# Implementation of Support Vector Machine Classification using R package - Caret for Heart Disease Recognition Dataset.

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Author: Subalakshmi Shanthosi S (186001008)

## Aim

Implementation of Support Vector Machine(SVM) using R package- Classification and Regression Training(CARET) for Heart Disease Recognition Dataset.

# Description

- 1. Support Vector Machine:
  - Support Vector Machine is a Supervised Learning Model.
  - SVM can be applied for both classification and regression algorithms but predominantly used for classification problems.
  - Support Vector Algorithm Working:
    - Input: Data points from the dataset (Heart Disease recognition dataset).
    - Output: Hyperplane The line which best separates the tags.
    - Careful choice of Kernal function which decides the accuracy of the model.
  - Advantages of using SVM for classification:
    - High Dimensionality.
    - Memory Efficiency.
    - Versatility.
  - Disadvantages of using SVM:
    - Kernel Parameters Selection: SVM shows poor performance on higher dimensional data.
    - Non-Probabilistic: Effectiveness is less evident as the algorithm places few data points above and below the decision boundry which might lead to misclassification if the between class varients among points is less.
- 2. Classification hyperplane based on the data point's distribution is presented below:

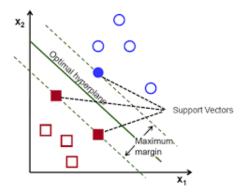


Figure 1: SVM Linear Model.

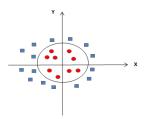


Figure 2: SVM Non Linear model by 3-D projection.

# Tools and Packages

- 1. Tools
  - RStudio.
  - R Version 1.1.463
- 2. Support Vector Machine and Visualisation Packages
  - •
  - ggplot2 (Visualisation)
  - GGally (Visualisation)

# Dataset Description - Heart Disease Databases

- This database contains 76 attributes, but all published experiments refer to using a subset of 14 of them.
- The "goal" field refers to the presence of heart disease in the patient. It is integer valued from 0 (no presence) to 4. Experiments with the Cleveland database have concentrated on simply attempting to distinguish presence (values 1,2,3,4) from absence (value 0).
- Number of instances in Heart Disease Dataset:
  - Cleveland: 303
    Hungarian: 294
    Switzerland: 123
    Long Beach VA: 200
- Attribute information:

Variable name	Short desciption	Variable name	Short description
age	Age of patient	thalach	maximum heart rate achieved
sex	Sex, 1 for male	exang	exercise induced angina (1 yes)
ср	chest pain	oldpeak	ST depression induc. ex.
trestbps	resting blood pressure	slope	slope of peak exercise ST
chol	serum cholesterol	ca	number of major vessel
fbs	fasting blood sugar larger 120mg/dl (1 true)	thal	no explanation provided, but probably thalassemia (3 normal; 6 fixed defect; 7 reversable defect)
restecg	resting electroc. result (1 anomality)	num	diagnosis of heart disease (angiographic disease status)

Figure 3: Heart Disease Detection Database important attributes.

## Procedure

- 1. Split the data set as:
  - Training dataset.
  - Testing dataset.
- 2. Exploratory data Visualisation : To decide on the model to fit for a better precision in classification.
- 3. Feature Scaling and Model Fitting.
- 4. Calculate prediction and evaluate the SVM model/kernal accuracy.
- 5. Display the confusion matrix.

# Support Vector Machine

- Support Vector Machine is a machine learning algorithm which:
  - 1. Solves classification problems.
  - 2. Uses flexible representation of decision boundary.
  - 3. Implements automatic complexity control to reduce overfitting.
  - 4. A single global minimum which can be found in polynomial time.
- Pseudocode :

#### • Initialisation:

- \* For the specified kernel, and kernel parameters, compute the kernel of distances between the datapoints.
- \* The main work here is the computation  $K=XX^{T}$ .
- \* For the linear kernel, return K, for the polynomial of degree d return  $\frac{1}{\sigma K^d}$ .
- \* For the RBF kernel, compute K =  $\exp(-\frac{(x-x^{'})^2}{2\sigma^2})$ .

#### • Training

\* Assemble the constraint set as matrices to solve:

$$min_{\mathbf{x}} \frac{1}{2} x^{\mathrm{T}} t_{\mathbf{i}} t_{\mathbf{j}} K_{\mathbf{x}} + q^{\mathrm{T}} x. \tag{1}$$

subject to  $G_x \le h$  $A_x = b$ 

- \* Pass these matrices to the solver.
- \* Identify the support vectors as those that are within some specified distance of the closest point and dispose of the rest of the training data.
- \* Calculate b\* using equation:

$$b^* = \frac{1}{N_s} \sum_{all support vectors} (t_j - \sum_{i=1}^n \lambda_i t_i x_i^T x_j).$$
 (2)

#### • Classification

- \* For the given test data z, Use the support vector to classify the data for the relevant kernal by :
  - · Compute the inner product of the test data and the support vectors.
  - Perform the classification as:

$$\sum_{i=1}^{n} \lambda_{i} t_{i} K(x_{i}, z) + b^{*}.$$
(3)

returning -

The label (Hard Classification)

The value(Soft Classification)

Algorithm 1: The Support Vector Algorithm

## **Confusion Matrix**

• A confusion matrix is a table that can be generated for a classifier on a Data Set

True Positives(TP)- These are the cases where the predicted and actual both are yes.

True Negatives(TN)- These are the cases where the predicted value is no and actual value is yes.

False Positive(FP)- These are the cases where the predicted value is yes and actual value is no.

False Negative(FN)- These are the cases where prediction is no and actual value is no.

# Coding

```
# Use library TeachingDemos to save output and commands
library (Teaching Demos)
txtStart("svmOutput.txt")
# SVM Classification using Linear Kernel
# Importing SVM library caret
library (caret)
# Loading CSV file to data frame
heart_df <- read.csv("/home/subalakshmi/PCP1211DALab/PCP1211ExptSevenB/heart_tidy.csv", se
# Showing the dataset description
# str(heart_df)
# head(heart_df)
# Split dataset for training and testing
set . seed (3033)
intrain <- createDataPartition(y = heart_df$V14, p= 0.7, list = FALSE)
training <- heart_df[intrain,]
testing <- heart_df[-intrain,]
# Printing the dimension
dim(training)
dim (testing)
# Preprocessing dataset - checking missing values
anyNA(heart_df)
# Summary Stats
summary (heart_df)
# Converting target to factor variable
training [["V14"]] = factor (training [["V14"]])
# Training SVM model
trctrl <- trainControl(method = "repeatedcv", number = 10, repeats = 3)
set.seed(3233)
```

```
svm_Linear <- train(V14 ~., data = training, method = "svmLinear",
                    trControl=trctrl,
                    preProcess = c("center", "scale"),
                    tuneLength = 10
# Printing trained SVM model
# svm_Linear
# Predicting the model
test_pred <- predict(svm_Linear, newdata = testing)
# Printing the prediction
#str(test_pred)
# Confusion Matrix
confusionMatrix(factor(test_pred, levels = 1:148),
  factor (testing V14, levels = 1:148))
# Parameter Tuning
grid \leftarrow expand.grid(C = c(0,0.01, 0.05, 0.1, 0.25, 0.5, 0.75, 1, 1.25, 1.5, 1.75, 2,5))
set.seed (3233)
svm_Linear_Grid <- train(V14 ~., data = training, method = "svmLinear",
                            trControl=trctrl,
                            preProcess = c("center", "scale"),
                            tuneGrid = grid,
                            tuneLength = 10
plot(svm_Linear_Grid, main = "SVM Linear Grid")
#Prediction - with tuning exprementation
test_pred_grid <- predict(svm_Linear_Grid, newdata = testing)
#test_pred_grid
#Confusion matrix
confusionMatrix(factor(test_pred_grid, levels = 1:148),
  factor(testing$V14, levels = 1:148))
# SVM Classification for Non Linear Kernal - RBF
set . seed (3233)
svm_Radial <- train(V14 ~., data = training, method = "svmRadial",
                      trControl=trctrl,
                      preProcess = c("center", "scale"),
                      tuneLength = 10
# Visualisation SVM -RBF Kernal
plot(svm_Radial, main= "SVM with RBF Kernal")
# Prediction of RBF trained model
test_pred_Radial <- predict(svm_Radial, newdata = testing)
confusionMatrix(factor(test_pred_Radial, levels = 1:148),
                factor (testing V14, levels = 1:148)
# Tuning parameters of SVM - RBF
```

```
grid_radial \leftarrow expand.grid(sigma = c(0,0.01, 0.02, 0.025, 0.03, 0.04,
                                         0.05, 0.06, 0.07, 0.08, 0.09, 0.1, 0.25, 0.5, 0.75, 0.9
                              C = c(0,0.01, 0.05, 0.1, 0.25, 0.5, 0.75,
                                     1, 1.5, 2, 5)
set . seed (3233)
svm_Radial_Grid <- train(V14 ~., data = training, method = "svmRadial",
                              trControl=trctrl,
                              preProcess \, = \, c \, ("\,center"\,, \, "\,scale") \, ,
                              tuneGrid = grid_radial,
                              tuneLength = 10)
#svm_Radial_Grid
# Visualisation
plot(svm_Radial_Grid, main="SVM RBF after tuning")
# Prediction with tuning
test_pred_Radial_Grid <- predict(svm_Radial_Grid, newdata = testing)
# Confusion Matrix
confusion Matrix (
  factor (test_pred_Radial_Grid, levels = 1:148),
  factor (testing V14, levels = 1:148)
txtStop()
Output
> library(caret)
> heart_df <- read.csv("/home/subalakshmi/PCP1211DALab/PCP1211ExptSevenB/heart_tidy.csv",
+ sep = ",", header = FALSE)
> str(heart_df)
'data.frame': 300 obs. of 14 variables:
 $ V1 : int 63 67 67 37 41 56 62 57 63 53 ...
 $ V2 : int 1 1 1 1 0 1 0 0 1 1 ...
 $ V3 : int 1 4 4 3 2 2 4 4 4 4 ...
 $ V4 : int 145 160 120 130 130 120 140 120 130 140 ...
 $ V5 : int 233 286 229 250 204 236 268 354 254 203 ...
 $ V6 : int 1 0 0 0 0 0 0 0 1 ...
 $ V7 : int 2 2 2 0 2 0 2 0 2 2 ...
 $ V8 : int 150 108 129 187 172 178 160 163 147 155 ...
 $ V9 : int 0 1 1 0 0 0 0 1 0 1 ...
 $ V10: num 2.3 1.5 2.6 3.5 1.4 0.8 3.6 0.6 1.4 3.1 ...
 $ V11: int 3 2 2 3 1 1 3 1 2 3 ...
 $ V12: int 0 3 2 0 0 0 2 0 1 0 ...
$ V13: int 6 3 7 3 3 3 3 3 7 7 ...
$ V14: int 0 1 1 0 0 0 1 0 1 1 ...
> head(heart_df)
 V1 V2 V3 V4 V5 V6 V7 V8 V9 V10 V11 V12 V13 V14
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2 67 1 4 160 286
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5 41 0 2 130 204
                  0 2 172 0 1.4
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6 56 1 2 120 236 0 0 178 0 0.8
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> set.seed(3033)
> intrain <- createDataPartition(y = heart_df$V14, p = 0.7, list = FALSE)</pre>
> training <- heart_df[intrain, ]</pre>
> testing <- heart_df[-intrain, ]</pre>
```

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> dim(training)
[1] 210 14
> dim(testing)
[1] 90 14
> anyNA(heart_df)
[1] FALSE
> summary(heart_df)
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                                               1st Qu.:120.0
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                                Median :3.000
 Median :56.00
                Median:1.00
                                              Median: 130.0 Median: 241.5
 Mean :54.48
                Mean :0.68
                                Mean :3.153
                                               Mean :131.6 Mean
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 3rd Qu.:61.00
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                                3rd Qu.:4.000
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                 {\tt Max.}
> training[["V14"]] = factor(training[["V14"]])
> trctrl <- trainControl(method = "repeatedcv", number = 10, repeats = 3)</pre>
> set.seed(3233)
> svm_Linear <- train(V14 ~ ., data = training, method = "svmLinear",
+ trControl = trctrl, preProcess = c("center", "scale"), tuneLength = 10)
> svm_Linear
Support Vector Machines with Linear Kernel
210 samples
 13 predictor
  2 classes: '0', '1'
Pre-processing: centered (13), scaled (13)
Resampling: Cross-Validated (10 fold, repeated 3 times)
Summary of sample sizes: 189, 189, 189, 189, 189, 189, ...
Resampling results:
  Accuracy
            Kappa
  0.7920635 0.581696
Tuning parameter 'C' was held constant at a value of 1
> test_pred <- predict(svm_Linear, newdata = testing)
> str(test_pred)
Factor w/ 2 levels "0", "1": 1 2 2 2 1 1 2 1 1 2 ...
> confusionMatrix(factor(test_pred, levels = 1:148), factor(testing$V14,
+ levels = 1:148))
Confusion Matrix and Statistics
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 [ reached getOption("max.print") -- omitted 142 rows ]
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Accuracy : 1 95% CI : (0.8942, 1)

No Information Rate : 1 P-Value [Acc > NIR] : 1

Kappa : NaN

Mcnemar's Test P-Value : NA  $\,$ 

## Statistics by Class:

	Class: 1	Class 2	Class: 3	Class	4 Cla	ss: 5 C	lassi	6	
Sensitivity	1	NA	NA		A	NA	Labb.	NA	
Specificity	NA	1	1	1,	1	1		1	
Pos Pred Value	NA NA	NA.	NA.	1/	Ā	NA		NA	
Neg Pred Value	NA NA	NA NA	NA NA		Α	NA		NA	
Prevalence	1	0	0	=	0	0		0	
Detection Rate	1	0	0		0	0		0	
Detection Rate	_	_	-	Cl	-	-	<b>01</b>		
G			Class: 9				Cras		
Sensitivity	NA	NA	NA		NA	NA		NA	
Specificity	1	1	1		1	1		1	
Pos Pred Value	NA	NA			NA	NA		NA	
Neg Pred Value	NA	NA			NA	NA		NA	
Prevalence	0	0	0		0	0		0	
Detection Rate	0	0	0	~-	0	0		0	
			14 Class:					:lass:	18
Sensitivity	NA		NA	NA	NA		NA		NA
Specificity	-	1	1	1	1		1		1
Pos Pred Value	NA		NA	NA	NA		NA		ΝA
Neg Pred Value	NA		NA	NA	NA		NA		NA
Prevalence		)	0	0	0		0		0
Detection Rate	(	-	0	0	0		0		0
	Class: 19	9 Class: 1	20 Class:	21 Clas	s: 22	Class:	23 C	:lass:	24
Sensitivity	NA	A 1	NA	NA	NA		NA		NA
Specificity	-	1	1	1	1		1		1
Pos Pred Value	NA	<b>A</b> 1	NA	NA	NA		NA		NA
Neg Pred Value	NA	<b>A</b> 1	NA	NA	NA		NA		NA
Prevalence	(	)	0	0	0		0		0
Detection Rate	(	)	0	0	0		0		0
	Class: 25	5 Class: 2	26 Class:	27 Clas	s: 28	Class:	29 C	Class:	30
Sensitivity	NA	<b>A</b> 1	NA	NA	NA		NA		NA
Specificity	-	1	1	1	1		1		1
Pos Pred Value	NA	<b>A</b> 1	NA	NA	NA		NA		NA
Neg Pred Value	NA	<b>A</b> 1	NA	NA	NA		NA		NA
Prevalence	(	)	0	0	0		0		0
Detection Rate	(	)	0	0	0		0		0
	Class: 3	1 Class: 3	32 Class:	33 Clas	s: 34	Class:	35 C	Class:	36
Sensitivity	NA	A 1	NA	NA	NA		NA		NA
Specificity	-	1	1	1	1		1		1
Pos Pred Value	NA	<b>A</b> 1	NA	NA	NA		NA		NA
Neg Pred Value	NA	<b>A</b> 1	NA	NA	NA		NA		NA
Prevalence	(	)	0	0	0		0		0
Detection Rate	(	)	0	0	0		0		0
	Class: 37	7 Class: 3	38 Class:	39 Clas	s: 40	Class:	41 0	Class:	42
Sensitivity	NA		NA	NA	NA		NA		NA
Specificity	:	1	1	1	1		1		1
Pos Pred Value	NA	<b>A</b> 1	NA	NA	NA		NA		NA
Neg Pred Value	NA	<b>A</b> 1	NA	NA	NA		NA		NA
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Prevalence		0		0		0		0		0		0
Detection Rate		0		0		0		0		0		0
	Class:		Class:		Class:		Class:	46	Class:		Class:	48
Sensitivity		ΝA		NA		NA		NA		NA		NA
Specificity		1		1		1		1		1		1
Pos Pred Value		NA		NA		NA		NA		NA		NA
Neg Pred Value		NA		NA		NA		NA		NA		NA
Prevalence		0		0		0		0		0		0
Detection Rate	C7	0	C1	0	C7	0	Class:	0	C7	0	07	0
Congitivity	Class:	49 NA	Class:	NA	Class:	NA	Class:	5∠ NA	Class:	NA	Class:	54 NA
Sensitivity Specificity		NA 1		NA 1		NA 1		NA 1		NA 1		NA 1
Pos Pred Value		NA		NA		NA		ΝA		NA		NA
Neg Pred Value		NA		NA		NA		NA		NA		NA NA
Prevalence		0		0		0		0		0		0
Detection Rate		0		0		0		0		0		0
Detection have	Class:	-	Class:	-	Class:	-	Class:	-	Class:	-	Class:	-
Sensitivity	Olubb.	NA	orabb.	NA	orabb.	NA	Olubb.	NA	Olubb.	NA	orabb.	NA
Specificity		1		1		1		1		1		1
Pos Pred Value		NA		NA		NA		NA		NA		NA
Neg Pred Value		NA		NA		NA		NA		NA		NA
Prevalence		0		0		0		0		0		0
Detection Rate		0		0		0		0		0		0
	Class:	61	Class:	62	Class:	63	Class:	64	Class:	65	Class:	66
Sensitivity		NA		NA		NA		NA		NA		NA
Specificity		1		1		1		1		1		1
Pos Pred Value		NA		NA		NA		NA		NA		NA
Neg Pred Value		NA		NA		NA		NA		NA		NA
Prevalence		0		0		0		0		0		0
Detection Rate		0		0		0		0		0		0
	Class:		Class:		Class:		Class:		Class:		Class:	
Sensitivity		NA		NA		NA		NA		NA		NA
Specificity		1		1		1		1		1		1
Pos Pred Value		NA		NA		NA		NA		NA		NA
Neg Pred Value		NA		NA		NA		NA		NA		NA
Prevalence		0		0		0		0		0		0
Detection Rate	C7	73	C1	0	C7	0 75	Class:	76	C7	77	07	0 78
Congitivity	Class:	NA	Class:	NA	Class:	NA	Class:	NA	Class:	NA	Class:	NA
Sensitivity Specificity		1		1		1		1		1		NA 1
Pos Pred Value		ΝA		NA		NA		NA		NA		NA
Neg Pred Value		NA		NA		NA		NA		NA		NA
Prevalence		0		0		0		0		0		0
Detection Rate		0		0		0		0		0		0
	Class:	79	Class:	80	Class:	81	Class:	82	Class:	83	Class:	84
Sensitivity		NA		NA		NA		NA		NA		NA
Specificity		1		1		1		1		1		1
Pos Pred Value		NA		NA		NA		NA		NA		NA
Neg Pred Value		NA		NA		NA		NA		NA		NA
Prevalence		0		0		0		0		0		0
Detection Rate		0		0		0		0		0		0
	Class:	85	Class:	86	Class:	87	Class:	88	Class:	89	Class:	90
Sensitivity		NA		NA		NA		NA		NA		NA
Specificity		1		1		1		1		1		1
Pos Pred Value		NA		NA		NA		NA		NA		NA
Neg Pred Value		NA		NA		NA		NA		NA		NA
Prevalence		0		0		0		0		0		0
Detection Rate		0		0		0		0		0		0

	Class:	91 (	Class:	92 C	lass: 93	3 Cla	ass: 94	Clas	ss: 95 (	Class:	96
Sensitivity		NA		NA	NA	A	NA		NA		NA
Specificity		1		1		1	1		1		1
Pos Pred Value		NA		NA	N.		NA		NA		ΝA
Neg Pred Value		NA		NA	NA NA		NA		NA		NA
Prevalence		0		0		)	0		0		0
Detection Rate	~-	0	~-	0		)	0		0		0
	Class:		Class:		lass: 99						
Sensitivity		ΝA		NA	NA	A	N.	A	NA	A	
Specificity		1		1	:	1	:	L	:	1	
Pos Pred Value		NA		NA	NA	4	N A	A	NA	A	
Neg Pred Value		NA		NA	NA	4	N	A	NA	A	
Prevalence		0		0	(	)	(	)	(	)	
Detection Rate		0		0	(	)	(	)	(	)	
	Class:	102	Class:	103	Class:	104	Class:	105	Class:	106	
Sensitivity		NA		NA		NA		NA		NA	
Specificity		1		1		1		1		1	
Pos Pred Value		NA		NA		NA		ΝA		NA	
Neg Pred Value		NA		NA		NA		NA		NA	
Prevalence		0		0		0		0		0	
Detection Rate		0		0		0		0		0	
	Class:	107	Class:	108	Class:	109	Class:	110	Class:	111	
Sensitivity		NA		NA		NA		NA		NA	
Specificity		1		1		1		1		1	
Pos Pred Value		NA		NA		NA		NA		NA	
Neg Pred Value		NA		NA		NA		NA		NA	
Prevalence		0		0		0		0		0	
Detection Rate		0		0		0		0		0	
	Class:	112	Class:	113	Class:	114	Class:	115	Class:	116	
Sensitivity	orabb.	NA	orabb.	NA	orabb.	NA	orabb.	NA	orabb.	NA	
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Specificity											
Pos Pred Value		NA		NA		NA		NA		NA	
Neg Pred Value		NA		NA		NA		NA		NA	
Prevalence		0		0		0		0		0	
Detection Rate		0		0		0		0		0	
	Class:		Class:		Class:				Class:		
Sensitivity		NA		NA		NA		NA		NA	
Specificity		1		1		1		1		1	
Pos Pred Value		NA		NA		NA		NA		NA	
Neg Pred Value		NA		NA		NA		NA		NA	
Prevalence		0		0		0		0		0	
Detection Rate		0		0		0		0		0	
	Class:	122	Class:	123	Class:	124	Class:	125	Class:	126	
Sensitivity		NA		NA		NA		NA		NA	
Specificity		1		1		1		1		1	
Pos Pred Value		NA		NA		NA		ΝA		NA	
Neg Pred Value		NA		NA		NA		NA		NA	
Prevalence		0		0		0		0		0	
Detection Rate		0		0		0		0		0	
	Class:		Class:		Class:		Class:		Class:		
Sensitivity		NA		NA		NA		NA		NA	
Specificity		1		1		1		1		1	
Pos Pred Value		NA		NA		NA		NA		NA	
Neg Pred Value		NA		NA		NA		NA		NA	
Prevalence		0		0		0		0		0	
Detection Rate		0		0		0		0		0	
	Class	-	Class		Class:		Class:		Class:		
Sensitivity		NA		NA		NA		NA		NA	
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Specificity
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Prevalence
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                      Class: 137 Class: 138 Class: 139 Class: 140 Class: 141
Sensitivity
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Specificity
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Detection Rate
                      Class: 147 Class: 148
Sensitivity
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Specificity
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Detection Rate
 [ reached getOption("max.print") -- omitted 2 rows ]
> grid <- expand.grid(C = c(0, 0.01, 0.05, 0.1, 0.25, 0.5, 0.75,
+ 1, 1.25, 1.5, 1.75, 2, 5))
> set.seed(3233)
> svm_Linear_Grid <- train(V14 ~ ., data = training, method = "svmLinear",
+ trControl = trctrl, preProcess = c("center", "scale"), tuneGrid = grid,
+ tuneLength = 10)
> plot(svm_Linear_Grid)
> test_pred_grid <- predict(svm_Linear_Grid, newdata = testing)</pre>
> test_pred_grid
 [1] 0 1 1 1 0 0 1 0 0 1 0 1 0 1 1 1 1 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1 1 1 1 1
[40] 1 0 0 1 0 0 1 0 1 1 1 1 1 0 1 1 1 0 0 0 0 0 0 1 0 0 1 0 0 0 0 1 1 0 1 1 0 0
[79] 0 1 0 1 1 0 1 0 0 0 1 0
Levels: 0 1
> confusionMatrix(factor(test_pred_grid, levels = 1:148), factor(testing$V14,
+ levels = 1:148))
Confusion Matrix and Statistics
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Prediction 1
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 [ reached getOption("max.print") -- omitted 142 rows ]
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Accuracy: 1

95% CI: (0.8911, 1)

No Information Rate: 1 P-Value [Acc > NIR] : 1

Kappa : NaN

Mcnemar's Test P-Value : NA

Statistics by Class:

Class: 1 Class: 2 Class: 3 Class: 4 Class: 5 Class: 6

Congitivity		1	NA	٨	NA		NA		NA		NA	
Sensitivity	,											
Specificity		NA		1	1		1		1		1	
Pos Pred Value		NA	NA		NA		NA		NA		NA	
Neg Pred Value		NA	N		NA		NA		NA		NA	
Prevalence		1		0	0		0		0		0	
Detection Rate		1		0	0		0		0		0	
	Class:	7 (	Class: 8	3 C.	lass: 9	Cla	ass: 10	Cl	ass: 11	Cla	ass: 12	
Sensitivity		NΑ	N A	A	NA		NA		NA		NA	
Specificity		1	;	1	1		1		1		1	
Pos Pred Value	]	NΑ	NA	A	NA		NA		NA		NA	
Neg Pred Value	1	NA	N	A	NA		NA		NA		NA	
Prevalence		0	(	С	0		C	1	0		0	
Detection Rate		0	(	С	0		C	1	0		0	
	Class:	13	Class:	14	Class:	15	Class:	16	Class:	17	Class:	18
Sensitivity		NA		NA		NA		NA		NA		NA
Specificity		1		1		1		1		1		1
Pos Pred Value		NA		NA		ΝA		ΝA		NA		ΝA
Neg Pred Value		NA		NA		NA		NA		NA		NA
Prevalence		0		0		0		0		0		0
Detection Rate		0		0		0		0		0		0
Detection hate	Class	•	Class:	-	Class	-	Clagg	-	Class:	-	Clagg	24
Congitivity	orass.	NA	Olass.	NA	Olass.	NA	CIASS.	NA	Olass.	NA	Class.	NA
Sensitivity		1		1 1		1 1		NA 1		1		1
Specificity				_		_		_				
Pos Pred Value		NA		NA		NA		NA		NA		NA
Neg Pred Value		NA		NA		NA		NA		NA		NA
Prevalence		0		0		0		0		0		0
Detection Rate		0		0		0		0		0		0
	Class:		Class:		Class:		Class:		Class:		Class:	30
Sensitivity		ΝA		ΝA		ΝA		NA		NA		NA
Specificity		1		1		1		1		1		1
Pos Pred Value		ΝA		NA		ΝA		NA		NA		NA
Neg Pred Value		NA		NA		NA		NA		NA		NA
Prevalence		0		0		0		0		0		0
Detection Rate		0		0		0		0		0		0
	Class:	31	Class:	32	Class:	33	Class:	34	Class:	35	Class:	36
Sensitivity		NA		NA		NA		NA		NA		NA
Specificity		1		1		1		1		1		1
Pos Pred Value		NA		NA		NA		NA		NA		NA
Neg Pred Value		NA		NA		NA		NA		NA		NA
Prevalence		0		0		0		0		0		0
Detection Rate		0		0		0		0		0		0
	Class:	37	Class:	38	Class:	39	Class:	40	Class:	41	Class:	42
Sensitivity		NA		NA		NA		NA		NA		NA
Specificity		1		1		1		1		1		1
Pos Pred Value		NA		NA		NA		NA		NA		ΝA
Neg Pred Value		NA		NA		NA		NA		NA		NA
Prevalence		0		0		0		0		0		0
Detection Rate		0		0		0		0		0		0
Detection hate	Class	-	Class:	-	Class		Clagg		Class:		Clagg	48
Congitivity	Class.		Class.	NA	Class.		CIASS.	NA	Class.	NA	Class.	
Sensitivity		NA				NA						NA
Specificity		1		1		1		1		1		1
Pos Pred Value		NA		NA		NA		NA		NA		NA
Neg Pred Value		NA		NA		NA		NA		NA		NA
Prevalence		0		0		0		0		0		0
Detection Rate		0		0		0		0		0		0
	Class:		Class:		Class:		Class:		Class:		Class:	
Sensitivity		NA		NA		NA		NA		NA		NA
Specificity		1		1		1		1		1		1

Pos Pred Value		NA		NA		NA		NA		NA		NA
Neg Pred Value		NA		NA		NA		NA		NA		NA
Prevalence		0		0		0		0		0		0
Detection Rate		0		0		0		0		0		0
	Class:	55	Class:	56	Class:	57	Class:	58	Class:	59	Class:	60
Sensitivity		NA		NA		NA		NA		NA		NA
Specificity		1		1		1		1		1		1
Pos Pred Value		NA		NA		NA		NA		NA		NA
Neg Pred Value		NA		NA		NA		NA		NA		NA
Prevalence		0		0		0		0		0		0
Detection Rate		0		0		0		0		0		0
	Class:	61	Class:	62	Class:	63	Class:	64	Class:	65	Class:	66
Sensitivity		NA		NA		NA		NA		NA		NA
Specificity		1		1		1		1		1		1
Pos Pred Value		NA		NA		NA		NA		NA		NA
Neg Pred Value		NA		NA		NA		NA		NA		NA
Prevalence		0		0		0		0		0		0
Detection Rate		0		0		0		0		0		0
	Class:	67	Class:	68	Class:	69	Class:	70	Class:	71	Class:	72
Sensitivity		NA		NA		NA		NA		NA		NA
Specificity		1		1		1		1		1		1
Pos Pred Value		ΝA		ΝA		NA		NA		NA		NA
Neg Pred Value		ΝA		ΝA		NA		NA		NA		NA
Prevalence		0		0		0		0		0		0
Detection Rate		0		0		0		0		0		0
	Class:	73	Class:	74	Class:		Class:		Class:		Class:	78
Sensitivity		ΝA		ΝA		NA		NA		NA		NA
Specificity		1		1		1		1		1		1
Pos Pred Value		ΝA		NA		ΝA		NA		NA		NA
Neg Pred Value		ΝA		NΑ		NA		NA		NA		ΝA
Prevalence		0		0		0		0		0		0
Detection Rate		0		0		0		0		0		0
	Class:		Class:		Class:		Class:		Class:		Class:	
Sensitivity		NA		NA		NA		NA		NA		NA
Specificity		1		1		1		1		1		1
Pos Pred Value		NA		NA		NA		NA		NA		NA
Neg Pred Value		NA		NA		NA		NA		NA		NA
Prevalence		0		0		0		0		0		0
Detection Rate	<b>G</b> 3	0	a.	0	<b>0</b> 7	0	<b>0</b> 3	0	<b>0</b> 7	0	<b>0</b> 3	0
0	Class:		Class:		Class:		Class:		Class:		Class:	
Sensitivity		NA		NA		NA 1		NA		NA		NA
Specificity Pos Pred Value		1 NA		1 NA		NA		1 NA		1 NA		1 NA
Neg Pred Value		NA NA		NA NA		NA NA		NA NA		NA NA		NA NA
Prevalence		0		N A		N A		NA 0		0		0
Detection Rate		0		0		0		0		0		0
Detection hate	Class	-	Clacc		Clacc		Class:		Clacci		Clacc	-
Sensitivity	Olabb.	NA	Olabb.	NA	orabb.	NA	orabb.	NA	orabb.	NA	orabb.	NA
Specificity		1		1		1		1		1		1
Pos Pred Value		NA		ΝA		ΝA		NA		NA		NA
Neg Pred Value		NA		NA		NA		NA		NA		NA
Prevalence		0		0		0		0		0		0
Detection Rate		0		0		0		0		0		0
2505001011 16406	Class	-	Class		Class		Class:	-	) Class		01	v
Sensitivity	Jiabb.	NA	JIGDD.	NA	JIGDD.	NA	Jacob.	N			NA	
Specificity		1		1		1			1	•	1	
Pos Pred Value		NA		ΝA		ΝA		N		1	NA	
Neg Pred Value		NA		NA		NA		N			NA	
G										-		

Prevalence		0		0	(	)	0	0	
Detection Rate		0		0		)	0	0	
2000001011 1,000	Class:	-	Class:	-			Class: 105	_	.06
Sensitivity		NA		NA		NA	NA		NA
Specificity		1		1		1	1		1
Pos Pred Value		NA		NA		NA	NA		NA
Neg Pred Value		NA		NA		NA	NA		NA
Prevalence		0		0		0	(	)	0
Detection Rate		0		0		0	(	)	0
	Class:	107	Class:	108	Class:	109	Class: 110	Class: 1	11
Sensitivity		NA		NA		NA	NA		NA
Specificity		1		1		1	1		1
Pos Pred Value		NA		NA		NA	NA		NA
Neg Pred Value		NA		NA		NA	NA		NA
Prevalence		0		0		0	(	)	0
Detection Rate		0		0		0	(	)	0
	Class:	112	Class:	113	Class:	114	Class: 115	Class: 1	16
Sensitivity		NA		NA		NA	NA		NA
Specificity		1		1		1	1		1
Pos Pred Value		NA		NA		NA	NA		NA
Neg Pred Value		NA		NA		NA	NA		NA
Prevalence		0		0		0	(	)	0
Detection Rate		0		0		0	(	)	0
	Class:	117	Class:	118	Class:	119	Class: 120	Class: 1	.21
Sensitivity		NA		NA		NA	NA		NA
Specificity		1		1		1	1		1
Pos Pred Value		NA		NA		NA	NA		NA
Neg Pred Value		NA		NA		NA	NA		NA
Prevalence		0		0		0	(	)	0
Detection Rate		0		0		0	(	)	0
	Class:	122	Class:	123	Class:	124	Class: 125	Class: 1	.26
Sensitivity		NA		NA		NA	NA		NA
Specificity		1		1		1	1		1
Pos Pred Value		NA		NA		NA	NA		NA
Neg Pred Value		NA		NA		NA	NA		NA
Prevalence		0		0		0	(	)	0
Detection Rate		0		0		0	(	)	0
	Class:	127	Class:	128	Class:	129	Class: 130	Class: 1	.31
Sensitivity		NA		NA		NA	NA		NA
Specificity		1		1		1	1		1
Pos Pred Value		NA		NA		NA	NA		NA
Neg Pred Value		NA		NA		NA	NA		NA
Prevalence		0		0		0	(		0
Detection Rate		0		0		0	(	)	0
	Class:		Class:		Class:				.36
Sensitivity		NA		NA		NA	NA	-	NA
Specificity		1		1		1	1		1
Pos Pred Value		NA		NA		ΝA	NA		ΝA
Neg Pred Value		NA		NA		NA	NA		NA
Prevalence		0		0		0	(		0
Detection Rate		0		0		0	(		0
	Class:		Class:		Class:				.41
Sensitivity		NA		NA		NA	NA	-	NA
Specificity		1		1		1	1		1
Pos Pred Value		NA		NA		NA	NA		NA
Neg Pred Value		NA		NA		NA	NA		NA
Prevalence		0		0		0	(		0
Detection Rate		0		0		0	(	1	0

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Sensitivity
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Pos Pred Value
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Detection Rate
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                       Class: 147 Class: 148
Sensitivity
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Specificity
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Pos Pred Value
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Neg Pred Value
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Prevalence
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Detection Rate
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 [ reached getOption("max.print") -- omitted 2 rows ]
> set.seed(3233)
> svm_Radial <- train(V14 ~ ., data = training, method = "svmRadial",
+ trControl = trctrl, preProcess = c("center", "scale"), tuneLength = 10)
> plot(svm_Radial)
> test_pred_Radial <- predict(svm_Radial, newdata = testing)
> confusionMatrix(factor(test_pred_Radial, levels = 1:148), factor(testing$V14,
+ levels = 1:148))
Confusion Matrix and Statistics
           Reference
Prediction 1 2
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Prediction 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114
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Class: 142 Class: 143 Class: 144 Class: 145 Class: 146

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F	Refe	cenc	Э															
${\tt Prediction}$	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132
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2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F	Refe	cenc	Э															
Prediction	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148		
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
[ reached	get(	Opti	on("r	nax. <sub>]</sub>	orin	5") -	on	nitte	ed 14	12 ro	ows ]							

Accuracy : 1 95% CI : (0.8911, 1)

No Information Rate : 1 P-Value [Acc > NIR] : 1

Kappa : NaN

Mcnemar's Test P-Value : NA

# Statistics by Class:

	Class	1 (	Class: 2	CI	lace · 3	C1 :	acc. 1	Cla	gg. F	. c	lago	s . 6		
Sensitivity	Olass.	1	Olass. 2 NA		NA	OT	NA	Ola	ss. c NA		Lasi	NA		
Specificity	1	JA	1		1		1		1			1		
Pos Pred Value		JA	NA		NA		NA		N A			NA		
Neg Pred Value		JA	NA		NA		NA		NA			NA		
Prevalence		1	0		0		0		C	)		0		
Detection Rate		1	0		0		0		C	)		0		
	Class:	7 (	Class: 8	C]	lass: 9	Cla	ass: 1	) Cl	ass:	11	Cla	ass:	12	
Sensitivity	1	ΙA	NA		NA		N.	A		NA			NA	
Specificity		1	1		1			1		1			1	
Pos Pred Value	1	ΙA	NA		NA		N.	A		NA			NA	
Neg Pred Value	1	ΙA	NA		NA		N.	A		NA			NA	
Prevalence		0	0		0		(	)		0			0	
Detection Rate		0	0		0		(	)		0			0	
	Class:	13	Class:	14	Class:	15	Class	: 16	Clas	s:	17	Clas	ss:	18
Sensitivity		NA		NA		NA		NA			NA			NA
Specificity		1		1		1		1			1			1
Pos Pred Value		NA		NA		NA		NA			NA			NA
Neg Pred Value		NA		NA		NA		NA			NA			NA
Prevalence		0		0		0		0			0			0
Detection Rate		0		0		0		0			0			0

	Class:		Class:		Class:		Class:		Class:		Class:	
Sensitivity		NA		ΝA								
Specificity		1		1		1		1		1		1
Pos Pred Value		NA										
Neg Pred Value		NA		ΝA								
Prevalence		0		0		0		0		0		0
Detection Rate		0		0		0		0		0		0
	Class:		Class:		Class:		Class:		Class:		Class:	30
Sensitivity		NA										
Specificity		1		1		1		1		1		1
Pos Pred Value		NA										
Neg Pred Value		NA										
Prevalence		0		0		0		0		0		0
Detection Rate	<b>G</b> 7	0	<b>~</b> 3	0	<b>47</b>	0	<b>G</b> 2	0	<b>G</b> 7	0	<b>~</b> 3	0
~	Class:		Class:	36								
Sensitivity		NA										
Specificity		1		1		1		1		1		1
Pos Pred Value		NA										
Neg Pred Value		NA										
Prevalence		0		0		0		0		0		0
Detection Rate	<b>0</b> 3	0	<b>0</b> 7	0	<b>0</b> 7	0	<b>0</b> 1	0	<b>0</b> 7	0	<b>0</b> 3	0
g	Class:		Class:	42								
Sensitivity		NA										
Specificity		1		1		1		1		1		1
Pos Pred Value		NA										
Neg Pred Value		NA										
Prevalence Detection Rate		0		0		0		0		0		0
Detection Rate	C7	•	Class:	-	C1	0	Class:	0	Class:	0	C1	0
Congitivity	Class:		Class:		Class:		Class:	HA NA	Class:		Class:	48 M A
Sensitivity		NA 1										
Specificity Pos Pred Value		NA		NA		NA		NA		ΝA		1 NA
		NA NA										
Neg Pred Value Prevalence		0		0		0		0		0		0
Detection Rate		0		0		0		0		0		0
Detection hate	Class	•	Class:	_	Clagg	_	Class:	-	Clagge	-	Class	54
Sensitivity	Class.	NA										
Specificity		1		1		1		1		1		1
Pos Pred Value		ΝA		ΝA		NA		ΝA		ΝA		ΝA
Neg Pred Value		NA										
Prevalence		0		0		0		0		0		0
Detection Rate		0		0		0		0		0		0
Dedection Made	Class:	-	Class:	-	Class:	-	Class:	-	Class:		Class:	60
Sensitivity	Olubb.	NA	orabb.	NA								
Specificity		1		1		1		1		1		1
Pos Pred Value		ΝA		NA		ΝA		ΝA		ΝA		NA
Neg Pred Value		NA										
Prevalence		0		0		0		0		0		0
Detection Rate		0		0		0		0		0		0
	Class:	61	Class:	62	Class:	63	Class:	64	Class:	65	Class:	66
Sensitivity		NA										
Specificity		1		1		1		1		1		1
Pos Pred Value		ΝA		NA		NA		NA		ΝA		NA
Neg Pred Value		NA										
Prevalence		0		0		0		0		0		0
Detection Rate		0		0		0		0		0		0
	Class:	67	Class:	68	Class:	69	Class:	70	Class:	71	Class:	72
Sensitivity		NA		NA		NA		NA		ΝA		NA
J												

Specificity		1	1		1		1		1		1
Pos Pred Value		NA	NA		NA		NA		NA		NA
Neg Pred Value		NA	NA		NA		NA		NA		NA
Prevalence		0	0		0		0		0		0
Detection Rate		0	0		0		0		0		0
	Class:	73 Cla	ass: 74	Class:	75	Class:	76	Clas	s: 77	Class:	78
Sensitivity		NA	NA		NA		NA		NA		NA
Specificity		1	1		1		1		1		1
Pos Pred Value		NA	NA		NA		NA		NA		NA
Neg Pred Value		NA	NA		NA		NA		NA		NA
Prevalence		0	0		0		0		0		0
Detection Rate		0	0		0		0		0		0
	Class:	79 Cla	ass: 80	Class:	81	Class:	82	Clas	s: 83	Class:	84
Sensitivity		NA	NA		NA		NA		NA		NA
Specificity		1	1		1		1		1		1
Pos Pred Value		NA	NA		ΝA		ΝA		NA		ΝA
Neg Pred Value		NA	NA		NA		NA		NA		NA
Prevalence		0	0		0		0		0		0
Detection Rate		0	0		0		0		0		0
Detection hate	Class	•	-	Class:	-	Clace.	-	മാ	-	Clacc	90
Sensitivity	Oldbb.	NA	NA		NA	orabb.	NA	OTAB	NA	orabb.	NA
Specificity		1	1		1		1		1		1
Pos Pred Value		NA	NA		ΝA		ΝA		NA		ΝA
Neg Pred Value		NA	NA NA		NA		NA		NA		NA
Prevalence		0	0		0		0		0		0
		0	0		0		0		0		
Detection Rate	C1	•	-	Class:	-	C7	-	<b>01</b>	-	C1	0
Ci+ii+	Class:			Class:	93 NA	Class:		Cras	ss: 95 NA	Class:	96 N A
Sensitivity		NA 1	NA 1				NA 1				NA 1
Specificity		1	1		1		1		1		1
Pos Pred Value		NA	NA		NA		NA		NA		NA
Neg Pred Value		NA	NA		NA		NA		NA		NA
Prevalence		0	0		0		0		0		0
Detection Rate	<b>47</b>	0	0	<b>a</b> 1	0	<b>a</b> 7	0		0		0
a	Class:			Class:		Class:		Cla			
Sensitivity		NA	NA		NA		NA		IV	íA	
Specificity		1	1		1		1			1	
Pos Pred Value		NA	NA		NA		NA			ΙA	
Neg Pred Value		NA	NA		NA		NA		IV	ΙA	
Prevalence		0	0		0		0			0	
Detection Rate	<b>~</b> -	0	0		0		0		~-	0	
	Class:			03 Clas			ss:		Class:		
Sensitivity		NA		NA		NA		NA		NA	
Specificity		1		1		1		1		1	
Pos Pred Value		NA		NA		NA		NA		NA	
Neg Pred Value		NA		NA		NA		NA		NA	
Prevalence		0		0		0		0		0	
Detection Rate		0		0		0		0		0	
	Class:	107 C	lass: 1	08 Clas	s: 1	.09 Clas	ss:	110	Class:	111	
Sensitivity		NA		NA		NA		NA		NA	
Specificity		1		1		1		1		1	
Pos Pred Value		NA		NA		NA		NA		NA	
Neg Pred Value		NA		NA		NA		NA		NA	
Prevalence		0		0		0		0		0	
Detection Rate		0		0		0		0		0	
	Class:	112 C	lass: 1	13 Clas	s: 1	.14 Clas	ss:	115	Class:	116	
Sensitivity		NA		NA		NA		NA		NA	
Specificity		1		1		1		1		1	
Pos Pred Value		NA		NA		NA		NA		NA	

```
Prevalence
                                 0
                                            0
                                                         0
                                                                     0
                                                                                 0
Detection Rate
                                 0
                                            0
                                                         0
                                                                     0
                                                                                 0
                       Class: 117 Class: 118 Class: 119 Class: 120 Class: 121
Sensitivity
                               NA
                                           NA
                                                        NA
                                                                    NA
Specificity
                                1
                                            1
                                                         1
                                                                     1
                                                                                 1
Pos Pred Value
                                                                                NA
                               NA
                                            NA
                                                        NA
                                                                    NA
Neg Pred Value
                               NA
                                            NA
                                                        NA
                                                                    NA
                                                                                NA
Prevalence
                                0
                                            0
                                                         0
                                                                     0
                                                                                 0
Detection Rate
                                0
                                            0
                                                         0
                                                                     0
                                                                                 0
                       Class: 122 Class: 123 Class: 124 Class: 125 Class: 126
Sensitivity
                               NA
                                           NA
                                                        NA
                                                                    NA
Specificity
                                            1
                                                         1
Pos Pred Value
                               NA
                                           NA
                                                       NA
                                                                    NA
                                                                                NA
Neg Pred Value
                                            NA
                                                       NA
                                                                    NA
                                                                                NA
                               NΑ
Prevalence
                                0
                                            0
                                                         0
                                                                     0
                                                                                 0
Detection Rate
                                 0
                                            0
                                                         0
                                                                     0
                                                                                 0
                       Class: 127 Class: 128 Class: 129 Class: 130 Class: 131
                               NA
                                           NA
                                                                    NA
Sensitivity
                                                        NA
Specificity
                                 1
                                            1
                                                         1
                                                                     1
                                                                                 1
Pos Pred Value
                               NA
                                           NA
                                                        NA
                                                                    NA
                                                                                NA
Neg Pred Value
                               NA
                                            NA
                                                        NA
                                                                    NA
                                                                                NA
                                0
                                            0
                                                         0
                                                                     0
                                                                                 0
Prevalence
Detection Rate
                                 0
                                            0
                                                         0
                                                                     0
                                                                                 0
                       Class: 132 Class: 133 Class: 134
                                                          Class: 135 Class: 136
Sensitivity
                               NA
                                           NA
                                                        NA
                                                                    NA
                                                                                NA
Specificity
                                 1
                                            1
                                                         1
                                                                     1
                                                                                 1
Pos Pred Value
                               NA
                                            NA
                                                        NA
                                                                    NA
                                                                                NA
Neg Pred Value
                               NA
                                            NA
                                                        NA
                                                                    NA
                                                                                NA
Prevalence
                                0
                                            0
                                                         0
                                                                     0
                                                                                 0
Detection Rate
                                0
                                            0
                                                         0
                                                                     0
                                                                                 0
                       Class: 137 Class: 138 Class: 139 Class: 140 Class: 141
Sensitivity
                               NA
                                           NA
                                                        NA
                                                                    NA
                                                                                NA
                                                                                 1
Specificity
                                 1
                                            1
                                                         1
                                                                     1
Pos Pred Value
                               NA
                                            NΑ
                                                        NΑ
                                                                    NΑ
                                                                                NA
Neg Pred Value
                               NA
                                            NA
                                                        NA
                                                                    NA
                                                                                NA
Prevalence
                                0
                                            0
                                                         0
                                                                     0
                                                                                 0
                                0
                                                         0
                                                                                 0
Detection Rate
                                            0
                                                                     0
                       Class: 142 Class:
                                          143 Class: 144
                                                          Class: 145 Class:
                                                                              146
Sensitivity
                               NA
                                           NA
                                                        NA
                                                                    NA
                                                                                NA
Specificity
                                 1
                                            1
                                                         1
                                                                     1
                                                                                 1
Pos Pred Value
                               NA
                                            NA
                                                        NA
                                                                    NA
                                                                                NA
Neg Pred Value
                               NA
                                            NA
                                                        NA
                                                                    NA
                                                                                NA
Prevalence
                                 0
                                                                                 0
                                            0
                                                         0
                                                                     0
Detection Rate
                                0
                                                         0
                                                                     0
                                                                                 0
                                             0
                       Class: 147 Class: 148
Sensitivity
                               NA
                                            NA
Specificity
                                1
                                            1
Pos Pred Value
                               NA
                                            NA
                                            NA
Neg Pred Value
                               NA
Prevalence
                                0
                                            0
Detection Rate
                                0
 [ reached getOption("max.print") -- omitted 2 rows ]
> grid_radial <- expand.grid(sigma = c(0, 0.01, 0.02, 0.025, 0.03,
+ 0.04, 0.05, 0.06, 0.07, 0.08, 0.09, 0.1, 0.25, 0.5, 0.75,
+ 0.9), C = c(0, 0.01, 0.05, 0.1, 0.25, 0.5, 0.75, 1, 1.5,
+ 2, 5))
```

NA

NA

NA

NA

NA

Neg Pred Value

> set.seed(3233)

```
> svm_Radial_Grid <- train(V14 ~ ., data = training, method = "svmRadial",
+ trControl = trctrl, preProcess = c("center", "scale"), tuneGrid = grid_radial,
+ tuneLength = 10)
> svm_Radial_Grid
Support Vector Machines with Radial Basis Function Kernel
210 samples
 13 predictor
  2 classes: '0', '1'
Pre-processing: centered (13), scaled (13)
Resampling: Cross-Validated (10 fold, repeated 3 times)
Summary of sample sizes: 189, 189, 189, 189, 189, 189, ...
Resampling results across tuning parameters:
  sigma C
              Accuracy
                         Kappa
  0.000 0.00
                    NaN
                                NaN
  0.000 0.01
              0.5238095
                         0.00000000
  0.000 0.05
             0.5238095
                        0.000000000
  0.000 0.10 0.5238095
                        0.000000000
  0.000 0.25 0.5238095
                        0.000000000
  0.000 0.50 0.5238095
                        0.000000000
  0.000 0.75 0.5238095
                        0.00000000
  0.000 1.00 0.5238095
                         0.00000000
  0.000
        1.50 0.5238095
                        0.000000000
  0.000 2.00 0.5238095
                        0.000000000
                        0.000000000
  0.000 5.00 0.5238095
  0.010 0.00
                    {\tt NaN}
  0.010 0.01 0.5238095 0.000000000
  0.010 0.05 0.5238095 0.000000000
  0.010 0.10 0.7904762 0.572773277
  0.010 0.25 0.8111111
                         0.617503180
  0.010 0.50 0.8190476 0.634519523
  0.010 0.75 0.8174603 0.631528851
  0.010 1.00 0.8174603 0.631352905
  0.010 1.50 0.8190476 0.634666550
  0.010 2.00 0.8190476
                        0.634666550
  0.010 5.00 0.8111111
                        0.619121228
  0.020 0.00
                    NaN
                                NaN
  0.020 0.01
              0.5238095
                        0.000000000
  0.020 0.05 0.6952381
                        0.370309451
  0.020 0.10 0.8174603 0.630021936
  0.020 0.25 0.8222222 0.641206267
  0.020 0.50 0.8142857 0.625078184
  0.020 0.75 0.8174603 0.631528851
 0.020 1.00 0.8190476 0.634722788
  0.020 1.50
             0.8111111
                        0.618915958
  0.020 2.00
              0.8095238
                         0.615630414
 0.020 5.00 0.7904762
                        0.578177897
  0.025 0.00
                    NaN
                                NaN
  0.025
        0.01 0.5238095
                        0.000000000
  0.025
        0.05 0.7571429
                        0.501717569
  0.025
        0.10 0.8158730
                        0.627180600
  0.025
        0.25 0.8158730
                        0.628156814
  0.025
        0.50 0.8142857
                         0.625105376
  0.025 0.75 0.8158730
                        0.628419020
  0.025 1.00 0.8142857
                        0.625368228
  0.025 1.50 0.8095238 0.615630414
```

0.025	2.00	0.8079365	0.612375952
0.025	5.00	0.7825397	0.562431414
0.030	0.00	NaN	NaN
0.030	0.01	0.5238095	0.00000000
0.030	0.05	0.7666667	0.522491751
0.030	0.10	0.8158730	0.627327897
0.030	0.25	0.8158730 0.8126984	0.628215207 0.621968353
0.030	0.75	0.8142857	0.625280394
0.030	1.00	0.8111111	0.618944058
0.030	1.50	0.8095238	0.615630414
0.030	2.00	0.8000000	0.596829329
0.030	5.00	0.7746032	0.546420219
0.040	0.00	NaN	NaN
0.040	0.01	0.5238095	0.000000000
0.040	0.05	0.7777778	0.546099884
0.040	0.10	0.8142857	0.624457829
0.040	0.25	0.8158730	0.628098443
0.040	0.50	0.8111111	0.619061556
0.040	0.75 1.00	0.8095238 0.8079365	0.615862243 0.612522040
0.040	1.50	0.8079365	0.612522040
0.040	2.00	0.7888889	0.574894377
0.040	5.00	0.7682540	0.533689992
0.050	0.00	NaN	NaN
0.050	0.01	0.5238095	0.000000000
0.050	0.05	0.7746032	0.539466957
0.050	0.10	0.8142857	0.624780963
0.050	0.25	0.8158730	0.628098443
0.050	0.50	0.8126984	0.622345065
0.050	0.75	0.8063492	0.609411690
0.050	1.00	0.8063492	0.609383154
0.050	1.50	0.7888889	0.574836119
0.050	2.00	0.7761905	0.549556877
0.050	5.00	0.7650794	0.527295716
0.060	0.00	NaN	NaN
0.060	0.01	0.5238095	0.000000000
0.060	0.05	0.7587302	0.506304402
0.060	0.10 0.25	0.8111111 0.8126984	0.618300573 0.621881063
0.060	0.25	0.8079365	0.612610195
0.060	0.75	0.8015873	0.599880768
0.060	1.00	0.7952381	0.587007531
0.060	1.50	0.7793651	0.555802949
0.060	2.00	0.7793651	0.556185239
0.060	5.00	0.7603175	0.518483308
0.070	0.00	NaN	NaN
0.070	0.01	0.5238095	0.000000000
0.070	0.05	0.7365079	0.458840485
0.070	0.10	0.8111111	0.618330431
0.070	0.25	0.8063492	0.609094732
0.070	0.50	0.8063492	0.609443172
0.070	0.75	0.7952381	0.587095518
0.070	1.00	0.7904762	0.577855206
0.070	1.50	0.7761905	0.549499422
0.070	2.00 5.00	0.7761905 0.7571429	0.549790799 0.512342204
0.070	0.00	0.7571429 NaN	0.512342204 NaN
0.000	0.00	INall	Man

```
0.080 0.01
             0.5238095
                         0.00000000
0.080
       0.05
             0.7015873
                         0.384579214
0.080
             0.8063492
       0.10
                         0.608623691
0.080
       0.25
             0.8079365
                         0.612787335
0.080
       0.50
             0.8015873
                         0.599970753
0.080
       0.75
             0.7952381
                         0.587185098
0.080
       1.00
             0.7841270
                         0.565155380
0.080
       1.50
             0.7793651
                         0.556038205
0.080
       2.00
             0.7714286
                         0.540317989
0.080
       5.00
             0.7571429
                         0.512520301
0.090
       0.00
                    NaN
                                 NaN
0.090
       0.01
             0.5238095
                         0.00000000
0.090
       0.05
             0.6571429
                         0.289294589
0.090
       0.10
             0.8063492
                         0.608476664
       0.25
0.090
             0.8079365
                         0.613251126
0.090
       0.50
             0.8000000
                         0.596745743
0.090
       0.75
             0.7936508
                         0.584014883
0.090
       1.00
             0.7809524
                         0.558792544
       1.50
0.090
             0.7761905
                         0.549791599
0.090
       2.00
             0.7698413
                         0.537236447
0.090
       5.00
                         0.522375325
             0.7619048
0.100
       0.00
                    NaN
                                 NaN
0.100
       0.01
             0.5238095
                         0.00000000
0.100
       0.05
             0.6142857
                         0.197118299
0.100
       0.10
             0.8095238
                         0.614631322
0.100
       0.25
             0.8111111
                         0.619993590
0.100
       0.50
             0.8000000
                         0.597123554
0.100
       0.75
             0.7920635
                         0.580877185
0.100
       1.00
             0.7809524
                         0.559381191
0.100
       1.50
             0.7746032
                         0.546822855
0.100
       2.00
             0.7682540
                         0.534499910
0.100
       5.00
             0.7587302
                         0.516073614
0.250
       0.00
                    NaN
                                 NaN
       0.01
0.250
             0.5238095
                         0.00000000
0.250
       0.05
             0.5238095
                         0.00000000
0.250
       0.10
             0.5253968
                         0.003475513
0.250
       0.25
             0.7253968
                         0.439136882
0.250
       0.50
             0.7476190
                         0.496851555
0.250
       0.75
             0.7380952
                         0.477159921
0.250
       1.00
             0.7460317
                         0.491597676
0.250
       1.50
             0.7301587
                         0.460075036
       2.00
0.250
             0.7285714
                         0.456789050
0.250
       5.00
             0.7253968
                         0.450540095
0.500
       0.00
                    NaN
                                 NaN
0.500
       0.01
                         0.00000000
             0.5238095
0.500
       0.05
             0.5238095
                         0.00000000
0.500
       0.10
             0.5238095
                         0.00000000
0.500
       0.25
             0.5238095
                         0.00000000
0.500
       0.50
             0.5682540
                         0.098762428
0.500
       0.75
             0.6126984
                         0.204503243
0.500
       1.00
             0.6888889
                         0.379763899
0.500
       1.50
             0.6841270
                         0.371094398
0.500
       2.00
             0.6904762
                         0.384000578
0.500
       5.00
             0.6888889
                         0.380945645
0.750
       0.00
                    NaN
                                 NaN
0.750
       0.01
             0.5238095
                         0.00000000
0.750
       0.05
             0.5238095
                         0.00000000
0.750
             0.5238095
                         0.00000000
      0.10
```

```
0.750 0.25 0.5238095 0.000000000
0.750 0.50 0.5301587 0.013902054
0.750 0.75 0.5571429 0.074827171
0.750 1.00 0.5809524 0.138239103
0.750 1.50 0.5968254 0.174064271
0.750 2.00 0.5984127 0.177738543
0.750 5.00 0.5984127 0.177738543
0.900 0.00
           NaN
                             NaN
0.900 0.01 0.5238095 0.000000000
0.900 0.05 0.5238095 0.000000000
0.900 0.10 0.5238095 0.000000000
0.900 0.25 0.5238095 0.000000000
0.900 0.50 0.5238095 0.000000000
0.900 0.75 0.5492063 0.055825807
0.900 1.00 0.5444444 0.055132187
0.900 1.50 0.5555556 0.081488190
0.900 2.00 0.5555556 0.081488190
0.900 5.00 0.5555556 0.081488190
```

Accuracy was used to select the optimal model using the largest value. The final values used for the model were sigma = 0.02 and C = 0.25.

- > plot(svm\_Radial\_Grid)
- > test\_pred\_Radial\_Grid <- predict(svm\_Radial\_Grid, newdata = testing)
- > confusionMatrix(factor(test\_pred\_Radial\_Grid, levels = 1:148),

> confusi											L_G	rid	, 1	evel	Ls =	= 1:	: 148	3),						
+ factor(								1:14	48)	)														
Confusion	Mat	rix	and	d St	tati	ist	ics																	
	Ref																							
Predictio		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Ref																							
Predictio					29	30	31		33		35	36	37	38		40	41		43		45	46	47	48
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Ref																							
Predictio				52	53	54		56		58		60	61		63		65				69	70	71	72
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D 1:	Refe			70	77	70	70	00	04	00	00	0.4	0.5	0.0	07	00	00	00	0.4	00	00	0.4	٥.	0.0
Predictio				76	77	78	79	80		82		84	85	86	87	88	89	90	91	92	93	94		96
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	U	0	0	0	0	0

6	0	0	0	0	0	0 0	0	0	0 0	0	0	0 0	0	0	0 (	0	0	0	0	0
I	Refe	rer	ıce																	
Prediction	97	98	99	100	101	. 102	103	104	105	106	3 107	108	109	110	11:	l 112	113	3 11	4	
1	0	0	0	0	C	) C	C	) (	) (	) (	) (	) (	) C	) (	) (	) (	) (	)	0	
2	0	0	0	0	C	) C	C	) (	) (	) (	) (	) (	) C	) (	) (	) (	) (	)	0	
3	0	0	0	0	C	) C	C	) (	) (	) (	) (	) (	) C	) (	) (	) (	) (	)	0	
4	0	0	0	0	C	) C	C	) (	) (	) (	) (	) (	) C	) (	) (	) (	) (	)	0	
5	0	0	0	0	C	) C	C	) (	) (	) (	) (	) (	) C	) (	) (	) (	) (	)	0	
6	0	0	0	0	C	) C	C	) (	) (	) (	) (	) (	) C	) (	) (	) (	) (	)	0	
I	Refe	rer	ice																	
Prediction	115	11	16	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	1	32
1	0	)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
2	0	)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
3	0	)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
4	0	)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
5	0	)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
6	0	)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
I	Refe	rer	ıce																	
Prediction	133	13	34 :	135	136	137	138	139	140	141	142	143	144	145	146	147	148			
1	0	)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
2	0	)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
3	0	)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
4	0	)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
5	0	)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
6	0	)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
[ reached	get	0pt	tio	n("ma	ax.p	rint	") -	- on	nitte	ed 14	12 ro	ows ]								

Accuracy : 1 95% CI : (0.8911, 1)

No Information Rate : 1 P-Value [Acc > NIR] : 1

Kappa : NaN

Mcnemar's Test P-Value : NA

## Statistics by Class:

	Class: 1	Class: 2	Class: 3	Class: 4	Class: 5 C	lass: 6	
Sensitivity	1	NA	NA	NA	NA	NA	
Specificity	NA	1	1	1	1	1	
Pos Pred Value	NA	NA	NA	NA	NA	NA	
Neg Pred Value	NA	NA	NA	NA	NA	NA	
Prevalence	1	0	0	0	0	0	
Detection Rate	1	0	0	0	0	0	
	Class: 7	Class: 8	Class: 9	Class: 10	Class: 11	Class: 12	2
Sensitivity	NA	NA	NA	NA	NA	NA	A
Specificity	1	1	1	1	1		1
Pos Pred Value	NA	NA	NA	NA	NA	NA	A
Neg Pred Value	NA	NA	NA	NA	NA	NA	A
Prevalence	0	0	0	0	0	(	0
Detection Rate	0	0	0	0	0	(	0
	Class: 13	3 Class:	14 Class:	15 Class:	16 Class:	17 Class	: 18
Sensitivity	N.	A 1	NA	NA	NA	NA	NA
Specificity	:	1	1	1	1	1	1
Pos Pred Value	N.	A 1	NA	NA	NA	NA	NA

Neg Pred Value		NA		NA		NA		NA		NA		NA
Prevalence		0		0		0		0		0		0
Detection Rate		0		0		0		0		0		0
	Class:	19	Class:	20	Class:	21	Class:	22	Class:	23	Class:	24
Sensitivity		NA		NA		NA		NA		NA		NA
Specificity		1		1		1		1		1		1
Pos Pred Value		NA		NA		NA		NA		NA		NA
Neg Pred Value		NA		NA		NA		NA		NA		NA
Prevalence		0		0		0		0		0		0
Detection Rate		0		0		0		0		0		0
	Class:	25	Class:	26	Class:	27	Class:	28	Class:	29	Class:	30
Sensitivity		NA		NA		NA		NA		NA		NA
Specificity		1		1		1		1		1		1
Pos Pred Value		NA		NA		NA		NA		NA		NA
Neg Pred Value		NA		NA		NA		NA		NA		NA
Prevalence		0		0		0		0		0		0
Detection Rate		0		0		0		0		0		0
	Class:	31	Class:	32	Class:	33	Class:	34	Class:	35	Class:	36
Sensitivity		NA		NA		NA		NA		NA		NA
Specificity		1		1		1		1		1		1
Pos Pred Value		NA		NA		NA		NA		NA		NA
Neg Pred Value		NA		NA		NA		NA		NA		NA
Prevalence		0		0		0		0		0		0
Detection Rate		0		0		0		0		0		0
	Class:	37	Class:	38	Class:	39	Class:	40	Class:	41	Class:	42
Sensitivity		NA		NA		NA		NA		NA		NA
Specificity		1		1		1		1		1		1
Pos Pred Value		NA		NA		NA		NA		NA		NA
Neg Pred Value		NA		NA		NA		NA		NA		NA
Prevalence		0		0		0		0		0		0
Prevalence Detection Rate		0		0		0		0		0		0
	Class:	0	Class:	0	Class:	0	Class:	0	Class:	0	Class:	
	Class:	0	Class:	0	Class:	0	Class:	0	Class:	0	Class:	0
Detection Rate	Class:	0 43	Class:	0 44	Class:	0 45	Class:	0 46	Class:	0 47	Class:	0 48
Detection Rate Sensitivity	Class:	0 43 NA	Class:	0 44 NA	Class:	0 45 NA	Class:	0 46 NA	Class:	0 47 NA	Class:	0 48 NA
Detection Rate Sensitivity Specificity	Class:	0 43 NA 1	Class:	0 44 NA 1	Class:	0 45 NA 1	Class:	0 46 NA 1	Class:	0 47 NA 1	Class:	0 48 NA 1
Detection Rate Sensitivity Specificity Pos Pred Value	Class:	0 43 NA 1 NA	Class:	0 44 NA 1 NA	Class:	0 45 NA 1 NA	Class:	0 46 NA 1 NA	Class:	0 47 NA 1 NA	Class:	0 48 NA 1 NA
Sensitivity Specificity Pos Pred Value Neg Pred Value	Class:	0 43 NA 1 NA	Class:	0 44 NA 1 NA NA	Class:	0 45 NA 1 NA	Class:	0 46 NA 1 NA	Class:	0 47 NA 1 NA NA	Class:	0 48 NA 1 NA NA
Sensitivity Specificity Pos Pred Value Neg Pred Value Prevalence		0 43 NA 1 NA NA 0		0 44 NA 1 NA NA 0		0 45 NA 1 NA NA 0		0 46 NA 1 NA NA 0		0 47 NA 1 NA NA 0	Class:	0 48 NA 1 NA NA 0
Sensitivity Specificity Pos Pred Value Neg Pred Value Prevalence		0 43 NA 1 NA NA 0		0 44 NA 1 NA NA 0		0 45 NA 1 NA NA 0		0 46 NA 1 NA NA 0		0 47 NA 1 NA NA 0		0 48 NA 1 NA NA 0
Detection Rate  Sensitivity Specificity Pos Pred Value Neg Pred Value Prevalence Detection Rate		0 43 NA 1 NA NA 0 0 49		0 44 NA 1 NA NA 0 0		0 45 NA 1 NA NA 0 0		0 46 NA 1 NA 0 0 52		0 47 NA 1 NA 0 0 53		0 48 NA 1 NA NA 0 0
Sensitivity Specificity Pos Pred Value Neg Pred Value Prevalence Detection Rate Sensitivity		0 43 NA 1 NA 0 0 49 NA		0 44 NA 1 NA 0 0 50 NA		0 45 NA 1 NA 0 0 51 NA		0 46 NA 1 NA 0 0 52 NA		0 47 NA 1 NA 0 0 53 NA		0 48 NA 1 NA NA 0 0 54 NA
Detection Rate  Sensitivity Specificity Pos Pred Value Neg Pred Value Prevalence Detection Rate  Sensitivity Specificity		0 43 NA 1 NA 0 0 49 NA 1		0 44 NA 1 NA 0 0 50 NA 1		0 45 NA 1 NA 0 0 51 NA		0 46 NA 1 NA 0 0 52 NA 1		0 47 NA 1 NA 0 0 53 NA 1		0 48 NA 1 NA 0 0 54 NA
Sensitivity Specificity Pos Pred Value Neg Pred Value Prevalence Detection Rate  Sensitivity Specificity Pos Pred Value		0 43 NA 1 NA 0 0 49 NA 1 NA		0 444 NA 1 NA 0 0 50 NA 1 NA		0 45 NA 1 NA NA 0 0 51 NA 1 NA		0 46 NA 1 NA NA 0 0 52 NA 1 NA		0 47 NA 1 NA 0 0 53 NA 1 NA		0 48 NA 1 NA 0 0 54 NA 1
Sensitivity Specificity Pos Pred Value Neg Pred Value Prevalence Detection Rate  Sensitivity Specificity Pos Pred Value Neg Pred Value Neg Pred Value		0 43 NA 1 NA 0 0 49 NA 1 NA		0 44 NA 1 NA 0 0 50 NA 1 NA		0 45 NA 1 NA 0 0 51 NA 1 NA		0 46 NA 1 NA NA 0 0 52 NA 1 NA		0 47 NA 1 NA NA 0 0 53 NA 1 NA		0 48 NA 1 NA 0 0 54 NA 1 NA
Sensitivity Specificity Pos Pred Value Neg Pred Value Prevalence Detection Rate  Sensitivity Specificity Pos Pred Value Neg Pred Value Prevalence	Class:	0 43 NA 1 NA 0 0 49 NA 1 NA 0 0	Class:	0 44 NA 1 NA 0 0 50 NA 1 NA 0 0	Class:	0 45 NA 1 NA 0 0 51 NA 1 NA 0 0	Class:	0 46 NA 1 NA 0 0 52 NA 1 NA 0 0	Class:	0 47 NA 1 NA 0 0 53 NA 1 NA 0 0		0 48 NA 1 NA 0 0 54 NA 1 NA 0 0
Sensitivity Specificity Pos Pred Value Neg Pred Value Prevalence Detection Rate  Sensitivity Specificity Pos Pred Value Neg Pred Value Prevalence	Class:	0 43 NA 1 NA 0 0 49 NA 1 NA 0 0	Class:	0 44 NA 1 NA 0 0 50 NA 1 NA 0 0	Class:	0 45 NA 1 NA 0 0 51 NA 1 NA 0 0	Class:	0 46 NA 1 NA 0 0 52 NA 1 NA 0 0	Class:	0 47 NA 1 NA 0 0 53 NA 1 NA 0 0	Class:	0 48 NA 1 NA 0 0 54 NA 1 NA 0 0
Sensitivity Specificity Pos Pred Value Neg Pred Value Prevalence Detection Rate  Sensitivity Specificity Pos Pred Value Neg Pred Value Prevalence Detection Rate	Class:	0 43 NA 1 NA 0 0 49 NA 1 NA 0 0 55	Class:	0 44 NA 1 NA 0 0 50 NA 1 NA 0 0 50 NA 0 50 50 So 0 50 50 50 50 50 50 50 50 50 50 50 50 5	Class:	0 45 NA 1 NA 0 0 51 NA 1 NA 0 0 51 S1 NA 0 57	Class:	0 46 NA 1 NA 0 0 52 NA 1 NA 0 0 52 S 0 0 52 S 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Class:	0 47 NA 1 NA 0 0 53 NA 1 NA 0 0 53 S	Class:	0 48 NA 1 NA 0 0 54 NA 1 NA 0 0 0 54 NA 0 0 6 0 6 0 6 0 0 0 0 0 0 0 0 0 0 0 0
Sensitivity Specificity Pos Pred Value Neg Pred Value Prevalence Detection Rate  Sensitivity Specificity Pos Pred Value Neg Pred Value Neg Pred Value Prevalence Detection Rate  Sensitivity	Class:	0 43 NA 1 NA 0 0 49 NA 1 NA 0 0 0 55 NA	Class:	0 44 NA 1 NA 0 0 50 NA 1 NA 0 0 0 50 NA 1 NA	Class:	0 45 NA 1 NA 0 0 51 NA 1 NA 0 0 551 NA 1 NA 1 NA 1 NA 1 NA 1 NA 1 NA 1	Class:	0 46 NA 1 NA 0 0 52 NA 1 NA 0 0 52 NA 1 NA NA NA	Class:	0 47 NA 1 NA 0 0 53 NA 1 NA 0 0 0 53 NA 1 NA 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Class:	0 48 NA 1 NA 0 0 54 NA 1 NA NA 0 0 0 54 NA 1 NA
Sensitivity Specificity Pos Pred Value Neg Pred Value Prevalence Detection Rate  Sensitivity Specificity Pos Pred Value Neg Pred Value Neg Pred Value Prevalence Detection Rate  Sensitivity Specificity Specificity Pos Pred Value Prevalence Detection Rate	Class:	0 43 NA 1 NA 0 0 49 NA 1 NA 0 0 55 NA 1	Class:	0 44 NA 1 NA 0 0 50 NA 1 NA 0 0 50 NA 1 NA 1 1 NA 1 1 1 1 1 1 1 1 1 1 1 1	Class:	0 45 NA 1 NA 0 0 51 NA 1 NA 0 0 57 NA	Class:	0 46 NA 1 NA 0 0 52 NA 1 NA 0 0 52 NA 1 NA 1 1 NA 1 1 1 1 1 1 1 1 1 1 1 1	Class:	0 47 NA 1 NA 0 0 53 NA 1 NA 0 0 53 NA 1 NA 1 NA 1 1 NA 1 1 1 1 1 1 1 1 1 1	Class:	0 48 NA 1 NA 0 0 54 NA 1 NA 0 0 0 60 NA
Sensitivity Specificity Pos Pred Value Neg Pred Value Prevalence Detection Rate  Sensitivity Specificity Pos Pred Value Neg Pred Value Neg Pred Value Prevalence Detection Rate  Sensitivity Specificity Pos Pred Value Prevalence Detection Rate	Class:	0 43 NA 1 NA 0 0 49 NA 1 NA 0 0 55 NA 1 NA	Class:	0 444 NA 1 NA 0 0 50 NA 1 NA 0 0 56 NA 1 NA	Class:	0 45 NA 1 NA 0 0 51 NA 1 NA 0 0 57 NA 1 NA	Class:	0 46 NA 1 NA 0 0 52 NA 1 NA 0 0 52 NA 1 NA 1 NA 1 NA 1 NA 1 NA 1 NA 1 NA	Class:	0 47 NA 1 NA 0 0 53 NA 1 NA 0 0 0 53 NA 1 NA 1 NA 1 NA 1 NA 1 NA 1 NA 1 NA	Class:	0 48 NA 1 NA 0 0 54 NA 1 NA 0 0 60 NA 1 NA
Sensitivity Specificity Pos Pred Value Neg Pred Value Prevalence Detection Rate  Sensitivity Specificity Pos Pred Value Neg Pred Value Prevalence Detection Rate  Sensitivity Specificity Pos Pred Value Prevalence Detection Rate	Class:	0 43 NA 1 NA 0 0 49 NA 1 NA 0 0 55 NA 1 NA	Class:	0 444 NA 1 NA 0 0 50 NA 1 NA 0 0 56 NA 1 NA	Class:	0 45 NA 1 NA 0 0 51 NA 1 NA 0 0 57 NA 1 NA	Class:	0 46 NA 1 NA 0 0 52 NA 1 NA 0 0 58 NA 1 NA NA NA NA NA NA NA NA NA NA NA NA NA	Class:	0 47 NA 1 NA 0 0 53 NA 1 NA 0 0 59 NA 1 NA	Class:	0 48 NA 1 NA 0 0 54 NA 1 NA 0 0 60 NA 1 NA
Sensitivity Specificity Pos Pred Value Neg Pred Value Prevalence Detection Rate  Sensitivity Specificity Pos Pred Value Neg Pred Value Prevalence Detection Rate  Sensitivity Specificity Pos Pred Value Prevalence Detection Rate	Class:	0 43 NA 1 NA 0 0 49 NA 1 NA 0 0 55 NA 1 NA 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Class:	0 444 NA 1 NA 0 0 50 NA 1 NA 0 0 56 NA 1 NA 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Class:	0 45 NA 1 NA 0 0 51 NA 1 NA 0 0 57 NA 1 NA 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Class:	0 46 NA 1 NA 0 0 52 NA 1 NA 0 0 58 NA 1 NA 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Class:	0 47 NA 1 NA 0 0 53 NA 1 NA 0 0 59 NA 1 NA 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Class:	0 48 NA 1 NA 0 0 54 NA 1 NA 0 60 NA 1 NA 0 0
Sensitivity Specificity Pos Pred Value Neg Pred Value Prevalence Detection Rate  Sensitivity Specificity Pos Pred Value Neg Pred Value Prevalence Detection Rate  Sensitivity Specificity Pos Pred Value Prevalence Detection Rate	Class:	0 43 NA 1 NA 0 0 49 NA 1 NA 0 0 55 NA 1 NA 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Class:	0 444 NA 1 NA 0 0 50 NA 1 NA 0 0 56 NA 1 NA 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Class:	0 45 NA 1 NA 0 0 51 NA 1 NA 0 0 57 NA 1 NA 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Class:	0 46 NA 1 NA 0 0 52 NA 1 NA 0 0 58 NA 1 NA 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Class:	0 47 NA 1 NA 0 0 53 NA 1 NA 0 0 59 NA 1 NA 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Class:	0 48 NA 1 NA 0 0 54 NA 1 NA 0 60 NA 1 NA 0 0
Sensitivity Specificity Pos Pred Value Neg Pred Value Prevalence Detection Rate  Sensitivity Specificity Pos Pred Value Neg Pred Value Neg Pred Value Prevalence Detection Rate  Sensitivity Specificity Pos Pred Value Prevalence Detection Rate  Sensitivity Specificity Pos Pred Value Neg Pred Value Neg Pred Value Prevalence Detection Rate  Sensitivity	Class:	0 43 NA 1 NA 0 0 49 NA 1 NA NA 0 0 55 NA 1 NA 0 0 0 55 NA 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Class:	0 444 NA 1 NA NA 0 0 0 566 NA 1 NA NA 0 0 62	Class:	0 45 NA 1 NA 0 0 51 NA 1 NA NA 0 0 57 NA 1 NA 0 0 0 57 NA 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Class:	0 46 NA 1 NA 0 0 52 NA 1 NA NA 0 0 58 NA 1 NA NA 0 0 0 58 NA 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Class:	0 47 NA 1 NA 0 0 53 NA 1 NA NA 0 0 59 NA 1 NA 0 0 59 NA 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Class:	0 48 NA 1 NA 0 0 54 NA 1 NA 0 0 60 NA 1 NA 0 0 60 NA 0 60 0 60 0 60 0 60 0 60 0
Sensitivity Specificity Pos Pred Value Neg Pred Value Prevalence Detection Rate  Sensitivity Specificity Pos Pred Value Neg Pred Value Neg Pred Value Prevalence Detection Rate  Sensitivity Specificity Pos Pred Value Prevalence Detection Rate  Sensitivity Specificity Pos Pred Value Neg Pred Value Neg Pred Value Prevalence Detection Rate	Class:	0 43 NA 1 NA NA 0 0 49 NA 1 NA NA 0 0 55 NA 1 NA NA 0 0 61 NA	Class:	0 444 NA 1 NA NA 0 0 0 560 NA 1 NA NA 0 0 62 NA	Class:	0 45 NA 1 NA 0 0 51 NA 1 NA 0 0 57 NA 1 NA 0 0 6 7 NA 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Class:	0 46 NA 1 NA 0 0 52 NA 1 NA 0 0 58 NA 1 NA 0 0 0 58 NA 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Class:	0 47 NA 1 NA 0 0 53 NA 1 NA 0 0 59 NA 1 NA 0 0 65 NA 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Class:	0 48 NA 1 NA 0 0 0 54 NA 1 NA 0 0 60 NA 1 NA 0 0 60 NA 0 0 60 NA 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Sensitivity Specificity Pos Pred Value Neg Pred Value Prevalence Detection Rate  Sensitivity Specificity Pos Pred Value Prevalence Detection Rate  Sensitivity Specificity Pos Pred Value Prevalence Detection Rate  Sensitivity Specificity Pos Pred Value Neg Pred Value Neg Pred Value Sensitivity Specificity Pos Pred Value Prevalence Detection Rate  Sensitivity Specificity Pos Pred Value Prevalence Detection Rate	Class:	0 43 NA 1 NA 0 0 49 NA 1 NA NA 0 0 55 NA 1 NA 0 0 61 NA 1	Class:	0 444 NA 1 NA NA 0 0 0 560 NA 1 NA NA 0 0 62 NA 1	Class:	0 45 NA 1 NA 0 0 51 NA 1 NA 0 0 57 NA 1 NA 0 0 57 NA 1 NA 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Class:	0 46 NA 1 NA 0 0 52 NA 1 NA 0 0 58 NA 1 NA 0 0 64 NA 1	Class:	0 47 NA 1 NA 0 0 53 NA 1 NA 0 0 59 NA 1 NA 0 0 59 NA 1 NA 1 NA 1 NA 1 1 1 1 1 1 1 1 1 1 1	Class:	0 48 NA 1 NA 0 0 0 54 NA 1 NA 0 0 0 60 NA 1 NA 0 0 0 60 NA 1 1 NA 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Sensitivity Specificity Pos Pred Value Neg Pred Value Prevalence Detection Rate  Sensitivity Specificity Pos Pred Value Neg Pred Value Neg Pred Value Prevalence Detection Rate  Sensitivity Specificity Pos Pred Value Prevalence Detection Rate  Sensitivity Specificity Pos Pred Value Neg Pred Value Prevalence Detection Rate  Sensitivity Specificity Specificity Specificity	Class:	0 43 NA 1 NA 0 0 49 NA 1 NA 0 0 55 NA 1 NA 0 0 0 61 NA 1 NA 1 NA 1 NA 1 NA 1 NA 1 NA 1 N	Class:	0 444 NA 1 NA 0 0 50 NA 1 NA 0 0 56 NA 1 NA 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Class:	0 45 NA 1 NA 0 0 51 NA 1 NA 0 0 57 NA 1 NA 0 0 0 57 NA 1 NA 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Class:	0 46 NA 1 NA 0 0 52 NA 1 NA 0 0 58 NA 1 NA 0 0 0 58 NA 1 NA 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Class:	0 47 NA 1 NA 0 0 53 NA 1 NA 0 0 59 NA 1 NA 0 0 0 59 NA 1 NA 1 NA 1 NA 1 NA 1 NA 1 NA 1 NA	Class:	0 48 NA 1 NA 0 0 54 NA 1 NA 0 0 60 NA 1 NA 0 0 60 NA 1 NA 1 NA 1 NA 1 NA 1 NA 1 NA 1 NA

Detection Rate		0		0		0		0		0		0
	Class:	67	Class:	68	Class:	69	Class:	70	Class:	71	Class:	72
Sensitivity		NA		NA		NA		NA		NA		NA
Specificity		1		1		1		1		1		1
Pos Pred Value		NA		NA		NA		NA		NA		NA
Neg Pred Value		NA		NA		NA		NA		NA		NA
Prevalence		0		0		0		0		0		0
Detection Rate		0		0		0		0		0		0
	Class:	73	Class:	74	Class:	75	Class:	76	Class:	77	Class:	78
Sensitivity		NA		NA		NA		NA		NA		NA
Specificity		1		1		1		1		1		1
Pos Pred Value		NA		NA		NA		NA		NA		NA
Neg Pred Value		NA		NA		NA		NA		NA		NA
Prevalence		0		0		0		0		0		0
Detection Rate		0		0		0		0		0		0
	Class:	79	Class:	80	Class:		Class:		Class:	83	Class:	
Sensitivity		NA		ΝA		NΑ		NA		NA		ΝA
Specificity		1		1		1		1		1		1
Pos Pred Value		ΝA		NA		ΝA		ΝA		NA		NA
Neg Pred Value		NA		NA		NA		NA		NA		NA
Prevalence		0		0		0		0		0		0
Detection Rate		0		0		0		0		0		0
Detection hate	Clacc	-	Clace.	-	Clacc	-	Clacc		Class:		Clacc	90
Sensitivity	Class.	NA	Class.	NA	Class.	NA	CIASS.	NA	Class.	NA	Class.	NA
Specificity		1		1		1		1		1		1
Pos Pred Value		NA		NA		NA		NA		NA		NA
Neg Pred Value		NA		NA		NA		NA NA		NA		NA
Prevalence		0		0		0		0		0		0
Detection Rate		0		0		0		0		0		0
Detection hate	Class.	-	Class	-	Claga.		Closs		Class:	-	Class	96
Ci+ii+	Class:	91 NA	Class:	92 NA	Class:	93 NA	Class:	94 NA	Class:	95 NA	Class:	96 NA
Sensitivity		NA 1		NA 1		NA 1						
Specificity Pos Pred Value		NA						1 NA		1 NA		1
				NA		NA						NA
Neg Pred Value		NA		NA		NA		NA		NA		NA
Prevalence		0		0		0		0		0		0
Detection Rate	<b>01</b>	0	01	0	07	0	<b>0</b> 7	0	0 01	0	14	0
O : + : : +	Class:		Class:		Class:				O Class			
Sensitivity		NA		NA		NA		N		ľ	JA	
Specificity		1		1		1			1		1	
Pos Pred Value		NA		NA		NA		N.			JA	
Neg Pred Value		NA		NA		NA		N		Γ	1A	
Prevalence		0		0		0			0		0	
Detection Rate	~-	0		0		0			0		0	
	Class:					s:		ss:	105 Cla	ass		
Sensitivity		NA		ľ	NA		NA		NA		NA	
Specificity		1			1		1		1		1	
Pos Pred Value		NA			NΑ		NA		NA		NA	
Neg Pred Value		NA		1	NA		NA		NA		NA	
Prevalence		C			0		0		0		0	
Detection Rate		C			0		0		0		0	
	Class:					s:		ss:	110 Cl	ass		
Sensitivity		NA		1	NA		NA		NA		NA	
Specificity		1			1		1		1		1	
Pos Pred Value		NA	1	1	NA		NA		NA		NA	
Neg Pred Value		NA	1	1	NA		NA		NA		NA	
Prevalence		C	)		0		0		0		0	
Detection Rate		C	)		0		0		0		0	
	Class:	112	Class	: 11	13 Clas	s:	114 Cla	ss:	115 Cl	ass	: 116	

Sensitivity		NA		NA		NA		NA		NA
Specificity		1		1		1		1		1
Pos Pred Value		NA		NA		NA		NA		NA
Neg Pred Value		NA		NA		NA		NA		NA
Prevalence		0		0		0		0		0
Detection Rate		0		0		0		0		0
	Class:	117	Class:	118	Class:	119	Class:	120	Class:	121
Sensitivity		NA		NA		NA		NA		NA
Specificity		1		1		1		1		1
Pos Pred Value		NA		NA		NA		NA		NA
Neg Pred Value		NA		NA		NA		NA		NA
Prevalence		0		0		0		0		0
Detection Rate		0		0		0		0		0
	Class:	122	Class:	123	Class:	124	Class:	125	Class:	126
Sensitivity		NA		NA		NA		NA		NA
Specificity		1		1		1		1		1
Pos Pred Value		NA		NA		NA		NA		NA
Neg Pred Value		NA		NA		NA		NA		NA
Prevalence		0		0		0		0		0
Detection Rate		0		0		0		0		0
	Class:	127	Class:	128	Class:	129	Class:	130	Class:	131
Sensitivity		NA		NA		NA		NA		NA
Specificity		1		1		1		1		1
Pos Pred Value		NA		NA		NA		NA		NA
Neg Pred Value		NA		NA		NA		NA		NA
Prevalence		0		0		0		0		0
Detection Rate		0		0		0		0		0
	Class:	132	Class:	133	Class:	134	Class:	135	Class:	136
Sensitivity		NA		NA		NA		NA		NA
Specificity		1		1		1		1		1
Pos Pred Value		NA		NA		NA		NA		NA
Neg Pred Value		NA		NA		NA		NA		NA
Prevalence		0		0		0		0		0
Detection Rate		0		0		0		0		0
	Class:	137	Class:	138	Class:	139	Class:	140	Class:	141
Sensitivity		NA		NA		NA		NA		NA
Specificity		1		1		1		1		1
Pos Pred Value		NA		NA		NA		NA		NA
Neg Pred Value		NA		NA		NA		NA		NA
Prevalence		0		0		0		0		0
Detection Rate		0		0		0		0		0
	Class:	142	Class:	143	Class:	144	Class:	145	Class:	146
Sensitivity		NA		NA		NA		NA		NA
Specificity		1		1		1		1		1
Pos Pred Value		NA		NA		NA		NA		NA
Neg Pred Value		NA		NA		NA		NA		NA
Prevalence		0		0		0		0		0
Detection Rate		0		0		0		0		0
	Class:	147	Class:	148						
Sensitivity		NA		NA						
Specificity		1		1						
Pos Pred Value		NA		NA						
Neg Pred Value		NA		NA						
Prevalence		0		0						
Detection Rate		0		0						
[ reached getOp	otion("max.pr	int'	') or	nitte	ed 2 ro	ws]				

# Result

Thus the implementation of Support Vector machine is executed successfully using R program.