

Question 1

a. Bagging: training B binary decision trees using all features, then use the majority vote. We are using the Information Gain to decide the **best** feature, As the features are continious, we need to choose the threshold to split the feature.

My way to choose the threshold: suppose the feature value lies in $[a, b]$

$$\delta = (b - a)/N$$

then we choose the threshold from $\{a + i \delta \mid 1 \leq i \leq N\}$ that can maximize the **Information Gain**.

In practice, I set $N = 20$

Following is the output

```
$ python myBagging2.py Ionosphere.csv 5 10 15 20 25 30 35 40 45 50
```

```
# Fold 0
```

```
5 Bases: [0.18037974683544303, 0.11428571428571428]
10 Bases: [0.17088607594936708, 0.11428571428571428]
15 Bases: [0.18037974683544303, 0.11428571428571428]
20 Bases: [0.18037974683544303, 0.11428571428571428]
25 Bases: [0.17405063291139242, 0.11428571428571428]
30 Bases: [0.18037974683544303, 0.11428571428571428]
35 Bases: [0.17721518987341772, 0.11428571428571428]
40 Bases: [0.17721518987341772, 0.11428571428571428]
45 Bases: [0.18037974683544303, 0.11428571428571428]
50 Bases: [0.18037974683544303, 0.11428571428571428]
```

```
# Fold 1
```

```
5 Bases: [0.15822784810126583, 0.2571428571428571]
10 Bases: [0.15822784810126583, 0.2571428571428571]
15 Bases: [0.15822784810126583, 0.2571428571428571]
20 Bases: [0.15822784810126583, 0.2571428571428571]
25 Bases: [0.15822784810126583, 0.2571428571428571]
30 Bases: [0.15822784810126583, 0.2571428571428571]
35 Bases: [0.15822784810126583, 0.2571428571428571]
40 Bases: [0.15822784810126583, 0.2571428571428571]
45 Bases: [0.15822784810126583, 0.2571428571428571]
50 Bases: [0.15822784810126583, 0.2571428571428571]
```

```
# Fold 2
```

```
5 Bases: [0.17405063291139242, 0.17142857142857143]
10 Bases: [0.16139240506329114, 0.17142857142857143]
15 Bases: [0.16772151898734178, 0.17142857142857143]
20 Bases: [0.16139240506329114, 0.17142857142857143]
25 Bases: [0.16139240506329114, 0.17142857142857143]
```

30 Bases: [0.17088607594936708, 0.17142857142857143]
35 Bases: [0.16772151898734178, 0.17142857142857143]
40 Bases: [0.17405063291139242, 0.17142857142857143]
45 Bases: [0.16139240506329114, 0.17142857142857143]
50 Bases: [0.16139240506329114, 0.17142857142857143]

Fold 3

5 Bases: [0.15822784810126583, 0.2571428571428571]
10 Bases: [0.1550632911392405, 0.2571428571428571]
15 Bases: [0.15822784810126583, 0.2571428571428571]
20 Bases: [0.16139240506329114, 0.2571428571428571]
25 Bases: [0.15822784810126583, 0.2571428571428571]
30 Bases: [0.1550632911392405, 0.2571428571428571]
35 Bases: [0.15822784810126583, 0.2571428571428571]
40 Bases: [0.15822784810126583, 0.2571428571428571]
45 Bases: [0.15822784810126583, 0.2571428571428571]
50 Bases: [0.15822784810126583, 0.2571428571428571]

Fold 4

5 Bases: [0.1518987341772152, 0.3142857142857143]
10 Bases: [0.1550632911392405, 0.34285714285714286]
15 Bases: [0.14873417721518986, 0.3142857142857143]
20 Bases: [0.1550632911392405, 0.34285714285714286]
25 Bases: [0.1550632911392405, 0.34285714285714286]
30 Bases: [0.1550632911392405, 0.34285714285714286]
35 Bases: [0.1550632911392405, 0.34285714285714286]
40 Bases: [0.1550632911392405, 0.34285714285714286]
45 Bases: [0.1550632911392405, 0.34285714285714286]
50 Bases: [0.1550632911392405, 0.34285714285714286]

Fold 5

5 Bases: [0.17405063291139242, 0.17142857142857143]
10 Bases: [0.17405063291139242, 0.17142857142857143]
15 Bases: [0.17405063291139242, 0.14285714285714285]
20 Bases: [0.17405063291139242, 0.14285714285714285]
25 Bases: [0.17405063291139242, 0.17142857142857143]
30 Bases: [0.17405063291139242, 0.17142857142857143]
35 Bases: [0.17088607594936708, 0.14285714285714285]
40 Bases: [0.17405063291139242, 0.17142857142857143]
45 Bases: [0.17405063291139242, 0.17142857142857143]
50 Bases: [0.17405063291139242, 0.17142857142857143]

Fold 6

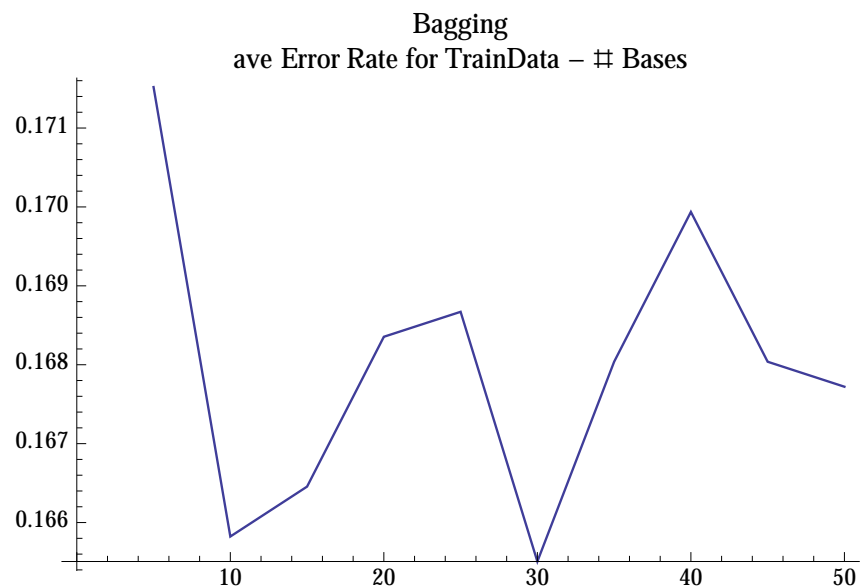
5 Bases: [0.18670886075949367, 0.2857142857142857]
10 Bases: [0.17405063291139242, 0.11428571428571428]
15 Bases: [0.16455696202531644, 0.11428571428571428]
20 Bases: [0.16772151898734178, 0.11428571428571428]
25 Bases: [0.16772151898734178, 0.11428571428571428]
30 Bases: [0.1550632911392405, 0.2]

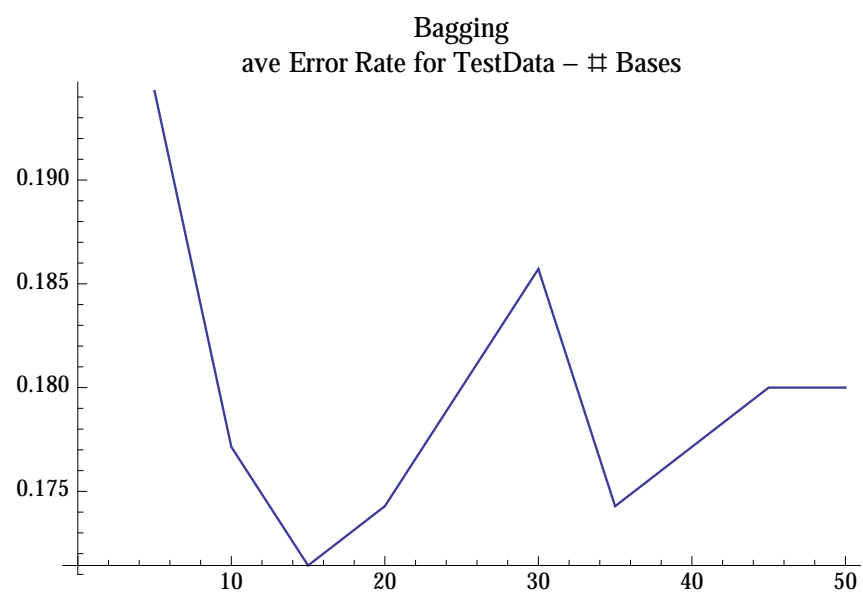
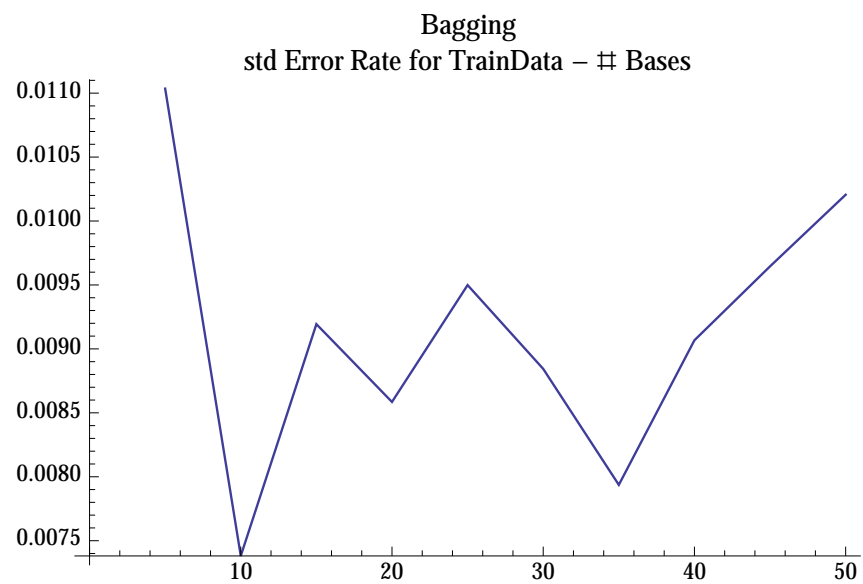
```

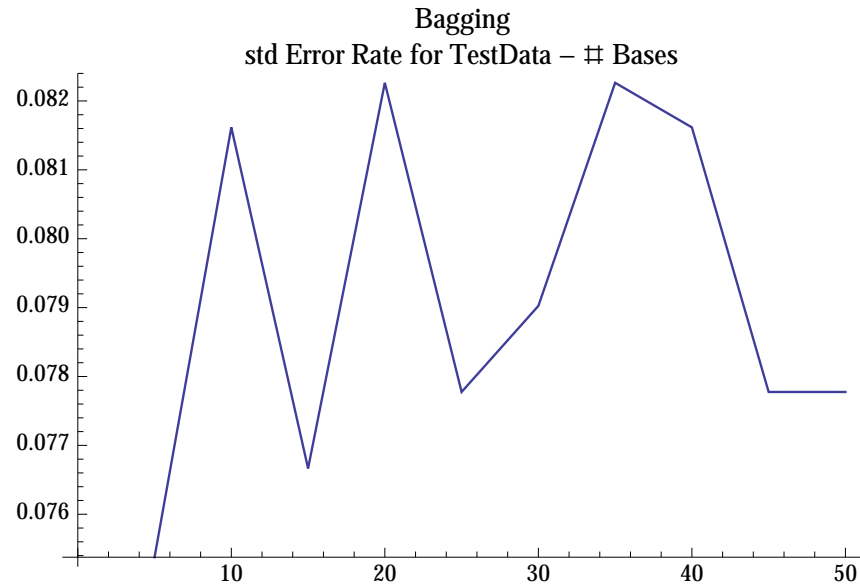
35 Bases: [0.16772151898734178, 0.11428571428571428]
40 Bases: [0.17405063291139242, 0.11428571428571428]
45 Bases: [0.16772151898734178, 0.11428571428571428]
50 Bases: [0.16455696202531644, 0.11428571428571428]
# Fold 7
5 Bases: [0.18354430379746836, 0.08571428571428572]
10 Bases: [0.17405063291139242, 0.05714285714285714]
15 Bases: [0.17721518987341772, 0.05714285714285714]
20 Bases: [0.17405063291139242, 0.05714285714285714]
25 Bases: [0.18354430379746836, 0.08571428571428572]
30 Bases: [0.17405063291139242, 0.05714285714285714]
35 Bases: [0.17721518987341772, 0.05714285714285714]
40 Bases: [0.18037974683544303, 0.05714285714285714]
45 Bases: [0.18354430379746836, 0.08571428571428572]
50 Bases: [0.18354430379746836, 0.08571428571428572]
# Fold 8
5 Bases: [0.17405063291139242, 0.11428571428571428]
10 Bases: [0.16772151898734178, 0.11428571428571428]
15 Bases: [0.17088607594936708, 0.11428571428571428]
20 Bases: [0.18037974683544303, 0.11428571428571428]
25 Bases: [0.18037974683544303, 0.11428571428571428]
30 Bases: [0.16772151898734178, 0.11428571428571428]
35 Bases: [0.17721518987341772, 0.11428571428571428]
40 Bases: [0.18037974683544303, 0.11428571428571428]
45 Bases: [0.17721518987341772, 0.11428571428571428]
50 Bases: [0.18037974683544303, 0.11428571428571428]
# Fold 9
5 Bases: [0.17405063291139242, 0.17142857142857143]
10 Bases: [0.16772151898734178, 0.17142857142857143]
15 Bases: [0.16455696202531644, 0.17142857142857143]
20 Bases: [0.17088607594936708, 0.17142857142857143]
25 Bases: [0.17405063291139242, 0.17142857142857143]
30 Bases: [0.16455696202531644, 0.17142857142857143]
35 Bases: [0.17088607594936708, 0.17142857142857143]
40 Bases: [0.16772151898734178, 0.17142857142857143]
45 Bases: [0.16455696202531644, 0.17142857142857143]
50 Bases: [0.16139240506329114, 0.17142857142857143]
# average errors in form of [trainData, testData]:
5 bases: [0.17151898734177218, 0.1942857142857143]
10 bases: [0.16582278481012658, 0.17714285714285716]
15 bases: [0.16645569620253164, 0.17142857142857143]
20 bases: [0.16835443037974684, 0.1742857142857143]
25 bases: [0.16867088607594938, 0.18]
30 bases: [0.16550632911392404, 0.18571428571428572]
35 bases: [0.1680379746835443, 0.1742857142857143]

```

```
40 bases: [0.1699367088607595, 0.17714285714285716]
45 bases: [0.1680379746835443, 0.18]
50 bases: [0.16772151898734178, 0.18]
# std derivation in form of [trainData, testData]:
5 bases: [0.011035187198837145, 0.07537660547584525]
10 bases: [0.007380951765626967, 0.08161632489763257]
15 bases: [0.009193569016667057, 0.07666518779999278]
20 bases: [0.008585227826740843, 0.08226388599364554]
25 bases: [0.009498943683420021, 0.07777518622180685]
30 bases: [0.008843790261064636, 0.07902466677679618]
35 bases: [0.007936668483534462, 0.08226388599364554]
40 bases: [0.009067435937907847, 0.08161632489763257]
45 bases: [0.009645411806410233, 0.07777518622180685]
50 bases: [0.01020538955480829, 0.07777518622180685]
```







b. Random Forest:

The only difference between **Bagging** and **Random Forest** is that **Random Forest** are using random m features rather than all features.

There is the output

```
python myRForest2.py Ionosphere.csv 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
```

```
# Fold 0
```

```
1 random features: [0.25, 0.2571428571428571]
2 random features: [0.25, 0.2571428571428571]
3 random features: [0.29430379746835444, 0.34285714285714286]
4 random features: [0.27848101265822783, 0.2571428571428571]
5 random features: [0.2721518987341772, 0.2857142857142857]
6 random features: [0.2626582278481013, 0.37142857142857144]
7 random features: [0.25949367088607594, 0.2857142857142857]
8 random features: [0.2721518987341772, 0.2571428571428571]
9 random features: [0.29430379746835444, 0.4]
10 random features: [0.2974683544303797, 0.37142857142857144]
11 random features: [0.3227848101265823, 0.4]
12 random features: [0.29430379746835444, 0.34285714285714286]
13 random features: [0.29430379746835444, 0.34285714285714286]
14 random features: [0.34810126582278483, 0.4]
15 random features: [0.3259493670886076, 0.4]
16 random features: [0.29430379746835444, 0.34285714285714286]
17 random features: [0.3227848101265823, 0.4]
18 random features: [0.31329113924050633, 0.4]
19 random features: [0.2689873417721519, 0.34285714285714286]
20 random features: [0.26582278481012656, 0.4]
21 random features: [0.310126582278481, 0.4]
22 random features: [0.3069620253164557, 0.4]
```

23 random features: [0.22468354430379747, 0.34285714285714286]
 24 random features: [0.2689873417721519, 0.4]
 25 random features: [0.29430379746835444, 0.4]
 26 random features: [0.2088607594936709, 0.34285714285714286]
 27 random features: [0.2120253164556962, 0.34285714285714286]
 28 random features: [0.2120253164556962, 0.34285714285714286]
 29 random features: [0.1962025316455696, 0.34285714285714286]
 30 random features: [0.16139240506329114, 0.2857142857142857]
 31 random features: [0.16139240506329114, 0.2857142857142857]
 32 random features: [0.16139240506329114, 0.2857142857142857]
 33 random features: [0.16139240506329114, 0.2857142857142857]
 34 random features: [0.16139240506329114, 0.2857142857142857]

Fold 1

1 random features: [0.2563291139240506, 0.2]
 2 random features: [0.2563291139240506, 0.2]
 3 random features: [0.3069620253164557, 0.22857142857142856]
 4 random features: [0.2848101265822785, 0.2]
 5 random features: [0.2911392405063291, 0.22857142857142856]
 6 random features: [0.2563291139240506, 0.2]
 7 random features: [0.310126582278481, 0.22857142857142856]
 8 random features: [0.30063291139240506, 0.22857142857142856]
 9 random features: [0.2911392405063291, 0.22857142857142856]
 10 random features: [0.3670886075949367, 0.2857142857142857]
 11 random features: [0.3069620253164557, 0.22857142857142856]
 12 random features: [0.31329113924050633, 0.22857142857142856]
 13 random features: [0.34810126582278483, 0.2857142857142857]
 14 random features: [0.3069620253164557, 0.22857142857142856]
 15 random features: [0.3069620253164557, 0.22857142857142856]
 16 random features: [0.310126582278481, 0.22857142857142856]
 17 random features: [0.27848101265822783, 0.22857142857142856]
 18 random features: [0.3037974683544304, 0.2571428571428571]
 19 random features: [0.29430379746835444, 0.2571428571428571]
 20 random features: [0.30063291139240506, 0.2571428571428571]
 21 random features: [0.30063291139240506, 0.2571428571428571]
 22 random features: [0.2911392405063291, 0.2571428571428571]
 23 random features: [0.29430379746835444, 0.2571428571428571]
 24 random features: [0.27848101265822783, 0.2571428571428571]
 25 random features: [0.2310126582278481, 0.2]
 26 random features: [0.2310126582278481, 0.2]
 27 random features: [0.2310126582278481, 0.2]
 28 random features: [0.22151898734177214, 0.2]
 29 random features: [0.20569620253164558, 0.2]
 30 random features: [0.17405063291139242, 0.17142857142857143]
 31 random features: [0.17405063291139242, 0.17142857142857143]
 32 random features: [0.17405063291139242, 0.17142857142857143]

33 random features: [0.17405063291139242, 0.17142857142857143]
 34 random features: [0.17405063291139242, 0.17142857142857143]

Fold 2

1 random features: [0.24367088607594936, 0.3142857142857143]
 2 random features: [0.24367088607594936, 0.3142857142857143]
 3 random features: [0.24367088607594936, 0.3142857142857143]
 4 random features: [0.2689873417721519, 0.34285714285714286]
 5 random features: [0.25949367088607594, 0.34285714285714286]
 6 random features: [0.24367088607594936, 0.3142857142857143]
 7 random features: [0.27531645569620256, 0.34285714285714286]
 8 random features: [0.25, 0.3142857142857143]
 9 random features: [0.2721518987341772, 0.37142857142857144]
 10 random features: [0.2911392405063291, 0.37142857142857144]
 11 random features: [0.3227848101265823, 0.42857142857142855]
 12 random features: [0.31329113924050633, 0.42857142857142855]
 13 random features: [0.2911392405063291, 0.37142857142857144]
 14 random features: [0.29430379746835444, 0.37142857142857144]
 15 random features: [0.2974683544303797, 0.37142857142857144]
 16 random features: [0.27848101265822783, 0.37142857142857144]
 17 random features: [0.2911392405063291, 0.4]
 18 random features: [0.2721518987341772, 0.37142857142857144]
 19 random features: [0.2848101265822785, 0.34285714285714286]
 20 random features: [0.25, 0.2857142857142857]
 21 random features: [0.23734177215189872, 0.2571428571428571]
 22 random features: [0.23734177215189872, 0.2571428571428571]
 23 random features: [0.23734177215189872, 0.2571428571428571]
 24 random features: [0.2974683544303797, 0.34285714285714286]
 25 random features: [0.2689873417721519, 0.2857142857142857]
 26 random features: [0.2689873417721519, 0.3142857142857143]
 27 random features: [0.23734177215189872, 0.22857142857142856]
 28 random features: [0.22151898734177214, 0.2]
 29 random features: [0.22468354430379747, 0.2571428571428571]
 30 random features: [0.18670886075949367, 0.2]
 31 random features: [0.17721518987341772, 0.2]
 32 random features: [0.17088607594936708, 0.2]
 33 random features: [0.16455696202531644, 0.2]
 34 random features: [0.16772151898734178, 0.2]

Fold 3

1 random features: [0.25, 0.2571428571428571]
 2 random features: [0.3575949367088608, 0.37142857142857144]
 3 random features: [0.25, 0.2571428571428571]
 4 random features: [0.2721518987341772, 0.3142857142857143]
 5 random features: [0.30063291139240506, 0.2857142857142857]
 6 random features: [0.28164556962025317, 0.2571428571428571]
 7 random features: [0.26582278481012656, 0.2571428571428571]


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8 random features: [0.28164556962025317, 0.2571428571428571]
9 random features: [0.2848101265822785, 0.2571428571428571]
10 random features: [0.29430379746835444, 0.3142857142857143]
11 random features: [0.2974683544303797, 0.3142857142857143]
12 random features: [0.2974683544303797, 0.3142857142857143]
13 random features: [0.2974683544303797, 0.3142857142857143]
14 random features: [0.3069620253164557, 0.3142857142857143]
15 random features: [0.34177215189873417, 0.37142857142857144]
16 random features: [0.31962025316455694, 0.3142857142857143]
17 random features: [0.30063291139240506, 0.2857142857142857]
18 random features: [0.2911392405063291, 0.2571428571428571]
19 random features: [0.3322784810126582, 0.3142857142857143]
20 random features: [0.3259493670886076, 0.3142857142857143]
21 random features: [0.3259493670886076, 0.3142857142857143]
22 random features: [0.2911392405063291, 0.2571428571428571]
23 random features: [0.2879746835443038, 0.2571428571428571]
24 random features: [0.24367088607594936, 0.2]
25 random features: [0.2310126582278481, 0.2]
26 random features: [0.24050632911392406, 0.22857142857142856]
27 random features: [0.24367088607594936, 0.22857142857142856]
28 random features: [0.22784810126582278, 0.22857142857142856]
29 random features: [0.2310126582278481, 0.2]
30 random features: [0.17405063291139242, 0.17142857142857143]
31 random features: [0.18037974683544303, 0.17142857142857143]
32 random features: [0.17405063291139242, 0.17142857142857143]
33 random features: [0.17405063291139242, 0.17142857142857143]
34 random features: [0.16772151898734178, 0.17142857142857143]
# Fold 4
1 random features: [0.24367088607594936, 0.3142857142857143]
2 random features: [0.24367088607594936, 0.3142857142857143]
3 random features: [0.2848101265822785, 0.42857142857142855]
4 random features: [0.2626582278481013, 0.4]
5 random features: [0.27848101265822783, 0.42857142857142855]
6 random features: [0.2626582278481013, 0.4]
7 random features: [0.2689873417721519, 0.42857142857142855]
8 random features: [0.2721518987341772, 0.42857142857142855]
9 random features: [0.28164556962025317, 0.42857142857142855]
10 random features: [0.29430379746835444, 0.42857142857142855]
11 random features: [0.31645569620253167, 0.42857142857142855]
12 random features: [0.2911392405063291, 0.42857142857142855]
13 random features: [0.310126582278481, 0.42857142857142855]
14 random features: [0.31329113924050633, 0.45714285714285713]
15 random features: [0.3322784810126582, 0.45714285714285713]
16 random features: [0.3322784810126582, 0.45714285714285713]
17 random features: [0.3291139240506329, 0.42857142857142855]
```

```
18 random features: [0.27848101265822783, 0.4]
19 random features: [0.2626582278481013, 0.4]
20 random features: [0.24050632911392406, 0.34285714285714286]
21 random features: [0.2120253164556962, 0.3142857142857143]
22 random features: [0.28164556962025317, 0.4]
23 random features: [0.22151898734177214, 0.34285714285714286]
24 random features: [0.3037974683544304, 0.42857142857142855]
25 random features: [0.21518987341772153, 0.34285714285714286]
26 random features: [0.23417721518987342, 0.34285714285714286]
27 random features: [0.2848101265822785, 0.4]
28 random features: [0.21518987341772153, 0.34285714285714286]
29 random features: [0.20569620253164558, 0.3142857142857143]
30 random features: [0.20253164556962025, 0.3142857142857143]
31 random features: [0.16139240506329114, 0.3142857142857143]
32 random features: [0.15822784810126583, 0.2571428571428571]
33 random features: [0.16139240506329114, 0.2571428571428571]
34 random features: [0.15822784810126583, 0.2571428571428571]
# Fold 5
1 random features: [0.24367088607594936, 0.3142857142857143]
2 random features: [0.24367088607594936, 0.3142857142857143]
3 random features: [0.29430379746835444, 0.34285714285714286]
4 random features: [0.2721518987341772, 0.3142857142857143]
5 random features: [0.2626582278481013, 0.3142857142857143]
6 random features: [0.27531645569620256, 0.34285714285714286]
7 random features: [0.2721518987341772, 0.34285714285714286]
8 random features: [0.28164556962025317, 0.34285714285714286]
9 random features: [0.3259493670886076, 0.37142857142857144]
10 random features: [0.29430379746835444, 0.34285714285714286]
11 random features: [0.29430379746835444, 0.34285714285714286]
12 random features: [0.30063291139240506, 0.34285714285714286]
13 random features: [0.34177215189873417, 0.37142857142857144]
14 random features: [0.34177215189873417, 0.37142857142857144]
15 random features: [0.3037974683544304, 0.34285714285714286]
16 random features: [0.33860759493670883, 0.37142857142857144]
17 random features: [0.310126582278481, 0.34285714285714286]
18 random features: [0.30063291139240506, 0.34285714285714286]
19 random features: [0.3227848101265823, 0.3142857142857143]
20 random features: [0.3227848101265823, 0.34285714285714286]
21 random features: [0.2911392405063291, 0.3142857142857143]
22 random features: [0.3259493670886076, 0.34285714285714286]
23 random features: [0.3069620253164557, 0.34285714285714286]
24 random features: [0.23734177215189872, 0.2857142857142857]
25 random features: [0.23734177215189872, 0.2571428571428571]
26 random features: [0.22784810126582278, 0.2571428571428571]
27 random features: [0.27531645569620256, 0.2857142857142857]
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28 random features: [0.21518987341772153, 0.2571428571428571]
29 random features: [0.19936708860759494, 0.2571428571428571]
30 random features: [0.20569620253164558, 0.2571428571428571]
31 random features: [0.2088607594936709, 0.2571428571428571]
32 random features: [0.16455696202531644, 0.14285714285714285]
33 random features: [0.16455696202531644, 0.14285714285714285]
34 random features: [0.16139240506329114, 0.14285714285714285]
# Fold 6
1 random features: [0.26582278481012656, 0.11428571428571428]
2 random features: [0.26582278481012656, 0.11428571428571428]
3 random features: [0.31645569620253167, 0.14285714285714285]
4 random features: [0.2911392405063291, 0.14285714285714285]
5 random features: [0.29430379746835444, 0.17142857142857143]
6 random features: [0.26582278481012656, 0.11428571428571428]
7 random features: [0.3037974683544304, 0.11428571428571428]
8 random features: [0.2848101265822785, 0.11428571428571428]
9 random features: [0.3322784810126582, 0.17142857142857143]
10 random features: [0.3227848101265823, 0.17142857142857143]
11 random features: [0.31645569620253167, 0.14285714285714285]
12 random features: [0.31962025316455694, 0.2]
13 random features: [0.3291139240506329, 0.2]
14 random features: [0.3575949367088608, 0.2]
15 random features: [0.31645569620253167, 0.14285714285714285]
16 random features: [0.3575949367088608, 0.2]
17 random features: [0.3291139240506329, 0.2]
18 random features: [0.3322784810126582, 0.17142857142857143]
19 random features: [0.3449367088607595, 0.2]
20 random features: [0.3037974683544304, 0.17142857142857143]
21 random features: [0.3037974683544304, 0.17142857142857143]
22 random features: [0.25949367088607594, 0.17142857142857143]
23 random features: [0.310126582278481, 0.17142857142857143]
24 random features: [0.2879746835443038, 0.17142857142857143]
25 random features: [0.2310126582278481, 0.14285714285714285]
26 random features: [0.23734177215189872, 0.14285714285714285]
27 random features: [0.2310126582278481, 0.14285714285714285]
28 random features: [0.2310126582278481, 0.14285714285714285]
29 random features: [0.2310126582278481, 0.11428571428571428]
30 random features: [0.2120253164556962, 0.14285714285714285]
31 random features: [0.18037974683544303, 0.11428571428571428]
32 random features: [0.16772151898734178, 0.14285714285714285]
33 random features: [0.17088607594936708, 0.14285714285714285]
34 random features: [0.17088607594936708, 0.14285714285714285]
# Fold 7
1 random features: [0.25, 0.2571428571428571]
2 random features: [0.25, 0.2571428571428571]
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3 random features: [0.25, 0.2571428571428571]
4 random features: [0.27848101265822783, 0.2571428571428571]
5 random features: [0.2689873417721519, 0.2571428571428571]
6 random features: [0.25, 0.2571428571428571]
7 random features: [0.25, 0.2571428571428571]
8 random features: [0.2848101265822785, 0.2571428571428571]
9 random features: [0.30063291139240506, 0.2571428571428571]
10 random features: [0.34177215189873417, 0.2857142857142857]
11 random features: [0.31329113924050633, 0.2571428571428571]
12 random features: [0.3037974683544304, 0.2571428571428571]
13 random features: [0.3037974683544304, 0.2571428571428571]
14 random features: [0.34810126582278483, 0.2857142857142857]
15 random features: [0.34177215189873417, 0.2571428571428571]
16 random features: [0.3512658227848101, 0.2857142857142857]
17 random features: [0.34810126582278483, 0.2857142857142857]
18 random features: [0.27531645569620256, 0.22857142857142856]
19 random features: [0.3037974683544304, 0.2571428571428571]
20 random features: [0.2974683544303797, 0.2571428571428571]
21 random features: [0.2848101265822785, 0.2571428571428571]
22 random features: [0.23417721518987342, 0.17142857142857143]
23 random features: [0.2468354430379747, 0.17142857142857143]
24 random features: [0.29430379746835444, 0.2571428571428571]
25 random features: [0.2563291139240506, 0.17142857142857143]
26 random features: [0.22468354430379747, 0.17142857142857143]
27 random features: [0.29430379746835444, 0.2571428571428571]
28 random features: [0.22468354430379747, 0.17142857142857143]
29 random features: [0.22468354430379747, 0.14285714285714285]
30 random features: [0.18037974683544303, 0.11428571428571428]
31 random features: [0.1962025316455696, 0.11428571428571428]
32 random features: [0.18037974683544303, 0.11428571428571428]
33 random features: [0.18037974683544303, 0.11428571428571428]
34 random features: [0.18037974683544303, 0.11428571428571428]
# Fold 8
1 random features: [0.2468354430379747, 0.2857142857142857]
2 random features: [0.2468354430379747, 0.2857142857142857]
3 random features: [0.2974683544303797, 0.3142857142857143]
4 random features: [0.3037974683544304, 0.37142857142857144]
5 random features: [0.26582278481012656, 0.2857142857142857]
6 random features: [0.2848101265822785, 0.3142857142857143]
7 random features: [0.27848101265822783, 0.3142857142857143]
8 random features: [0.2848101265822785, 0.3142857142857143]
9 random features: [0.29430379746835444, 0.34285714285714286]
10 random features: [0.29430379746835444, 0.3142857142857143]
11 random features: [0.28164556962025317, 0.2857142857142857]
12 random features: [0.30063291139240506, 0.3142857142857143]
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13 random features: [0.2974683544303797, 0.3142857142857143]
14 random features: [0.3069620253164557, 0.3142857142857143]
15 random features: [0.3037974683544304, 0.3142857142857143]
16 random features: [0.33860759493670883, 0.4]
17 random features: [0.3291139240506329, 0.4]
18 random features: [0.30063291139240506, 0.34285714285714286]
19 random features: [0.28164556962025317, 0.3142857142857143]
20 random features: [0.2911392405063291, 0.3142857142857143]
21 random features: [0.3069620253164557, 0.37142857142857144]
22 random features: [0.31962025316455694, 0.37142857142857144]
23 random features: [0.310126582278481, 0.37142857142857144]
24 random features: [0.23417721518987342, 0.2857142857142857]
25 random features: [0.2848101265822785, 0.2857142857142857]
26 random features: [0.21518987341772153, 0.2571428571428571]
27 random features: [0.2879746835443038, 0.3142857142857143]
28 random features: [0.21518987341772153, 0.2571428571428571]
29 random features: [0.21518987341772153, 0.2571428571428571]
30 random features: [0.18037974683544303, 0.2]
31 random features: [0.2120253164556962, 0.2571428571428571]
32 random features: [0.17088607594936708, 0.2]
33 random features: [0.17088607594936708, 0.2]
34 random features: [0.17088607594936708, 0.2]
# Fold 9
1 random features: [0.25949367088607594, 0.17142857142857143]
2 random features: [0.25949367088607594, 0.17142857142857143]
3 random features: [0.25949367088607594, 0.17142857142857143]
4 random features: [0.25949367088607594, 0.17142857142857143]
5 random features: [0.27848101265822783, 0.17142857142857143]
6 random features: [0.25949367088607594, 0.17142857142857143]
7 random features: [0.310126582278481, 0.22857142857142856]
8 random features: [0.2974683544303797, 0.22857142857142856]
9 random features: [0.29430379746835444, 0.22857142857142856]
10 random features: [0.3037974683544304, 0.22857142857142856]
11 random features: [0.3037974683544304, 0.22857142857142856]
12 random features: [0.29430379746835444, 0.22857142857142856]
13 random features: [0.310126582278481, 0.22857142857142856]
14 random features: [0.3069620253164557, 0.22857142857142856]
15 random features: [0.34810126582278483, 0.22857142857142856]
16 random features: [0.3512658227848101, 0.22857142857142856]
17 random features: [0.31329113924050633, 0.22857142857142856]
18 random features: [0.3259493670886076, 0.22857142857142856]
19 random features: [0.2974683544303797, 0.22857142857142856]
20 random features: [0.3449367088607595, 0.22857142857142856]
21 random features: [0.3037974683544304, 0.22857142857142856]
22 random features: [0.310126582278481, 0.17142857142857143]

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23 random features: [0.3449367088607595, 0.22857142857142856]
24 random features: [0.2468354430379747, 0.17142857142857143]
25 random features: [0.2563291139240506, 0.14285714285714285]
26 random features: [0.24367088607594936, 0.14285714285714285]
27 random features: [0.25316455696202533, 0.14285714285714285]
28 random features: [0.23734177215189872, 0.14285714285714285]
29 random features: [0.23734177215189872, 0.14285714285714285]
30 random features: [0.2120253164556962, 0.08571428571428572]
31 random features: [0.2120253164556962, 0.08571428571428572]
32 random features: [0.18670886075949367, 0.05714285714285714]
33 random features: [0.18670886075949367, 0.05714285714285714]
34 random features: [0.18670886075949367, 0.05714285714285714]
# average errors in form of [trainData, testData]:
1 random features: [0.2509493670886076, 0.24857142857142853]
2 random features: [0.2617088607594937, 0.25999999999999995]
3 random features: [0.27974683544303797, 0.27999999999999999]
4 random features: [0.27721518987341776, 0.27714285714285714]
5 random features: [0.27721518987341776, 0.2771428571428571]
6 random features: [0.26424050632911394, 0.27428571428571424]
7 random features: [0.27943037974683543, 0.27999999999999997]
8 random features: [0.2810126582278481, 0.2742857142857143]
9 random features: [0.29715189873417724, 0.3057142857142857]
10 random features: [0.310126582278481, 0.3114285714285714]
11 random features: [0.30759493670886073, 0.3057142857142857]
12 random features: [0.30284810126582273, 0.3085714285714286]
13 random features: [0.31234177215189873, 0.3114285714285715]
14 random features: [0.3231012658227848, 0.31714285714285717]
15 random features: [0.32183544303797473, 0.3114285714285714]
16 random features: [0.32721518987341774, 0.31999999999999995]
17 random features: [0.31518987341772153, 0.31999999999999995]
18 random features: [0.2993670886075949, 0.3]
19 random features: [0.2993670886075949, 0.29714285714285715]
20 random features: [0.29430379746835433, 0.2914285714285715]
21 random features: [0.28765822784810124, 0.2885714285714286]
22 random features: [0.28575949367088604, 0.27999999999999999]
23 random features: [0.2784810126582279, 0.27428571428571435]
24 random features: [0.2693037974683544, 0.27999999999999999]
25 random features: [0.2506329113924051, 0.24285714285714283]
26 random features: [0.23322784810126582, 0.24]
27 random features: [0.2550632911392405, 0.2542857142857142]
28 random features: [0.2221518987341772, 0.22857142857142856]
29 random features: [0.2170886075949367, 0.2228571428571428]
30 random features: [0.18892405063291143, 0.19428571428571426]
31 random features: [0.18639240506329113, 0.19714285714285712]
32 random features: [0.1708860759493671, 0.17428571428571427]

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33 random features: [0.1708860759493671, 0.17428571428571427]
34 random features: [0.1699367088607595, 0.17428571428571427]
# std derivation in form of [trainData, testData]:
1 random features: [0.007083237115696003, 0.06395151224456969]
2 random features: [0.03273596135993671, 0.07390009803644322]
3 random features: [0.02516569031907728, 0.08161632489763257]
4 random features: [0.012674040756013158, 0.0818659930393966]
5 random features: [0.0133662734695841, 0.07345691504104251]
6 random features: [0.01251901293978006, 0.0868496237346895]
7 random features: [0.020265522337449826, 0.08060991988380506]
8 random features: [0.013485617564976274, 0.07897299977763002]
9 random features: [0.01775821246404835, 0.08285714285714287]
10 random features: [0.024430707677998462, 0.07050835816716038]
11 random features: [0.012721361545722648, 0.09039595439746499]
12 random features: [0.009067435937907847, 0.07645193234434086]
13 random features: [0.019303797468354433, 0.06694499722205703]
14 random features: [0.021807907789898797, 0.07923099785064028]
15 random features: [0.017622349104209938, 0.09075645813867766]
16 random features: [0.02484529927391205, 0.07959079015533782]
17 random features: [0.01972207145681378, 0.08060991988380506]
18 random features: [0.019569145359164944, 0.07693092581620721]
19 random features: [0.02559968153943884, 0.05742786069211938]
20 random features: [0.03192910950792263, 0.062335497797918374]
21 random features: [0.0336233246461854, 0.06446008098673417]
22 random features: [0.03094315383777123, 0.0883407133356589]
23 random features: [0.04050138419183837, 0.06904597699196899]
24 random features: [0.025413185459384622, 0.08456370621113567]
25 random features: [0.02462667906119458, 0.08206518066482898]
26 random features: [0.015762543551154768, 0.07250615737399727]
27 random features: [0.027156250573322705, 0.07923099785064028]
28 random features: [0.00772566811122386, 0.06880911187881311]
29 random features: [0.013880830505988168, 0.0720544012166771]
30 random features: [0.016985742911797014, 0.06975174637562116]
31 random features: [0.018638676357755974, 0.07499659856232392]
32 random features: [0.008129894037129827, 0.06318098396427424]
33 random features: [0.007879683289866287, 0.06318098396427424]
34 random features: [0.008378609047388432, 0.06318098396427424]
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