Classification

Here Collective feature selection for the extracted features are performed with the use of Bio-Geography-Based optimization algorithm. and Classifying with KNN and LDA and Decision Tree.

There are bunch of options that can be selected and changed. Like Mutation Rate, Feature Num, Classifier type, CostFunction...

(Note: The process is Accelerated Using Parallel Prgramming Toolbox!)

```
% Loading Datas with Labels and Features
clear;
[f1, l1] = importfile('Data\X_train.txt','Data\y_train.txt');
[f2, l2] = importfile('Data\X_test.txt','Data\y_test.txt');

features = [f1; f2];
labels = [l1; l2];
clear f1 f2 l1 l2

% Starting Parallel Pool
p = parpool('local', 4);
```

```
Starting parallel pool (parpool) using the 'local' profile ...
Connected to the parallel pool (number of workers: 4).
```

```
% BBO Parameters
classifier_type = 'knn';
CV_k =10;                                   % Cross Validation K
Range = [1, size(features, 2)];                                  % Range of Produced Answers us
MaxIt = 100;                                % Maximum Search Iteration of the Optimizer
HabitationNum = 60;                        % Number of the Iterations
CostFunction = @(x) Classifier(features, labels, x, classifier_type, CV_k);

% If We Wanna reduce Numeber of Features to n What Would N Be?
FeatureNum = (10:10:120);

% BBO Evaluation for Feature Reduction
for iter = 1:numel(FeatureNum)
    % Log the Solutions
    Sol = DiscreteBBO(CostFunction, HabitationNum, MaxIt, FeatureNum(iter), Range);
    disp(['Solution with ', num2str(FeatureNum(iter)), ' Features : '])
    Sol
end
```

```
Solution with 10 Features :
Sol = struct with fields:
        SIV: [42 43 142 167 215 275 317 360 484 544]
        HSI: 1.1038
        Acc: [0.9983 0.9943 0.9828 0.9562 0.9713 1]
    MeanAcc: 0.9838
Solution with 20 Features :
Sol = struct with fields:
        SIV: [54 57 58 59 86 88 101 102 129 138 202 275 338 352 419 427 441 480 509 561]
        HSI: 1.1091
```

```
        Acc: [0.9988 0.9937 0.9785 0.9538 0.9735 1]
    MeanAcc: 0.9830
Solution with 30 Features :
Sol = struct with fields:
        SIV: [17 43 50 51 56 63 69 85 103 128 135 175 183 204 228 254 268 347 348 349 352 375 438 444 452 461 462 50
        HSI: 1.1295
        Acc: [0.9960 0.9955 0.9790 0.9545 0.9562 0.9995]
    MeanAcc: 0.9801
Solution with 40 Features :
Sol = struct with fields:
        SIV: [8 41 43 53 54 56 67 69 74 86 103 125 131 151 158 160 184 186 198 215 234 237 246 262 266 273 343 346 3
        HSI: 1.1273
        Acc: [0.9983 0.9966 0.9834 0.9374 0.9673 1]
    MeanAcc: 0.9805
Solution with 50 Features :
Sol = struct with fields:
        SIV: [14 35 42 52 54 55 63 84 88 120 143 146 149 154 160 163 168 183 185 187 202 205 220 229 247 261 282 290
        HSI: 1.1147
        Acc: [0.9983 0.9974 0.9898 0.9348 0.9748 0.9990]
    MeanAcc: 0.9823
Solution with 60 Features :
Sol = struct with fields:
        SIV: [25 42 43 46 50 51 52 54 55 56 59 66 91 93 103 114 115 124 134 135 146 159 160 171 178 183 188 189 198
        HSI: 1.0742
        Acc: [0.9988 0.9994 0.9902 0.9652 0.9759 1]
    MeanAcc: 0.9882
Solution with 70 Features :
Sol = struct with fields:
        SIV: [1 41 43 48 51 55 56 67 68 77 86 87 88 92 95 101 102 109 118 121 124 129 134 141 160 163 174 178 183 18
        HSI: 1.1032
        Acc: [0.9989 0.9981 0.9887 0.9441 0.9741 1]
    MeanAcc: 0.9840
Solution with 80 Features :
Sol = struct with fields:
        SIV: [8 9 10 29 40 42 54 55 56 57 61 64 65 66 85 92 93 94 99 102 105 115 118 119 127 133 138 140 142 145 147
        HSI: 1.0867
        Acc: [1 0.9987 0.9971 0.9458 0.9770 1]
    MeanAcc: 0.9864
Solution with 90 Features :
Sol = struct with fields:
        SIV: [1 21 31 33 46 49 51 54 55 56 57 68 90 96 103 106 110 113 127 134 136 143 144 145 159 160 163 166 174 1
        HSI: 1.0860
        Acc: [1 0.9994 0.9950 0.9493 0.9764 0.9990]
    MeanAcc: 0.9865
Solution with 100 Features :
Sol = struct with fields:
        SIV: [2 32 39 41 42 43 51 54 55 61 77 83 89 95 97 100 106 110 116 120 121 124 125 130 138 142 152 155 157 16
        HSI: 1.1013
        Acc: [0.9994 0.9986 0.9942 0.9443 0.9690 1]
    MeanAcc: 0.9843
Solution with 110 Features :
Sol = struct with fields:
        SIV: [16 22 23 28 38 40 41 42 45 47 50 52 56 65 71 84 86 90 112 113 117 122 124 127 129 143 155 157 158 166
        HSI: 1.0774
        Acc: [0.9994 0.9987 0.9970 0.9518 0.9799 1]
    MeanAcc: 0.9878
Solution with 120 Features :
Sol = struct with fields:
        SIV: [2 8 14 30 40 42 43 53 54 55 56 59 64 66 67 72 86 96 97 99 103 104 106 109 117 118 125 126 133 140 145
        HSI: 1.0771
        Acc: [0.9994 1 0.9958 0.9532 0.9786 1]
    MeanAcc: 0.9878
```

```
delete(gcp('nocreate'))             % ShutDown the Current Pool
clear;
```