Fruits DT best parameters:

{'ccp_alpha': 0.014736842105263158, 'criterion': 'entropy'}

Fruits DT time to train: 0.018931150436401367 seconds

Fruits DT time to test: 0.0 seconds

Fruits DT test results:

	precision	recall	f1-score	support
0.0	0.6471	0.7857	0.7097	14
1.0	0.6667	0.6364	0.6512	22
2.0	0.8857	0.9118	0.8986	34
3.0	0.7857	0.6471	0.7097	17
4.0	0.8718	1.0000	0.9315	34
5.0	1.0000	0.9737	0.9867	38
6.0	0.7500	0.6000	0.6667	20
accuracy			0.8380	179
macro avg	0.8010	0.7935	0.7934	179
weighted avg	0.8371	0.8380	0.8345	179

```
[[11  0  0  2  1  0  0]
 [ 0 14  4  0  0  0  4]
 [ 0  3 31  0  0  0  0]
 [ 4  0  0 11  2  0  0]
 [ 0  0  0  0 34  0  0]
 [ 0  0  0  1  0 37  0]
```

[2 4 0 0 2 0 12]]

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Phones DT best parameters:

{'ccp_alpha': 0.0, 'criterion': 'entropy'}

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Phones DT time to train: 0.009966611862182617 seconds

Phones DT time to test: 0.0 seconds

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Phones DT test results:

	precision	recall	f1-score	support
0.0	0.9375	0.9184	0.9278	98
1.0	0.8469	0.7981	0.8218	104
2.0	0.8125	0.8585	0.8349	106
3.0	0.9149	0.9348	0.9247	92
accuracy			0.8750	400
macro avg	0.8780	0.8774	0.8773	400
weighted avg	0.8756	0.8750	0.8749	400

[[90 8 0 0]

 [6 83 15 0]

 [0 7 91 8]

 [0 0 6 86]]

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Fruits boosting best parameters:

{'estimator__criterion': 'entropy', 'estimator__max_depth': 9, 'estimator__splitter': 'random', 'n_estimators': 50}

Fruits boosting time to train: 0.22317981719970703 seconds

Fruits boosting time to test: 0.0069768428802490234 seconds

Fruits boosting test results:

	precision	recall	f1-score	support
0.0	0.9231	0.8571	0.8889	14
1.0	0.9412	0.7273	0.8205	22
2.0	0.8919	0.9706	0.9296	34
3.0	0.8824	0.8824	0.8824	17
4.0	0.9429	0.9706	0.9565	34
5.0	1.0000	1.0000	1.0000	38
6.0	0.8636	0.9500	0.9048	20
accuracy			0.9274	179
macro avg	0.9207	0.9083	0.9118	179
weighted avg	0.9290	0.9274	0.9258	179

[[12 0 0 2 0 0 0]
 [0 16 4 0 0 0 2]
 [0 1 33 0 0 0 0]
 [1 0 0 15 1 0 0]
 [0 0 0 0 33 0 1]
 [0 0 0 0 0 38 0]
 [0 0 0 0 1 0 19]]

Phones boosting best parameters:

{'estimator__criterion': 'entropy', 'estimator__max_depth': 6, 'estimator__splitter': 'best', 'n_estimators': 42}

Phones boosting time to train: 0.7585134506225586 seconds

Phones boosting time to test: 0.006952047348022461 seconds

Phones boosting test results:

	precision	recall	f1-score	support
0.0	0.9388	0.9388	0.9388	98
1.0	0.8505	0.8750	0.8626	104
2.0	0.8750	0.8585	0.8667	106
3.0	0.9451	0.9348	0.9399	92
accuracy			0.9000	400
macro avg	0.9023	0.9018	0.9020	400
weighted avg	0.9004	0.9000	0.9001	400

[[92 6 0 0]
 [6 91 7 0]
 [0 10 91 5]
 [0 0 6 86]]

Fruits KNN best parameters:

{'algorithm': 'ball_tree', 'leaf_size': 1, 'n_neighbors': 3, 'weights': 'distance'}

Fruits KNN time to train: 0.003985404968261719 seconds

Fruits KNN time to test: 0.009968757629394531 seconds

Fruits KNN test results:

	precision	recall	f1-score	support
0.0	0.9231	0.8571	0.8889	14
1.0	0.8824	0.6818	0.7692	22
2.0	0.8684	0.9706	0.9167	34
3.0	0.9333	0.8235	0.8750	17
4.0	0.8919	0.9706	0.9296	34
5.0	1.0000	1.0000	1.0000	38
6.0	0.8095	0.8500	0.8293	20
accuracy			0.9050	179
macro avg	0.9012	0.8791	0.8869	179
weighted avg	0.9064	0.9050	0.9028	179

[[12 0 0 1 1 0 0]
 [0 15 5 0 0 0 2]
 [0 1 33 0 0 0 0]
 [1 0 0 14 1 0 1]
 [0 0 0 0 33 0 1]
 [0 0 0 0 0 38 0]
 [0 1 0 0 2 0 17]]

Phones KNN best parameters:

{'algorithm': 'ball_tree', 'leaf_size': 1, 'n_neighbors': 300, 'weights': 'distance'}

Phones KNN time to train: 0.008971691131591797 seconds

Phones KNN time to test: 0.06976890563964844 seconds

Phones KNN test results:

```
         precision   recall  f1-score   support

     0.0    0.6724   0.7959   0.7290       98
     1.0    0.4400   0.3173   0.3687      104
     2.0    0.4828   0.5283   0.5045      106
     3.0    0.7204   0.7283   0.7243       92


 accuracy                     0.5850      400
macro avg    0.5789   0.5924   0.5816      400
weighted avg    0.5728   0.5850   0.5748      400


[[78 16  4  0]
 [38 33 31  2]
 [ 0 26 56 24]
 [ 0  0 25 67]]---------------------
```

Fruits NN best parameters:

{'activation': 'tanh', 'hidden_layer_sizes': [25, 25], 'learning_rate': 'adaptive', 'learning_rate_init': 0.01}

Fruits NN time to train: 0.25514698028564453 seconds

Fruits NN time to test: 0.001992464065551758 seconds

Fruits NN test results:

	precision	recall	f1-score	support
0.0	1.0000	0.8571	0.9231	14
1.0	0.8571	0.8182	0.8372	22
2.0	0.9429	0.9706	0.9565	34
3.0	0.8889	0.9412	0.9143	17
4.0	0.8947	1.0000	0.9444	34
5.0	1.0000	1.0000	1.0000	38
6.0	0.8824	0.7500	0.8108	20
accuracy			0.9274	179
macro avg	0.9237	0.9053	0.9123	179
weighted avg	0.9279	0.9274	0.9259	179

```
[[12  0  0  1  1  0  0]
 [ 0 18  2  0  0  0  2]
 [ 0  1 33  0  0  0  0]
 [ 0  0  0 16  1  0  0]
 [ 0  0  0  0 34  0  0]
 [ 0  0  0  0  0 38  0]
 [ 0  2  0  1  2  0 15]]
```

Phones NN best parameters:

{'activation': 'logistic', 'hidden_layer_sizes': [25, 25], 'learning_rate': 'constant', 'learning_rate_init': 0.01}

Phones NN time to train: 0.5949392318725586 seconds

Phones NN time to test: 0.001993417739868164 seconds

Phones NN test results:

          precision   recall f1-score   support

     0.0   1.0000   0.9592   0.9792   98

     1.0   0.9439   0.9712   0.9573   104

     2.0   0.9709   0.9434   0.9569   106

     3.0   0.9583   1.0000   0.9787   92

   accuracy   0.9675   400

  macro avg   0.9683   0.9684   0.9680   400

weighted avg   0.9681   0.9675   0.9675   400

[[94   4   0   0]

 [0 101   3   0]

 [0   2 100   4]

 [0   0   0 92]]

Phones SVM best parameters:

{'C': 2, 'degree': 2, 'gamma': 2.0, 'kernel': 'linear'}

Phones SVM time to train: 0.048836469650268555 seconds

Phones SVM time to test: 0.004982948303222656 seconds

Phones SVM test results:

	precision	recall	f1-score	support
0.0	0.9794	0.9694	0.9744	98
1.0	0.9423	0.9423	0.9423	104
2.0	0.9612	0.9340	0.9474	106
3.0	0.9583	1.0000	0.9787	92
accuracy			0.9600	400
macro avg	0.9603	0.9614	0.9607	400
weighted avg	0.9601	0.9600	0.9599	400

```
[[95  3  0  0]
 [ 2 98  4  0]
 [ 0  3 99  4]
 [ 0  0  0 92]]
```

Fruits SVM best parameters:

{'C': 0.2, 'degree': 2, 'gamma': 10.577777777777778, 'kernel': 'poly'}

Fruits SVM time to train: 0.010960817337036133 seconds

Fruits SVM time to test: 0.0009982585906982422 seconds

Fruits SVM test results:

	precision	recall	f1-score	support

	precision	recall	f1-score	support
0.0	0.9286	0.9286	0.9286	14
1.0	0.7727	0.7727	0.7727	22
2.0	0.9429	0.9706	0.9565	34
3.0	0.9375	0.8824	0.9091	17
4.0	0.9714	1.0000	0.9855	34
5.0	1.0000	0.9737	0.9867	38
6.0	0.8500	0.8500	0.8500	20
accuracy			0.9274	179
macro avg	0.9147	0.9111	0.9127	179
weighted avg	0.9275	0.9274	0.9272	179

```
[[13  0  0  1  0  0  0]
 [ 0 17  2  0  0  0  3]
 [ 0  1 33  0  0  0  0]
 [ 1  0  0 15  1  0  0]
 [ 0  0  0  0 34  0  0]
 [ 0  1  0  0  0 37  0]
 [ 0  3  0  0  0  0 17]]
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```

Process finished with exit code 0