**Training model – Test results**

1. **Original training data – unbalanced data**
2. **Training model: Random forest – 47 images (36 train 11 test)**
   1. **ntree = 200**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Precision** | **Precision recall** | **F1-score** | **Accuracy**  **(P = 1)** |
| TP/predicted P | TP/actual yes |  | (TP+TN)/total |
| Morphology features | 0.60204 | 0.34706 | 0.44030 | 0.9181 |
| SURF | 0.68293 | 0.32941 | 0.4444 | 0.9236 |
| BRISK | 0.75 | 0.24706 | 0.37168 | 0.9225 |
| HOG | 0.80822 | 0.34706 | 0.4856 | 0.9318 |
| FREAK | 0.75862 | 0.25882 | 0.38596 | 0.9236 |
| Morphology + SURF | 0.8 | 0.32941 | 0.46667 | 0.9301 |
| Morphology  + SURF + BRISK | 0.7971 | 0.32353 | 0.46025 | 0.9296 |
| Morphology + SURF + BRISK + HOG + FREAK | 0.83077 | 0.31765 | 0.45957 | 0.9307 |

* 1. **ntree = 600**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Precision** | **Precision recall** | **F1-score** | **Accuracy**  **(P = 1)** |
| TP/predicted P | TP/actual yes |  | (TP+TN)/total |
| Morphology features | 0.60638 | 0.33529 | 0.43182 | 0.9181 |
| SURF | 0.71014 | 0.28824 | 0.41004 | 0.923 |
| BRISK | 0.73846 | 0.28235 | 0.40851 | 0.9241 |
| HOG | 0.85915 | 0.35882 | 0.50622 | 0.935 |
| FREAK | 0.70492 | 0.25294 | 0.37229 | 0.9209 |
| Morphology + SURF | 0.78873 | 0.32941 | 0.46473 | 0.9296 |
| Morphology  + SURF + BRISK | 0.8125 | 0.30588 | 0.44444 | 0.929 |
| Morphology + SURF + BRISK + HOG + FREAK | 0.84615 | 0.32353 | 0.46809 | 0.9318 |

1. **Training model: SVM – 47 images (36 train 11 test)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Cost** | **Gamma** | **Precision** | **Precision recall** | **F1-score** | **Accuracy**  **(P = 1)** |
| TP/predicted P | TP/actual yes |  | (TP+TN)/total |
| Morphology features | 1000 | 1 | 0.33916 | **0.57059** | 0.42544 | 0.8570 |
| SURF | 10000 | 0.001 | 0.42781 | 0.47059 | 0.44818 | 0.8925 |
| BRISK | 10000 | 0.001 | 0.36404 | 0.48824 | 0.41709 | 0.8734 |
| HOG | 10000 | 0.01 | 0.40722 | 0.4647 | 0.43407 | 0.8876 |
| FREAK | 10000 | 0.001 | 0.3477 | 0.48824 | 0.41709 | 0.8734 |
| Morphology + SURF | 1e+05 | 0.001 | 0.44118 | 0.52941 | 0.48128 | 0.8941 |
| Morphology  + SURF  + BRISK | 10000 | 0.001 | 0.51176 | 0.51176 | 0.51176 | 0.9094 |
| Morphology + SURF  + BRISK  + HOG  + FREAK | 100 | 0.01 | **0.55346** | 0.51765 | **0.53495** | **0.9165** |

1. **Oversampling data**
2. **Random Forest** 
   1. **ntree = 200**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Precision** | **Precision recall** | **F1-score** | **Accuracy**  **(P = 1)** |
| TP/predicted P | TP/actual yes |  | (TP+TN)/total |
| Morphology features | 0.90875 | 0.4314 | 0.58507 | 0.694 |
| SURF | 0.98163 | 0.28941 | 0.44702 | 0.642 |
| BRISK | 0.96043 | 0.3213 | 0.48151 | 0.654 |
| HOG | 0.98018 | 0.38688 | 0.55479 | 0.6895 |
| FREAK | 0.98534 | 0.36402 | 0.53163 | 0.6793 |
| Morphology + SURF | 0.98716 | 0.37004 | 0.53829 | 0.6826 |
| Morphology  + SURF + BRISK | 0.98633 | 0.30385 | 0.46458 | 0.6498 |
| Morphology + SURF + BRISK + HOG + FREAK | 0.97938 | 0.34296 | 0.50802 | 0.6679 |

* 1. **ntree = 600**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Precision** | **Precision recall** | **F1-score** | **Accuracy**  **(P = 1)** |
| TP/predicted P | TP/actual yes |  | (TP+TN)/total |
| Morphology features | 0.90495 | 0.40674 | 0.56123 | 0.682 |
| SURF | 0.98899 | 0.27016 | 0.42439 | 0.6336 |
| BRISK | 0.96460 | 0.32792 | 0.4895 | 0.6579 |
| HOG | 0.97977 | 0.40794 | 0.57604 | 0.6998 |
| FREAK | 0.96902 | 0.33875 | 0.502 | 0.664 |
| Morphology + SURF | 0.98673 | 0.358 | 0.52539 | 0.6766 |
| Morphology  + SURF + BRISK | 0.98962 | 0.34416 | 0.51071 | 0.6703 |
| Morphology + SURF + BRISK + HOG + FREAK | 0.97909 | 0.33815 | 0.50268 | 0.6655 |

1. **SVM**

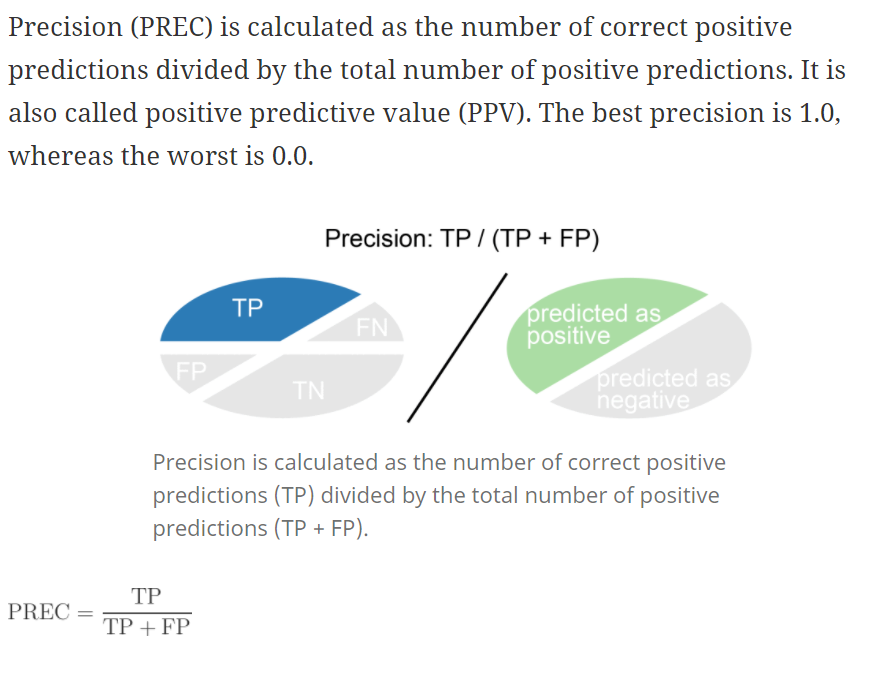
|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Cost** | **Gamma** | **Precision** | **Precision recall** | **F1-score** | **Accuracy**  **(P = 1)** |
| TP/predicted P | TP/actual yes |  | (TP+TN)/total |
| Morphology features | 10000 | 0.001 | 0.68838 | 0.87726 | 0.77143 | 0.7401 |
| SURF | 0.1 | 0.001 | 0.59225 | 0.91155 | 0.71801 | 0.642 |
| BRISK | 0.1 | 0.1 | 0.71287 | 0.73646 | 0.72447 | 0.7199 |
| HOG | 0.1 | 0.1 | 0.78868 | 0.75451 | 0.77122 | 0.7762 |
| FREAK | 0.1 | 0.1 | 0.70181 | 0.76895 | 0.73385 | 0.7211 |
| Morphology + SURF | 0.1 | 0.1 | 0.69840 | 0.7858 | 0.73952 | 0.7232 |
| Morphology  + SURF  + BRISK | 1 | 1e-04 | 0.77635 | 0.72683 | 0.75078 | 0.7587 |
| Morphology + SURF  + BRISK  + HOG  + FREAK | 0.1 | 0.01 | 0.76923 | 0.74007 | 0.75437 | 0.759 |

**Note:**

**1.**

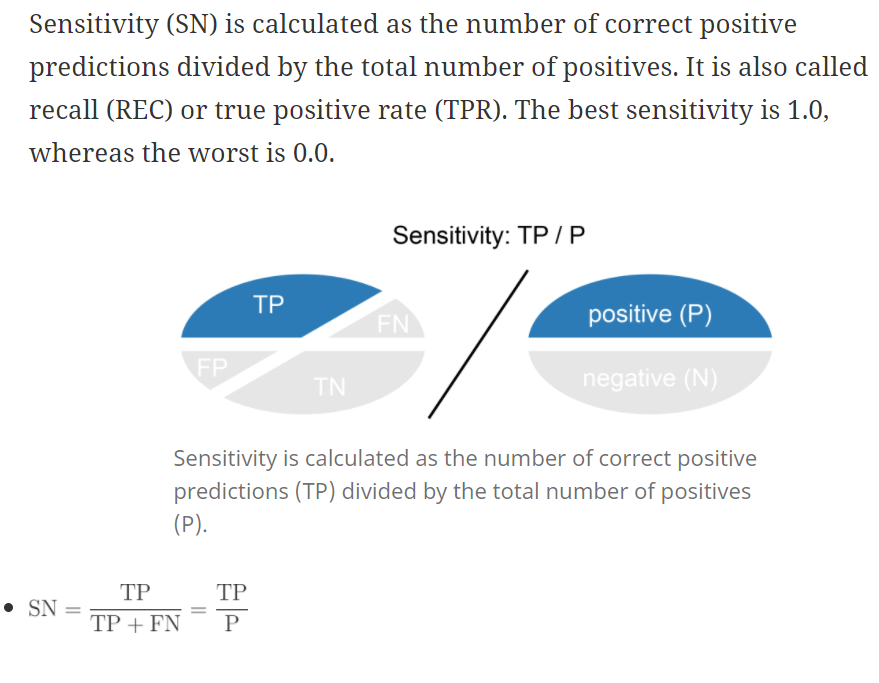
|  |  |  |  |
| --- | --- | --- | --- |
| n = total | **Actual: NO** | **Actual: YES** |  |
| **Predicted: NO** | TN | FN | TN+FN |
| **Predicted: YES** | FP | TP | FP+TP |
|  | N = TN+FP | P = FN+TP |  |

1. **Precision (Pos Pred Value):** When it predicts yes, how often is it correct? **TP/predicted: YES**

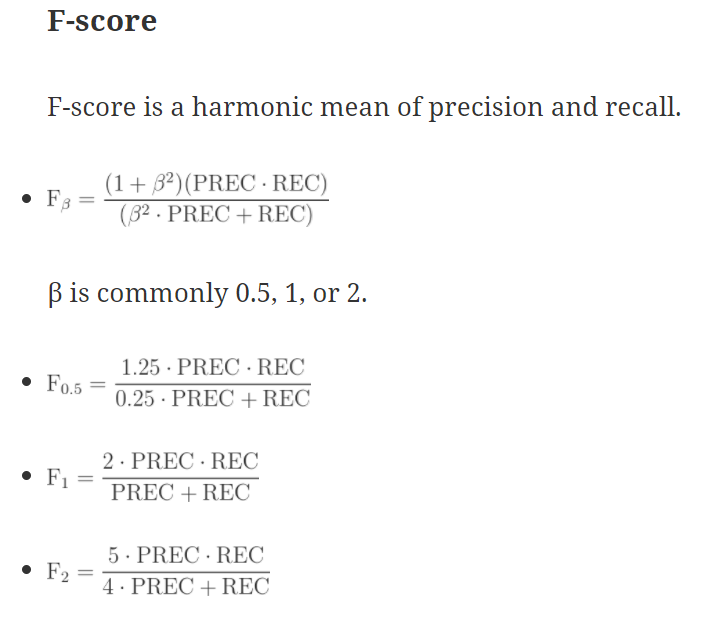


1. **Precision recall (Sensitivity/True Positive Rate):**

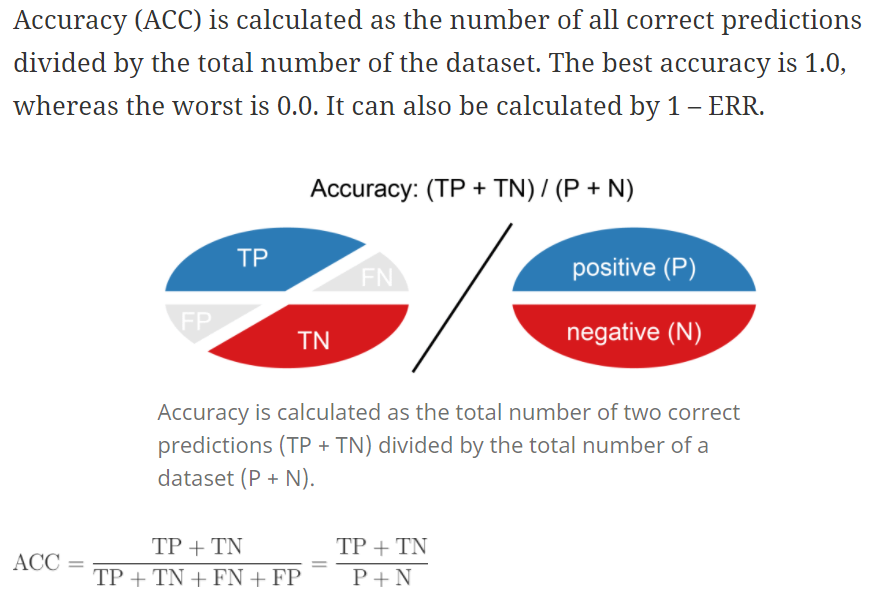
When it's actually yes, how often does it predict yes? **TP/actual: YES**



1. **F-score:** This is a weighted average of the true positive rate (recall) and precision.



1. **Accuracy:** Overall, how often is the classifier correct? **(TP+TN)/total**



**output <- X[,c("X","Y","isLandmark",colnames(a),colnames(output1)[1],colnames(output1)[2],colnames(output1)[3],colnames(output1)[4], "SURFfeature1","SURFfeature2","SURFfeature3","SURFfeature4","SURFfeature5","SURFfeature6","SURFfeature7","SURFfeature8","SURFfeature9","SURFfeature10","SURFfeature11","SURFfeature12","SURFfeature13","SURFfeature14","SURFfeature15","SURFfeature16","SURFfeature17","SURFfeature18","SURFfeature19","SURFfeature20","SURFfeature21","SURFfeature22","SURFfeature23","SURFfeature24","SURFfeature25","SURFfeature26","SURFfeature27","SURFfeature28","SURFfeature29","SURFfeature30","SURFfeature31","SURFfeature32","SURFfeature33","SURFfeature34","SURFfeature35","SURFfeature36","SURFfeature37","SURFfeature38","SURFfeature39","SURFfeature40","SURFfeature41","SURFfeature42","SURFfeature43","SURFfeature44","SURFfeature45","SURFfeature46","SURFfeature47","SURFfeature48","SURFfeature49","SURFfeature50","SURFfeature51","SURFfeature52","SURFfeature53","SURFfeature54","SURFfeature55","SURFfeature56","SURFfeature57","SURFfeature58","SURFfeature59","SURFfeature60","SURFfeature61","SURFfeature62","SURFfeature63","SURFfeature64", "BRISKfeature1","BRISKfeature2","BRISKfeature3","BRISKfeature4","BRISKfeature5","BRISKfeature6","BRISKfeature7","BRISKfeature8","BRISKfeature9","BRISKfeature10","BRISKfeature11","BRISKfeature12","BRISKfeature13","BRISKfeature14","BRISKfeature15","BRISKfeature16","BRISKfeature17","BRISKfeature18","BRISKfeature19","BRISKfeature20","BRISKfeature21","BRISKfeature22","BRISKfeature23","BRISKfeature24","BRISKfeature25","BRISKfeature26","BRISKfeature27","BRISKfeature28","BRISKfeature29","BRISKfeature30","BRISKfeature31","BRISKfeature32","BRISKfeature33","BRISKfeature34","BRISKfeature35","BRISKfeature36","BRISKfeature37","BRISKfeature38","BRISKfeature39","BRISKfeature40","BRISKfeature41","BRISKfeature42","BRISKfeature43","BRISKfeature44","BRISKfeature45","BRISKfeature46","BRISKfeature47","BRISKfeature48","BRISKfeature49","BRISKfeature50","BRISKfeature51","BRISKfeature52","BRISKfeature53","BRISKfeature54","BRISKfeature55","BRISKfeature56","BRISKfeature57","BRISKfeature58","BRISKfeature59","BRISKfeature60","BRISKfeature61","BRISKfeature62","BRISKfeature63","BRISKfeature64")]**