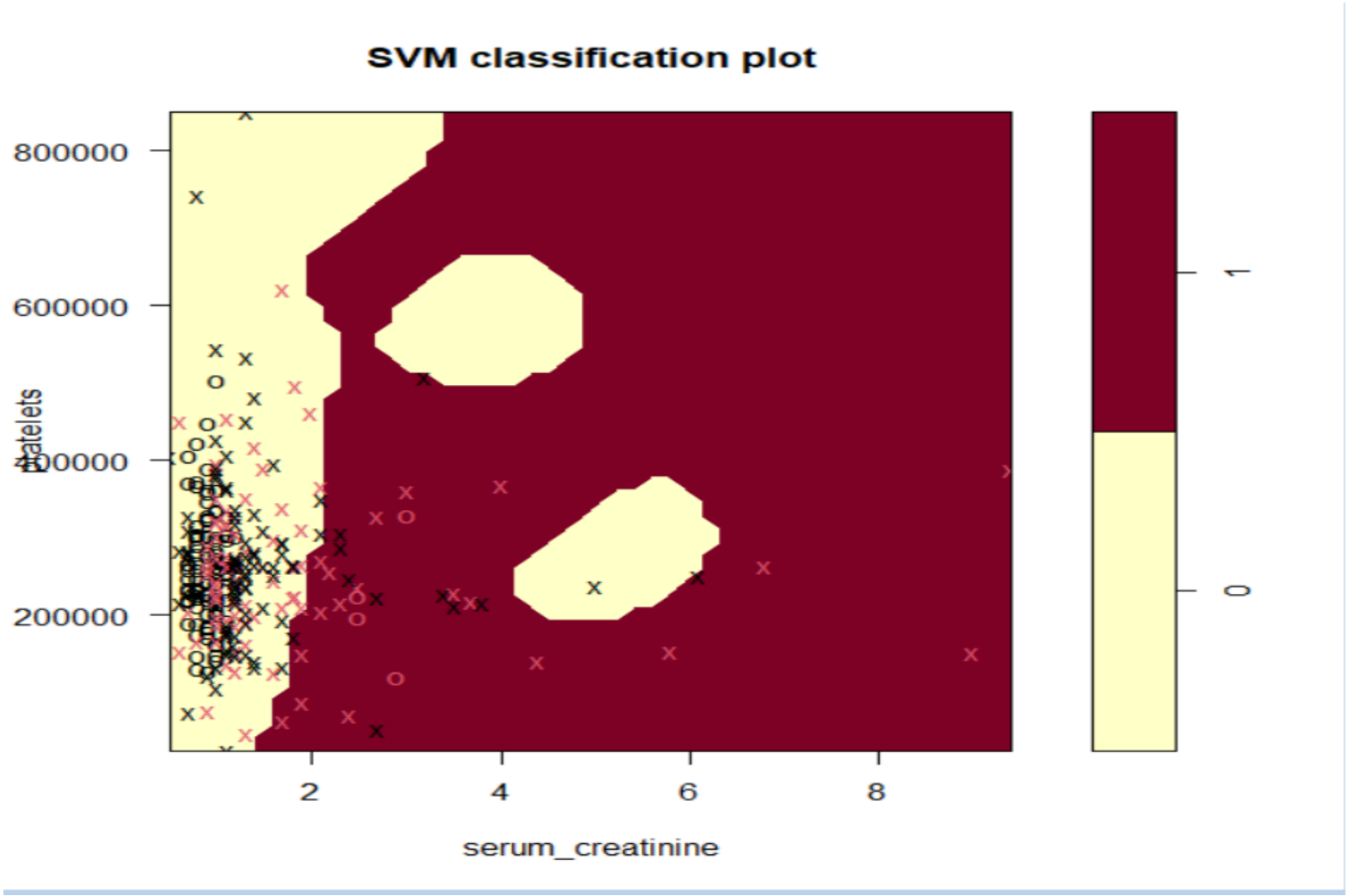
1.MODEL <- SVM(DEATH_EVENT~ SERUM_SODIUM+ SERUM_CREATININE , DATA=HEARTFAILURE)



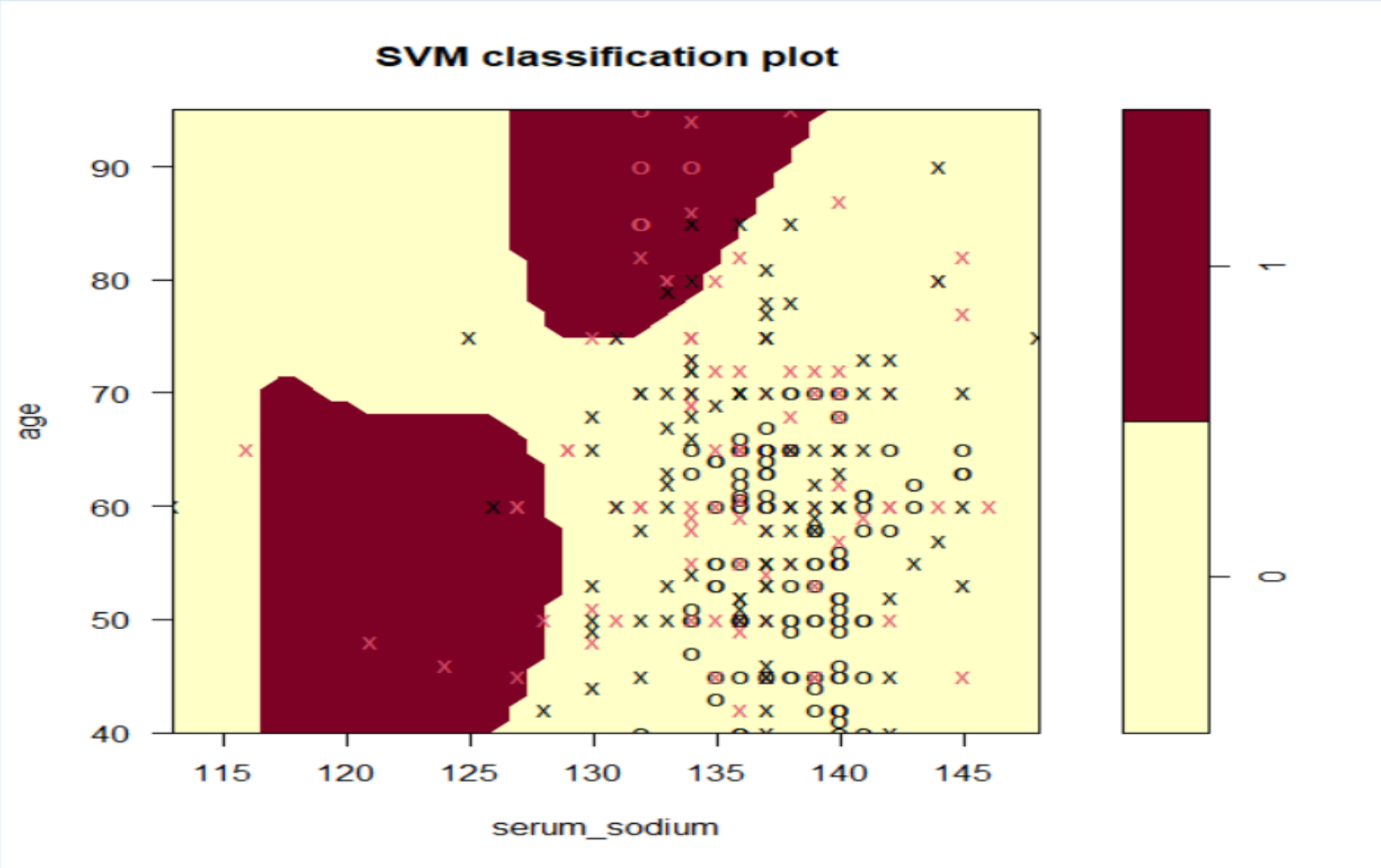
2.MODEL <- SVM(DEATH_EVENT~ CREATININE_PHOSPHOKINASE+ SERUM_SODIUM , DATA=HEARTFAILURE)



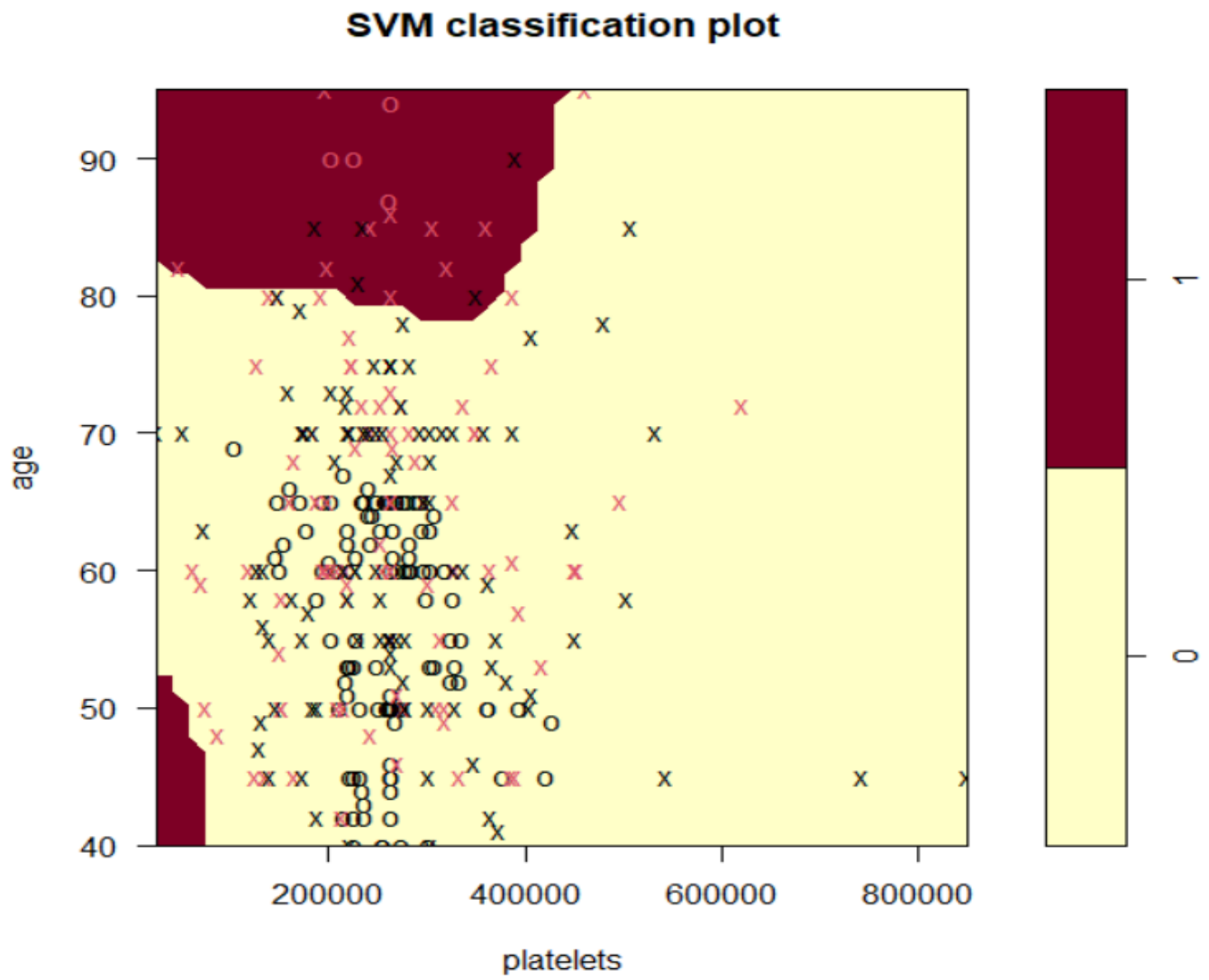
3.MODEL <- SVM(DEATH_EVENT~ PLATELETS+ SERUM_CREATININE , DATA=HEARTFAILURE)



4.DEATH_EVENT~ AGE+ SERUM_SODIUM

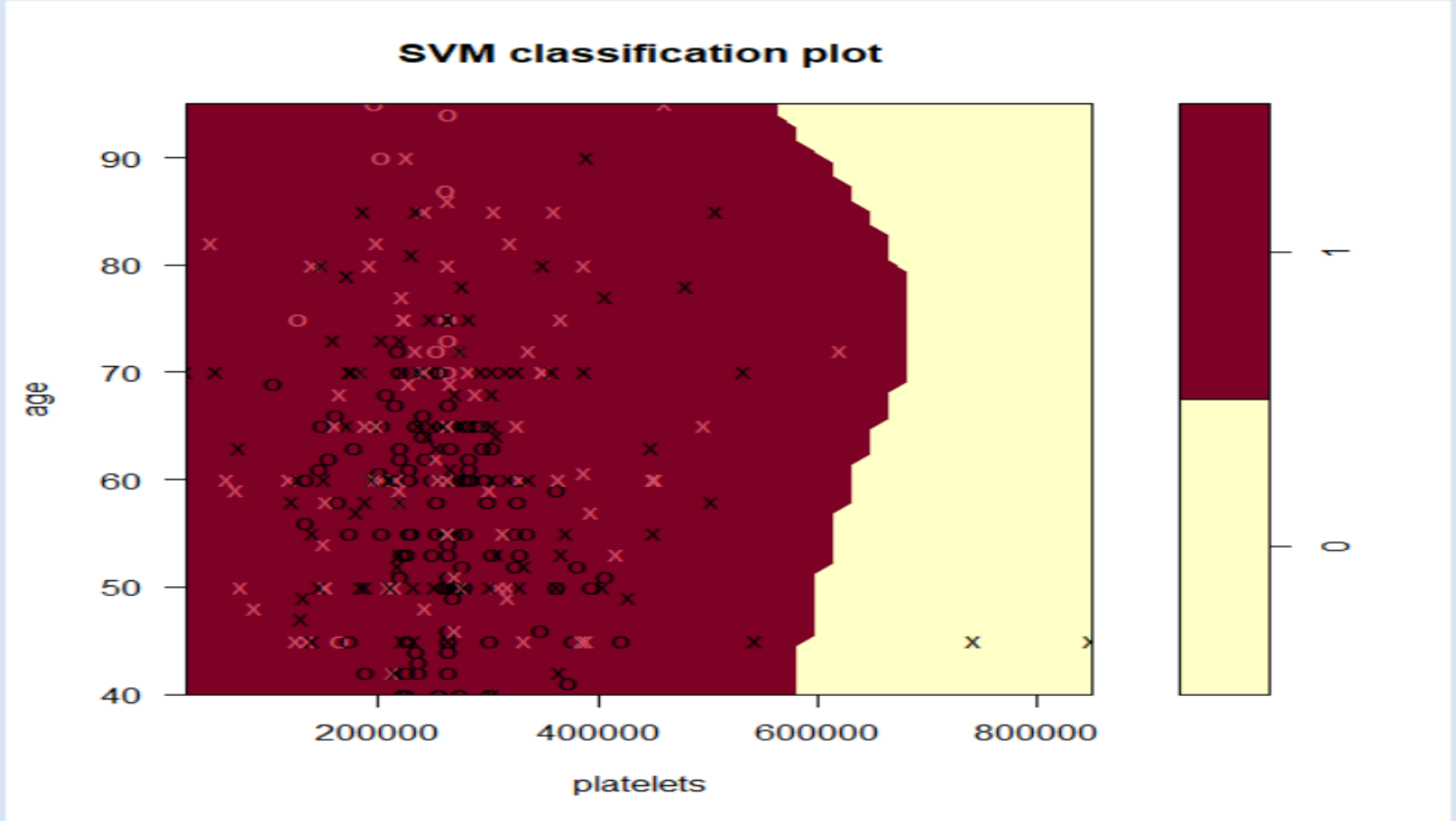


5.model <- svm(DEATH_EVENT~ age+ platelets , data=HeartFailure)

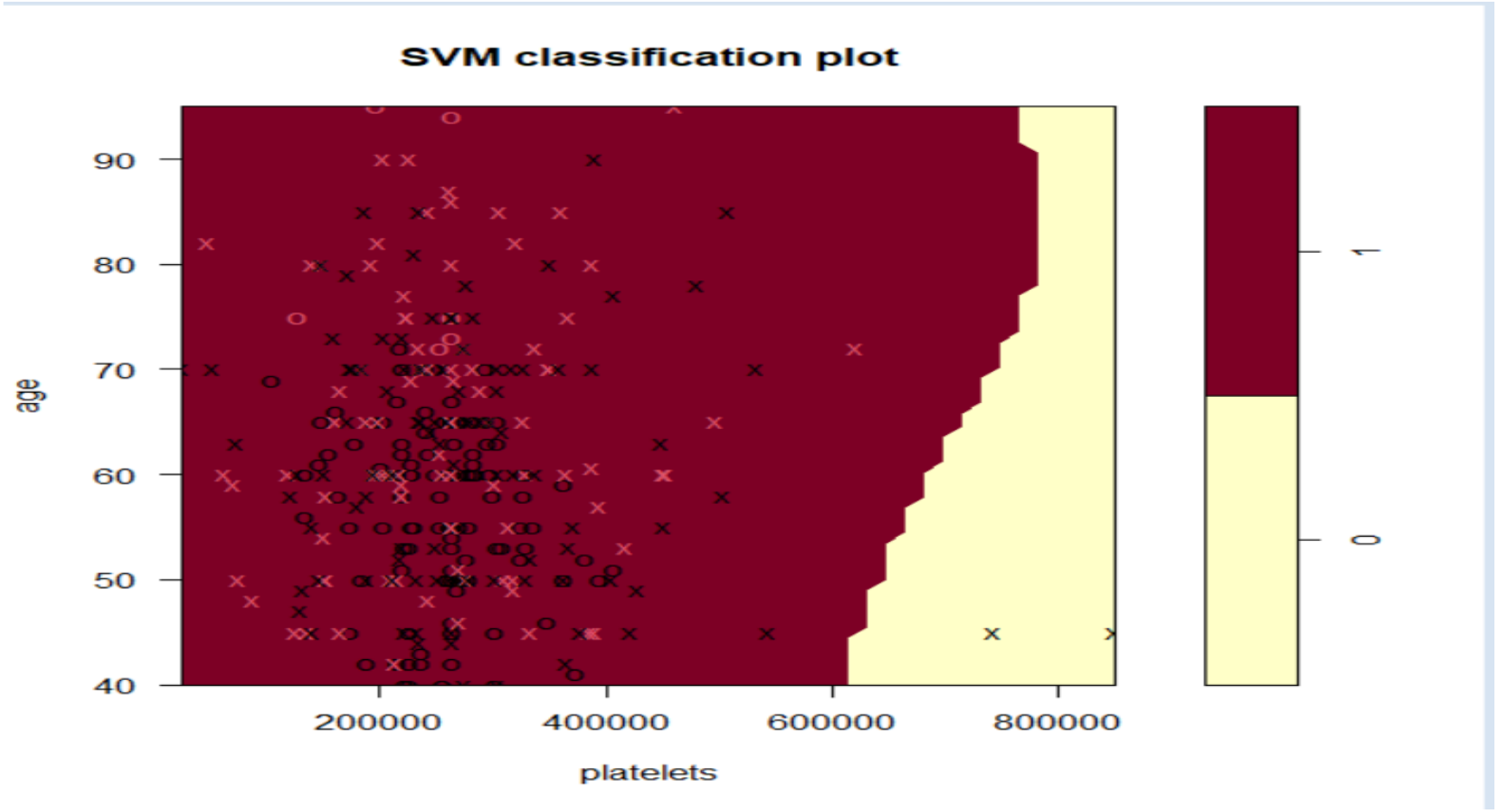


SVM WITH 3 X VARIABLES

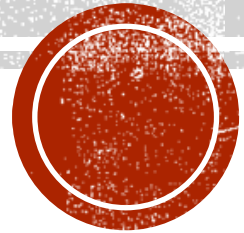
1.MODEL <- SVM(DEATH_EVENT~ AGE+ PLATELETS+EJECTION_FRACTION , DATA=HEARTFAILURE)



2.DEATH_EVENT~ EJECTION_FRACTION + PLATELETS+AGE+ HIGH_BLOOD_PRESSURE , DATA=HEARTFAILURE

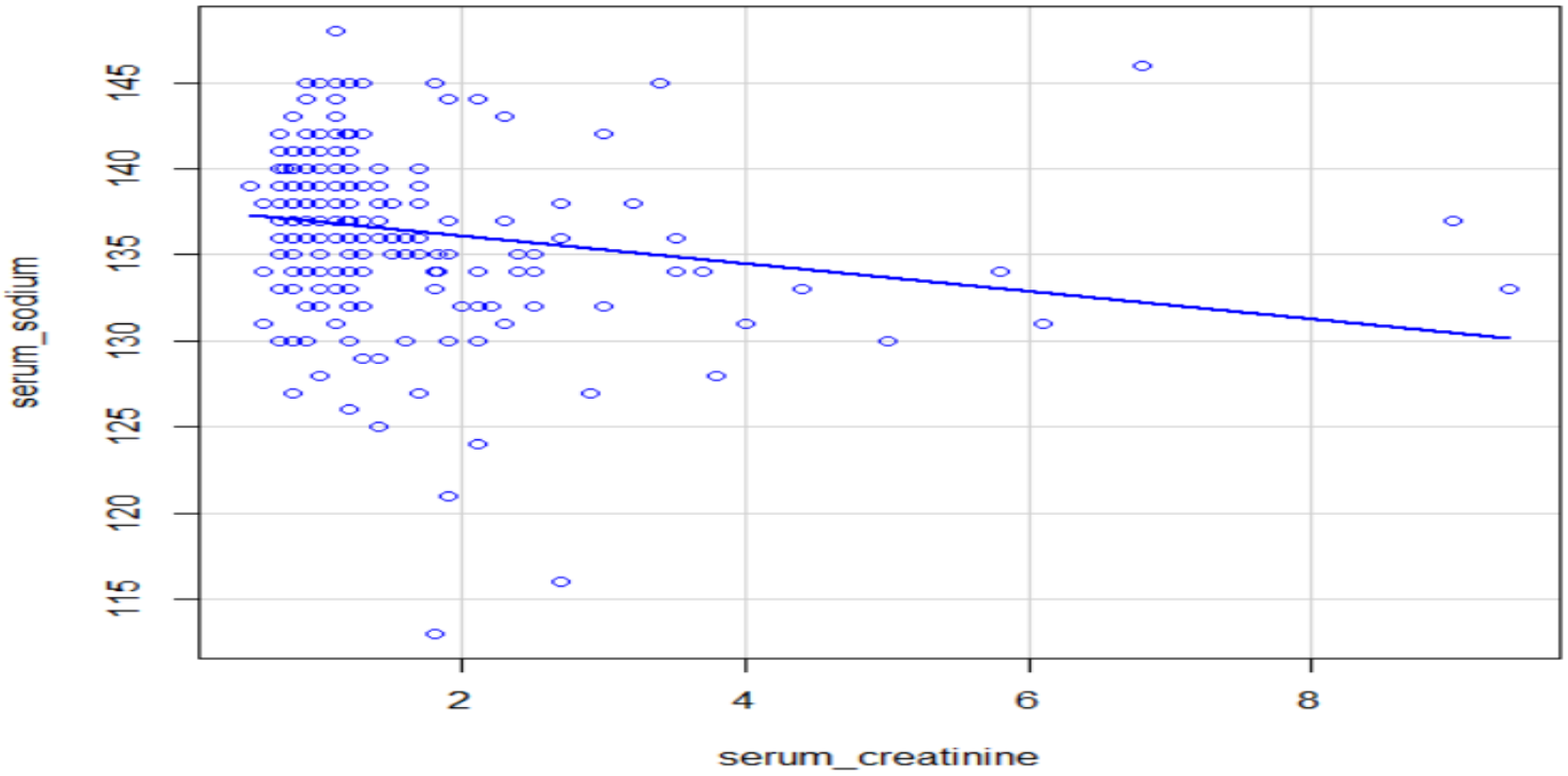


4.LESSONS LEARNED



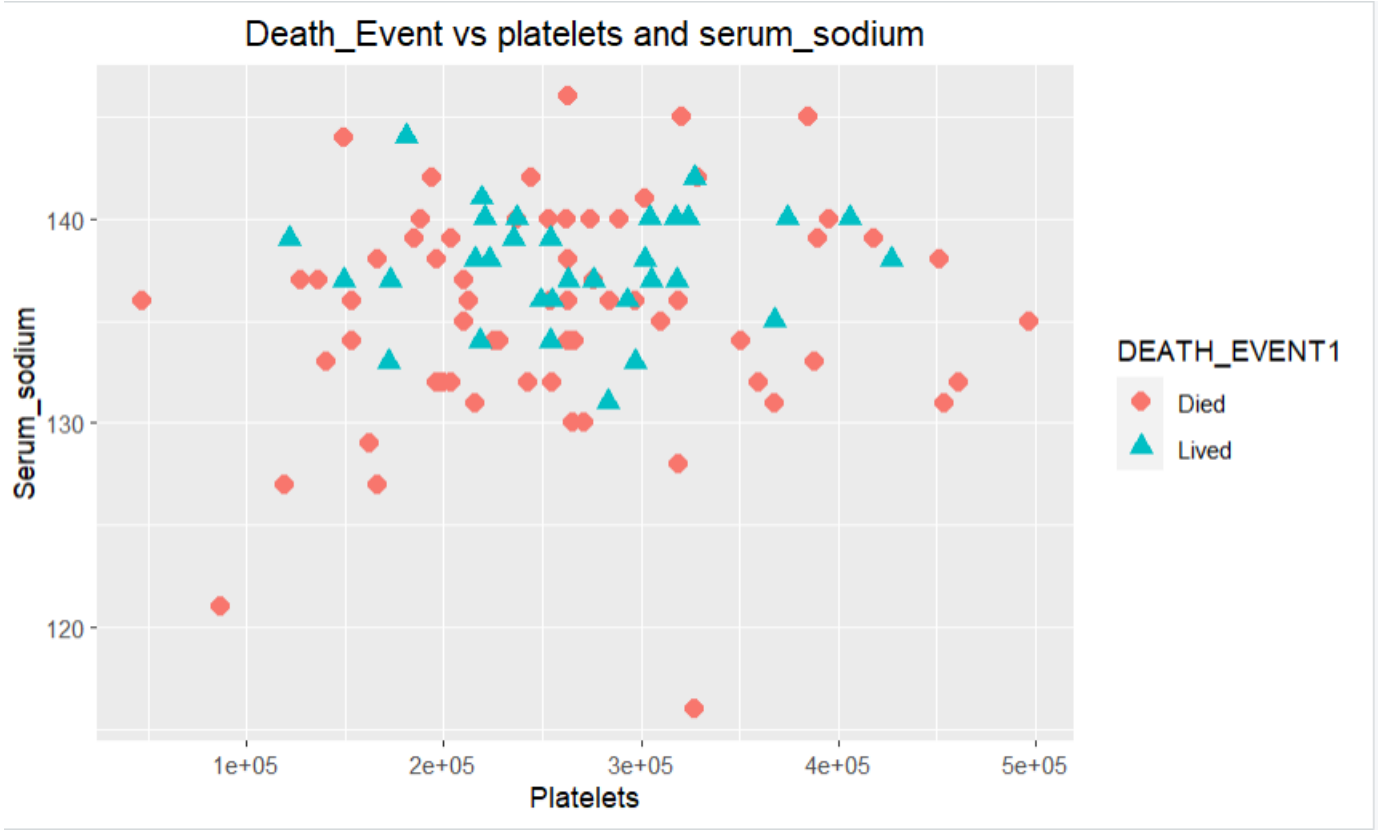
WHEN DO VISUALIZATIONS HELP

- Visualizations like scatter-plot work when we want to see relationship between pair of variables and the dataset is not complex



WHEN VISUALIZATIONS DO NOT HELP

NO CLEAR BIFURCATION BETWEEN TWO CLASSES AS DATASET IS COMPLEX



Perceptrons didn't work as the dataset is very complex

SVM'S were able to do classification of the Death Event as they use kernels and advanced algorithms

When dataset is very complex , we require advanced ML techniques like SVM and neural networks in order to solve a classification problem

Thank You!