

Assignment 5 Part II Report

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1 Choose DataSet

Dota2 Games Results Data Set <https://archive.ics.uci.edu/ml/datasets/Dota2+Games+Results>

2 Preprocess the DataSet

The data set is by default normalized. Most attributes are either 1 or 0. Only attribute that is not normalized is area code, which is categorical. Thus, no preprocess was conducted for the data set.

3 Finding Best Classifier Parameters

Hyperparameters tuning was conducted using *grid search*. The corresponding scikit-learn class used was **ParameterGrid**. The gini-score was used as evaluation metric.

Scikit-Learn library was used throughout the assignment. Classifiers and actual scikit-learn class used are listed in table 1:

Table 1: Mapping from Algorithm to Actual Class	
Class in Scikit-Learn	ML Algorithm
MLPClassifier	Perceptron, Neural Network and Deep Learning
LogisticRegression	Logistic Regression
GaussianNB	Naive Bayes
DecisionTreeClassifier	Decision Trees
BaggingClassifier	Decision Trees
GradientBoostingClassifier	Gradient Boosting
AdaBoostClassifier	AdaBoost
RandomForestClassifier	Random Forests
SVC	SVM
KNeighborsClassifier	K-Nearest Neighbors

The tuning result were recorded in the log, and are listed in the appendix A.

All classifiers are trained and tested in batch mode. Since the size of the data set is relatively large, training time is long. One execution of all classifiers except **SVC** took a little more than 3 hours.

The **SVC** classifier, based on scikit-learn's documentation, has fit time complexity more than quadratic with the number of samples, which makes it hard to scale to dataset with more than a couple of 10000 samples. Furthermore, the **SVC** classifier does not support **predict_proba** interface, which made it not possible to fit in the gini-score based metric. Thus the **SVC** classifier was jumped over in the experiment.

4 Testing All Classifiers Together

After best parameters set for each classifier was determined, all classifiers were tested on the same set of testing data using same K-fold sample.

Average accuracy and gini-score are listed in table 2.

Table 2: Final Evaluation			
Model	Best Parameters	Accuracies	Gini Score
MLPClassifier	{'hidden_layer_sizes': (30, 30, 30, 30), 'max_iter': 1000, 'solver': 'adam', 'warm_start': False}	0.5751528220128237	-0.2320081259257396
LogisticRegression	{'C': 0.1, 'fit_intercept': False, 'penalty': 'l2', 'random_state': 0, 'solver': 'liblinear'}	0.5843800851839605	-0.2388195096109058
GaussianNB	{'priors': None}	0.5241446342766946	-0.07582639860482021
DecisionTreeClassifier	{'max_depth': 10, 'max_features': None, 'min_samples_split': 4, 'splitter': 'random'}	0.5378446159833772	-0.06988636352674393
BaggingClassifier	{'bootstrap': True, 'n_estimators': 20, 'warm_start': False}	0.535124423494844	-0.09586354074015561
GradientBoostingClassifier	{'loss': 'exponential', 'max_depth': 4, 'n_estimators': 200}	0.5589247945511916	-0.16708993198114297
AdaBoostClassifier	{'algorithm': 'SAMME.R', 'n_estimators': 100}	0.5785503139289678	-0.20789640626993564
RandomForestClassifier	{'bootstrap': True, 'criterion': 'entropy', 'max_depth': 10, 'n_estimators': 40, 'warm_start': True}	0.5530028894239795	-0.15313258803558907
KNeighborsClassifier	{'algorithm': 'brute', 'leaf_size': 30, 'n_neighbors': 15}	0.5256996837786969	-0.049596920647069796

5 Analysis

From result we can see that performances of all classifiers were relatively close. All accuracies were ranging from 50% to 60%. Neural Network and Logistic Regression provide both the maximum accuracies and the minimum gini-score. No attribute is superior in influence of the result.

This result is acceptable. Since the model is based on Dota2 hero picks. Although Dota2's more than 100 heros might be imbalance in some way, heroes that might be picked by the players were only a small subset, and between which heroes are fairly balanced.

On the other hand, heroes picked in a match does not necessarily have much impact on the result of the game. It's player's actions and collaboration that determines the game result. Guessing a game's result based on heroes picked by each side is not much more than guess the side of tossed coin.

A Hyperparameter Tuning Result

Parameter tuning process of **MLPClassifier** in shown in table 3

Parameter tuning process of **LogisticRegression** in shown in table 4

Parameter tuning process of **GaussianNB** in shown in table 5

Parameter tuning process of **DecisionTreeClassifier** in shown in table 6

Parameter tuning process of **BaggingClassifier** in shown in table 7

Parameter tuning process of **GradientBoostingClassifier** in shown in table 8

Parameter tuning process of **AdaBoostClassifier** in shown in table 9

Parameter tuning process of **RandomForestClassifier** in shown in table 10

Parameter tuning process of **KNeighborsClassifier** in shown in table 11

Final result is shown in table 12:

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Parameters	Gini Score	Logloss	Accuracies
{'hidden_layer_sizes': (10, 10, 10, 10, 10, 10, 10, 10, 10, 10), 'max_iter': 200, 'solver': 'lbfgs', 'warm_start': True}	0.023441920407409222	0.6917400850960969	0.5265231234148184
{'hidden_layer_sizes': (10, 10, 10, 10, 10, 10, 10, 10, 10, 10), 'max_iter': 200, 'solver': 'lbfgs', 'warm_start': False}	-0.19741087500808052	0.6771277916300255	0.5737952619934165
{'hidden_layer_sizes': (10, 10, 10, 10, 10, 10, 10, 10, 10, 10), 'max_iter': 200, 'solver': 'sgd', 'warm_start': True}	-0.009794351031875426	0.6917705051963632	0.5265231234148184
{'hidden_layer_sizes': (10, 10, 10, 10, 10, 10, 10, 10, 10, 10), 'max_iter': 200, 'solver': 'sgd', 'warm_start': False}	-0.014576338604566974	0.691666932738916	0.5265231234148184
{'hidden_layer_sizes': (10, 10, 10, 10, 10, 10, 10, 10, 10, 10), 'max_iter': 200, 'solver': 'adam', 'warm_start': True}	-0.24612697624535151	0.6689261421858412	0.5936538772867087
{'hidden_layer_sizes': (10, 10, 10, 10, 10, 10, 10, 10, 10, 10), 'max_iter': 200, 'solver': 'adam', 'warm_start': False}	-0.25128628872857295	0.6685290768072865	0.5891748961200151
{'hidden_layer_sizes': (10, 10, 10, 10, 10, 10, 10, 10, 10, 10), 'max_iter': 1000, 'solver': 'lbfgs', 'warm_start': True}	0.00748795222423375	0.6917593344980979	0.5265231234148184
{'hidden_layer_sizes': (10, 10, 10, 10, 10, 10, 10, 10, 10, 10), 'max_iter': 1000, 'solver': 'lbfgs', 'warm_start': False}	0.005268344453838947	0.6917517105568209	0.5265231234148184
{'hidden_layer_sizes': (10, 10, 10, 10, 10, 10, 10, 10, 10, 10), 'max_iter': 1000, 'solver': 'sgd', 'warm_start': True}	-0.0016919930233556535	0.6917551205603422	0.5265231234148184
{'hidden_layer_sizes': (10, 10, 10, 10, 10, 10, 10, 10, 10, 10), 'max_iter': 1000, 'solver': 'sgd', 'warm_start': False}	0.004178118196964009	0.6917526444160114	0.5265231234148184
{'hidden_layer_sizes': (10, 10, 10, 10, 10, 10, 10, 10, 10, 10), 'max_iter': 1000, 'solver': 'adam', 'warm_start': True}	-0.004314320551517259	0.6917472693766709	0.5265231234148184
{'hidden_layer_sizes': (10, 10, 10, 10, 10, 10, 10, 10, 10, 10), 'max_iter': 1000, 'solver': 'adam', 'warm_start': False}	-0.2508723784171458	0.669860899285235	0.5897145324051589
{'hidden_layer_sizes': 100, 'max_iter': 200, 'solver': 'lbfgs', 'warm_start': True}	-0.23812467907466228	0.6698343142368847	0.5871242782364686
{'hidden_layer_sizes': 100, 'max_iter': 200, 'solver': 'lbfgs', 'warm_start': False}	-0.24051181807738864	0.6690753982483032	0.5897684960336733
{'hidden_layer_sizes': 100, 'max_iter': 200, 'solver': 'sgd', 'warm_start': True}	-0.19815814233445095	0.6811253263698115	0.5591711186660191
{'hidden_layer_sizes': 100, 'max_iter': 200, 'solver': 'sgd', 'warm_start': False}	-0.19409279408009894	0.6974344363042961	0.5059629809508391
{'hidden_layer_sizes': 100, 'max_iter': 200, 'solver': 'adam', 'warm_start': True}	-0.24976502757607077	0.6712933348636116	0.586746532836868
{'hidden_layer_sizes': 100, 'max_iter': 200, 'solver': 'adam', 'warm_start': False}	-0.24224852659072948	0.692719864985088	0.563650099832713
{'hidden_layer_sizes': 100, 'max_iter': 1000, 'solver': 'lbfgs', 'warm_start': True}	-0.25191823961891013	0.667006245106153	0.5927904592304787
{'hidden_layer_sizes': 100, 'max_iter': 1000, 'solver': 'lbfgs', 'warm_start': False}	0.0	0.6917395777231605	0.5265231234148184
{'hidden_layer_sizes': 100, 'max_iter': 1000, 'solver': 'sgd', 'warm_start': True}	-0.18553073560321853	0.6833056736431758	0.5597647185796772
{'hidden_layer_sizes': 100, 'max_iter': 1000, 'solver': 'sgd', 'warm_start': False}	-0.15477710835112246	0.6882174126002556	0.53143381360906272
{'hidden_layer_sizes': 100, 'max_iter': 1000, 'solver': 'adam', 'warm_start': True}	-0.2524856871300152	0.6679102559520324	0.594247477200367
{'hidden_layer_sizes': 100, 'max_iter': 1000, 'solver': 'adam', 'warm_start': False}	-0.24473874017120711	0.6708652563829381	0.5870163509794398
{'hidden_layer_sizes': 1, 'max_iter': 200, 'solver': 'lbfgs', 'warm_start': True}	0.0	0.6917395679178476	0.5265231234148184
{'hidden_layer_sizes': 1, 'max_iter': 200, 'solver': 'lbfgs', 'warm_start': False}	0.0	0.6917395721820144	0.5265231234148184
{'hidden_layer_sizes': 1, 'max_iter': 200, 'solver': 'sgd', 'warm_start': True}	0.0	0.6917399390615526	0.5265231234148184
{'hidden_layer_sizes': 1, 'max_iter': 200, 'solver': 'sgd', 'warm_start': False}	0.0	0.6917396555865307	0.5265231234148184
{'hidden_layer_sizes': 1, 'max_iter': 200, 'solver': 'adam', 'warm_start': True}	-0.25085754334079247	0.6688500127580644	0.588311478063785
{'hidden_layer_sizes': 1, 'max_iter': 200, 'solver': 'adam', 'warm_start': False}	0.0	0.6917400819109822	0.5265231234148184
{'hidden_layer_sizes': 1, 'max_iter': 1000, 'solver': 'lbfgs', 'warm_start': True}	0.0	0.6917395678329331	0.5265231234148184
{'hidden_layer_sizes': 1, 'max_iter': 1000, 'solver': 'lbfgs', 'warm_start': False}	0.0	0.691739584342401	0.5265231234148184
{'hidden_layer_sizes': 1, 'max_iter': 1000, 'solver': 'sgd', 'warm_start': True}	0.0	0.6917395917034717	0.5265231234148184
{'hidden_layer_sizes': 1, 'max_iter': 1000, 'solver': 'sgd', 'warm_start': False}	0.0	0.6917396569173438	0.5265231234148184
{'hidden_layer_sizes': 1, 'max_iter': 1000, 'solver': 'adam', 'warm_start': True}	-0.2481441961945623	0.6678793817348317	0.593114241001565
{'hidden_layer_sizes': 1, 'max_iter': 1000, 'solver': 'adam', 'warm_start': False}	0.0	0.691743246666027	0.5265231234148184
{'hidden_layer_sizes': (30, 30, 30, 30), 'max_iter': 200, 'solver': 'lbfgs', 'warm_start': True}	-0.20849681217571492	0.6752778358701035	0.5802708974151422
{'hidden_layer_sizes': (30, 30, 30, 30), 'max_iter': 200, 'solver': 'lbfgs', 'warm_start': False}	-0.1623509171196056	0.6822008161607809	0.5603583184933355
{'hidden_layer_sizes': (30, 30, 30, 30), 'max_iter': 200, 'solver': 'sgd', 'warm_start': True}	-0.06836561543290887	0.692887749648827	0.5102800712319896
{'hidden_layer_sizes': (30, 30, 30, 30), 'max_iter': 200, 'solver': 'sgd', 'warm_start': False}	-0.04656485162972901	0.6913282807666403	0.5265231234148184
{'hidden_layer_sizes': (30, 30, 30, 30), 'max_iter': 200, 'solver': 'adam', 'warm_start': True}	-0.25182626214551784	0.6670561221345881	0.5933300955156224
{'hidden_layer_sizes': (30, 30, 30, 30), 'max_iter': 200, 'solver': 'adam', 'warm_start': False}	-0.252010333903927	0.6732699997831298	0.5808644973288004
{'hidden_layer_sizes': (30, 30, 30, 30), 'max_iter': 1000, 'solver': 'lbfgs', 'warm_start': True}	-0.2514514370037595	0.667048965996199	0.5953267497706546
{'hidden_layer_sizes': (30, 30, 30, 30), 'max_iter': 1000, 'solver': 'lbfgs', 'warm_start': False}	-0.24230690904082008	0.6689416453234696	0.5909556958609897
{'hidden_layer_sizes': (30, 30, 30, 30), 'max_iter': 1000, 'solver': 'sgd', 'warm_start': True}	-0.05301927795977934	0.6912022126190805	0.5265231234148184
{'hidden_layer_sizes': (30, 30, 30, 30), 'max_iter': 1000, 'solver': 'sgd', 'warm_start': False}	-0.05103941436818982	0.691169710249169	0.5304085046678538
{'hidden_layer_sizes': (30, 30, 30, 30), 'max_iter': 1000, 'solver': 'adam', 'warm_start': True}	-0.2528792488563967	0.6671545071807288	0.592412713830878
{'hidden_layer_sizes': (30, 30, 30, 30), 'max_iter': 1000, 'solver': 'adam', 'warm_start': False}	-0.2533946684698021	0.6667630909822776	0.5931682046300794
{'hidden_layer_sizes': (5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5), 'max_iter': 200, 'solver': 'lbfgs', 'warm_start': True}	-0.009600864256505082	0.6917362719289238	0.5265231234148184
{'hidden_layer_sizes': (5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5), 'max_iter': 200, 'solver': 'lbfgs', 'warm_start': False}	0.0	0.6917395688124434	0.5265231234148184
{'hidden_layer_sizes': (5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5), 'max_iter': 200, 'solver': 'sgd', 'warm_start': True}	0.0	0.6917395697246583	0.5265231234148184
{'hidden_layer_sizes': (5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5), 'max_iter': 200, 'solver': 'sgd', 'warm_start': False}	0.007066799592065687	0.6917826571738176	0.5265231234148184
{'hidden_layer_sizes': (5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5), 'max_iter': 200, 'solver': 'adam', 'warm_start': True}	0.0	0.691739691688917	0.5265231234148184
{'hidden_layer_sizes': (5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5), 'max_iter': 200, 'solver': 'adam', 'warm_start': False}	0.0	0.6917768964494576	0.5265231234148184
{'hidden_layer_sizes': (5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5), 'max_iter': 1000, 'solver': 'lbfgs', 'warm_start': True}	-0.009066661333826609	0.6917362162764207	0.5265231234148184
{'hidden_layer_sizes': (5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5), 'max_iter': 1000, 'solver': 'lbfgs', 'warm_start': False}	0.005456714880041735	0.6917403831400613	0.5265231234148184
{'hidden_layer_sizes': (5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5), 'max_iter': 1000, 'solver': 'sgd', 'warm_start': True}	-0.00707523339137861	0.6917254750028513	0.5265231234148184
{'hidden_layer_sizes': (5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5), 'max_iter': 1000, 'solver': 'sgd', 'warm_start': False}	0.0	0.691739786738686	0.5265231234148184
{'hidden_layer_sizes': (5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5), 'max_iter': 1000, 'solver': 'adam', 'warm_start': True}	-0.24974610409284792	0.6676570129433181	0.5941395499433382
{'hidden_layer_sizes': (5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5), 'max_iter': 1000, 'solver': 'adam', 'warm_start': False}	-0.24808565020819673	0.668463628140003	0.5910636231180184

Parameters	Gini Score	Logloss	Accuracies
{'C': 0.1, 'fit_intercept': True, 'penalty': 'l2', 'random_state': 0, 'solver': 'liblinear'}	-0.2524223285047067	0.6668351389242444	0.5934380227726512
{'C': 0.1, 'fit_intercept': True, 'penalty': 'l1', 'random_state': 0, 'solver': 'liblinear'}	-0.2524336125076654	0.6667069827796888	0.5919270411742485
{'C': 0.1, 'fit_intercept': False, 'penalty': 'l2', 'random_state': 0, 'solver': 'liblinear'}	-0.25294066840873297	0.6667992432399723	0.5933840591441368
{'C': 0.1, 'fit_intercept': False, 'penalty': 'l1', 'random_state': 0, 'solver': 'liblinear'}	-0.25284278026712426	0.6666781803118859	0.5926825319734499
{'C': 1, 'fit_intercept': True, 'penalty': 'l2', 'random_state': 0, 'solver': 'liblinear'}	-0.25240057818016326	0.6668904332782875	0.5938157681722519
{'C': 1, 'fit_intercept': True, 'penalty': 'l1', 'random_state': 0, 'solver': 'liblinear'}	-0.25239188739527574	0.6668804622969574	0.593276131887108
{'C': 1, 'fit_intercept': False, 'penalty': 'l2', 'random_state': 0, 'solver': 'liblinear'}	-0.2529090591830536	0.6668566912268221	0.5933300955156224
{'C': 1, 'fit_intercept': False, 'penalty': 'l1', 'random_state': 0, 'solver': 'liblinear'}	-0.25293564550886516	0.6668315057392386	0.59354595002968
{'C': 10, 'fit_intercept': True, 'penalty': 'l2', 'random_state': 0, 'solver': 'liblinear'}	-0.2524121658933465	0.6668937034206066	0.5938697318007663
{'C': 10, 'fit_intercept': True, 'penalty': 'l1', 'random_state': 0, 'solver': 'liblinear'}	-0.25237588420267376	0.6669048471331865	0.5931682046300794
{'C': 10, 'fit_intercept': False, 'penalty': 'l2', 'random_state': 0, 'solver': 'liblinear'}	-0.2528625915186957	0.6668625697112861	0.5943919864011656
{'C': 10, 'fit_intercept': False, 'penalty': 'l1', 'random_state': 0, 'solver': 'liblinear'}	-0.25291779669259107	0.6668553937259752	0.59354595002968

Parameters	Gini Score	Logloss	Accuracies
{'priors': None}	-0.13714668309069245	0.7439216577784568	0.5527494468728077

Table 6: DecisionTreeClassifier			
Parameters	Gini Score	Logloss	Accuracies
{'max_depth': None, 'max_features': 'auto', 'min_samples_split': 2, 'splitter': 'best'}	-0.020710502502817363	16.871652545442537	0.5115212346878204
{'max_depth': None, 'max_features': 'auto', 'min_samples_split': 2, 'splitter': 'random'}	-0.04114568000590779	16.511929410087117	0.521936214991096
{'max_depth': None, 'max_features': 'auto', 'min_samples_split': 4, 'splitter': 'best'}	-0.04913235946235717	14.31192383931627	0.5210727969348659
{'max_depth': None, 'max_features': 'auto', 'min_samples_split': 4, 'splitter': 'random'}	-0.048327796034007164	13.909929258400737	0.5198855971075496
{'max_depth': None, 'max_features': 'auto', 'min_samples_split': 8, 'splitter': 'best'}	-0.052674333231652604	11.256321160165053	0.5192380335653769
{'max_depth': None, 'max_features': 'auto', 'min_samples_split': 8, 'splitter': 'random'}	-0.03898668338856234	10.539607860509177	0.5155145431978846
{'max_depth': None, 'max_features': 'sqrt', 'min_samples_split': 2, 'splitter': 'best'}	-0.03895256511202616	16.562250870493525	0.5204791970212077
{'max_depth': None, 'max_features': 'sqrt', 'min_samples_split': 2, 'splitter': 'random'}	-0.03139589260890552	16.685267135902127	0.5169175975392586
{'max_depth': None, 'max_features': 'sqrt', 'min_samples_split': 4, 'splitter': 'best'}	-0.04807473532997264	14.197689859149907	0.5195618153364632
{'max_depth': None, 'max_features': 'sqrt', 'min_samples_split': 4, 'splitter': 'random'}	-0.035832304670696535	14.204473137606321	0.5142733797420539
{'max_depth': None, 'max_features': 'sqrt', 'min_samples_split': 8, 'splitter': 'best'}	-0.04905646694970445	11.29865425514423	0.5177270519669742
{'max_depth': None, 'max_features': 'sqrt', 'min_samples_split': 8, 'splitter': 'random'}	-0.048742045099146036	10.575464434953705	0.5195078517079489
{'max_depth': None, 'max_features': 'log2', 'min_samples_split': 2, 'splitter': 'best'}	-0.02623180253022861	16.76727845414882	0.5145431978846258
{'max_depth': None, 'max_features': 'log2', 'min_samples_split': 2, 'splitter': 'random'}	-0.05007383779617203	16.349775487149625	0.5266310506718471
{'max_depth': None, 'max_features': 'log2', 'min_samples_split': 4, 'splitter': 'best'}	-0.04552700370542828	13.422968375601922	0.5165938157681722
{'max_depth': None, 'max_features': 'log2', 'min_samples_split': 4, 'splitter': 'random'}	-0.028878251658917886	13.218263067445722	0.5128163617721656
{'max_depth': None, 'max_features': 'log2', 'min_samples_split': 8, 'splitter': 'best'}	-0.02714794422617698	10.337428281080651	0.5099562894609033
{'max_depth': None, 'max_features': 'log2', 'min_samples_split': 8, 'splitter': 'random'}	-0.050076057217044	9.166910081488856	0.517834979224003
{'max_depth': None, 'max_features': None, 'min_samples_split': 2, 'splitter': 'best'}	-0.0555539266823426	16.280807149367856	0.5286277049268793
{'max_depth': None, 'max_features': None, 'min_samples_split': 2, 'splitter': 'random'}	-0.04763748605590434	16.42059583975515	0.5245804327883007
{'max_depth': None, 'max_features': None, 'min_samples_split': 4, 'splitter': 'best'}	-0.046322082029842004	15.56173132438178	0.5226377421617829
{'max_depth': None, 'max_features': None, 'min_samples_split': 4, 'splitter': 'random'}	-0.04469569041499177	15.528193346925073	0.518968215422805
{'max_depth': None, 'max_features': None, 'min_samples_split': 8, 'splitter': 'best'}	-0.06647456371967841	13.187665309754978	0.5261453780152178
{'max_depth': None, 'max_features': None, 'min_samples_split': 8, 'splitter': 'random'}	-0.05038505900821	13.264605915638724	0.5192380335653769
{'max_depth': 10, 'max_features': 'auto', 'min_samples_split': 2, 'splitter': 'best'}	-0.0674656519505592	0.7609313628982107	0.5413631212562733
{'max_depth': 10, 'max_features': 'auto', 'min_samples_split': 2, 'splitter': 'random'}	-0.09265092745276204	0.7549302319167248	0.5381253035454104
{'max_depth': 10, 'max_features': 'auto', 'min_samples_split': 4, 'splitter': 'best'}	-0.07339555904162998	0.7639390131015542	0.5308941773244833
{'max_depth': 10, 'max_features': 'auto', 'min_samples_split': 4, 'splitter': 'random'}	-0.0893235600006066	0.7542918016101855	0.539906103286385
{'max_depth': 10, 'max_features': 'auto', 'min_samples_split': 8, 'splitter': 'best'}	-0.09883689730662537	0.7377082199942254	0.5353191948626626
{'max_depth': 10, 'max_features': 'auto', 'min_samples_split': 8, 'splitter': 'random'}	-0.07544556801393076	0.7403238927824821	0.5365603583184934
{'max_depth': 10, 'max_features': 'sqrt', 'min_samples_split': 2, 'splitter': 'best'}	-0.09610532754692147	0.7978453143174602	0.5396902487723274
{'max_depth': 10, 'max_features': 'sqrt', 'min_samples_split': 2, 'splitter': 'random'}	-0.0926321558246519	0.7612583704357989	0.5384490853164967
{'max_depth': 10, 'max_features': 'sqrt', 'min_samples_split': 4, 'splitter': 'best'}	-0.09643605630030616	0.792733583504035	0.5395823215152987
{'max_depth': 10, 'max_features': 'sqrt', 'min_samples_split': 4, 'splitter': 'random'}	-0.08417175850486158	0.7421250572848473	0.5408774485996438
{'max_depth': 10, 'max_features': 'sqrt', 'min_samples_split': 8, 'splitter': 'best'}	-0.08775511863283514	0.7508715225586701	0.5383951216879823
{'max_depth': 10, 'max_features': 'sqrt', 'min_samples_split': 8, 'splitter': 'random'}	-0.07922032398919021	0.7313337243658097	0.5379094490313528
{'max_depth': 10, 'max_features': 'log2', 'min_samples_split': 2, 'splitter': 'best'}	-0.07828593612100199	0.7384978930076804	0.5335923587502024
{'max_depth': 10, 'max_features': 'log2', 'min_samples_split': 2, 'splitter': 'random'}	-0.08705607114519465	0.7533432914931568	0.541039339485187
{'max_depth': 10, 'max_features': 'log2', 'min_samples_split': 4, 'splitter': 'best'}	-0.0903647604185398	0.7025504606499695	0.5361286492903783
{'max_depth': 10, 'max_features': 'log2', 'min_samples_split': 4, 'splitter': 'random'}	-0.07459320526869995	0.7551882998382376	0.5330527224650585
{'max_depth': 10, 'max_features': 'log2', 'min_samples_split': 8, 'splitter': 'best'}	-0.09532900916945564	0.7242354020730722	0.5403378123145001
{'max_depth': 10, 'max_features': 'log2', 'min_samples_split': 8, 'splitter': 'random'}	-0.09524412216169065	0.7300082072945722	0.5451945388807944
{'max_depth': 10, 'max_features': 'log2', 'min_samples_split': 2, 'splitter': 'best'}	-0.10949454465181607	0.8728889716103384	0.5477308294209703
{'max_depth': 10, 'max_features': None, 'min_samples_split': 2, 'splitter': 'random'}	-0.11458608303031026	0.84239028377677229	0.550375047218175
{'max_depth': 10, 'max_features': None, 'min_samples_split': 4, 'splitter': 'best'}	-0.1095797236886431	0.8762829462300609	0.5477847930494847
{'max_depth': 10, 'max_features': None, 'min_samples_split': 4, 'splitter': 'random'}	-0.12123934610814824	0.8344583870145453	0.548540283848686
{'max_depth': 10, 'max_features': None, 'min_samples_split': 8, 'splitter': 'best'}	-0.10862448494542254	0.853535819996185	0.5475689385354271
{'max_depth': 10, 'max_features': None, 'min_samples_split': 8, 'splitter': 'random'}	-0.11735748555408154	0.806710181141043	0.548971992876801
{'max_depth': 20, 'max_features': 'auto', 'min_samples_split': 2, 'splitter': 'best'}	-0.10861490639218663	1.903262987600323	0.5490259565053154
{'max_depth': 20, 'max_features': 'auto', 'min_samples_split': 2, 'splitter': 'random'}	-0.10020064966420494	1.5754177361733002	0.5458960660514813
{'max_depth': 20, 'max_features': 'auto', 'min_samples_split': 4, 'splitter': 'best'}	-0.08756913116377851	1.5710848032786964	0.5379634126598672
{'max_depth': 20, 'max_features': 'auto', 'min_samples_split': 4, 'splitter': 'random'}	-0.09605405892478314	1.553208257892036	0.5403378123145001
{'max_depth': 20, 'max_features': 'auto', 'min_samples_split': 8, 'splitter': 'best'}	-0.09955386369751462	1.5176468478007938	0.5461119205655388
{'max_depth': 20, 'max_features': 'auto', 'min_samples_split': 8, 'splitter': 'random'}	-0.1032652493663031	1.2150410526561939	0.5422805029410177
{'max_depth': 20, 'max_features': 'sqrt', 'min_samples_split': 2, 'splitter': 'best'}	-0.09672998939186894	1.6827003977794193	0.5422805029410177
{'max_depth': 20, 'max_features': 'sqrt', 'min_samples_split': 2, 'splitter': 'random'}	-0.10310375729497356	1.7169573831120009	0.5475689385354271
{'max_depth': 20, 'max_features': 'sqrt', 'min_samples_split': 4, 'splitter': 'best'}	-0.09273880483812258	1.7814329814020278	0.544439048081593
{'max_depth': 20, 'max_features': 'sqrt', 'min_samples_split': 4, 'splitter': 'random'}	-0.12029597542601134	1.4656799354557548	0.5493497382764017
{'max_depth': 20, 'max_features': 'sqrt', 'min_samples_split': 8, 'splitter': 'best'}	-0.11358401450669575	1.4852648309664345	0.5500512654470887
{'max_depth': 20, 'max_features': 'sqrt', 'min_samples_split': 8, 'splitter': 'random'}	-0.10443344738275284	1.1684627251920119	0.5458421024229669
{'max_depth': 20, 'max_features': 'log2', 'min_samples_split': 2, 'splitter': 'best'}	-0.11219298663471755	1.4903040168346533	0.5434677027683341
{'max_depth': 20, 'max_features': 'log2', 'min_samples_split': 2, 'splitter': 'random'}	-0.0872342322353874	1.4489705311267467	0.5355890130052344
{'max_depth': 20, 'max_features': 'log2', 'min_samples_split': 4, 'splitter': 'best'}	-0.10207364230023663	1.4726343869489673	0.5428201392261616
{'max_depth': 20, 'max_features': 'log2', 'min_samples_split': 4, 'splitter': 'random'}	-0.08862191929489538	1.2586263628638854	0.541039339485187
{'max_depth': 20, 'max_features': 'log2', 'min_samples_split': 8, 'splitter': 'best'}	-0.09911812129340669	1.248722203446923	0.5400140305434138
{'max_depth': 20, 'max_features': 'log2', 'min_samples_split': 8, 'splitter': 'random'}	-0.08084621331405328	1.1098189373391072	0.5439533754249636
{'max_depth': 20, 'max_features': None, 'min_samples_split': 2, 'splitter': 'best'}	-0.10523472840444503	2.53539011800077	0.5498893745615455
{'max_depth': 20, 'max_features': None, 'min_samples_split': 2, 'splitter': 'random'}	-0.09348922607836352	2.3379130326897184	0.5465975932221683
{'max_depth': 20, 'max_features': None, 'min_samples_split': 4, 'splitter': 'best'}	-0.10502641823388359	2.4794575733360795	0.5499973018185743
{'max_depth': 20, 'max_features': None, 'min_samples_split': 4, 'splitter': 'random'}	-0.10516466479187114	2.2833700467495968	0.5518320651880633
{'max_depth': 20, 'max_features': None, 'min_samples_split': 8, 'splitter': 'best'}	-0.10859594786547655	2.2074834768313947	0.550375047218175
{'max_depth': 20, 'max_features': None, 'min_samples_split': 8, 'splitter': 'random'}	-0.10385041720089516	2.077547497398118	0.5513463925314338
{'max_depth': 40, 'max_features': 'auto', 'min_samples_split': 2, 'splitter': 'best'}	-0.045333248263320636	8.029124079242077	0.5293831957260806
{'max_depth': 40, 'max_features': 'auto', 'min_samples_split': 2, 'splitter': 'random'}	-0.05703145356250827	6.686717187721453	0.5320274135232853
{'max_depth': 40, 'max_features': 'auto', 'min_samples_split': 4, 'splitter': 'best'}	-0.051401004752854806	7.081103389013952	0.5303545410393394
{'max_depth': 40, 'max_features': 'auto', 'min_samples_split': 4, 'splitter': 'random'}	-0.05203998770300666	6.1599341920292225	0.5306243591819114
{'max_depth': 40, 'max_features': 'auto', 'min_samples_split': 8, 'splitter': 'best'}	-0.06472754073986464	5.201419260575808	0.5336463223787168
{'max_depth': 40, 'max_features': 'auto', 'min_samples_split': 8, 'splitter': 'random'}	-0.056734296470099865	5.063905072267169	0.5307862500674545
{'max_depth': 40, 'max_features': 'sqrt', 'min_samples_split': 2, 'splitter': 'best'}	-0.040997995068633664	7.764663025842688	0.528303923155793
{'max_depth': 40, 'max_features': 'sqrt', 'min_samples_split': 2, 'splitter': 'random'}	-0.05681063286692711	7.137587701654034	0.5331066860935729
{'max_depth': 40, 'max_features': 'sqrt', 'min_samples_split': 4, 'splitter': 'best'}	-0.06441681013665113	6.708312423477944	0.5352112676056338
{'max_depth': 40, 'max_features': 'sqrt', 'min_samples_split': 4, 'splitter': 'random'}	-0.060002206805216396	6.650603108044395	0.5315417408666558
{'max_depth': 40, 'max_features': 'sqrt', 'min_samples_split': 8, 'splitter': 'best'}	-0.06243922437174554	5.8115047221752905	0.5321353407803411
{'max_depth': 40, 'max_features': 'sqrt', 'min_samples_split': 8, 'splitter': 'random'}	-0.07070525882897893	4.685152680998963	0.5351573039771195
{'max_depth': 40, 'max_features': 'log2', 'min_samples_split': 2, 'splitter': 'best'}	-0.06288106434266982	6.900423156504733	0.5336463223787168
{'max_depth': 40, 'max_features': 'log2', 'min_samples_split': 2, 'splitter': 'random'}	-0.06816030732110545	5.946678367663425	0.5313798499811128
{'max_depth': 40, 'max_features': 'log2', 'min_samples_split': 4, 'splitter': 'best'}	-0.06597298628381543	5.935813517642	0.5345097404349468
{'max_depth': 40, 'max_features': 'log2', 'min_samples_split': 4, 'splitter': 'random'}	-0.04982151300537385	5.031451622491039	0.5268469051859047
{'max_depth': 40, 'max_features': 'log2', 'min_samples_split': 8, 'splitter': 'best'}	-0.07058767624742379	4.45951915201144	0.5303005774108251
{'max_depth': 40, 'max_features': 'log2', 'min_samples_split': 8, 'splitter': 'random'}	-0.06761708654099019	4.398800092524693	0.5330527224650585
{'max_depth': 40, 'max_features': 'log2', 'min_samples_split': 2, 'splitter': 'best'}	-0.05359714506781943	9.969752586554485	0.5333765042361448
{'max_depth': 40, 'max_features': None, 'min_samples_split': 2, 'splitter': 'random'}	-0.06072489606572214	9.43748198397123	0.5361286492903783
{'max_depth': 40, 'max_features': None, 'min_samples_split': 4, 'splitter': 'best'}	-0.062397032012856624	9.430934787918622	0.5362365765474071
{'max_depth': 40, 'max_features': None, 'min_samples_split': 4, 'splitter': 'random'}	-0.053377001879662656	8.811233855938893	0.5326210134369435
{'max_depth': 40, 'max_features': None, 'min_samples_split': 8, 'splitter': 'best'}	-0.06490970846878907	8.1688074379898	0.5355350493767201
{'max_depth': 40, 'max_features': None, 'min_samples_split': 8, 'splitter': 'random'}	-0.05119682971381212	7.705180896796142	0.5303545410393394

Table 7: BaggingClassifier			
Parameters	Gini Score	Logloss	Accuracies
{'bootstrap': True, 'n_estimators': 10, 'warm_start': True}	-0.1050794273492317	0.8352751295569847	0.5373158491176947
{'bootstrap': True, 'n_estimators': 10, 'warm_start': False}	-0.0950557166920003	0.8507019609573805	0.5320813771517997
{'bootstrap': True, 'n_estimators': 15, 'warm_start': True}	-0.13200721690252992	0.7274381610227858	0.5498893745615455
{'bootstrap': True, 'n_estimators': 15, 'warm_start': False}	-0.11543862099297852	0.7327921551230738	0.5439533754249636
{'bootstrap': True, 'n_estimators': 20, 'warm_start': True}	-0.1336617484378022	0.7079155241594297	0.5499973018185743
{'bootstrap': True, 'n_estimators': 20, 'warm_start': False}	-0.14225358219785234	0.7020294034628034	0.5531271922724084
{'bootstrap': False, 'n_estimators': 10, 'warm_start': True}	-0.058100291610876376	11.104426727555026	0.5254978144730452
{'bootstrap': False, 'n_estimators': 10, 'warm_start': False}	-0.057744587784508437	11.145889776416714	0.5261453780152178
{'bootstrap': False, 'n_estimators': 15, 'warm_start': True}	-0.06043090546834695	10.775951129113652	0.5267389779288759
{'bootstrap': False, 'n_estimators': 15, 'warm_start': False}	-0.05923563051726122	10.76881176008108	0.5261453780152178
{'bootstrap': False, 'n_estimators': 20, 'warm_start': True}	-0.059276970151288744	10.563334173249881	0.5264151961577896
{'bootstrap': False, 'n_estimators': 20, 'warm_start': False}	-0.060298265868351075	10.574644529000668	0.5283578867843074

Table 8: GradientBoostingClassifier			
Parameters	Gini Score	Logloss	Accuracies
{'loss': 'deviance', 'max_depth': 2, 'n_estimators': 50}	-0.18548897544734122	0.6830182206531282	0.5617613728347094
{'loss': 'deviance', 'max_depth': 2, 'n_estimators': 100}	-0.20884735218067085	0.6790623469832585	0.5733635529653014
{'loss': 'deviance', 'max_depth': 2, 'n_estimators': 200}	-0.22828790206064808	0.6745222675318447	0.5819977335276024
{'loss': 'deviance', 'max_depth': 3, 'n_estimators': 50}	-0.1988989382968056	0.6806617762586397	0.5699638443688954
{'loss': 'deviance', 'max_depth': 3, 'n_estimators': 100}	-0.2200881815628315	0.6761389761261933	0.5795154066159408
{'loss': 'deviance', 'max_depth': 3, 'n_estimators': 200}	-0.2363291442270561	0.6716330811401792	0.5843181695537208
{'loss': 'deviance', 'max_depth': 4, 'n_estimators': 50}	-0.20835705874776678	0.6786232897049046	0.5751983163347903
{'loss': 'deviance', 'max_depth': 4, 'n_estimators': 100}	-0.22308359373954167	0.6745045916086958	0.5816739517565161
{'loss': 'deviance', 'max_depth': 4, 'n_estimators': 200}	-0.23893764125883776	0.6702457865034233	0.5862608601802385
{'loss': 'exponential', 'max_depth': 2, 'n_estimators': 50}	-0.1847440910781173	0.6829407350856749	0.5626247908909395
{'loss': 'exponential', 'max_depth': 2, 'n_estimators': 100}	-0.20926705634868958	0.6790046050934061	0.5727159894231288
{'loss': 'exponential', 'max_depth': 2, 'n_estimators': 200}	-0.22726333561809087	0.6744367426838893	0.5822135880416599
{'loss': 'exponential', 'max_depth': 3, 'n_estimators': 50}	-0.19914204665040436	0.6805231369871149	0.5690464626841509
{'loss': 'exponential', 'max_depth': 3, 'n_estimators': 100}	-0.21974755886482367	0.6760982466129021	0.5769251524472505
{'loss': 'exponential', 'max_depth': 3, 'n_estimators': 200}	-0.23496752952221067	0.6717685050183627	0.5862608601802385
{'loss': 'exponential', 'max_depth': 4, 'n_estimators': 50}	-0.20788199755074044	0.6784826306494052	0.574442825535589
{'loss': 'exponential', 'max_depth': 4, 'n_estimators': 100}	-0.22697333907828487	0.6739273385116046	0.5828611515838324
{'loss': 'exponential', 'max_depth': 4, 'n_estimators': 200}	-0.23990841594816037	0.669975810297706	0.5855593330095515

Table 9: AdaBoostClassifier			
Parameters	Gini Score	Logloss	Accuracies
{'algorithm': 'SAMME', 'n_estimators': 50}	-0.16202343572939126	0.692352531481664	0.5604122821218499
{'algorithm': 'SAMME', 'n_estimators': 100}	-0.18649596174036143	0.6925477881994658	0.5714208623387836
{'algorithm': 'SAMME', 'n_estimators': 10}	-0.1090623065964531	0.6917914459964255	0.5416329393988452
{'algorithm': 'SAMME.R', 'n_estimators': 50}	-0.21190654350453886	0.6922926735159969	0.5801629701581135
{'algorithm': 'SAMME.R', 'n_estimators': 100}	-0.2379642616702815	0.6925967515039755	0.5866386055798392
{'algorithm': 'SAMME.R', 'n_estimators': 10}	-0.1312413298031614	0.691336877395664	0.5502671199611462

Table 10: RandomForestClassifier			
Parameters	Gini Score	Logloss	Accuracies
{'bootstrap': True, 'criterion': 'gini', 'max_depth': None, 'n_estimators': 10, 'warm_start': True}	-0.11059480502726404	0.8108144819689164	0.5383951216879823
{'bootstrap': True, 'criterion': 'gini', 'max_depth': None, 'n_estimators': 10, 'warm_start': False}	-0.10724791835259917	0.7999703977034974	0.5342399222923749
{'bootstrap': True, 'criterion': 'gini', 'max_depth': None, 'n_estimators': 20, 'warm_start': True}	-0.14197208954433393	0.6974313656584554	0.5517781015595489
{'bootstrap': True, 'criterion': 'gini', 'max_depth': None, 'n_estimators': 20, 'warm_start': False}	-0.13928760655059969	0.6993283667958945	0.5534509740434946
{'bootstrap': True, 'criterion': 'gini', 'max_depth': None, 'n_estimators': 40, 'warm_start': True}	-0.16910703283310768	0.6852118780989652	0.5644595542604285
{'bootstrap': True, 'criterion': 'gini', 'max_depth': None, 'n_estimators': 40, 'warm_start': False}	-0.16478368274299116	0.6853344661428263	0.5592250822945335
{'bootstrap': True, 'criterion': 'gini', 'max_depth': 10, 'n_estimators': 10, 'warm_start': True}	-0.17395222717599546	0.6834943150280455	0.556742755382872
{'bootstrap': True, 'criterion': 'gini', 'max_depth': 10, 'n_estimators': 10, 'warm_start': False}	-0.17211760715872093	0.6830526728876479	0.5622470454913389
{'bootstrap': True, 'criterion': 'gini', 'max_depth': 10, 'n_estimators': 20, 'warm_start': True}	-0.18212568842055	0.6833223356645429	0.5636500998327127
{'bootstrap': True, 'criterion': 'gini', 'max_depth': 10, 'n_estimators': 20, 'warm_start': False}	-0.17488292379683856	0.6828162887323403	0.558577518752361
{'bootstrap': True, 'criterion': 'gini', 'max_depth': 10, 'n_estimators': 40, 'warm_start': True}	-0.19727468433468953	0.6828882987004091	0.5623010091198533
{'bootstrap': True, 'criterion': 'gini', 'max_depth': 10, 'n_estimators': 40, 'warm_start': False}	-0.20095039573325457	0.682911102161185	0.5620311909772813
{'bootstrap': True, 'criterion': 'gini', 'max_depth': 50, 'n_estimators': 10, 'warm_start': True}	-0.11365036350959978	0.7348347533858612	0.5402298850574713
{'bootstrap': True, 'criterion': 'gini', 'max_depth': 50, 'n_estimators': 10, 'warm_start': False}	-0.10840343062659219	0.72042118585603	0.541740866655874
{'bootstrap': True, 'criterion': 'gini', 'max_depth': 50, 'n_estimators': 20, 'warm_start': True}	-0.13361592323738103	0.6950368913324827	0.5474610112783984
{'bootstrap': True, 'criterion': 'gini', 'max_depth': 50, 'n_estimators': 20, 'warm_start': False}	-0.14390772825476272	0.6929337565083244	0.5527494468728077
{'bootstrap': True, 'criterion': 'gini', 'max_depth': 50, 'n_estimators': 40, 'warm_start': True}	-0.1675447240756398	0.6832073449108156	0.5600885003507636
{'bootstrap': True, 'criterion': 'gini', 'max_depth': 50, 'n_estimators': 40, 'warm_start': False}	-0.17064113158317906	0.6824275605025176	0.5644595542604285
{'bootstrap': True, 'criterion': 'entropy', 'max_depth': None, 'n_estimators': 10, 'warm_start': True}	-0.09519094951006757	0.8072881387837687	0.5319194862662565
{'bootstrap': True, 'criterion': 'entropy', 'max_depth': None, 'n_estimators': 10, 'warm_start': False}	-0.10992948105571276	0.8091766972583542	0.538232308024391
{'bootstrap': True, 'criterion': 'entropy', 'max_depth': None, 'n_estimators': 20, 'warm_start': True}	-0.1306005012293372	0.7024186860357193	0.54611192053912363067
{'bootstrap': True, 'criterion': 'entropy', 'max_depth': None, 'n_estimators': 20, 'warm_start': False}	-0.13739479098183405	0.6995778110970007	0.5503210835896606
{'bootstrap': True, 'criterion': 'entropy', 'max_depth': None, 'n_estimators': 40, 'warm_start': True}	-0.177097730600945144	0.6828104835730007	0.5634882089471696
{'bootstrap': True, 'criterion': 'entropy', 'max_depth': None, 'n_estimators': 40, 'warm_start': False}	-0.18048550135280705	0.6827526742409444	0.5665101721439749
{'bootstrap': True, 'criterion': 'entropy', 'max_depth': 10, 'n_estimators': 10, 'warm_start': True}	-0.17725565992622316	0.683323483595032	0.5612217365495656
{'bootstrap': True, 'criterion': 'entropy', 'max_depth': 10, 'n_estimators': 10, 'warm_start': False}	-0.1627335102344154	0.6843361683518244	0.5599805730937348
{'bootstrap': True, 'criterion': 'entropy', 'max_depth': 10, 'n_estimators': 20, 'warm_start': True}	-0.18178816123060004	0.6834987207254766	0.5602503912363067
{'bootstrap': True, 'criterion': 'entropy', 'max_depth': 10, 'n_estimators': 20, 'warm_start': False}	-0.18745041784569505	0.6828798615828626	0.5580378824672171
{'bootstrap': True, 'criterion': 'entropy', 'max_depth': 10, 'n_estimators': 40, 'warm_start': True}	-0.20606640614715088	0.6826435639686521	0.5640278452323134
{'bootstrap': True, 'criterion': 'entropy', 'max_depth': 10, 'n_estimators': 40, 'warm_start': False}	-0.19608350947163555	0.68255029776144	0.5632723544331211
{'bootstrap': True, 'criterion': 'entropy', 'max_depth': 50, 'n_estimators': 10, 'warm_start': True}	-0.12572511108143059	0.7173654795308102	0.5475689385354271
{'bootstrap': True, 'criterion': 'entropy', 'max_depth': 50, 'n_estimators': 10, 'warm_start': False}	-0.13005010821545748	0.7127662178741435	0.5484863202201716
{'bootstrap': True, 'criterion': 'entropy', 'max_depth': 50, 'n_estimators': 20, 'warm_start': True}	-0.14809763274467214	0.691085483737955	0.5557174464410987
{'bootstrap': True, 'criterion': 'entropy', 'max_depth': 50, 'n_estimators': 20, 'warm_start': False}	-0.14972369728697288	0.6908591075939468	0.5554476282985268
{'bootstrap': True, 'criterion': 'entropy', 'max_depth': 50, 'n_estimators': 40, 'warm_start': True}	-0.17389787472696172	0.6814542031934401	0.5659705358588312
{'bootstrap': True, 'criterion': 'entropy', 'max_depth': 50, 'n_estimators': 40, 'warm_start': False}	-0.1842748821434952	0.6798672218090966	0.5656467540877449
{'bootstrap': False, 'criterion': 'gini', 'max_depth': None, 'n_estimators': 10, 'warm_start': True}	-0.11668616914617647	0.8522990317706787	0.5390966488586693
{'bootstrap': False, 'criterion': 'gini', 'max_depth': None, 'n_estimators': 10, 'warm_start': False}	-0.12418208792322227	0.8320298713030495	0.5382332308024391
{'bootstrap': False, 'criterion': 'gini', 'max_depth': None, 'n_estimators': 20, 'warm_start': True}	-0.14939189386663987	0.7029547948646525	0.5553397010141498
{'bootstrap': False, 'criterion': 'gini', 'max_depth': None, 'n_estimators': 20, 'warm_start': False}	-0.13093258499757	0.7087404646424914	0.5495116291619448
{'bootstrap': False, 'criterion': 'gini', 'max_depth': None, 'n_estimators': 40, 'warm_start': True}	-0.1638280117967592	0.6887915463125265	0.559710754951163
{'bootstrap': False, 'criterion': 'gini', 'max_depth': None, 'n_estimators': 40, 'warm_start': False}	-0.16315051605390063	0.6888832251485147	0.5615994819491663
{'bootstrap': False, 'criterion': 'gini', 'max_depth': 10, 'n_estimators': 10, 'warm_start': True}	-0.1739654268896016	0.6833312413509286	0.5574982461820733
{'bootstrap': False, 'criterion': 'gini', 'max_depth': 10, 'n_estimators': 10, 'warm_start': False}	-0.16803141971049929	0.6839329933803643	0.5558793373266419
{'bootstrap': False, 'criterion': 'gini', 'max_depth': 10, 'n_estimators': 20, 'warm_start': True}	-0.1836420551659721	0.6827352096425712	0.5627327181479682
{'bootstrap': False, 'criterion': 'gini', 'max_depth': 10, 'n_estimators': 20, 'warm_start': False}	-0.1791037483238409	0.6828962141389359	0.5609519184066937
{'bootstrap': False, 'criterion': 'gini', 'max_depth': 10, 'n_estimators': 40, 'warm_start': True}	-0.19243794715343965	0.6827396309763001	0.563973881603799
{'bootstrap': False, 'criterion': 'gini', 'max_depth': 10, 'n_estimators': 40, 'warm_start': False}	-0.18965871825080471	0.6829325740843305	0.5611138092925368
{'bootstrap': False, 'criterion': 'gini', 'max_depth': 50, 'n_estimators': 10, 'warm_start': True}	-0.1246688186015692	0.7175305169814419	0.5497274836760023
{'bootstrap': False, 'criterion': 'gini', 'max_depth': 50, 'n_estimators': 10, 'warm_start': False}	-0.13073906317871198	0.7220205638736964	0.5489180292482867
{'bootstrap': False, 'criterion': 'gini', 'max_depth': 50, 'n_estimators': 20, 'warm_start': True}	-0.14816335096480215	0.6949396999770198	0.5552857374129837
{'bootstrap': False, 'criterion': 'gini', 'max_depth': 50, 'n_estimators': 20, 'warm_start': False}	-0.14543026265397563	0.6966986618263223	0.5586854460098386
{'bootstrap': False, 'criterion': 'gini', 'max_depth': 50, 'n_estimators': 40, 'warm_start': True}	-0.16318795417965903	0.6855317271979298	0.56343442453186553
{'bootstrap': False, 'criterion': 'gini', 'max_depth': 50, 'n_estimators': 40, 'warm_start': False}	-0.16522034795893514	0.6853215999135548	0.5635961362041984
{'bootstrap': False, 'criterion': 'entropy', 'max_depth': None, 'n_estimators': 10, 'warm_start': True}	-0.10804405966279895	0.8438509041157952	0.5388268307160974
{'bootstrap': False, 'criterion': 'entropy', 'max_depth': None, 'n_estimators': 10, 'warm_start': False}	-0.10591995707686741	0.87957091887665	0.5340780314068317
{'bootstrap': False, 'criterion': 'entropy', 'max_depth': None, 'n_estimators': 20, 'warm_start': True}	-0.12718714874014325	0.712919006069912	0.5491878473908586
{'bootstrap': False, 'criterion': 'entropy', 'max_depth': None, 'n_estimators': 20, 'warm_start': False}	-0.14646901002778723	0.7023098388207916	0.5555015919270412
{'bootstrap': False, 'criterion': 'entropy', 'max_depth': None, 'n_estimators': 40, 'warm_start': True}	-0.16369369010936574	0.6898240786638478	0.5620851546057957
{'bootstrap': False, 'criterion': 'entropy', 'max_depth': None, 'n_estimators': 40, 'warm_start': False}	-0.15735297989608865	0.690247181892502	0.5561491554692137
{'bootstrap': False, 'criterion': 'entropy', 'max_depth': 10, 'n_estimators': 10, 'warm_start': True}	-0.16615154686976497	0.6833645148755811	0.5579839188387027
{'bootstrap': False, 'criterion': 'entropy', 'max_depth': 10, 'n_estimators': 10, 'warm_start': False}	-0.17700157127989025	0.6835051957027212	0.5589552641519616
{'bootstrap': False, 'criterion': 'entropy', 'max_depth': 10, 'n_estimators': 20, 'warm_start': True}	-0.18035886587032768	0.683035036036675	0.5632183908045977
{'bootstrap': False, 'criterion': 'entropy', 'max_depth': 10, 'n_estimators': 20, 'warm_start': False}	-0.18297683632488293	0.6826906024747122	0.5630025362905402
{'bootstrap': False, 'criterion': 'entropy', 'max_depth': 10, 'n_estimators': 40, 'warm_start': True}	-0.19080108921700445	0.6827127709413083	0.5640278452323134
{'bootstrap': False, 'criterion': 'entropy', 'max_depth': 10, 'n_estimators': 40, 'warm_start': False}	-0.19070446264094398	0.6829508658985224	0.5637580270897415
{'bootstrap': False, 'criterion': 'entropy', 'max_depth': 50, 'n_estimators': 10, 'warm_start': True}	-0.1234302298999608	0.7195689725092813	0.547137229507312
{'bootstrap': False, 'criterion': 'entropy', 'max_depth': 10, 'n_estimators': 10, 'warm_start': False}	-0.12130869716981074	0.7189517817956053	0.5486482111057147
{'bootstrap': False, 'criterion': 'entropy', 'max_depth': 50, 'n_estimators': 20, 'warm_start': True}	-0.15954171435403897	0.6908385730473875	0.5613836274351087
{'bootstrap': False, 'criterion': 'entropy', 'max_depth': 50, 'n_estimators': 20, 'warm_start': False}	-0.15802555786954198	0.6911146955547585	0.5591711186660191
{'bootstrap': False, 'criterion': 'entropy', 'max_depth': 50, 'n_estimators': 40, 'warm_start': True}	-0.17148288783287557	0.6834172661765084	0.5611138092925368
{'bootstrap': False, 'criterion': 'entropy', 'max_depth': 50, 'n_estimators': 40, 'warm_start': False}	-0.17647011343039565	0.6828977166775779	0.56694188117209

Table 11: KNeighborsClassifier				
Parameters	Gini Score	Logloss	Accuracies	
{'algorithm': 'auto', 'leaf_size': 30, 'n_neighbors': 5}	-0.047863551593440246	1.7816013390952237	0.5190221790513194	
{'algorithm': 'auto', 'leaf_size': 30, 'n_neighbors': 10}	-0.066646825822817	0.780029225583593	0.5214505423344665	
{'algorithm': 'auto', 'leaf_size': 30, 'n_neighbors': 15}	-0.07590010540847403	0.7179234248871208	0.5265770870433328	
{'algorithm': 'auto', 'leaf_size': 50, 'n_neighbors': 5}	-0.04877717035473261	1.7965438460845415	0.5186444336517188	
{'algorithm': 'auto', 'leaf_size': 50, 'n_neighbors': 10}	-0.06811903777405237	0.7814457313273296	0.5232853057039555	
{'algorithm': 'auto', 'leaf_size': 50, 'n_neighbors': 15}	-0.07681012637172202	0.7177130155978387	0.526037450758189	
{'algorithm': 'auto', 'leaf_size': 80, 'n_neighbors': 5}	-0.0510214253779655	1.7929229505071442	0.520101451621607	
{'algorithm': 'auto', 'leaf_size': 80, 'n_neighbors': 10}	-0.0682661503343649	0.7776619721338062	0.5216663968485241	
{'algorithm': 'auto', 'leaf_size': 80, 'n_neighbors': 15}	-0.07610522662167774	0.7178024065624691	0.5263612325292752	
{'algorithm': 'ball_tree', 'leaf_size': 30, 'n_neighbors': 5}	-0.049159074280956006	1.793979042969222	0.5210727969348659	
{'algorithm': 'ball_tree', 'leaf_size': 30, 'n_neighbors': 10}	-0.0682296116581178	0.7794700583972313	0.523069451189898	
{'algorithm': 'ball_tree', 'leaf_size': 30, 'n_neighbors': 15}	-0.07453593252904489	0.7163663700429584	0.5250661054449302	
{'algorithm': 'ball_tree', 'leaf_size': 50, 'n_neighbors': 5}	-0.050025466102329386	1.794699213483488	0.520101451621607	
{'algorithm': 'ball_tree', 'leaf_size': 50, 'n_neighbors': 10}	-0.06717118152552204	0.7776094879792579	0.5211807241918947	
{'algorithm': 'ball_tree', 'leaf_size': 50, 'n_neighbors': 15}	-0.07715454544753686	0.7155392420836387	0.5257676326156171	
{'algorithm': 'ball_tree', 'leaf_size': 80, 'n_neighbors': 5}	-0.051753180120558406	1.8047906931496462	0.5218282877340672	
{'algorithm': 'ball_tree', 'leaf_size': 80, 'n_neighbors': 10}	-0.06920649559541903	0.779274394143611	0.5226377421617829	
{'algorithm': 'ball_tree', 'leaf_size': 80, 'n_neighbors': 15}	-0.07283832086653508	0.7168951331937534	0.5256597053585883	
{'algorithm': 'kd_tree', 'leaf_size': 30, 'n_neighbors': 5}	-0.047863551593440246	1.7816013390952237	0.5190221790513194	
{'algorithm': 'kd_tree', 'leaf_size': 30, 'n_neighbors': 10}	-0.066646825822817	0.780029225583593	0.5214505423344665	
{'algorithm': 'kd_tree', 'leaf_size': 30, 'n_neighbors': 15}	-0.07590010540847403	0.7179234248871208	0.5265770870433328	
{'algorithm': 'kd_tree', 'leaf_size': 50, 'n_neighbors': 5}	-0.04877717035473261	1.7965438460845415	0.5186444336517188	
{'algorithm': 'kd_tree', 'leaf_size': 50, 'n_neighbors': 10}	-0.06811903777405237	0.7814457313273296	0.5232853057039555	
{'algorithm': 'kd_tree', 'leaf_size': 50, 'n_neighbors': 15}	-0.07681012637172202	0.7177130155978387	0.526037450758189	
{'algorithm': 'kd_tree', 'leaf_size': 80, 'n_neighbors': 5}	-0.0510214253779655	1.7929229505071442	0.520101451621607	
{'algorithm': 'kd_tree', 'leaf_size': 80, 'n_neighbors': 10}	-0.0682661503343649	0.7776619721338062	0.5216663968485241	
{'algorithm': 'kd_tree', 'leaf_size': 80, 'n_neighbors': 15}	-0.07610522662167774	0.7178024065624691	0.5263612325292752	
{'algorithm': 'brute', 'leaf_size': 30, 'n_neighbors': 5}	-0.04915329210552688	1.7262704462274479	0.5195618153364632	
{'algorithm': 'brute', 'leaf_size': 30, 'n_neighbors': 10}	-0.06254292973227082	0.7709663767965982	0.520802978792294	
{'algorithm': 'brute', 'leaf_size': 30, 'n_neighbors': 15}	-0.07890419668890924	0.7149639610152951	0.5339701041498031	
{'algorithm': 'brute', 'leaf_size': 50, 'n_neighbors': 5}	-0.04915329210552688	1.7262704462274479	0.5195618153364632	
{'algorithm': 'brute', 'leaf_size': 50, 'n_neighbors': 10}	-0.06254292973227082	0.7709663767965982	0.520802978792294	
{'algorithm': 'brute', 'leaf_size': 50, 'n_neighbors': 15}	-0.07890419668890924	0.7149639610152951	0.5339701041498031	
{'algorithm': 'brute', 'leaf_size': 80, 'n_neighbors': 5}	-0.04915329210552688	1.7262704462274479	0.5195618153364632	
{'algorithm': 'brute', 'leaf_size': 80, 'n_neighbors': 10}	-0.06254292973227082	0.7709663767965982	0.520802978792294	
{'algorithm': 'brute', 'leaf_size': 80, 'n_neighbors': 15}	-0.07890419668890924	0.7149639610152951	0.5339701041498031	

Table 12: Final Evaluation				
Model	Best Parameters	Accuracies	Gini Score	
MLPClassifier	{'hidden_layer_sizes': (30, 30, 30, 30), 'max_iter': 1000, 'solver': 'adam', 'warm_start': False}	0.5751528220128237	-0.2320081259257396	
LogisticRegression	{'C': 0.1, 'fit_intercept': False, 'penalty': 'l2', 'random_state': 0, 'solver': 'liblinear'}	0.5843800851839605	-0.2388195096109058	
GaussianNB	{'priors': None}	0.5241446342766946	-0.07582639860482021	
DecisionTreeClassifier	{'max_depth': 10, 'max_features': None, 'min_samples_split': 4, 'splitter': 'random'}	0.5378446159833772	-0.06988636352674393	
BaggingClassifier	{'bootstrap': True, 'n_estimators': 20, 'warm_start': False}	0.535124423494844	-0.09586354074015561	
GradientBoostingClassifier	{'loss': 'exponential', 'max_depth': 4, 'n_estimators': 200}	0.5589247945511916	-0.16708993198114297	
AdaBoostClassifier	{'algorithm': 'SAMME.R', 'n_estimators': 100}	0.5785503139289678	-0.20789640626993564	
RandomForestClassifier	{'bootstrap': True, 'criterion': 'entropy', 'max_depth': 10, 'n_estimators': 40, 'warm_start': True}	0.5530028894239795	-0.15313258803558907	
KNeighborsClassifier	{'algorithm': 'brute', 'leaf_size': 30, 'n_neighbors': 15}	0.5256096837786969	-0.049596920647069796	