

CS462

A: it's a great day
X: it's sunny out
Y: It's the weekend
Z: There's no chores to do
F: it's not raining
G: It's Saturday
B: The dishes are done
C: The laundry is done

Part I

1. If it's sunny, and it's the weekend, and there's no chores, then it's a great day.

$$X \wedge Y \wedge Z \Rightarrow A$$

2. If it's not raining, then it's sunny.

$$F \Rightarrow X$$

3. If it's Saturday, then it's the weekend

$$G \Rightarrow Y$$

4. If the dishes are done and the laundry is done, then the chores are done.

$$B \wedge C \Rightarrow Z$$

5. Either the dishes are not done, or it's not raining.

$$\neg B \vee F$$

Modus ponens: $B \Rightarrow F$

6. The dishes are done

$$B$$

7. If the laundry is not done, then the dishes are not done.

$$\neg C \Rightarrow \neg B$$

Modus ponens: $B \Rightarrow C$

8. If the dishes are done and it's not raining, then it must be Saturday.

$$B \wedge F \Rightarrow G$$

Part II – Forward Chaining

$$X \wedge Y \wedge Z \Rightarrow A$$

$$F \Rightarrow X$$

$G \Rightarrow Y$
 $B \wedge C \Rightarrow Z$
 $B \Rightarrow F$
 $B \Rightarrow C$
 $B \wedge F \Rightarrow G$
 B
 F
 X
 C
 Z
 G
 Y
 A

1. We know that B holds, and that B implies F, so we add F to our KB.
2. We know that F holds, and that F implies X, so we add X to our KB.
3. We know that B holds, and that B implies C, so we add C to our KB.
4. We know that B and C holds, and that B and C imply Z, so we add Z to our KB.
5. We know that B and F holds, and that B and F imply G, so we add G to our KB.
6. We know that G holds, and that G implies Y, so we add Y to our KB.
7. We know that X, Y and Z holds, and that X and Y and Z imply A, so we add A to our KB.

Part III – Backward Chaining

$X \wedge Y \wedge Z \Rightarrow A$
 $F \Rightarrow X$
 $G \Rightarrow Y$

$B \wedge C \Rightarrow Z$

$B \Rightarrow F$

$B \Rightarrow C$

$B \wedge F \Rightarrow G$

B

[A]

[X, Y, Z]

[F, Y, Z]

[B, Y, Z]

[Y, Z]

[G, Z]

[B, F, Z]

[F, Z]

[Z]

[B, C]

[C]

[B]

[]

Stack is empty, so therefore it is a great day!

Part IV – Resolution with CNF

$X \wedge Y \wedge Z \Rightarrow A$

$F \Rightarrow X$

$G \Rightarrow Y$

$B \wedge C \Rightarrow Z$

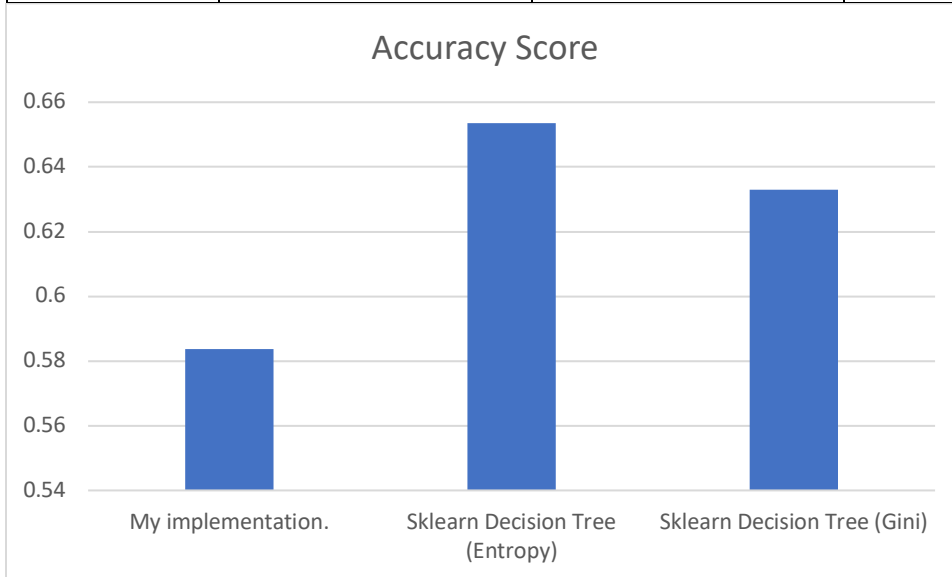
$B \Rightarrow F$
 $B \Rightarrow C$
 $B \wedge F \Rightarrow G$
 B

$\neg X \vee \neg Y \vee \neg Z \vee A$
 $\neg F \vee X$
 $\neg G \vee Y$
 $\neg B \vee \neg C \vee Z$
 $\neg B \vee F$
 $\neg B \vee C$
 $\neg B \vee \neg F \vee G$
 B
 $\neg A$
 $\neg X \vee \neg Y \vee \neg Z$
 $\neg F \vee \neg Y \vee \neg Z$
 $\neg F \vee \neg G \vee \neg Z$
 $\neg F \vee \neg G \vee \neg B \vee \neg C$
 $\neg G \vee \neg B \vee \neg C$
 $\neg G \vee \neg B$
 $\neg B \vee \neg F$
 $\neg B$

Assuming that $\neg A$ holds results in a contradiction in our KB stating that B and $\neg B$ both hold, therefore A must hold and it is a great day!

Comparing my tree to sklearn with entropy and with gini.

	My implementation.	Sklearn Decision Tree (Entropy)	Sklearn Decision Tree (Gini)
Accuracy Score	0.584	0.654	0.633

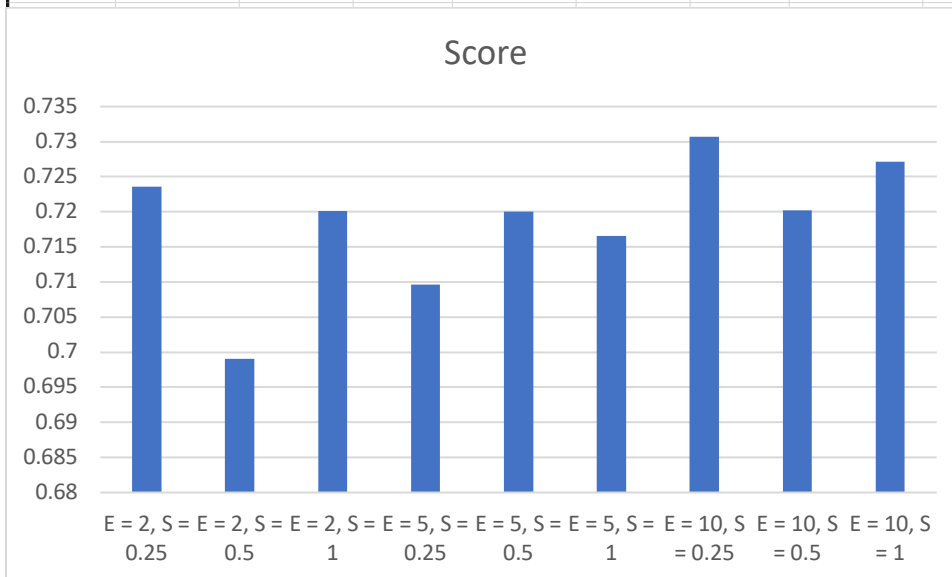


Comparing random forests with different parameters.

E = Estimators

S = Sample Ratio

	E = 2, S = 0.25	E = 2, S = 0.5	E = 2, S = 1	E = 5, S = 0.25	E = 5, S = 0.5	E = 5, S = 1	E = 10, S = 0.25	E = 10, S = 0.5	E = 10, S = 1
Score	0.723593466	0.69909256	0.7201452	0.709618875	0.7200242	0.7165759	0.730671506	0.720205687	0.72710224



Random Forest with 10 estimators and 0.25 Sample ratio seems to do the best with our data.