**Input:** (run configurations)

*"E:\Eclipse Neon Workspace\Machine Learning\data\data\_sets1\training\_set.csv" "E:\Eclipse Neon Workspace\Machine Learning\data\data\_sets1\validation\_set.csv" "E:\Eclipse Neon Workspace\Machine Learning\data\data\_sets1\test\_set.csv" 0.2*

**Output:**

Assumed Pruning factor = 0.2

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Number of training instances = 600

Number of training attributes = 20

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Decison Tree :

| XO = 0 :

| | XM = 0 :

| | | XF = 0 :

| | | | XB = 0 :

| | | | | XG = 0 : 0

| | | | | XG = 1 :

| | | | | | XD = 0 :

| | | | | | | XS = 0 : 0

| | | | | | | XS = 1 :

| | | | | | | | XC = 0 : 1

| | | | | | | | XC = 1 :

| | | | | | | | | XH = 0 : 0

| | | | | | | | | XH = 1 : 1

| | | | | | XD = 1 :

| | | | | | | XE = 0 : 0

| | | | | | | XE = 1 :

| | | | | | | | XK = 0 : 0

| | | | | | | | XK = 1 : 1

| | | | XB = 1 :

| | | | | XD = 0 : 0

| | | | | XD = 1 :

| | | | | | XI = 0 : 0

| | | | | | XI = 1 :

| | | | | | | XG = 0 : 1

| | | | | | | XG = 1 : 0

| | | XF = 1 : 0

| | XM = 1 :

| | | XB = 0 :

| | | | XD = 0 :

| | | | | XG = 0 :

| | | | | | XF = 0 : 0

| | | | | | XF = 1 :

| | | | | | | XJ = 0 :

| | | | | | | | XN = 0 : 1

| | | | | | | | XN = 1 :

| | | | | | | | | XE = 0 :

| | | | | | | | | | XK = 0 : 0

| | | | | | | | | | XK = 1 : 1

| | | | | | | | | XE = 1 : 0

| | | | | | | XJ = 1 :

| | | | | | | | XC = 0 :

| | | | | | | | | XT = 0 :

| | | | | | | | | | XL = 0 :

| | | | | | | | | | | XE = 0 :

| | | | | | | | | | | | XI = 0 : 0

| | | | | | | | | | | | XI = 1 : 1

| | | | | | | | | | | XE = 1 : 1

| | | | | | | | | | XL = 1 : 0

| | | | | | | | | XT = 1 : 1

| | | | | | | | XC = 1 : 1

| | | | | XG = 1 :

| | | | | | XF = 0 : 1

| | | | | | XF = 1 :

| | | | | | | XQ = 0 :

| | | | | | | | XC = 0 : 0

| | | | | | | | XC = 1 : 1

| | | | | | | XQ = 1 :

| | | | | | | | XJ = 0 :

| | | | | | | | | XL = 0 : 1

| | | | | | | | | XL = 1 : 0

| | | | | | | | XJ = 1 : 1

| | | | XD = 1 :

| | | | | XC = 0 :

| | | | | | XF = 0 :

| | | | | | | XG = 0 : 0

| | | | | | | XG = 1 :

| | | | | | | | XP = 0 :

| | | | | | | | | XS = 0 : 0

| | | | | | | | | XS = 1 : 1

| | | | | | | | XP = 1 : 0

| | | | | | XF = 1 :

| | | | | | | XJ = 0 : 1

| | | | | | | XJ = 1 :

| | | | | | | | XE = 0 :

| | | | | | | | | XG = 0 :

| | | | | | | | | | XI = 0 : 1

| | | | | | | | | | XI = 1 : 0

| | | | | | | | | XG = 1 : 0

| | | | | | | | XE = 1 :

| | | | | | | | | XT = 0 :

| | | | | | | | | | XG = 0 : 1

| | | | | | | | | | XG = 1 : 0

| | | | | | | | | XT = 1 : 1

| | | | | XC = 1 : 0

| | | XB = 1 :

| | | | XI = 0 : 0

| | | | XI = 1 :

| | | | | XC = 0 :

| | | | | | XK = 0 :

| | | | | | | XP = 0 : 1

| | | | | | | XP = 1 :

| | | | | | | | XS = 0 :

| | | | | | | | | XG = 0 : 1

| | | | | | | | | XG = 1 :

| | | | | | | | | | XF = 0 : 0

| | | | | | | | | | XF = 1 : 1

| | | | | | | | XS = 1 : 0

| | | | | | XK = 1 : 0

| | | | | XC = 1 : 0

| XO = 1 :

| | XI = 0 :

| | | XM = 0 :

| | | | XQ = 0 :

| | | | | XF = 0 :

| | | | | | XH = 0 :

| | | | | | | XB = 0 : 0

| | | | | | | XB = 1 :

| | | | | | | | XC = 0 : 1

| | | | | | | | XC = 1 : 0

| | | | | | XH = 1 : 1

| | | | | XF = 1 : 0

| | | | XQ = 1 :

| | | | | XJ = 0 :

| | | | | | XN = 0 :

| | | | | | | XP = 0 : 1

| | | | | | | XP = 1 :

| | | | | | | | XB = 0 :

| | | | | | | | | XF = 0 : 0

| | | | | | | | | XF = 1 : 1

| | | | | | | | XB = 1 : 0

| | | | | | XN = 1 : 0

| | | | | XJ = 1 :

| | | | | | XL = 0 :

| | | | | | | XH = 0 : 0

| | | | | | | XH = 1 :

| | | | | | | | XK = 0 :

| | | | | | | | | XB = 0 :

| | | | | | | | | | XC = 0 : 1

| | | | | | | | | | XC = 1 : 0

| | | | | | | | | XB = 1 : 1

| | | | | | | | XK = 1 : 1

| | | | | | XL = 1 : 1

| | | XM = 1 :

| | | | XQ = 0 :

| | | | | XF = 0 :

| | | | | | XL = 0 :

| | | | | | | XC = 0 : 1

| | | | | | | XC = 1 :

| | | | | | | | XH = 0 : 1

| | | | | | | | XH = 1 :

| | | | | | | | | XN = 0 :

| | | | | | | | | | XP = 0 : 1

| | | | | | | | | | XP = 1 :

| | | | | | | | | | | XS = 0 : 1

| | | | | | | | | | | XS = 1 : 0

| | | | | | | | | XN = 1 : 0

| | | | | | XL = 1 :

| | | | | | | XC = 0 :

| | | | | | | | XB = 0 : 0

| | | | | | | | XB = 1 :

| | | | | | | | | XP = 0 : 0

| | | | | | | | | XP = 1 : 1

| | | | | | | XC = 1 : 1

| | | | | XF = 1 : 0

| | | | XQ = 1 : 0

| | XI = 1 :

| | | XT = 0 :

| | | | XH = 0 :

| | | | | XP = 0 :

| | | | | | XF = 0 : 0

| | | | | | XF = 1 :

| | | | | | | XQ = 0 :

| | | | | | | | XK = 0 : 1

| | | | | | | | XK = 1 :

| | | | | | | | | XC = 0 : 0

| | | | | | | | | XC = 1 : 1

| | | | | | | XQ = 1 :

| | | | | | | | XK = 0 : 0

| | | | | | | | XK = 1 : 1

| | | | | XP = 1 :

| | | | | | XS = 0 :

| | | | | | | XD = 0 :

| | | | | | | | XC = 0 :

| | | | | | | | | XJ = 0 :

| | | | | | | | | | XN = 0 : 0

| | | | | | | | | | XN = 1 : 1

| | | | | | | | | XJ = 1 :

| | | | | | | | | | XB = 0 : 0

| | | | | | | | | | XB = 1 :

| | | | | | | | | | | XG = 0 : 1

| | | | | | | | | | | XG = 1 : 0

| | | | | | | | XC = 1 : 0

| | | | | | | XD = 1 :

| | | | | | | | XM = 0 :

| | | | | | | | | XC = 0 : 1

| | | | | | | | | XC = 1 : 0

| | | | | | | | XM = 1 : 1

| | | | | | XS = 1 : 1

| | | | XH = 1 :

| | | | | XJ = 0 :

| | | | | | XC = 0 :

| | | | | | | XN = 0 : 1

| | | | | | | XN = 1 :

| | | | | | | | XF = 0 :

| | | | | | | | | XG = 0 : 1

| | | | | | | | | XG = 1 : 0

| | | | | | | | XF = 1 : 0

| | | | | | XC = 1 :

| | | | | | | XM = 0 : 0

| | | | | | | XM = 1 :

| | | | | | | | XF = 0 :

| | | | | | | | | XR = 0 : 1

| | | | | | | | | XR = 1 : 0

| | | | | | | | XF = 1 : 1

| | | | | XJ = 1 :

| | | | | | XS = 0 : 1

| | | | | | XS = 1 :

| | | | | | | XG = 0 :

| | | | | | | | XB = 0 : 0

| | | | | | | | XB = 1 :

| | | | | | | | | XD = 0 : 1

| | | | | | | | | XD = 1 :

| | | | | | | | | | XE = 0 : 0

| | | | | | | | | | XE = 1 : 1

| | | | | | | XG = 1 :

| | | | | | | | XC = 0 : 1

| | | | | | | | XC = 1 :

| | | | | | | | | XD = 0 : 1

| | | | | | | | | XD = 1 : 0

| | | XT = 1 :

| | | | XS = 0 :

| | | | | XQ = 0 :

| | | | | | XK = 0 :

| | | | | | | XC = 0 :

| | | | | | | | XR = 0 :

| | | | | | | | | XH = 0 :

| | | | | | | | | | XE = 0 : 0

| | | | | | | | | | XE = 1 : 1

| | | | | | | | | XH = 1 : 1

| | | | | | | | XR = 1 :

| | | | | | | | | XB = 0 :

| | | | | | | | | | XD = 0 : 0

| | | | | | | | | | XD = 1 : 1

| | | | | | | | | XB = 1 : 0

| | | | | | | XC = 1 : 1

| | | | | | XK = 1 :

| | | | | | | XD = 0 :

| | | | | | | | XF = 0 : 0

| | | | | | | | XF = 1 : 1

| | | | | | | XD = 1 : 0

| | | | | XQ = 1 :

| | | | | | XM = 0 :

| | | | | | | XN = 0 :

| | | | | | | | XD = 0 :

| | | | | | | | | XB = 0 : 1

| | | | | | | | | XB = 1 : 0

| | | | | | | | XD = 1 : 0

| | | | | | | XN = 1 :

| | | | | | | | XP = 0 :

| | | | | | | | | XB = 0 :

| | | | | | | | | | XF = 0 : 0

| | | | | | | | | | XF = 1 : 1

| | | | | | | | | XB = 1 : 1

| | | | | | | | XP = 1 : 1

| | | | | | XM = 1 : 0

| | | | XS = 1 :

| | | | | XL = 0 :

| | | | | | XD = 0 :

| | | | | | | XH = 0 :

| | | | | | | | XK = 0 : 1

| | | | | | | | XK = 1 : 0

| | | | | | | XH = 1 :

| | | | | | | | XB = 0 : 1

| | | | | | | | XB = 1 :

| | | | | | | | | XP = 0 : 0

| | | | | | | | | XP = 1 : 1

| | | | | | XD = 1 :

| | | | | | | XG = 0 : 0

| | | | | | | XG = 1 : 1

| | | | | XL = 1 :

| | | | | | XH = 0 :

| | | | | | | XD = 0 :

| | | | | | | | XQ = 0 : 0

| | | | | | | | XQ = 1 :

| | | | | | | | | XB = 0 : 0

| | | | | | | | | XB = 1 : 1

| | | | | | | XD = 1 :

| | | | | | | | XB = 0 : 1

| | | | | | | | XB = 1 : 0

| | | | | | XH = 1 : 0

Number of nodes in the tree = 281

Number of Leaf Nodes in the tree = 141

Average Depth:4.131672597864768

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Pre-pruning Accuracy:

Training data size = 600

Accuracy of the model on the Training dataset = 100.0

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Number of validating instances = 2000

Number of validating attributes = 20

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Validation data size = 2000

Accuracy of the model on the Validation dataset = 75.35

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Number of testing instances = 2000

Number of testing attributes = 20

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Testing data size = 2000

Accuracy of the model on the Testing dataset = 74.8

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Post-pruning Accuracy:

Validation data size = 2000

Accuracy after pruning on validation data = 55.2

Testing data size = 2000

Accuracy after pruning on testing data = 56.75

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Randomly generated Decision Tree

| XB = 0 :

| | XI = 0 :

| | | XD = 0 :

| | | | XF = 0 :

| | | | | XT = 0 :

| | | | | | XT = 0 : 1

| | | | | | XT = 1 : 0

| | | | | XT = 1 :

| | | | | | XE = 0 : 1

| | | | | | XE = 1 : 1

| | | | XF = 1 :

| | | | | XE = 0 :

| | | | | | XL = 0 : 0

| | | | | | XL = 1 : 1

| | | | | XE = 1 :

| | | | | | XQ = 0 : 0

| | | | | | XQ = 1 : 1

| | | XD = 1 :

| | | | XN = 0 :

| | | | | XT = 0 :

| | | | | | XF = 0 : 0

| | | | | | XF = 1 : 1

| | | | | XT = 1 :

| | | | | | XG = 0 : 1

| | | | | | XG = 1 : 0

| | | | XN = 1 :

| | | | | XC = 0 : 1

| | | | | XC = 1 : 0

| | XI = 1 :

| | | XD = 0 :

| | | | XL = 0 :

| | | | | XG = 0 : 1

| | | | | XG = 1 : 1

| | | | XL = 1 :

| | | | | XO = 0 : 1

| | | | | XO = 1 : 1

| | | XD = 1 :

| | | | XS = 0 :

| | | | | XT = 0 : 1

| | | | | XT = 1 : 0

| | | | XS = 1 :

| | | | | XS = 0 : 0

| | | | | XS = 1 : 0

| XB = 1 :

| | XL = 0 :

| | | XS = 0 :

| | | | XC = 0 :

| | | | | XI = 0 : 0

| | | | | XI = 1 : 1

| | | | XC = 1 :

| | | | | XK = 0 : 1

| | | | | XK = 1 : 0

| | | XS = 1 :

| | | | XS = 0 :

| | | | | XL = 0 : 0

| | | | | XL = 1 : 0

| | | | XS = 1 :

| | | | | XH = 0 : 0

| | | | | XH = 1 : 1

| | XL = 1 :

| | | XJ = 0 :

| | | | XS = 0 :

| | | | | XI = 0 : 0

| | | | | XI = 1 : 1

| | | | XS = 1 :

| | | | | XO = 0 : 0

| | | | | XO = 1 : 0

| | | XJ = 1 :

| | | | XN = 0 :

| | | | | XM = 0 : 0

| | | | | XM = 1 : 1

| | | | XN = 1 :

| | | | | XH = 0 : 1

| | | | | XH = 1 : 0

Number of nodes in the tree = 111

Average Depth:0.018018018018018018

Training data size = 600

Accuracy of the Random model on the Training dataset = 65.0

Validation data size = 2000

Accuracy of the Random model on the Validation dataset = 60.35

Testing data size = 2000

Accuracy of the Random model on the Testing dataset = 61.3