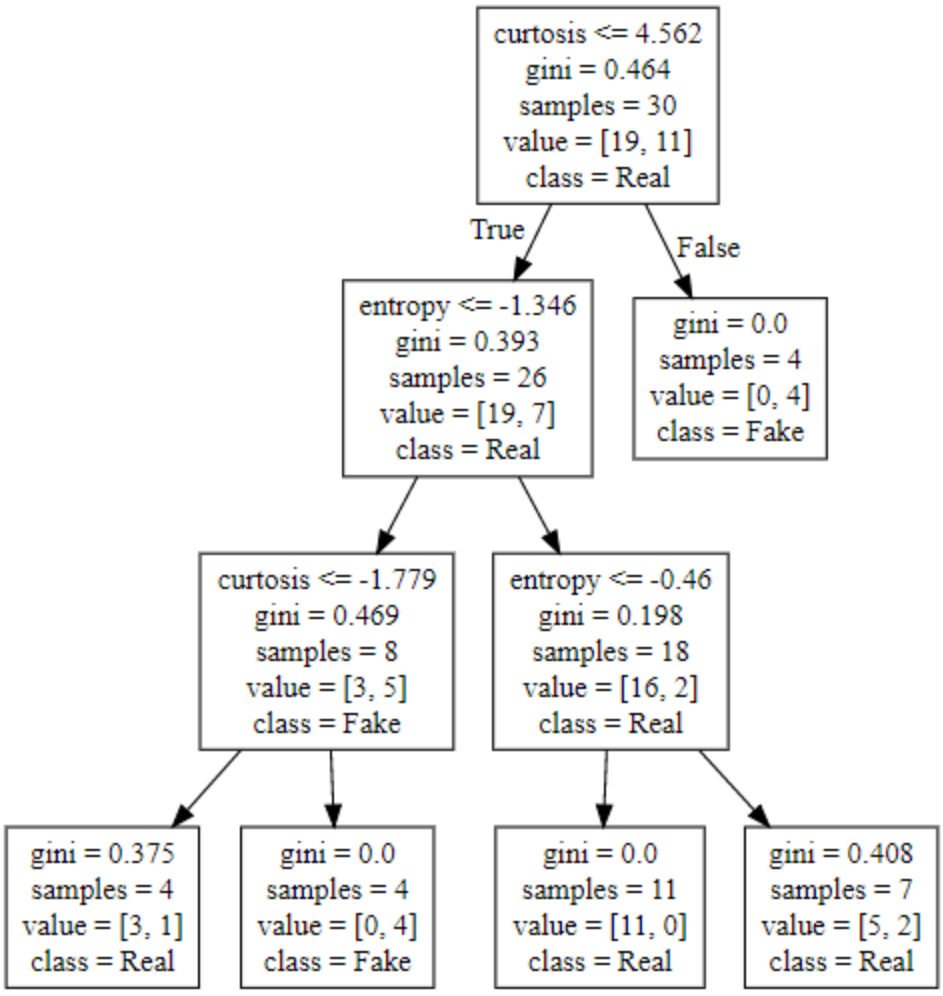
Decision Trees Unplugged: Solutions & Data

The Configuration

An sklearn `tree.DecisionTreeClassifier` object was created with the `min_samples_leaf` parameter set to 4. Then it was fitted to the data shown on the original handout.

The Tree (Visual)

The raw GraphViz output (shown on the next page) was pasted into the text window at webgraphviz.com to produce the graph below. The "gini" field is a measure of purity at each node. The "value" field shows how many samples fell into each class.



The Tree (Raw Graphviz Output)

```
digraph Tree {
	node [shape=box] ;
	0 [label="curtosis <= 4.562\ngini = 0.464\nsamples = 30\nvalue = [19, 11]\nclass =
	Real"] ;
	1 [label="entropy <= -1.346\ngini = 0.393\nsamples = 26\nvalue = [19, 7]\nclass =
	Real"] ;
	0 -> 1 [labeldistance=2.5, labelangle=45, headlabel="True"] ;
	2 [label="curtosis <= -1.779\ngini = 0.469\nsamples = 8\nvalue = [3, 5]\nclass =
	Fake"] ;
	1 -> 2 ;
	3 [label="gini = 0.375\nsamples = 4\nvalue = [3, 1]\nclass = Real"] ;
	2 -> 3 ;
	4 [label="gini = 0.0\nsamples = 4\nvalue = [0, 4]\nclass = Fake"] ;
	2 -> 4 ;
	5 [label="entropy <= -0.46\ngini = 0.198\nsamples = 18\nvalue = [16, 2]\nclass =
	Real"] ;
	1 -> 5 ;
	6 [label="gini = 0.0\nsamples = 11\nvalue = [11, 0]\nclass = Real"] ;
	5 -> 6 ;
	7 [label="gini = 0.408\nsamples = 7\nvalue = [5, 2]\nclass = Real"] ;
	5 -> 7 ;
	8 [label="gini = 0.0\nsamples = 4\nvalue = [0, 4]\nclass = Fake"] ;
	0 -> 8 [labeldistance=2.5, labelangle=-45, headlabel="False"] ;
}
```

Iris Raw Data

Left table is sorted by Sepal Length, Right table sorted by Sepal Width

Sepal Length	Sepal Width	Classification
4.3	3	Setosa
4.6	3.1	Setosa
4.7	3.2	Setosa
4.7	3.2	Setosa
4.8	3.1	Setosa
4.8	3.4	Setosa
4.8	3.4	Setosa
5	3	Setosa
5	3.2	Setosa
5.1	3.5	Setosa
5.1	3.3	Setosa
5.1	3.7	Setosa
5.1	3.8	Setosa
5.2	3.5	Setosa
5.2	3.4	Setosa
5.4	3	Versicolor
5.4	3.9	Setosa
5.4	3.9	Setosa
5.7	2.8	Versicolor
5.7	2.6	Versicolor
5.8	4	Setosa
5.8	2.6	Versicolor
5.9	3	Versicolor
6	2.7	Versicolor
6	2.2	Versicolor
6.1	2.8	Versicolor
6.3	3.3	Versicolor
6.4	2.9	Versicolor
6.7	3	Versicolor
6.8	2.8	Versicolor

Sepal Length	Sepal Width	Classification
6	2.2	Versicolor
5.7	2.6	Versicolor
5.8	2.6	Versicolor
6	2.7	Versicolor
5.7	2.8	Versicolor
6.1	2.8	Versicolor
6.8	2.8	Versicolor
6.4	2.9	Versicolor
4.3	3	Setosa
5	3	Setosa
5.4	3	Versicolor
5.9	3	Versicolor
6.7	3	Versicolor
4.6	3.1	Setosa
4.8	3.1	Setosa
4.7	3.2	Setosa
4.7	3.2	Setosa
5	3.2	Setosa
5.1	3.3	Setosa
6.3	3.3	Versicolor
4.8	3.4	Setosa
4.8	3.4	Setosa
5.2	3.4	Setosa
5.1	3.5	Setosa
5.2	3.5	Setosa
5.1	3.7	Setosa
5.1	3.8	Setosa
5.4	3.9	Setosa
5.4	3.9	Setosa
5.8	4	Setosa

Banknotes Example

Left table is sorted by Curtosis, right table sorted by Entropy

Curtosis	Entropy	Classification
-4.413	-4.0211	Real
-4.1722	-4.7582	Real
-4.1594	-1.9379	Fake
-3.3034	-1.0509	Real
-3.2846	-1.1608	Real
-3.2794	-1.2009	Real
-3.1123	-2.7164	Real
-2.9024	-1.0379	Real
-2.6848	-0.92544	Real
-2.6256	-1.0341	Real
-2.4774	-0.50648	Real
-1.8785	1.3258	Fake
-0.44499	-1.4905	Fake
-0.0834	-6.4172	Fake
0.16594	-4.5396	Fake
0.20792	0.33662	Real
0.52581	-7.0107	Fake
0.65005	-0.92544	Real
0.77344	1.2095	Real
0.9885	-0.87371	Real
1.5454	-0.26079	Real
1.7785	-0.47156	Real
1.9833	-0.44829	Fake
2.0416	1.1319	Real
2.1341	0.3211	Real
3.0895	-0.9849	Real
6.0344	-0.20777	Fake
6.2169	-0.62285	Fake
8.6521	1.8198	Fake
10.2184	-1.0043	Fake

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0.52581	-7.0107	Fake
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-4.413	-4.0211	Real
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0.65005	-0.92544	Real
0.9885	-0.87371	Real
6.2169	-0.62285	Fake
-2.4774	-0.50648	Real
1.7785	-0.47156	Real
1.9833	-0.44829	Fake
1.5454	-0.26079	Real
6.0344	-0.20777	Fake
2.1341	0.3211	Real
0.20792	0.33662	Real
2.0416	1.1319	Real
0.77344	1.2095	Real
-1.8785	1.3258	Fake
8.6521	1.8198	Fake