Algorithmic Machine Learning HW#02

Weijun Zhu

1(a).

P[1|up]	5/7	3/7	1/7	6/7	6/7	0	4/7	P[up]=7/12
P[1|Down]	4/5	0	5/5=1	0	3/5	4/5	1/5	
P[0|up]	2/7	4/7	6/7	1/7	1/7	7/7	3/7	P[down]=5/12
P[0|Down]	1/5	5/5=1	0	5/5=1	3/5	3/5	4/5	

Use Laplace Smooth $\alpha=1$ $\beta=1$; then we have:

6/9	4/9	2/9	7/9	7/9	1/9	5/9
5/7	1/7	6/7	1/7	3/7	5/7	2/7
3/6	5/9	7/9	2/9	2/9	8/9	4/9
2/7	6/7	1/7	4/7	4/7	3/7	5/7

Algorithmic Machine Learning HW#02

Weijun Zhu.

1(b). P[{interestLow, bankrupcy}|up] × P[up]

$= \frac{2}{7} \times \frac{4}{7} \times \frac{6}{7} \times \frac{6}{7} \times \frac{1}{7} \times 0 \times \frac{3}{7} \times \frac{7}{12}$

$= 0$

P[{interestLow, bankrupcy}|down] × P[down]

$= \frac{1}{5} \times 1 \times 0 \times 0 \times \frac{3}{5} \times \frac{4}{5} \times \frac{4}{5} \times \frac{5}{12}$

$= 0$

We can not make any decision, because both of them are zero.

(c). Use Laplace Smoothing, $\alpha = 1$ & $\beta = 2$

then we have

P[{interestLow, bankrupcy}|up] × P[up]

$= \frac{3}{9} \times \frac{5}{9} \times \frac{2}{9} \times \frac{2}{9} \times \frac{2}{9} \times \frac{1}{9} \times \frac{4}{9} \times \frac{7}{12}$

$= 0.00071728$

P[{interestLow, bankrupcy}|down] × P[down]

$= \frac{2}{7} \times \frac{6}{7} \times \frac{1}{7} \times \frac{1}{7} \times \frac{4}{7} \times \frac{6}{7} \times \frac{6}{7} \times \frac{5}{12}$

$= 0.00060733$

After we use Laplace Smoothing, and we detect that it will up more likely.

2.(a). Before: 5/11

After: $R_1: 3/5$ $R_2: 1/2$

(b). $Gini(P) = 2P(1-P)$ & $Gini = \frac{1}{N}\sum_i (R_i)|R_i|$

Before: $Gini = 2 \times \frac{6}{11} \times \frac{3}{11} \times \frac{2}{11}$

$= 0.054094666$

After: $Gini = \frac{1}{11}[2 \cdot \frac{2}{5} \times \frac{3}{5} \times 5 + 2 \cdot \frac{3}{6} \times \frac{2}{6} \times \frac{1}{6} \times 6]$

$= \frac{1}{11}[2.4 + 0.3333]$

$= 0.24848818$

(c). $H(P) = -P\log(P) - (1-P)\log(1-P)$ & $E = \frac{1}{N}\sum_i entropy(R_i)|R_i|$

Before: $H(P) = -\frac{6}{11}\log(\frac{6}{11}) - \frac{3}{11}\log(\frac{3}{11}) - \frac{2}{11}\log(\frac{2}{11})$

$= 0.143586 + 0.1538892 + 0.134611$

$= 0.432089$

After: $E = \frac{1}{11}[5 \cdot (-\frac{2}{5}\log\frac{2}{5} - \frac{3}{5}\log\frac{3}{5}) + 6(-\frac{3}{6}\log\frac{3}{6} - \frac{2}{6}\log\frac{2}{6} - \frac{1}{6}\log\frac{1}{6})]$

$= \frac{1}{11}[5 \cdot (0.159176 + 0.133109) + 6(0.1505149 + 0.1590404 + 0.1296918]$

$= 0.37244615$