

## **REPORT**

### **Team Members:-**

- 1) Utkarsh Gandhi
- 2) Abhishek Kumar Mishra

### **Best Results:-**

Number of training instances = 600  
Number of training attributes = 20  
Total number of nodes in the tree = 118  
Number of leaf nodes in the tree = 60  
Accuracy of the model on the training dataset = 64.5%

Number of validation instances = 2000  
Number of validation attributes = 20  
Accuracy of the model on the validation dataset before pruning = 64.15%

Number of testing instances = 2000  
Number of testing attributes = 20  
Accuracy of the model on the testing dataset = 63.75%

### **Accomplishments:-**

We implemented ID3 algorithm successfully, which builds a classifier which learns from the training data and classifies correctly the test data. Moreover, pruning of the decision tree was also done which turns in increasing the accuracy of the model.

### **What we learnt:-**

- a) We learnt that ID3 algorithm splits the attributes which has the highest Information gain or attribute having lowest randomness (entropy). We also observed that on providing more training data the model learns well.
- b) Furtherly, we also learnt that pruning is a technique of trimming the decision tree and assigning label to the pruned node according to the probability of the positive and negative training instances.
- c) Also pruning a decision tree tends to increase the accuracy of the prediction majority of the times depending on the node that is pruned.

## Screenshots of 1 run of program:-

```
Problems Javadoc Declaration Console
<terminated> ID3 [Java Application] C:\Program Files\Java\jre1.8.0_102\bin\javaw.exe (Sep 24, 2017, 1:19:05 PM)
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
XP = 0
XE = 0 : 0
XE = 1 : 1
XP = 1 : 0
XB = 1
XD = 0 : 0
XD = 1
XI = 0 : 0
XT = 1
XC = 0
XE = 0 : 0
XE = 1
XG = 0 : 1
XG = 1 : 0
XC = 1 : 0
XF = 1 : 0
XM = 1
XB = 0
XD = 0
XG = 0
XF = 0 : 0
XF = 1
XJ = 0
```

```
Problems Javadoc Declaration Console
<terminated> ID3 [Java Application] C:\Program Files\Java\jre1.8.0_102\bin\javaw.exe (Sep 24, 2017, 1:19:05 PM)
XJ = 0
XN = 0 : 1
XN = 1
XE = 0
XC = 0 : 0
XC = 1
XH = 0 : 0
XH = 1
XI = 0 : 0
XI = 1
XK = 0 : 0
XK = 1 : 1
XE = 1 : 0
XJ = 1
XC = 0
XT = 0
XL = 0
XE = 0
XH = 0 : 0
XH = 1
XI = 0 : 0
XI = 1 : 1
XE = 1 : 1
XL = 1 : 0
XT = 1 : 1
XC = 1 : 1
XG = 1
XU = 0 : 1
XU = 1
XI = 0 : 0
XI = 1 : 1
XD = 1
XC = 0
XF = 0
XG = 0 : 0
XG = 1
```

```

Problems @ Javadoc Declaration Console
<terminated> ID3 [Java Application] C:\Program Files\Java\jre1.8.0_102\bin\javaw.exe (Sep 24, 2017, 1:19:05 PM)
| | | | | 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
| | | | | | | | | | | | | | | | | | | XD = 0 : 0
| | | | | | | | | | | | | | | | | | | XD = 1
| | | | | | | | | | | | | | | | | | | | XG = 0 : 1
| | | | | | | | | | | | | | | | | | | | XG = 1
| | | | | | | | | | | | | | | | | | | | | XF = 0 : 0
| | | | | | | | | | | | | | | | | | | | | XF = 1 : 1
| | | | | | | | | | | | | | | | | | | | | XS = 1 : 0
| | | | | | | | | | | | | | | | | | | | | XK = 1 : 0
| | | | | | | | | | | | | | | | | | | | | XC = 1 : 0
| | | | | | | | | | | | | | | | | | | | | | | XO = 1

```

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Problems @ Javadoc Declaration Console
<terminated> ID3 [Java Application] C:\Program Files\Java\jre1.8.0_102\bin\javaw.exe (Sep 24, 2017, 1:19:05 PM)
| | | | | XC = 1 : 0
| | | | | | | 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
| | | | | | | | | | | | | | | | | | | | XC = 0
| | | | | | | | | | | | | | | | | | | | | XF = 0 : 0
| | | | | | | | | | | | | | | | | | | | | XF = 1 : 1
| | | | | | | | | | | | | | | | | | | | | XC = 1 : 0
| | | | | | | | | | | | | | | | | | | | | XB = 1 : 0
| | | | | | | | | | | | | | | | | | | | | XN = 1 : 0
| | | | | | | | | | | | | | | | | | | | | XJ = 1
| | | | | | | | | | | | | | | | | | | | | XL = 0
| | | | | | | | | | | | | | | | | | | | | | XH = 0 : 0
| | | | | | | | | | | | | | | | | | | | | | XH = 1
| | | | | | | | | | | | | | | | | | | | | | XK = 0
| | | | | | | | | | | | | | | | | | | | | | | XU = 0 : 1
| | | | | | | | | | | | | | | | | | | | | | | XU = 1 : 0
| | | | | | | | | | | | | | | | | | | | | | | XK = 1 : 1
| | | | | | | | | | | | | | | | | | | | | | | XL = 1 : 1
| | | | | | | | | | | | | | | | | | | | | | | XM = 1
| | | | | | | | | | | | | | | | | | | | | | | XQ = 0
| | | | | | | | | | | | | | | | | | | | | | | XF = 0

```



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Problems @ Javadoc Declaration Console
<terminated> ID3 [Java Application] C:\Program Files\Java\jre1.8.0_102\bin\javaw.exe (Sep 24, 2017, 1:19:05 PM)
| | | | | XM = 0 : 0
| | | | | XM = 1
| | | | | XF = 0
| | | | | XB = 0 : 0
| | | | | XB = 1
| | | | | XD = 0
| | | | | XE = 0 : 0
| | | | | XE = 1
| | | | | XG = 0
| | | | | XK = 0
| | | | | XL = 0
| | | | | XN = 0 : 0
| | | | | XN = 1
| | | | | XP = 0 : 0
| | | | | XP = 1
| | | | | XQ = 0
| | | | | XR = 0 : 1
| | | | | XR = 1 : 0
| | | | | XQ = 1 : 0
| | | | | XL = 1 : 0
| | | | | XK = 1 : 0
| | | | | XG = 1 : 0
| | | | | XD = 1 : 0
| | | | | XF = 1 : 1
| | | | | XJ = 1
| | | | | XS = 0 : 1
| | | | | XS = 1
| | | | | XG = 0
| | | | | XB = 0 : 0
| | | | | XB = 1
| | | | | XD = 0 : 1
| | | | | XD = 1
| | | | | XC = 0
| | | | | XE = 0 : 0
| | | | | XE = 1 : 1
| | | | | XC = 1 : 0
| | | | | XG = 1
```

```
Problems @ Javadoc Declaration Console
<terminated> ID3 [Java Application] C:\Program Files\Java\jre1.8.0_102\bin\javaw.exe (Sep 24, 2017, 1:19:05 PM)
| | | | | 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
| | | | | XB = 0
| | | | | XF = 0 : 0
| | | | | XF = 1 : 1
| | | | | XB = 1 : 0
| | | | | XD = 1 : 0
| | | | | XQ = 1
| | | | | XM = 0
| | | | | XN = 0
| | | | | XU = 0 : 1
| | | | | XU = 1 : 0
| | | | | XN = 1
| | | | | XP = 0
| | | | | XB = 0
| | | | | XC = 0
```



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Problems @ Javadoc Declaration Console
<terminated> ID3 [Java Application] C:\Program Files\Java\jre1.8.0_102\bin\javaw.exe (Sep 24, 2017, 1:19:05 PM)
Post-Pruned Accuracy
-----
XO = 0
| XM = 0
| | XF = 0
| | | XB = 0 : 0
| | | XB = 1
| | | | XD = 0 : 0
| | | | XD = 1
| | | | | XI = 0 : 0
| | | | | XI = 1
| | | | | | XC = 0
| | | | | | XE = 0 : 0
| | | | | | XE = 1 : 1
| | | | | | XC = 1 : 0
| | | | XF = 1 : 0
| | XM = 1 : 1
XO = 1
| XI = 0
| | XM = 0
| | | XQ = 0
| | | | XF = 0
| | | | | XH = 0 : 0
| | | | | XH = 1 : 1
| | | | XF = 1 : 0
| | | XQ = 1
| | | | XJ = 0
| | | | | XN = 0
| | | | | | XP = 0 : 1
| | | | | | XP = 1
| | | | | | | XB = 0 : 1
| | | | | | | XB = 1 : 0
| | | | | XN = 1 : 0
| | | | XJ = 1
| | | | | XL = 0
| | | | | | XH = 0 : 0

```

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Problems @ Javadoc Declaration Console
<terminated> ID3 [Java Application] C:\Program Files\Java\jre1.8.0_102\bin\javaw.exe (Sep 24, 2017, 1:19:05 PM)
| | | | XH = 0 : 0
| | | | XH = 1 : 1
| | | XF = 1 : 0
| | | XQ = 1
| | | | XJ = 0
| | | | | XN = 0
| | | | | | XP = 0 : 1
| | | | | | XP = 1
| | | | | | | XB = 0 : 1
| | | | | | | XB = 1 : 0
| | | | | XN = 1 : 0
| | | | XJ = 1
| | | | | XL = 0
| | | | | | XH = 0 : 0
| | | | | | XH = 1
| | | | | | | XK = 0
| | | | | | | XU = 0 : 1
| | | | | | | XU = 1 : 0
| | | | | | | XK = 1 : 1
| | | | XL = 1 : 1
| | XM = 1 : 0
| XI = 1 : 1

Number of training instances= 600
Number of training attributes= 20
Total number of nodes in the tree= 42
Number of leaf nodes in the tree= 22
Accuracy of the model on the training dataset = 63.333332%

Number of validation instances= 2000
Number of validation attributes= 20
Accuracy of the model on the validation dataset = 61.9%

Number of testing instances= 2000
Number of testing attributes= 20
Accuracy of the model on the testing dataset = 60.2%

```



### Pre-Pruned Accuracy

-----  
Number of training instances= 600  
Number of training attributes= 20  
Total number of nodes in the tree= 334  
Number of leaf nodes in the tree= 168  
Accuracy of the model on the training dataset = 57.833332%

Number of validation instances= 2000  
Number of validation attributes= 20  
Accuracy of the model on the validation dataset = 57.1%

Number of testing instances: 2000  
Number of testing attributes: 20  
Accuracy of the model on the testing dataset = 57.35%

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### Post- Pruned Accuracy

Number of training instances= 600  
Number of training attributes= 20  
Total number of nodes in the tree= 42  
Number of leaf nodes in the tree= 22  
Accuracy of the model on the training dataset = 63.333332%

Number of validation instances= 2000  
Number of validation attributes= 20  
Accuracy of the model on the validation dataset = 61.9%

Number of testing instances: 2000  
Number of testing attributes: 20  
Accuracy of the model on the testing dataset = 60.2%