

# classification

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```
library(tidyverse)
library(caret)
```

## 1. Load Data

```
load("final_data.RData")
final_data = final_data %>%
  mutate(binary_recovery_time = as.factor(binary_recovery_time))
levels(final_data$binary_recovery_time) = c("low", "high")
```

## 2. Train/test split

```
set.seed(2)
training_rows <- createDataPartition(final_data$binary_recovery_time,
                                     p = 0.8,
                                     list = F)
```

```
train_x <- model.matrix(binary_recovery_time~., final_data %>% dplyr::select(-id, -recovery_time))[training_rows,]
train_y <- final_data$binary_recovery_time[training_rows]
test_x <- model.matrix(binary_recovery_time~., final_data %>% dplyr::select(-id, -recovery_time))[!training_rows,]
test_y <- final_data$binary_recovery_time[!training_rows]
```

```
test_x_df = as.data.frame(test_x)
test_y_df = as.data.frame(test_y)
```

```
training_set <- final_data[training_rows,]
```

## Setting methods

```
ctrl2 = trainControl(method = "cv", number = 10,
                     summaryFunction = twoClassSummary,
                     classProbs = TRUE)
```

### (a) Perform a logistic regression using the training data.

```
set.seed(2)
#fit a logistic regression using caret
model.glm = train(train_x, train_y, method = "glm", metric = "ROC",
                  trControl = ctrl2)
summary(model.glm)
```

```
##
## Call:
## NULL
##
## Deviance Residuals:
##      Min       1Q   Median       3Q      Max
## -2.4670  -1.1407   0.6120   0.8681   1.6411
##
## Coefficients:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept) -7.460e+01  1.388e+01 -5.374 7.70e-08 ***
## age          1.720e-02  1.092e-02  1.575 0.115307
## gender1     -3.090e-01  8.555e-02 -3.611 0.000304 ***
## race2       -3.677e-02  1.961e-01 -0.188 0.851260
## race3       -1.764e-01  1.070e-01 -1.648 0.099291 .
## race4        1.095e-03  1.439e-01  0.008 0.993928
## smoking1     2.959e-01  9.780e-02  3.026 0.002480 **
## smoking2     4.111e-01  1.549e-01  2.654 0.007949 **
## height       4.321e-01  8.133e-02  5.313 1.08e-07 ***
## weight      -4.735e-01  8.678e-02 -5.457 4.84e-08 ***
## bmi          1.437e+00  2.506e-01  5.737 9.66e-09 ***
## hypertension1 2.714e-01  1.415e-01  1.918 0.055148 .
## diabetes1    -3.350e-02  1.193e-01 -0.281 0.778852
## sbp          -1.345e-04  9.589e-03 -0.014 0.988810
## ldl          -5.396e-04  2.260e-03 -0.239 0.811341
## vaccine1     -5.989e-01  8.919e-02 -6.715 1.88e-11 ***
## severity1     6.580e-01  1.656e-01  3.974 7.07e-05 ***
## studyB       -1.103e+00  1.211e-01 -9.111 < 2e-16 ***
## studyC        3.074e-02  1.557e-01  0.197 0.843475
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##      Null deviance: 3577.1  on 2887  degrees of freedom
## Residual deviance: 3253.9  on 2869  degrees of freedom
## AIC: 3291.9
##
## Number of Fisher Scoring iterations: 4
```

```
model.glm$finalModel #My generalized linear model (GLM)
```

```
##
## Call:  NULL
##
## Coefficients:
##      (Intercept)          age          gender1          race2          race3
##      -7.460e+01      1.720e-02     -3.090e-01     -3.677e-02     -1.764e-01
##           race4      smoking1      smoking2          height          weight
##           1.095e-03      2.959e-01      4.111e-01      4.321e-01     -4.735e-01
##           bmi hypertension1 diabetes1          sbp          ldl
##           1.437e+00      2.714e-01     -3.350e-02     -1.345e-04     -5.396e-04
##           vaccine1 severity1          studyB          studyC
##           -5.989e-01      6.580e-01     -1.103e+00      3.074e-02
##
```

```
## Degrees of Freedom: 2887 Total (i.e. Null); 2869 Residual
## Null Deviance: 3577
## Residual Deviance: 3254 AIC: 3292
```

```
contrasts(final_data$binary_recovery_time)
```

```
##      high
## low      0
## high     1
```

*#We first consider the simple classifier with a cut-off of 0.5 and evaluate its performance on the test*

```
test.pred.prob = predict(model.glm$finalModel, newdata = test_x_df, type = "response")
test.pred = rep("low", length(test.pred.prob))
test.pred[test.pred.prob > 0.5] = "high"
```

```
confusionMatrix = confusionMatrix(data = as.factor(test.pred),
                                   reference = test_y,
                                   positive = "high")
confusionMatrix
```

```
## Confusion Matrix and Statistics
```

```
##
```

```
##           Reference
```

```
## Prediction low high
```

```
##      low   54   42
```

```
##      high 169  456
```

```
##
```

```
##           Accuracy : 0.7074
```

```
##           95% CI : (0.6726, 0.7403)
```

```
##      No Information Rate : 0.6907
```

```
##      P-Value [Acc > NIR] : 0.1772
```

```
##
```

```
##           Kappa : 0.1873
```

```
##
```

```
##      McNemar's Test P-Value : <2e-16
```

```
##
```

```
##           Sensitivity : 0.9157
```

```
##           Specificity : 0.2422
```

```
##      Pos Pred Value : 0.7296
```

```
##      Neg Pred Value : 0.5625
```

```
##           Prevalence : 0.6907
```

```
##      Detection Rate : 0.6325
```

```
##      Detection Prevalence : 0.8669
```

```
##      Balanced Accuracy : 0.5789
```

```
##
```

```
##      'Positive' Class : high
```

```
##
```