**2. Medical Diagnostics.**

**1.**

**a)**

|  |  |  |
| --- | --- | --- |
| **Alphas** | **Weighted Errors** | **Iteratiom** |
| 0.6469605204944376 | 0.21518987341772156 | 1 |
| 0.3731412176567786 | 0.3216318785578748 | 2 |
| 0.2793711408869235 | 0.3638385213606452 | 3 |
| 0.3573072595191374 | 0.3285800031079028 | 4 |
| 0.29796331416089333 | 0.35527616897935554 | 5 |

**b)** Accuracies on Train and Test Data on AdaBoost for 10 rounds:

**Training Accuracy =** [78.48101265822784, 78.48101265822784, 81.0126582278481, 79.74683544303798, 79.74683544303798, 82.27848101265823, 84.81012658227847, 87.34177215189874, 86.07594936708861, 89.87341772151899]

**Testing Accuracy =** [71.50537634408603, 71.50537634408603, 66.12903225806451, 74.19354838709677, 74.73118279569893, 80.10752688172043, 78.49462365591397, 75.80645161290323, 79.56989247311827, 75.80645161290323]

**2.** Hypothesis Space is all decision trees of height 1.

a) Co-ordinate Descent:

Final exponential loss = 39.33399205

Number of Iterations = 1868152

Alphas for coordinate descent is as follows:

[0.592167

-0.23213

0.17005

0.19975

-0.70160

0.17005

7.77942

6.29791

0.73456

0.17005

0.33120

0.17005

-0.23213

0.17005

7.77942

6.29791

-0.70161

7.77942

0.17005

2.60657]

**B)** Accuracy of Coordinate Descent Classifier is

Train Accuracy is 83.544%

Test Accuracy is 67.741%

**C)** Accuracy of Adaboost for 20 rounds is

Train Accuracy is 82.278%

Test Accuracy is 68.817%

Alphas for Adaboost is as follows:

[0.47600440723811704, 0.24480796047956638, 0.30374073389838535, 0.2748915989068595, 0.13022282695998275, 0.18298975949341767, 0.18995144135867476, 0.17659267049635347, 0.16660040082868943, 0.14252594872703953, 0.16033530765943185, 0.09828833190420162, 0.13007812973578875, 0.08260484071366543, 0.11696757264455056, 0.11807933241544234, 0.1308969258733171, 0.06894402419691942, 0.10691617605239612, 0.10556151382052988]

Alphas for Adaboost is different from Alphas for co-ordinate descent. Co-ordinate descent considers 20 hypotheses for 20 iterations unlike co-ordinate descent which considers whole hypothesis space.

**D)** Bagging from 20 Bootstrap samples:

Training Accuracy is 68.35443037974683

Testing Accuracy is 46.236559139784944

Accuracy from bagging is less compared to adaboost and co-ordinate descent. The reason for low accuracy is bagging is effective when variance is high. But we are considering one splitt decision trees for which variance will be low. So low accuracy is expected.

**E)** Out of three methods, I prefer adaboost because it is computationally less expensive and the accuracies are almost similar to co-ordinate descent method.

Bagging is not very useful in this case because of less variance.