**Description of Algorithm:**

**Perceptron Learning Algorithm - pla(X,Y,w0,Dt):**

**Step 1:** Initialize the weight vector[w] as either 0 or from pseudo inverse function.

**Step 2:** Add an artificial coordinate X [0] = 1 into X.

**Step 3:** Calculated *Yprediction* through Sign(WtX) function

**Step 4:** Compared *Yprediction* with actual Y

**Step 5:** If both are not same then take one misclassified point having highest Dt and updated weight through w = w + YnXn.

**Step 6:** Repeat step 3, 4, 5 till 100

**Step 7:** Take w having minimum classification error rate

**Pseudo Inverse:**

**Step 1:** Add an artificial coordinate X [0] = 1 before each point.

**Step 2:** Computed the (X dagger) X+. Where X+= (X+\*X)-1 XT

**Step 3:** Calculated final weights through W = X+\*Y.

**Decision Stump:**

**Step 1:** Calculated Decision boundary through each attribute of X, i.e X[0]..X[16]

**Step 2:** Calculate Ypred through eac Decision Boundary

**Step 3:** Compare with Actual Y and find attribute having minimum error as final weak classifier

**AdaBoost:**

**Step 1:** Calculate Dt = 1/ # training example

Step 2: Find out Ypred and ht based on version provided

Step 3: Calculate Et, Alphat, Dt+1 based on Ypred

Step 4: Assign Dt+1 as new Dt

Step 5: iterate loop for 15 times, calculate validation error for each ht.

Step 6: Find hk having minimum error, take h1 to hk as H

Step 7: Calculate Prediction on Test data for final accuracy

**Experiment Results of Stump**

|  |  |  |
| --- | --- | --- |
| **Best** | **Worst** | **avg** |
| 36.697248 | 26.605505 | 30.55046 |

|  |  |
| --- | --- |
| **iteration** | **Accuracy** |
| 1 | 30.275229 |
| 2 | 28.440367 |
| 3 | 26.605505 |
| 4 | 30.275229 |
| 5 | 33.027523 |
| 6 | 29.357798 |
| 7 | 28.440367 |
| 8 | 29.357798 |
| 9 | 36.697248 |
| 10 | 33.027523 |

**Experiment Results of Perceptron**

|  |  |  |
| --- | --- | --- |
| **Best** | **Worst** | **avg** |
| 97.247706 | 89.908257 | 93.85321 |

|  |  |
| --- | --- |
| **iteration** | **Accuracy** |
| 1 | 94.495413 |
| 2 | 90.825688 |
| 3 | 89.908257 |
| 4 | 97.247706 |
| 5 | 92.66055 |
| 6 | 96.330275 |
| 7 | 94.495413 |
| 8 | 91.743119 |
| 9 | 93.577982 |
| 10 | 97.247706 |

**Observation:**

1. Adaboost with perceptron is giving good accuracy for me , but it is also very time consuming
2. Adaboost with Decision stump is highly inaccurate and unpredictable for me
3. Combination of weak classifier is performing, giving very good accuracy compare to single classifier like Decision tree