

```
> confusionMatrix(predictions, testing_data$class)
Confusion Matrix and Statistics
```

Prediction	Reference	alternarialeaf-spot	anthracnose	bacterial-blight	bacterial-pustule	brown-spot	brown-stem-rot
alternarialeaf-spot		18	0	0	0	0	0
anthracnose		0	8	0	0	0	0
bacterial-blight		0	0	4	1	0	0
bacterial-pustule		0	0	0	3	0	0
brown-spot		0	0	0	0	18	0
brown-stem-rot		0	0	0	0	0	8
charcoal-rot		0	0	0	0	0	0
diaporthe-stem-canker		0	0	0	0	0	0
downy-mildew		0	0	0	0	0	0
frog-eye-leaf-spot		0	0	0	0	0	0
phylllosticta-leaf-spot		0	0	0	0	0	0
phytophthora-rot		0	0	0	0	0	0
powdery-mildew		0	0	0	0	0	0
purple-seed-stain		0	0	0	0	0	0
rhizoctonia-root-rot		0	0	0	0	0	0

Prediction	Reference	charcoal-rot	diaporthe-stem-canker	downy-mildew	frog-eye-leaf-spot	phylllosticta-leaf-spot
alternarialeaf-spot		0	0	0	5	0
anthracnose		0	0	0	0	0
bacterial-blight		0	0	0	0	0
bacterial-pustule		0	0	0	0	0
brown-spot		0	0	0	0	0
brown-stem-rot		0	0	0	0	0
charcoal-rot		4	0	0	0	0
diaporthe-stem-canker		0	4	0	0	0
downy-mildew		0	0	4	0	0
frog-eye-leaf-spot		0	0	0	13	0
phylllosticta-leaf-spot		0	0	0	0	4
phytophthora-rot		0	0	0	0	0
powdery-mildew		0	0	0	0	0
purple-seed-stain		0	0	0	0	0
rhizoctonia-root-rot		0	0	0	0	0

Prediction	Reference	phytophthora-rot	powdery-mildew	purple-seed-stain	rhizoctonia-root-rot
alternarialeaf-spot		0	0	0	0
anthracnose		0	0	0	0
bacterial-blight		0	0	0	0
bacterial-pustule		0	0	0	0
brown-spot		0	0	0	0
brown-stem-rot		0	0	0	0
charcoal-rot		0	0	0	0
diaporthe-stem-canker		0	0	0	0
downy-mildew		0	0	0	0
frog-eye-leaf-spot		0	0	0	0
phylllosticta-leaf-spot		0	0	0	0
phytophthora-rot		4	0	0	0
powdery-mildew		0	4	0	0
purple-seed-stain		0	0	4	0
rhizoctonia-root-rot		0	0	0	4

```
> model <- train(Class ~ ., data = training_data, method = "rf")
> model
Random Forest
```

```
452 samples
35 predictor
15 classes: 'alternarialeaf-spot', 'anthracnose', 'bacterial-blight', 'bacterial-pustule', 'brown-spot', 'brown-stem-rot',
'charcoal-rot', 'diaporthe-stem-canker', 'downy-mildew', 'fryog-eye-leaf-spot', 'phylllosticta-leaf-spot', 'phytophthora-rot',
'powdery-mildew', 'purple-seed-stain', 'rhizoctonia-root-rot'
```

```
No pre-processing
Resampling: Bootstrapped (25 reps)
Summary of sample sizes: 452, 452, 452, 452, 452, ...
Resampling results across tuning parameters:
```

mtry	Accuracy	Kappa
2	0.8801004	0.8649966
18	0.9174848	0.9076075
35	0.9010951	0.8892425

```
Accuracy was used to select the optimal model using the largest value.
The final value used for the model was mtry = 18.
```

```
> # Make predictions on the testing data
> predictions <- predict(model, newdata = testing_data)
> predictions
```

```
[1] diaporthe-stem-canker diaporthe-stem-canker charcoal-rot charcoal-rot rhizoctonia-root-rot
[6] rhizoctonia-root-rot phytophthora-rot phytophthora-rot phytophthora-rot brown-stem-rot
[11] brown-stem-rot brown-stem-rot brown-spot brown-spot powdery-mildew brown-spot
[16] brown-spot brown-spot brown-spot brown-spot brown-spot brown-spot
[21] brown-spot brown-spot bacterial-blight bacterial-pustule anthracnose
[26] bacterial-blight anthracnose anthracnose phylllosticta-leaf-spot phylllosticta-leaf-spot
[31] anthracnose anthracnose anthracnose phylllosticta-leaf-spot phylllosticta-leaf-spot
[36] alternarialeaf-spot alternarialeaf-spot alternarialeaf-spot alternarialeaf-spot alternarialeaf-spot
[41] alternarialeaf-spot alternarialeaf-spot alternarialeaf-spot alternarialeaf-spot alternarialeaf-spot
[46] frog-eye-leaf-spot alternarialeaf-spot alternarialeaf-spot frog-eye-leaf-spot frog-eye-leaf-spot
[51] diaporthe-stem-canker charcoal-rot brown-stem-rot brown-stem-rot brown-stem-rot
[56] rhizoctonia-root-rot phytophthora-rot brown-stem-rot brown-stem-rot brown-stem-rot
[61] brown-stem-rot powdery-mildew powdery-mildew powdery-mildew downy-mildew
[66] downy-mildew brown-spot brown-spot brown-spot brown-spot brown-spot
[71] brown-spot brown-spot bacterial-blight bacterial-blight bacterial-pustule
[76] brown-spot purple-seed-stain purple-seed-stain purple-seed-stain anthracnose
[81] purple-seed-stain anthracnose phylllosticta-leaf-spot phylllosticta-leaf-spot alternarialeaf-spot
[86] anthracnose alternarialeaf-spot alternarialeaf-spot alternarialeaf-spot alternarialeaf-spot
[91] alternarialeaf-spot alternarialeaf-spot alternarialeaf-spot alternarialeaf-spot alternarialeaf-spot
[96] alternarialeaf-spot alternarialeaf-spot alternarialeaf-spot alternarialeaf-spot alternarialeaf-spot
[101] alternarialeaf-spot frog-eye-leaf-spot alternarialeaf-spot frog-eye-leaf-spot frog-eye-leaf-spot
[106] frog-eye-leaf-spot frog-eye-leaf-spot frog-eye-leaf-spot frog-eye-leaf-spot frog-eye-leaf-spot
15 levels: alternarialeaf-spot anthracnose bacterial-blight bacterial-pustule brown-spot brown-stem-rot ... rhizoctonia-root-rot
```

```
> predictions <- as.factor(predictions)
> testing_data$class <- as.factor(testing_data$class)
> typeof(testing_data$class)
[1] "integer"
> typeof(predictions)
[1] "integer"
```

Overall Statistics

```
Accuracy : 0.9455
95% CI : (0.8851, 0.9797)
No Information Rate : 0.1636
P-value [Acc > NIR] : < 2.2e-16
```

```
Kappa : 0.9391
```

```
McNemar's Test P-Value : NA
```

Statistics by Class:

	Class: alternarialeaf-spot	Class: anthracnose	Class: bacterial-blight	Class: bacterial-pustule
Sensitivity	1.0000	1.00000	1.00000	0.75000
Specificity	0.9457	1.00000	0.99057	1.00000
Pos Pred Value	0.7826	1.00000	0.80000	1.00000
Neg Pred Value	1.0000	1.00000	1.00000	0.99065
Prevalence	0.1636	0.07273	0.03636	0.03636
Detection Rate	0.1636	0.07273	0.03636	0.02727
Detection Prevalence	0.2091	0.07273	0.04545	0.02727
Balanced Accuracy	0.9728	1.00000	0.99528	0.87500
	Class: brown-spot	Class: brown-stem-rot	Class: charcoal-rot	Class: diaporthe-stem-canker
Sensitivity	1.0000	1.00000	1.00000	1.00000
Specificity	1.0000	1.00000	1.00000	1.00000
Pos Pred Value	1.0000	1.00000	1.00000	1.00000
Neg Pred Value	1.0000	1.00000	1.00000	1.00000
Prevalence	0.1636	0.07273	0.03636	0.03636
Detection Rate	0.1636	0.07273	0.03636	0.03636
Detection Prevalence	0.1636	0.07273	0.03636	0.03636
Balanced Accuracy	1.0000	1.00000	1.00000	1.00000
	Class: downy-mildew	Class: frog-eye-leaf-spot	Class: phylllosticta-leaf-spot	Class: phytophthora-rot
Sensitivity	1.00000	0.7222	1.00000	1.00000
Specificity	1.00000	1.0000	1.00000	1.00000
Pos Pred Value	1.00000	1.0000	1.00000	1.00000
Neg Pred Value	1.00000	0.9485	1.00000	1.00000
Prevalence	0.03636	0.1636	0.03636	0.03636
Detection Rate	0.03636	0.1182	0.03636	0.03636
Detection Prevalence	0.03636	0.1182	0.03636	0.03636
Balanced Accuracy	1.00000	0.8611	1.00000	1.00000
	Class: powdery-mildew	Class: purple-seed-stain	Class: rhizoctonia-root-rot	
Sensitivity	1.00000	1.00000	1.00000	
Specificity	1.00000	1.00000	1.00000	
Pos Pred Value	1.00000	1.00000	1.00000	
Neg Pred Value	1.00000	1.00000	1.00000	
Prevalence	0.03636	0.03636	0.03636	
Detection Rate	0.03636	0.03636	0.03636	
Detection Prevalence	0.03636	0.03636	0.03636	
Balanced Accuracy	1.00000	1.00000	1.00000	