1.Random Forest Classification

from sklearn.ensemble import RandomForestClassifier

(n\_estimators = 100, criterion = 'gini',max\_features = 'sqrt', random\_state = 0)

classifier.fit(X\_train, y\_train)

precision recall f1-score support

False 0.98 0.98 0.98 51

True 0.99 0.99 0.99 82

accuracy 0.98 133

macro avg 0.98 0.98 0.98 133

weighted avg 0.98 0.98 0.98 133

[[50 1]

[ 1 81]]

(n\_estimators = 100, criterion = 'entropy',max\_features = 'log2', random\_state = 0)

classifier.fit(X\_train, y\_train)

[[51 0]

[ 1 81]]

precision recall f1-score support

False 0.98 1.00 0.99 51

True 1.00 0.99 0.99 82

accuracy 0.99 133

macro avg 0.99 0.99 0.99 133

weighted avg 0.99 0.99 0.99 133

(n\_estimators = 100, criterion = 'entropy',max\_features = 'sqrt', random\_state = 0)

classifier.fit(X\_train, y\_train)

[[50 1]

[ 1 81]]

precision recall f1-score support

False 0.98 0.98 0.98 51

True 0.99 0.99 0.99 82

accuracy 0.98 133

macro avg 0.98 0.98 0.98 133

weighted avg 0.98 0.98 0.98 133

(n\_estimators = 100, criterion = 'log\_loss',max\_features = 'sqrt', random\_state = 0)

classifier.fit(X\_train, y\_train)

[[50 1]

[ 1 81]]

precision recall f1-score support

False 0.98 0.98 0.98 51

True 0.99 0.99 0.99 82

accuracy 0.98 133

macro avg 0.98 0.98 0.98 133

weighted avg 0.98 0.98 0.98 133

(n\_estimators = 100, criterion = 'log\_loss',max\_features = 'log2', random\_state = 0)

classifier.fit(X\_train, y\_train)

[[51 0]

[ 1 81]]

precision recall f1-score support

False 0.98 1.00 0.99 51

True 1.00 0.99 0.99 82

accuracy 0.99 133

macro avg 0.99 0.99 0.99 133

weighted avg 0.99 0.99 0.99 133

2.LogisticRegression

( penalty = 'l1', solver = 'saga' , multi\_class = 'multinomial' , random\_state=0)

precision recall f1-score support

False 0.00 0.00 0.00 51

True 0.62 1.00 0.76 82

accuracy 0.62 133

macro avg 0.31 0.50 0.38 133

weighted avg 0.38 0.62 0.47 133

LogisticRegression( penalty = 'l2', solver = 'lbfgs' , multi\_class = 'auto' , random\_state=0)

precision recall f1-score support

False 0.87 0.92 0.90 51

True 0.95 0.91 0.93 82

accuracy 0.92 133

macro avg 0.91 0.92 0.91 133

weighted avg 0.92 0.92 0.92 133

LogisticRegression( penalty = 'l2', solver = 'liblinear' , multi\_class = 'auto' , random\_state=0)

precision recall f1-score support

False 1.00 0.96 0.98 51

True 0.98 1.00 0.99 82

accuracy 0.98 133

macro avg 0.99 0.98 0.98 133

weighted avg 0.99 0.98 0.98 133

LogisticRegression( penalty = 'l2', solver = 'liblinear' , multi\_class = 'ovr' , random\_state=0)

classifier.fit(X\_train, y\_train)

precision recall f1-score support

False 1.00 0.96 0.98 51

True 0.98 1.00 0.99 82

accuracy 0.98 133

macro avg 0.99 0.98 0.98 133

weighted avg 0.99 0.98 0.98 133

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LogisticRegression( penalty = 'l2', solver = 'newton-cg' , multi\_class = 'multinomial' , random\_state=0)

classifier.fit(X\_train, y\_train)

precision recall f1-score support

False 1.00 1.00 1.00 51

True 1.00 1.00 1.00 82

accuracy 1.00 133

macro avg 1.00 1.00 1.00 133

weighted avg 1.00 1.00 1.00 133

LogisticRegression( penalty = 'l2', solver = 'newton-cg' , multi\_class = 'auto' , random\_state=0)

precision recall f1-score support

False 1.00 1.00 1.00 51

True 1.00 1.00 1.00 82

accuracy 1.00 133

macro avg 1.00 1.00 1.00 133

weighted avg 1.00 1.00 1.00 133

LogisticRegression( penalty = 'l2', solver = 'newton-cg' , multi\_class = 'ovr' , random\_state=0)

precision recall f1-score support

False 1.00 1.00 1.00 51

True 1.00 1.00 1.00 82

accuracy 1.00 133

macro avg 1.00 1.00 1.00 133

weighted avg 1.00 1.00 1.00 133

LogisticRegression( penalty = 'l2', solver = 'newton-cg' , multi\_class = 'auto' , random\_state=0)

precision recall f1-score support

False 1.00 1.00 1.00 51

True 1.00 1.00 1.00 82

accuracy 1.00 133

macro avg 1.00 1.00 1.00 133

weighted avg 1.00 1.00 1.00 133

LogisticRegression( penalty = 'l2', solver = 'newton-cholesky' , multi\_class = 'auto' , random\_state=0)

precision recall f1-score support

False 1.00 1.00 1.00 51

True 1.00 1.00 1.00 82

accuracy 1.00 133

macro avg 1.00 1.00 1.00 133

weighted avg 1.00 1.00 1.00 133

LogisticRegression( penalty = 'l2', solver = 'newton-cholesky' , multi\_class = 'ovr' , random\_state=0)

precision recall f1-score support

False 1.00 1.00 1.00 51

True 1.00 1.00 1.00 82

accuracy 1.00 133

macro avg 1.00 1.00 1.00 133

weighted avg 1.00 1.00 1.00 133

LogisticRegression( penalty = 'l2', solver = 'sag' , multi\_class = 'multinomial' , random\_state=0)

precision recall f1-score support

False 0.00 0.00 0.00 51

True 0.62 1.00 0.76 82

accuracy 0.62 133

macro avg 0.31 0.50 0.38 133

weighted avg 0.38 0.62 0.47 133

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LogisticRegression( penalty = 'l2', solver = 'saga' , multi\_class = 'multinomial' , random\_state=0)

precision recall f1-score support

False 0.00 0.00 0.00 51

True 0.62 1.00 0.76 82

accuracy 0.62 133

macro avg 0.31 0.50 0.38 133

weighted avg 0.38 0.62 0.47 133

LogisticRegression( penalty = 'l2', solver = 'saga' , multi\_class = 'ovr' , random\_state=0)

precision recall f1-score support

False 0.00 0.00 0.00 51

True 0.62 1.00 0.76 82

accuracy 0.62 133

macro avg 0.31 0.50 0.38 133

weighted avg 0.38 0.62 0.47 133

LogisticRegression( penalty = 'l2', solver = 'saga' , multi\_class = 'auto' , random\_state=0)

precision recall f1-score support

False 0.00 0.00 0.00 51

True 0.62 1.00 0.76 82

accuracy 0.62 133

macro avg 0.31 0.50 0.38 133

weighted avg 0.38 0.62 0.47 133

3.Decision Tree classification

DecisionTreeClassifier(criterion = 'gini', splitter = 'random' , max\_features = 'sqrt' , random\_state = 0)

precision recall f1-score support

False 0.96 1.00 0.98 51

True 1.00 0.98 0.99 82

accuracy 0.98 133

macro avg 0.98 0.99 0.98 133

weighted avg 0.99 0.98 0.99 133

DecisionTreeClassifier(criterion = 'gini', splitter = 'best' , max\_features = 'sqrt' , random\_state = 0)

precision recall f1-score support

False 0.88 0.96 0.92 51

True 0.97 0.91 0.94 82

accuracy 0.93 133

macro avg 0.92 0.94 0.93 133

weighted avg 0.94 0.93 0.93 133

DecisionTreeClassifier(criterion = 'gini', splitter = 'best' , max\_features = 'log2' , random\_state = 0)

precision recall f1-score support

False 0.93 1.00 0.96 51

True 1.00 0.95 0.97 82

accuracy 0.97 133

macro avg 0.96 0.98 0.97 133

weighted avg 0.97 0.97 0.97 133

DecisionTreeClassifier(criterion = 'gini', splitter = 'random' , max\_features = 'log2' , random\_state = 0)

precision recall f1-score support

False 0.94 0.88 0.91 51

True 0.93 0.96 0.95 82

accuracy 0.93 133

macro avg 0.93 0.92 0.93 133

weighted avg 0.93 0.93 0.93 133

DecisionTreeClassifier(criterion = 'entropy', splitter = 'random' , max\_features = 'log2' , random\_state = 0)

precision recall f1-score support

False 0.93 0.98 0.95 51

True 0.99 0.95 0.97 82

accuracy 0.96 133

macro avg 0.96 0.97 0.96 133

weighted avg 0.96 0.96 0.96 133

DecisionTreeClassifier(criterion = 'entropy', splitter = 'random' , max\_features = 'sqrt' , random\_state = 0)

precision recall f1-score support

False 0.96 1.00 0.98 51

True 1.00 0.98 0.99 82

accuracy 0.98 133

macro avg 0.98 0.99 0.98 133

weighted avg 0.99 0.98 0.99 133

DecisionTreeClassifier(criterion = 'entropy', splitter = 'best' , max\_features = 'sqrt' , random\_state = 0)

precision recall f1-score support

False 0.88 0.96 0.92 51

True 0.97 0.91 0.94 82

accuracy 0.93 133

macro avg 0.92 0.94 0.93 133

weighted avg 0.94 0.93 0.93 133

DecisionTreeClassifier(criterion = 'entropy', splitter = 'best' , max\_features = 'log2' , random\_state = 0)

precision recall f1-score support

False 0.96 0.98 0.97 51

True 0.99 0.98 0.98 82

accuracy 0.98 133

macro avg 0.97 0.98 0.98 133

weighted avg 0.98 0.98 0.98 133

DecisionTreeClassifier(criterion = 'log\_loss', splitter = 'best' , max\_features = 'log2' , random\_state = 0)

precision recall f1-score support

False 0.96 0.98 0.97 51

True 0.99 0.98 0.98 82

accuracy 0.98 133

macro avg 0.97 0.98 0.98 133

weighted avg 0.98 0.98 0.98 133

DecisionTreeClassifier(criterion = 'log\_loss', splitter = 'random' , max\_features = 'log2' , random\_state = 0)

precision recall f1-score support

False 0.93 0.98 0.95 51

True 0.99 0.95 0.97 82

accuracy 0.96 133

macro avg 0.96 0.97 0.96 133

weighted avg 0.96 0.96 0.96 133

DecisionTreeClassifier(criterion = 'log\_loss', splitter = 'random' , max\_features = 'sqrt' , random\_state = 0)

precision recall f1-score support

False 0.96 1.00 0.98 51

True 1.00 0.98 0.99 82

accuracy 0.98 133

macro avg 0.98 0.99 0.98 133

weighted avg 0.99 0.98 0.99 133

DecisionTreeClassifier(criterion = 'log\_loss', splitter = 'best' , max\_features = 'sqrt' , random\_state = 0)

precision recall f1-score support

False 0.88 0.96 0.92 51

True 0.97 0.91 0.94 82

accuracy 0.93 133

macro avg 0.92 0.94 0.93 133

weighted avg 0.94 0.93 0.93 133

5. KNeighborsClassifier

KNeighborsClassifier(n\_neighbors = 5, weights = 'uniform', algorithm = 'ball\_tree' , p = 2)

precision recall f1-score support

False 0.61 0.86 0.72 51

True 0.89 0.66 0.76 82

accuracy 0.74 133

macro avg 0.75 0.76 0.74 133

weighted avg 0.78 0.74 0.74 133

KNeighborsClassifier(n\_neighbors = 5, weights = 'uniform', algorithm = 'kd\_tree' , p = 2)

precision recall f1-score support

False 0.61 0.86 0.72 51

True 0.89 0.66 0.76 82

accuracy 0.74 133

macro avg 0.75 0.76 0.74 133

weighted avg 0.78 0.74 0.74 133

KNeighborsClassifier(n\_neighbors = 5, weights = 'distance', algorithm = 'brute' , p = 2)

precision recall f1-score support

False 0.63 0.90 0.74 51

True 0.92 0.67 0.77 82

accuracy 0.76 133

macro avg 0.77 0.79 0.76 133

weighted avg 0.81 0.76 0.76 133

KNeighborsClassifier(n\_neighbors = 5, weights = 'distance', algorithm = 'auto' , p = 2)

precision recall f1-score support

False 0.63 0.90 0.74 51

True 0.92 0.67 0.77 82

accuracy 0.76 133

macro avg 0.77 0.79 0.76 133

weighted avg 0.81 0.76 0.76 133

KNeighborsClassifier(n\_neighbors = 5, weights = 'distance', algorithm = 'ball\_tree' , p = 2)

precision recall f1-score support

False 0.63 0.90 0.74 51

True 0.92 0.67 0.77 82

accuracy 0.76 133

macro avg 0.77 0.79 0.76 133

weighted avg 0.81 0.76 0.76 133

KNeighborsClassifier(n\_neighbors = 5, weights = 'distance', algorithm = 'kd\_tree' , p = 2)

precision recall f1-score support

False 0.63 0.90 0.74 51

True 0.92 0.67 0.77 82

accuracy 0.76 133

macro avg 0.77 0.79 0.76 133

weighted avg 0.81 0.76 0.76 133

KNeighborsClassifier(n\_neighbors = 5, weights = 'distance', algorithm = 'brute' , p = 2)

precision recall f1-score support

False 0.63 0.90 0.74 51

True 0.92 0.67 0.77 82

accuracy 0.76 133

macro avg 0.77 0.79 0.76 133

weighted avg 0.81 0.76 0.76 133

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print(cm)

6.SVM-kernel Classification

SVC(kernel = 'linear', gamma = 'scale' , decision\_function\_shape = 'ovo' , random\_state = 0)

precision recall f1-score support

False 0.98 0.98 0.98 51

True 0.99 0.99 0.99 82

accuracy 0.98 133

macro avg 0.98 0.98 0.98 133

weighted avg 0.98 0.98 0.98 133

SVC(kernel = 'linear', gamma = 'auto' , decision\_function\_shape = 'ovo' , random\_state = 0)

precision recall f1-score support

False 0.98 0.98 0.98 51

True 0.99 0.99 0.99 82

accuracy 0.98 133

macro avg 0.98 0.98 0.98 133

weighted avg 0.98 0.98 0.98 133

SVC(kernel = 'linear', gamma = 'auto' , decision\_function\_shape = 'ovr' , random\_state = 0)

precision recall f1-score support

False 0.98 0.98 0.98 51

True 0.99 0.99 0.99 82

accuracy 0.98 133

macro avg 0.98 0.98 0.98 133

weighted avg 0.98 0.98 0.98 133

SVC(kernel = 'linear', gamma = 'scale' , decision\_function\_shape = 'ovr' , random\_state = 0)

precision recall f1-score support

False 0.98 0.98 0.98 51

True 0.99 0.99 0.99 82

accuracy 0.98 133

macro avg 0.98 0.98 0.98 133

weighted avg 0.98 0.98 0.98 133

SVC(kernel = 'poly', gamma = 'scale' , decision\_function\_shape = 'ovo' , random\_state = 0)

precision recall f1-score support

False 0.00 0.00 0.00 51

True 0.62 1.00 0.76 82

accuracy 0.62 133

macro avg 0.31 0.50 0.38 133

weighted avg 0.38 0.62 0.47 133

SVC(kernel = 'rbf', gamma = 'auto' , decision\_function\_shape = 'ovr' , random\_state = 0)

precision recall f1-score support

False 0.00 0.00 0.00 51

True 0.62 1.00 0.76 82

accuracy 0.62 133

macro avg 0.31 0.50 0.38 133

weighted avg 0.38 0.62 0.47 133

SVC(kernel = 'rbf', gamma = 'auto' , decision\_function\_shape = 'ovo' , random\_state = 0)

precision recall f1-score support

False 0.00 0.00 0.00 51

True 0.62 1.00 0.76 82

accuracy 0.62 133

macro avg 0.31 0.50 0.38 133

weighted avg 0.38 0.62 0.47 133

SVC(kernel = 'rbf', gamma = 'scale' , decision\_function\_shape = 'ovo' , random\_state = 0)

precision recall f1-score support

False 0.00 0.00 0.00 51

True 0.62 1.00 0.76 82

accuracy 0.62 133

macro avg 0.31 0.50 0.38 133

weighted avg 0.38 0.62 0.47 133

SVC(kernel = 'rbf', gamma = 'scale' , decision\_function\_shape = 'ovr' , random\_state = 0)

precision recall f1-score support

False 0.00 0.00 0.00 51

True 0.62 1.00 0.76 82

accuracy 0.62 133

macro avg 0.31 0.50 0.38 133

weighted avg 0.38 0.62 0.47 133

SVC(kernel = 'sigmoid', gamma = 'scale' , decision\_function\_shape = 'ovr' , random\_state = 0)

precision recall f1-score support

False 0.27 0.12 0.16 51

True 0.59 0.80 0.68 82

accuracy 0.54 133

macro avg 0.43 0.46 0.42 133

weighted avg 0.47 0.54 0.48 133

SVC(kernel = 'sigmoid', gamma = 'scale' , decision\_function\_shape = 'ovo' , random\_state = 0)

precision recall f1-score support

False 0.27 0.12 0.16 51

True 0.59 0.80 0.68 82

accuracy 0.54 133

macro avg 0.43 0.46 0.42 133

weighted avg 0.47 0.54 0.48 133

SVC(kernel = 'sigmoid', gamma = 'auto' , decision\_function\_shape = 'ovo' , random\_state = 0)

precision recall f1-score support

False 0.00 0.00 0.00 51

True 0.62 1.00 0.76 82

accuracy 0.62 133

macro avg 0.31 0.50 0.38 133

weighted avg 0.38 0.62 0.47 133

In [ ]:

SVC(kernel = 'sigmoid', gamma = 'auto' , decision\_function\_shape = 'ovr' , random\_state = 0)

precision recall f1-score support

False 0.00 0.00 0.00 51

True 0.62 1.00 0.76 82

accuracy 0.62 133

macro avg 0.31 0.50 0.38 133

weighted avg 0.38 0.62 0.47 133

7.DC-GridGrid

param\_grid = {'criterion':['gini','entropy'],

'max\_features': ['auto','sqrt','log2'],

'splitter':['best','random']}

The report:

precision recall f1-score support

False 0.94 0.98 0.96 51

True 0.99 0.96 0.98 82

accuracy 0.97 133

macro avg 0.97 0.97 0.97 133

weighted avg 0.97 0.97 0.97 133

8.Grid RandomForestClassifier

param\_grid = {'criterion':['gini','entropy'],

'max\_features': ['auto','sqrt','log2'],

'n\_estimators':[10,100]}

precision recall f1-score support

False 0.98 0.98 0.98 51

True 0.99 0.99 0.99 82

accuracy 0.98 133

macro avg 0.98 0.98 0.98 133

weighted avg 0.98 0.98 0.98 133

9.Logistic-Grid-Classification

param\_grid = {'solver':['newton-cg', 'lbfgs', 'liblinear', 'saga'],

'penalty':['l2']}

The report:

precision recall f1-score support

False 0.98 1.00 0.99 51

True 1.00 0.99 0.99 82

accuracy 0.99 133

macro avg 0.99 0.99 0.99 133

weighted avg 0.99 0.99 0.99 133

10.MultinomialNB

precision recall f1-score support

False 0.68 0.98 0.81 51

True 0.98 0.72 0.83 82

accuracy 0.82 133

macro avg 0.83 0.85 0.82 133

weighted avg 0.87 0.82 0.82 133

[[50 1]

[23 59]]

11.BernoulliNB

precision recall f1-score support

False 0.86 1.00 0.93 51

True 1.00 0.90 0.95 82

accuracy 0.94 133

macro avg 0.93 0.95 0.94 133

weighted avg 0.95 0.94 0.94 133

[[51 0]

[ 8 74]]

12.ComplementNB

precision recall f1-score support

False 0.68 0.98 0.81 51

True 0.98 0.72 0.83 82

accuracy 0.82 133

macro avg 0.83 0.85 0.82 133

weighted avg 0.87 0.82 0.82 133

[[50 1]

[23 59]]