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CSCE A415
HW #1.2

Problem 2: Large Data Set / Jupyter Notebook

Entries = 10,000 Classes = 3 Attributes = 17

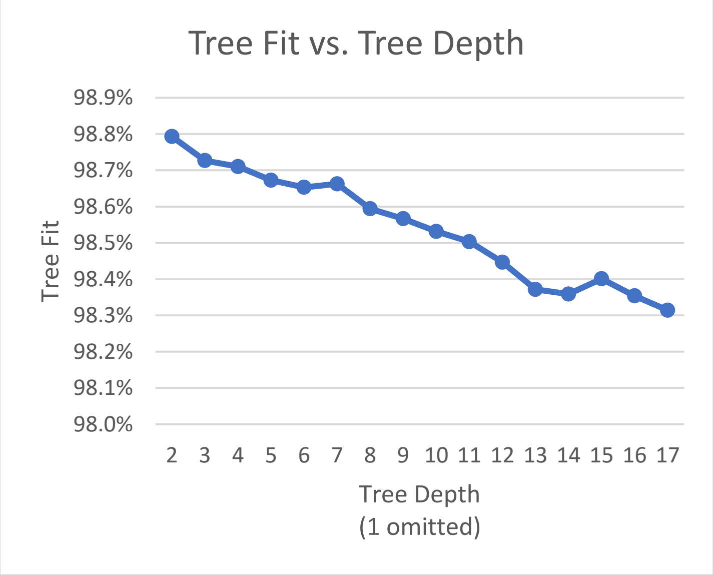
Examine and Analyze Data:

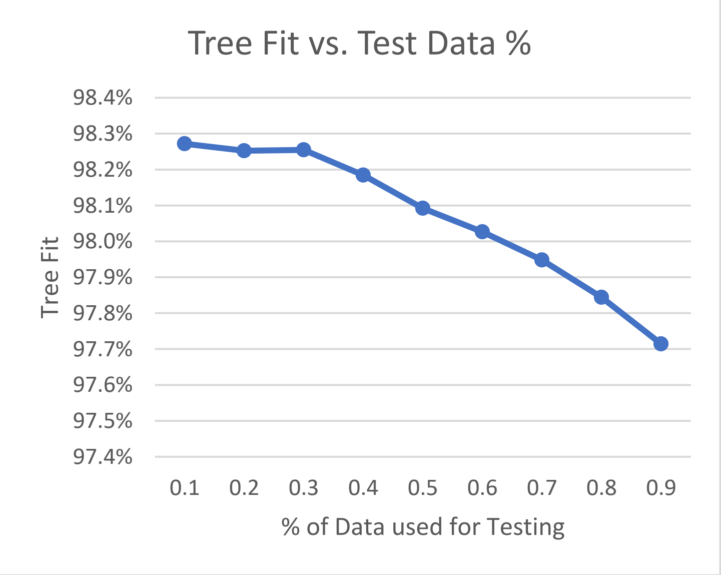
To get an idea of a possible "best fit", 1,530 decision trees were systematically created and compared with varying tree depths and test/train split ratios. Results below. The test/train splits were all stratified to promote consistency.

Test Data Ratio

Tree Depth

Tree Fit	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	Mean
1	91.2%	91.2%	91.2%	91.2%	91.2%	91.2%	91.2%	91.2%	91.2%	**91.2%**
2	98.9%	98.7%	98.8%	98.8%	98.8%	98.8%	98.8%	98.7%	98.7%	**98.8%**
3	98.7%	98.8%	98.9%	98.8%	98.7%	98.8%	98.6%	98.5%	98.5%	**98.7%**
4	98.8%	98.8%	98.8%	98.7%	98.7%	98.6%	98.6%	98.5%	98.3%	**98.7%**
5	98.6%	98.7%	98.8%	98.8%	98.7%	98.6%	98.6%	98.5%	98.1%	**98.7%**
6	98.9%	98.9%	98.8%	98.7%	98.5%	98.5%	98.6%	98.4%	98.2%	**98.7%**
7	99.0%	98.9%	98.8%	98.7%	98.7%	98.5%	98.4%	98.3%	98.1%	**98.7%**
8	98.7%	98.8%	98.8%	98.6%	98.7%	98.6%	98.3%	98.2%	98.1%	**98.6%**
9	98.8%	98.9%	98.8%	98.6%	98.6%	98.6%	98.3%	98.0%	97.9%	**98.6%**
10	98.8%	98.8%	98.7%	98.5%	98.5%	98.4%	98.4%	98.2%	98.1%	**98.5%**
11	98.7%	98.7%	98.7%	98.6%	98.4%	98.3%	98.3%	98.2%	98.0%	**98.5%**
12	98.9%	98.5%	98.5%	98.6%	98.5%	98.3%	98.1%	98.2%	98.0%	**98.4%**
13	98.5%	98.5%	98.7%	98.4%	98.4%	98.3%	98.2%	98.2%	98.0%	**98.4%**
14	98.6%	98.5%	98.5%	98.5%	98.4%	98.3%	98.2%	97.9%	98.2%	**98.4%**
15	98.6%	98.5%	98.5%	98.5%	98.3%	98.3%	98.2%	98.2%	98.2%	**98.4%**
16	98.5%	98.5%	98.5%	98.5%	98.3%	98.3%	98.1%	98.1%	97.8%	**98.4%**
17	98.5%	98.4%	98.4%	98.6%	98.2%	98.2%	98.2%	98.0%	97.9%	**98.3%**
Mean	**98.3%**	**98.3%**	**98.3%**	**98.2%**	**98.1%**	**98.0%**	**97.9%**	**97.8%**	**97.7%**	





A maximum tree depth of 2 yields the most accurate decision tree (explanation as to why coming later). Additionally, tree fit appears to drop off when the test/train ratio exceeds 30%. Based on these results, a tree depth of 2 was chosen and the test/train ratio was set to the Scikit default of 25%.

Create the Final Tree

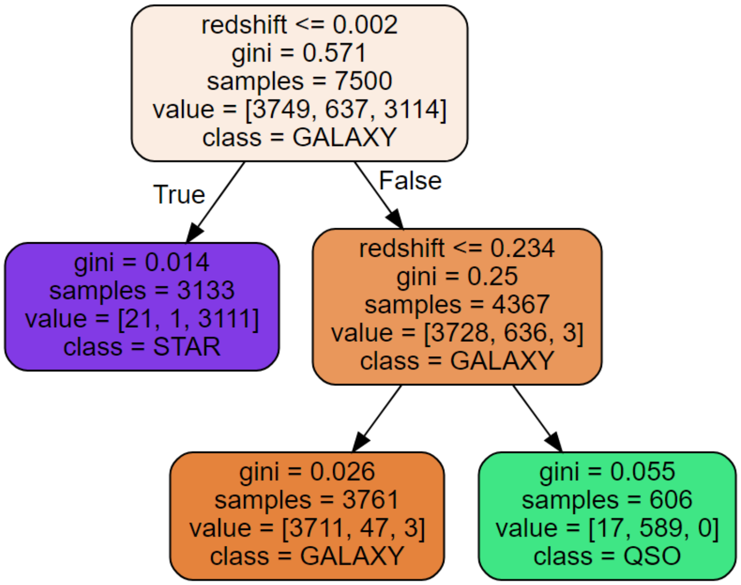
Tree Depth = 2

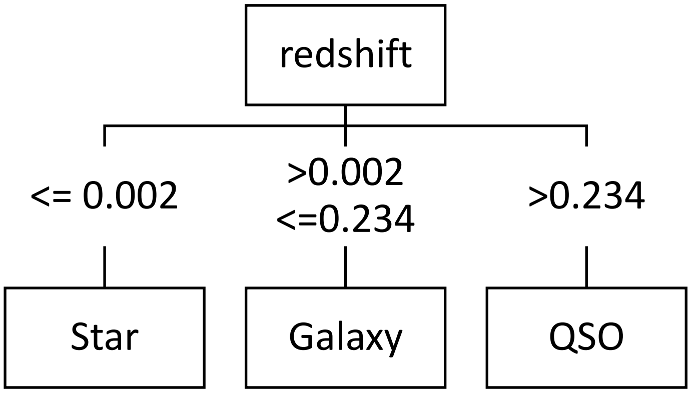
Test/Train Ratio = 0.25

Tree Fit (Score) ≈ 98.8% - 99.0%

The biggest factor in categorizing the data into classes is an entry's *redshift* value. Therefore, a maximum tree depth of 2 gave the best fit. Anything greater causes overfitting and ultimately reduces the tree's accuracy.

Below is an auto-generated, two-deep, binary decision tree and a simplified, non-binary version.


redshift <= 0.002
gini = 0.571
samples = 7500
value = [3749, 637, 3114]
class = GALAXY
True
False
gini = 0.014
samples = 3133
value = [21, 1, 3111]
class = STAR
redshift <= 0.234
gini = 0.25
samples = 4367
value = [3728, 636, 3]
class = GALAXY
gini = 0.026
samples = 3761
value = [3711, 47, 3]
class = GALAXY
gini = 0.055
samples = 606
value = [17, 589, 0]
class = QSO


redshift
<= 0.002
>0.002
<=0.234
>0.234
Star
Galaxy
QSO