|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| MODEL | TRAIN TEST SPLIT EVALUATION | | | | 10-FOLD  CROSS-VALIDATION EVALUATION | SCREENSHOTS |
|  | ACCURACY | PRECISION | RECALL | F1 | ACCURACY |  |
| SGD Classifier | 0.8090 | 0.7042 | 0.2193 | 0.3345 | 0.8051 |  |
| Random Forest | 0.8023 | 0.5862 | 0.3290 | 0.4215 | 0.8061 |  |
| Decision Tree | 0.7268 | 0.3846 | 0.4136 | 0.3985 | 0.7252 |  |
| Gradient Boosting | 0.8203 | 0.6667 | 0.3580 | 0.4658 | 0.8213 |  |
| Gaussian Naïve Bayes | 0.2902 | 0.2326 | 0.9756 | 0.3756 | 0.2886 |  |
| K-Nearest Neighbors | 0.7978 | 0.5604 | 0.3534 | 0.4334 | 0.7932 |  |
| Extra Trees Classifier | 0.8102 | 0.6107 | 0.3656 | 0.4574 | 0.8090 |  |
| AdaBoost | 0.8183 | 0.6819 | 0.3184 | 0.4341 | 0.8164 |  |
| Linear SVM | 0.8005 | 0.6946 | 0.1577 | 0.2570 | 0.8017 |  |
| XGB classifier | 0.8158 | 0.6450 | 0.3610 | 0.4618 | 0.8140 |  |

**CONCLUSION:**

Here are some potential reasons why each model may not have performed as well as the Gradient Boosting Classifier:

**1. SGD Classifier:**

- The SGD Classifier is known for its simplicity and efficiency but may struggle with complex nonlinear relationships present in the data, leading to lower performance compared to Gradient Boosting.

**2. Random Forest:**

- Random Forest is an ensemble method that combines multiple decision trees. However, it may not perform as well as Gradient Boosting if the individual decision trees in the ensemble fail to capture the intricate relationships and patterns in the data.

**3. Decision Tree:**

- Decision Trees are prone to overfitting and may not generalize well to unseen data. If the Decision Tree model overfits the training data, it can result in lower performance compared to the more robust Gradient Boosting method.

**4. Gaussian Naïve Bayes:**

- Gaussian Naïve Bayes assumes independence between features, which may not hold true in some datasets. If the dependencies between features are significant, Gaussian Naïve Bayes may not be able to capture them effectively, leading to lower performance compared to Gradient Boosting.

**5. K-Nearest Neighbors:**

- K-Nearest Neighbors relies heavily on the choice of k (the number of neighbors) and the distance metric. If the value of k is not properly selected or the distance metric is not appropriate for the data, K-Nearest Neighbors may struggle to accurately classify instances, resulting in lower performance compared to Gradient Boosting.

**6. Extra Trees Classifier:**

- Extra Trees Classifier, similar to Random Forest, uses an ensemble of decision trees. However, if the random feature selection and split points in Extra Trees do not effectively capture the underlying patterns in the data, it may not perform as well as Gradient Boosting.

**7. AdaBoost:**

- AdaBoost is sensitive to noisy data and outliers. If the dataset contains a significant amount of noise or outliers, it can negatively impact the performance of AdaBoost compared to Gradient Boosting.

**8. Linear SVM:**

- Linear SVM assumes that the data is linearly separable, and if the data has complex non-linear boundaries, Linear SVM may not be able to capture them accurately, resulting in lower performance compared to the more flexible Gradient Boosting.

**9. XGB classifier:**

- XGB classifier is a powerful boosting algorithm but can be sensitive to hyperparameter tuning. If the hyperparameters are not properly tuned or optimized, XGB classifier may not achieve its full potential and may perform worse than Gradient Boosting.

It's important to note that the performance of different models can vary depending on the specific dataset and problem at hand. The suitability of each model depends on the characteristics of the data and the underlying relationships present.