|  |  |  |
| --- | --- | --- |
| Decision Tree Classifier Assessment | | |
|  |  |  |
| **Exhaustive Grid Search** | **Setting / Result** | **Comments** |
| **Hyperparameters:** |  |  |
| Criterion | Entropy |  |
| Max Depth | 8 |  |
| Minimum Impurity Decrease | .00001 |  |
| Minimum Sample Split | 200 |  |
| This set of parameters yields a best score of 0.917.  Overfitting is mitigated by having a higher min sample split and reducing the number of splits. | | |
| **Cross Validation Results** |  |  |
| Accuracy Range | 0.900 to 0.912 |  |
| Mean Accuracy | 0.907 |  |
| Assessment | Accuracy is stable |  |
| **Classification Report** |  |  |
| Accuracy | 0.923 (Moderately high) |  |
| Precision (True Positive) | 0.94 | Highest for Bad and Good (0.94) |
| Recall (Sensitivity to True Positive) | 0.93 | Highest for Standard (0.93) |
| Support | Highest = Standard | Lowest = Bad |
| **Importance (Top 3 Features)** |  |  |
| Non Payment of Min Amount |  |  |
| Outstanding Debt |  |  |
| Interest Rates |  |  |

|  |  |  |
| --- | --- | --- |
| Random Forest Classifier Assessment | | |
|  |  |  |
| **Exhaustive Grid Search** | **Setting / Result** | **Comments** |
| **Hyperparameters:** |  |  |
| N Estimators | 300 |  |
| Criterion | Entropy |  |
| Max Depth | 15 |  |
| Minimum Impurity Decrease | .00001 |  |
| Minimum Sample Split | 2 |  |
| This set of parameters yields a best score of 0.94.  Overfitting is mitigated by using the ensemble random forest. | | |
| **Cross Validation Results** |  |  |
| Accuracy Range | 0.930 to 0.939 |  |
| Mean Accuracy | 0.934 |  |
| Assessment | Accuracy is stable |  |
| **Classification Report** |  |  |
| Accuracy | 0.98 (Very high) |  |
| Precision (True Positive) | 0.99 | Highest for Standard (0.99) |
| Recall (Sensitivity to True Positive) | 1.00 | Highest for Good (1.00) |
| Support | Highest = Standard | Lowest = Bad |
| **Importance (Top 3 Features)** |  |  |
| Interest Rate |  |  |
| Outstanding Debt |  |  |
| Number of Delayed Payments |  |  |

|  |  |  |
| --- | --- | --- |
| Gradient Boosting Classifier Assessment | | |
|  |  |  |
| **Exhaustive Grid Search** | **Setting / Result** | **Comments** |
| **Hyperparameters:** |  |  |
| N Estimators | 75 |  |
| Max Depth | 4 |  |
| Minimum Impurity Decrease | .1 |  |
| Minimum Sample Split | 100 |  |
| This set of parameters yields a best score of 0.937. This is an increase from the default model (accuracy = .914).  Overfitting is mitigated by using the gradient boosting. | | |
| **Cross Validation Results** |  |  |
| Accuracy Range | 0.95 |  |
| Mean Accuracy | 0.95 |  |
| Assessment | Accuracy is relatively stable |  |
| **Classification Report** |  |  |
| Accuracy | 0.95 (Very high) |  |
| Precision (True Positive) | 0.96 | Highest for Bad (0.96) |
| Recall (Sensitivity to True Positive) | 0.97 | Highest for Bad (0.97) |
| Support | Highest = Standard | Lowest = Bad |
| **Importance (Top 3 Features)** |  |  |
| Outstanding Debt |  |  |
| Non Payment of Min Amount |  |  |
| Interest Rate |  |  |

|  |  |  |
| --- | --- | --- |
| Multi-layer Perceptron Classifier Assessment | | |
| **Exhaustive Grid Search** | **Setting / Result** | **Comments** |
| **Hyperparameters:** |  |  |
| Hidden Layer Size | 10, |  |
| Activation | ReLu |  |
| Solver | Adam |  |
| Learning Rate | Constant |  |
| This set of parameters yields a best score of 0.643. This is an increase from the default model (accuracy = 0.575).  Overfitting is mitigated by using the gradient boosting. | | |
| **Cross Validation Results** |  |  |
| Accuracy Range | 0.556 to 0.693 |  |
| Mean Accuracy | 0.652 | Loss to 0.592 on valid data indicates overfitting |
| Assessment | Accuracy is moderately low, |  |
| **Classification Report** |  |  |
| Accuracy | 0.642 |  |
| Precision (True Positive) | 0.727 | Highest for Bad (0.96) |
| Recall (Sensitivity to True Positive) | 0.642 | Highest for Bad (0.97) |
| F-1 | 0.587 | Lowest = Bad |