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!)

```matlab
% 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).
```

```matlab
% BBO Parameters
classifier_type = 'lda';
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: [23 42 53 76 125 183 237 370 452 505]
       HSI: 1.7851
       Acc: [0.9272 0.8844 0.9001 0.8364 0.9075 1]
    MeanAcc: 0.9093
Solution with 20 Features :
Sol = struct with fields:
       SIV: [4 41 51 58 101 146 150 203 215 219 229 314 331 347 348 371 398 423 451 516]
       HSI: 1.5782
```

```
        Acc: [0.9521 0.9621 0.9028 0.8270 0.9270 0.9995]
    MeanAcc: 0.9284
Solution with 30 Features :
Sol = struct with fields:
        SIV: [53 54 87 90 119 127 137 144 166 172 173 225 228 229 248 270 271 275 319 328 344 350 355 360 383 446 56
        HSI: 1.5294
        Acc: [0.9355 0.9711 0.9402 0.8013 0.9554 1]
    MeanAcc: 0.9339
Solution with 40 Features :
Sol = struct with fields:
        SIV: [40 53 54 76 114 124 129 135 142 144 146 147 150 164 169 170 183 189 196 215 239 243 254 269 270 271 29
        HSI: 1.4297
        Acc: [0.9784 0.9466 0.9297 0.8793 0.9237 1]
    MeanAcc: 0.9430
Solution with 50 Features :
Sol = struct with fields:
        SIV: [12 53 54 59 64 88 116 119 120 136 154 163 170 180 181 183 199 201 239 243 252 262 272 273 275 281 322
        HSI: 1.3747
        Acc: [0.9768 0.9557 0.9290 0.8940 0.9383 1]
    MeanAcc: 0.9490
Solution with 60 Features :
Sol = struct with fields:
        SIV: [8 46 50 54 63 75 85 86 88 93 99 105 123 129 138 145 158 161 178 183 186 187 193 197 199 213 214 233 24
        HSI: 1.3272
        Acc: [0.9914 0.9718 0.9422 0.8779 0.9478 0.9974]
    MeanAcc: 0.9548
Solution with 70 Features :
Sol = struct with fields:
        SIV: [18 31 41 54 55 67 69 70 71 86 87 93 97 116 122 134 137 141 150 159 175 176 183 184 186 193 223 242 260
        HSI: 1.3073
        Acc: [0.9812 0.9730 0.9554 0.8932 0.9389 1]
    MeanAcc: 0.9570
Solution with 80 Features :
Sol = struct with fields:
        SIV: [6 34 46 48 50 51 54 58 62 64 68 75 93 94 100 103 110 111 115 117 126 128 129 135 136 141 144 149 156 1
        HSI: 1.3149
        Acc: [0.9877 0.9768 0.9671 0.8824 0.9247 0.9990]
    MeanAcc: 0.9563
Solution with 90 Features :
Sol = struct with fields:
        SIV: [4 6 19 29 30 33 41 53 54 58 60 67 77 80 81 88 93 94 96 114 116 119 125 135 136 143 148 149 157 159 178
        HSI: 1.2475
        Acc: [0.9836 0.9766 0.9682 0.9008 0.9569 1]
    MeanAcc: 0.9643
Solution with 100 Features :
Sol = struct with fields:
        SIV: [3 8 23 25 32 37 40 41 44 47 48 51 60 63 75 80 88 90 92 94 104 105 106 126 134 135 143 144 146 167 187
        HSI: 1.2711
        Acc: [0.9890 0.9786 0.9688 0.8748 0.9592 1]
    MeanAcc: 0.9617
Solution with 110 Features :
Sol = struct with fields:
        SIV: [31 37 42 43 47 48 50 51 52 58 59 69 71 76 86 89 93 98 103 115 116 117 119 121 122 126 130 143 146 147
        HSI: 1.2271
        Acc: [0.9936 0.9837 0.9501 0.9369 0.9366 1]
    MeanAcc: 0.9668
Solution with 120 Features :
Sol = struct with fields:
        SIV: [9 11 16 31 38 42 51 53 59 66 76 84 89 92 93 101 104 108 110 113 118 126 127 129 130 132 135 137 138 14
        HSI: 1.2472
        Acc: [0.9943 0.9761 0.9703 0.8944 0.9519 1]
    MeanAcc: 0.9645
```

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