VG441 Problem Set 1

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Problem 1

$$\theta^T X^T X \theta = \sum_i (X^T X)_{i,i} \theta_i^2 + \sum_{i \neq j} (X^T X)_{i,j} \theta_i \theta_j$$

$$\Rightarrow \frac{d(\theta^T X^T X \theta)}{d\theta_i} = 2(X^T X)_{i,i} \theta_i + \sum_{i \not j} (X^T X)_{i,j} \theta_j + \sum_{i \not j} (X^T X)_{j,i} \theta_j$$

Since $X^T X$ is symmetric, we could conclude that:

$$\Rightarrow \frac{d(\theta^T X^T X \theta)}{d\theta} = 2(X^T X)\theta$$

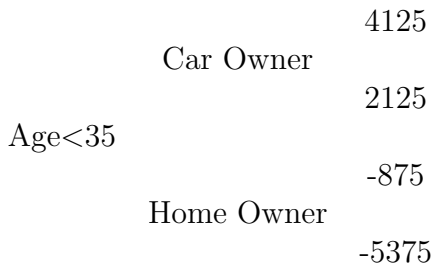
Problem 2

Iterations

Firstly, we get PR0 =

$$4125, -5375, 2125, -875$$

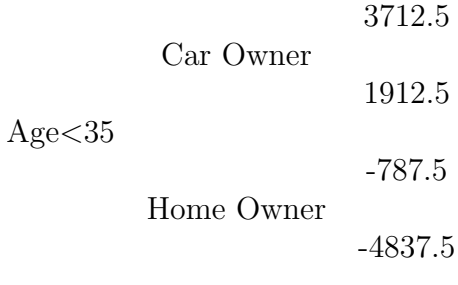
and get the decision tree like:



Secondly, we get PR1=

$$3712.5, -4837.5, 1912.5, -787.5$$

and get the decision tree like:



Results

Finally, we run GBM o paper and get the table that:

F0	PR0	F1	PR1	F2	PR2
5875	4125	6287.5	3712.5	6658.75	3341.25
5875	-5375	5337.5	-4837.5	4853.75	-4353.75
5875	2125	5787.5	1912.5	6278.75	1721.25
5875	-875	6087.5	-787.5	5708.75	-708.75

XGBM

Iterations

Firstly, we get PR0 =

$$4125, -5375, 2125, -875$$

and get the decision tree like:

2125,4125

Age<35

-875

Home Owner

-5375

Secondly, we get PR1=

$$3916.7, -5106.25, 1916.7, -831.25$$

and get the decision tree like:

3916.7,1916.7

Age<35

-831.25

Home Owner

-5106.25

Results

Finally, we run XGBM o paper and get the table that:

F0	PR0	F1	PR1	F2	PR2
5875	4125	6083.3	3916.7	6277.7	3277.25
5875	-5375	5606.25	-5106.25	5350.9375	-4850.9375
5875	2125	6083.3	1916.7	6277.7	1722.25
5875	-875	5831.25	-831.25	5789.6875	-789.6875