MNIST

MNIST dataset - Logistic regression

Classification of mnist data for digits 2 and 7

Load the data

```
data("mnist_27")
mnist_27$train %>% ggplot(aes(x_1, x_2, color = y)) + geom_point()
```

Create logistic regression model

```
fit <- glm(y ~ x_1 + x_2, data=mnist_27$train, family="binomial")
```

Predict with the glm model and classification

```
p_hat <- predict(fit, newdata = mnist_27$test)
y_hat <- factor(ifelse(p_hat > 0.5, 7, 2))
```

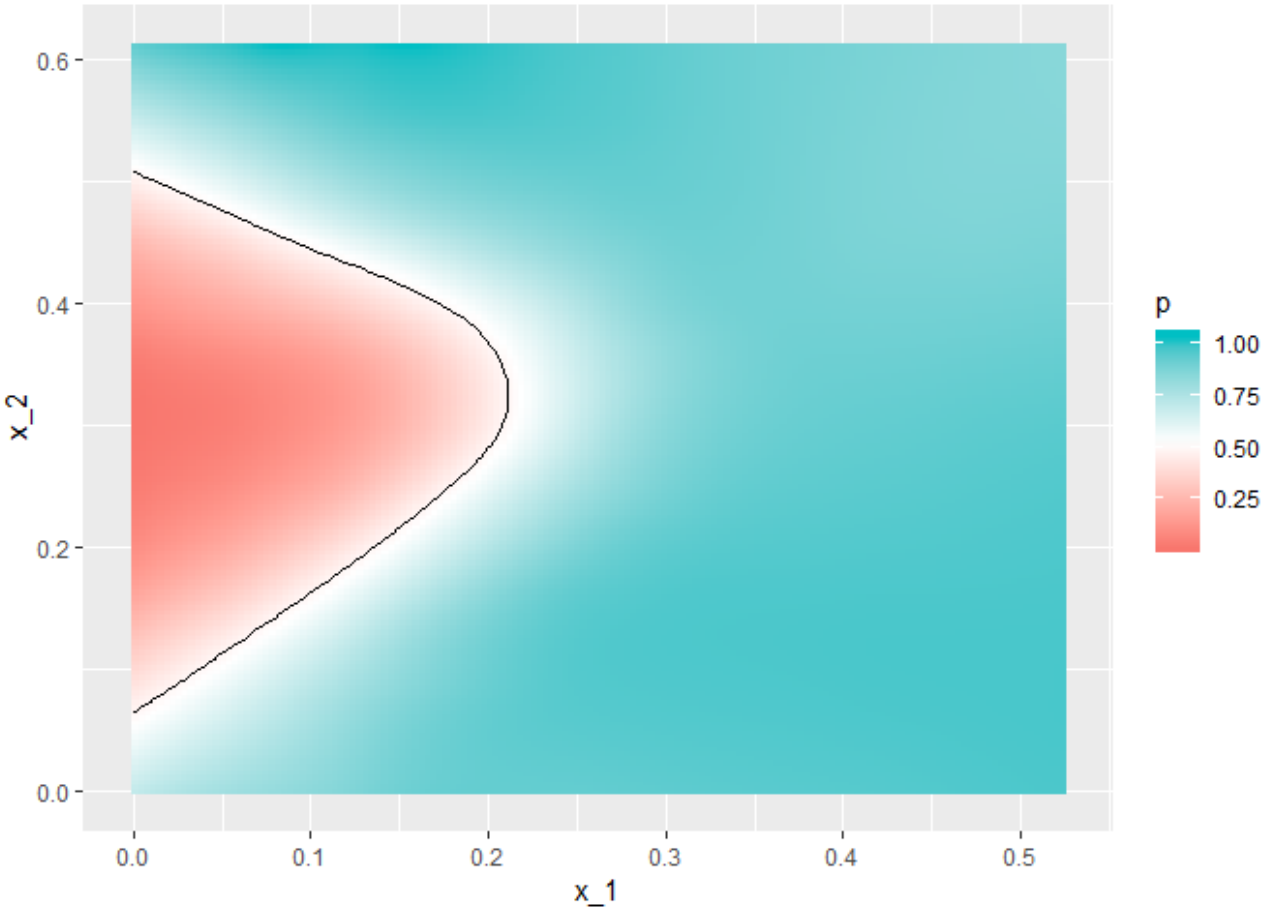
Confusion matrix

```
confusionMatrix(data = y_hat, reference = mnist_27$test$y)
```

```
## Confusion Matrix and Statistics
##
##           Reference
## Prediction  2  7
##          2 92 34
##          7 14 60
##
##                Accuracy : 0.76
##                  95% CI : (0.6947, 0.8174)
##     No Information Rate : 0.53
##     P-Value [Acc > NIR] : 1.668e-11
##
##                   Kappa : 0.5124
##  Mcnemar's Test P-Value : 0.006099
##
##             Sensitivity : 0.8679
##             Specificity : 0.6383
##          Pos Pred Value : 0.7302
##          Neg Pred Value : 0.8108
##              Prevalence : 0.5300
##          Detection Rate : 0.4600
##    Detection Prevalence : 0.6300
##       Balanced Accuracy : 0.7531
##
##        'Positive' Class : 2
##
```

Plot true probabilities

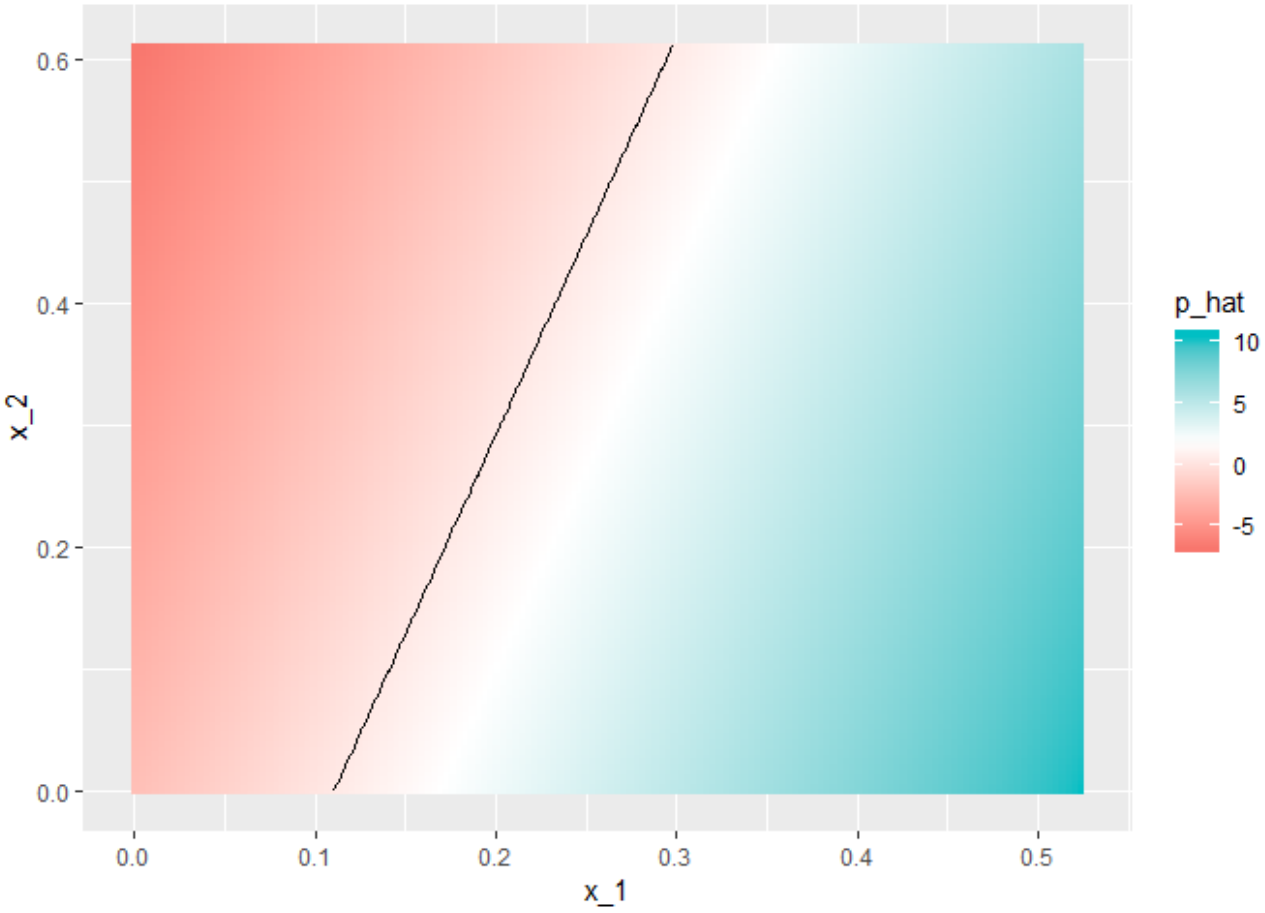
```
mnist_27$true_p %>% ggplot(aes(x_1, x_2, z=p, fill=p)) +  geom_raster() +
  scale_fill_gradientn(colors=c("#F8766D","white","#00BFC4")) +
  stat_contour(breaks=c(0.5),color="black")
```



Predict the probabilities with Logistic Regression and Plot predicted probabilities

```
p_hat <- predict(fit, newdata = mnist_27$true_p)

mnist_27$true_p %>% mutate(p_hat = p_hat) %>%
  ggplot(aes(x_1, x_2,  z=p_hat, fill=p_hat)) + geom_raster() +
  scale_fill_gradientn(colors=c("#F8766D","white","#00BFC4")) +
  stat_contour(breaks=c(0.5),color="black")
```



Plot Logistic regression line with test data

```
mnist_27$true_p %>% mutate(p_hat = p_hat) %>% ggplot() +
  stat_contour(aes(x_1, x_2, z=p_hat), breaks=c(0.5), color="black") +
  geom_point(mapping = aes(x_1, x_2, color=y), data = mnist_27$test)
```

Logistic regression is able to classify the data with 76% accuracy.