# CS 573000 : Homework 4

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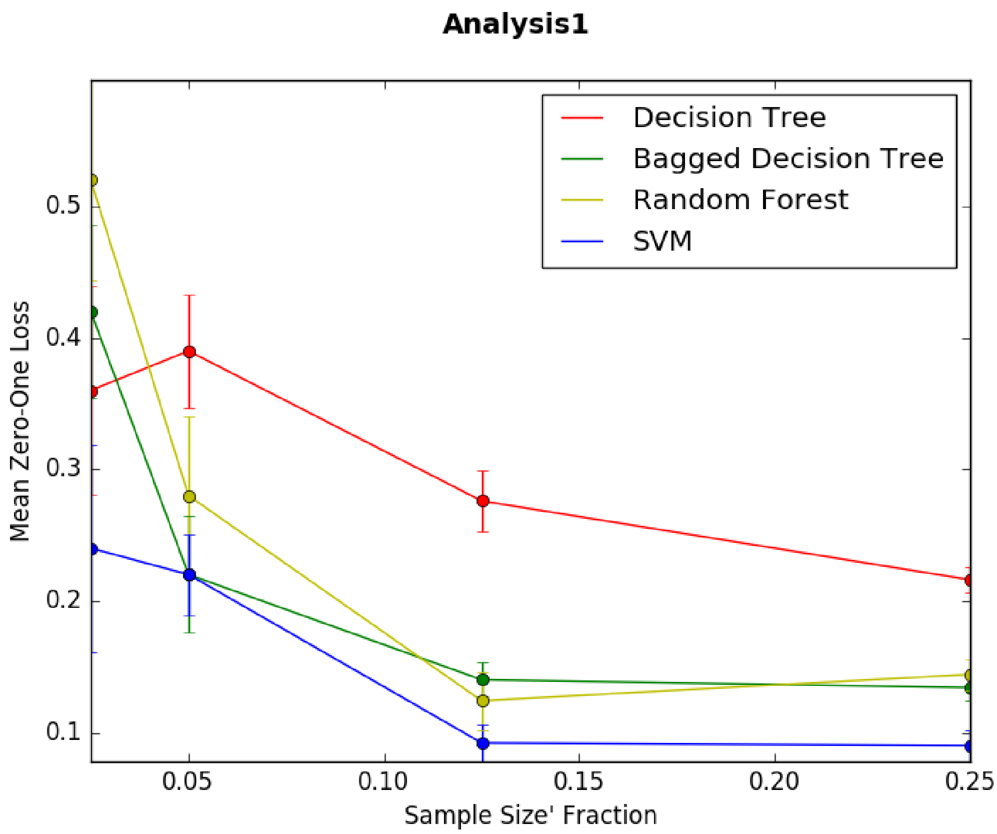
April 17, 2017

## 1 Note

I used all 4 late days for this assignment.

## 2 Question 1

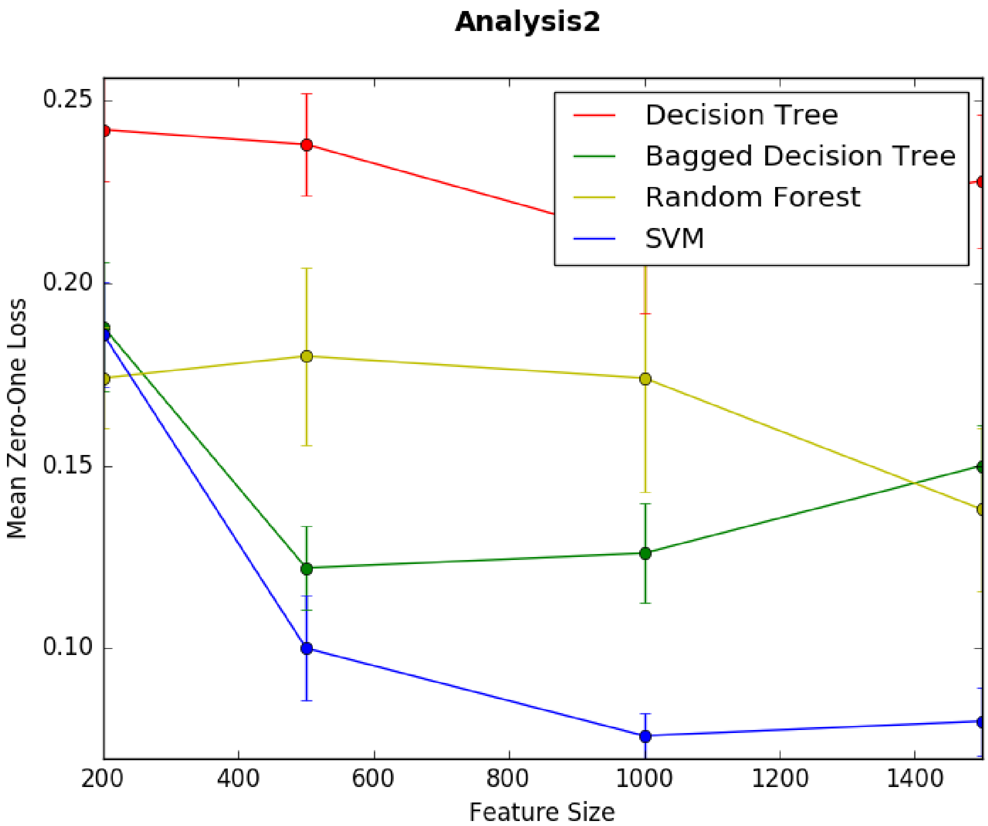
### 2.1 Part a




We state the null hypothesis as
$\mu_{RF} < \mu_{SVM}$ and the alternative hypothesis as $\mu_{RF} = \mu_{SVM}$

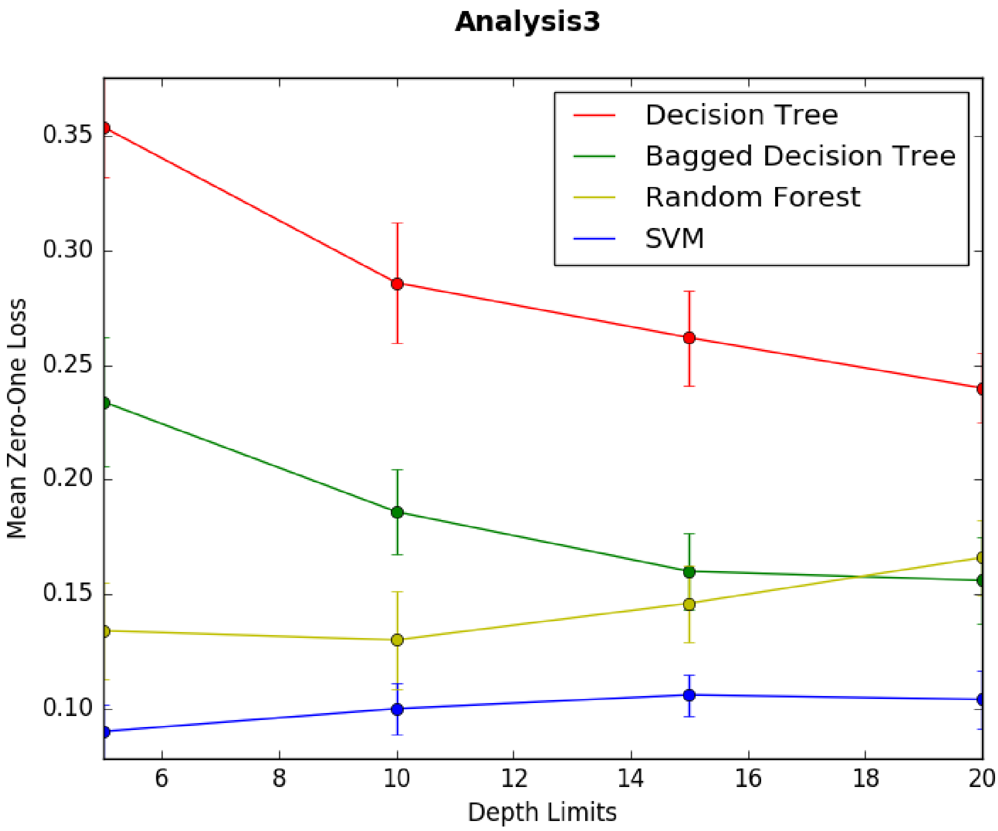
We perform a one-tailed t-test to test if the hypothesis is true for significance value $\alpha = 0.05$, and apply Bonferroni's correction so the null hypothesis is rejected for values lesser than 0.025. The p-values obtained for this paired t-test are 2.416e- 06, 9.883e-05, 5.94e-07, 2.923e-08 all lesser than 0.025 hence, the null hypothesis can be rejected for increasing training size.

# 3 Question 2



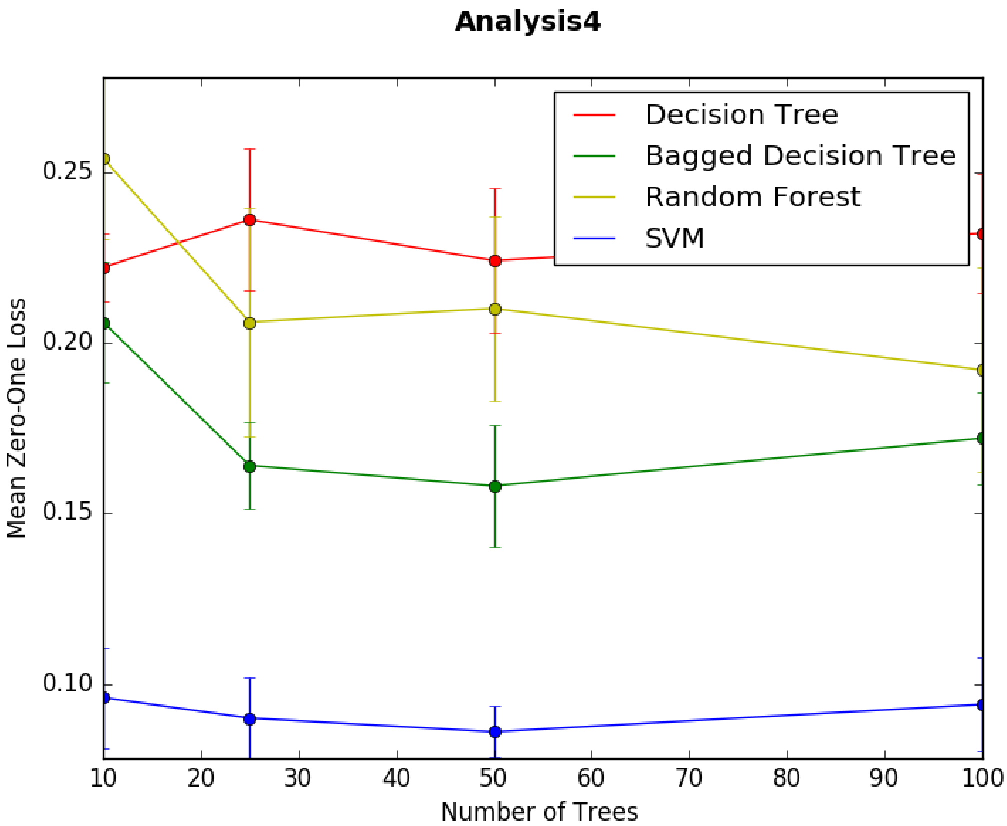

We perform a one-tailed t-test to test if the hypothesis is true for significance value $\alpha = 0.05$, and apply Bonferroni's correction so the null hypothesis is rejected for values lesser than 0.025. The p-values obtained for this paired t-test are 5.346e- 02, 2.343e-07, 6.349e-07, 4.439e-05 all lesser than 0.025 hence, the null hypothesis can be rejected for increasing the feature size.

## 4 Question 3




We perform a one-tailed t-test to test if the hypothesis is true for significance value $\alpha = 0.05$, and apply Bonferroni's correction so the null hypothesis is rejected for values lesser than 0.025. The p-values obtained for this paired t-test are 0.194, 0.023. 0.145. 0.119 some are greater than 0.025 hence, the null hypothesis is accepted for increasing the depth of the tree.

# 5 Question 4




We perform a one-tailed t-test to test if the hypothesis is true for significance value $\alpha = 0.05$, and apply Bonferroni's correction so the null hypothesis is rejected for values lesser than 0.025. The p-values obtained for this paired t-test are 0.004, 0.02. 0.005. 0.03 all are lesser than 0.025 hence, the null hypothesis is rejected for increasing the number of trees.

# 6 Question 5

$E[(X-y)^2] = E[X^2] + E[y^2] - 2E[X]E[Y]$ where X is the true variable
$= E[X^2] + E[y^2] - 2E[X]E[y]$ as X and y are independent
$= (E[X^2] - E[X]^2) + (E[y^2] - E[y]^2) + E[X]^2 + E[y]^2 - 2E[X]E[y]$
$= (E[X^2] + E[X]^2 - 2E[X]E[X]) + (E[y^2] + E[y]^2 - 2E[y]E[y]) + E[X]^2 + E[y]^2 - 2E[X]E[y]$
$= (E[X^2]+E[E[X]^2]]-2E[X]E[X])+(E[y^2]+E[E[y]^2]-2E[y]E[y])+E[X]^2+E[y]^2-2E[X]E[y]$
$= (E(X-E[X])^2) + E(y-E[y])^2 + (E[X]-E[y])^2$ which is noise + variance + bias respectively.