AI Tutorials Solution

Machine Learning

1.

(a) For Outcome, I (p, n) = I (10, 6) = $-(10/16)\log_2(10/16) - (6/16)\log_2(6/16)$ = 0.954434

(b) SPLIT ON "TIME"

For (TIME=Evening): I (2, 0) = 0
For (TIME=Day and Night): I (7, 4) = 0.946
For (TIME=Day): I (1, 2) = 0.918
Remainder(TIME) = (2/16)*I(2,0) + (11/16)*I(7,4) + (3/16)*I(1,2) = 0.8225
IG(TIME) = 0.954434 – 0.8225 = 0.132

SPLIT ON "MATCH TYPE"

For (MATCH TYPE=T20): I (3, 3) = 1.0
For (MATCH TYPE=ODI): I (6, 1) = 0.592
For (MATCH TYPE=Test): I (1, 2) = 0.918
Remainder(MATCH TYPE) = (6/16)*I(3,3) + (7/16)*I(6,1) + (3/16)*I(3,16) = 0.8061
IG(MATCH TYPE) = 0.954434 – 0.8061 = 0.148

SPLIT ON "PITCH TYPE"

For (PITCH TYPE=Fast): I (4, 0) = 0
For (PITCH TYPE=Dusty): I (2, 3) = 0.971
For (PITCH TYPE=Bouncy): I (4, 1) = 0.722
For (PITCH TYPE=Neutral): I (0, 2) = 0
Remainder(PITCH TYPE) = (4/16)*I(4,0) + (5/16)*I(2,3) + (5/16)*I(4,1) + (2/16)*I(0,2) = 0.529
IG(PITCH TYPE) = 0.954434 – 0.529 = 0.425

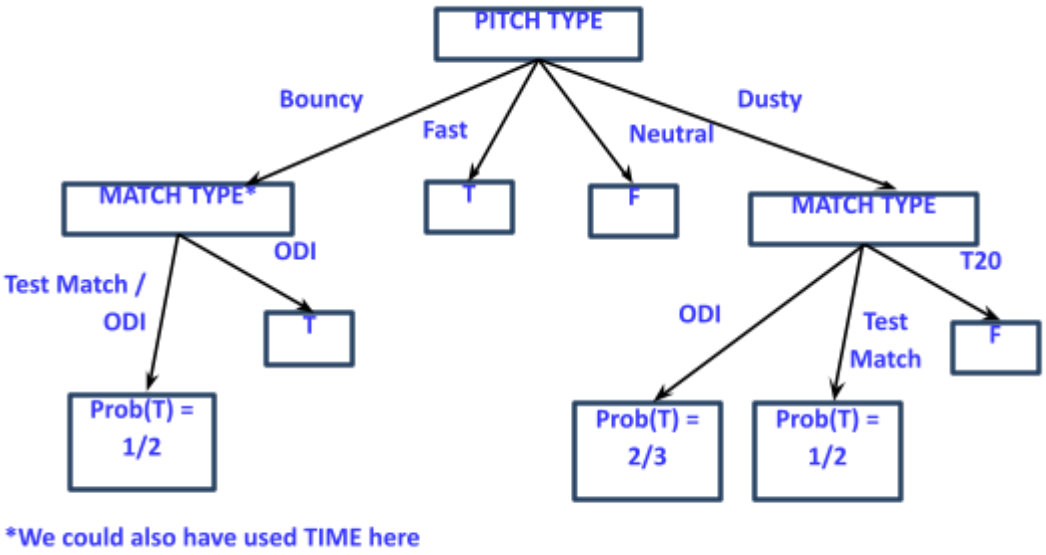
We choose PITCH TYPE because it yields the maximum information gain.

(c) $$remainder(PITCH\ TYPE) = \sum_{i=1}^{v} \frac{p_i+n_i}{p+n} I\left(\frac{p_i}{p_i+n_i}, \frac{n_i}{p_i+n_i}\right)$$

$$IG(PITCH\ TYPE) = I\left(\frac{p}{p+n}, \frac{n}{p+n}\right) - remainder(PITCH\ TYPE)$$

IG(PITCH TYPE) = 0.425

(d)



(e) India will win with a probability of 2/3.

2.

a. H1 = ReLU([-1,0]*[1,1] + 0) = ReLU(-1) = 0
H2 = ReLU([-1,1]*[1,1] + 0) = ReLU(0) = 0

O1 = ReLU([0,-1]*[0,0] + 1) = ReLU(1) = 1
O2 = ReLU([-1,1]*[0,0] + 1) = ReLU(1) = 1

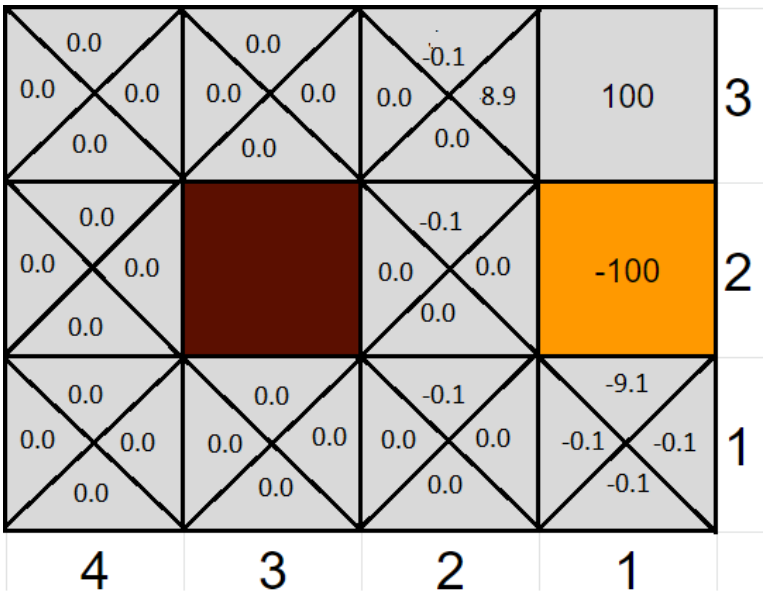
b. MSE (O1) = $(1-1)^2$ = 0
MSE (O2) = $(0-1)^2$ = 1
LOSS = 0+1 = 1

c. O1 = Sigmoid([0,-1]*[0,0] + 1) = Sigmoid(1) = 0.731
O2 = Sigmoid([-1,1]*[0,0] + 1) = Sigmoid(1) = 0.731

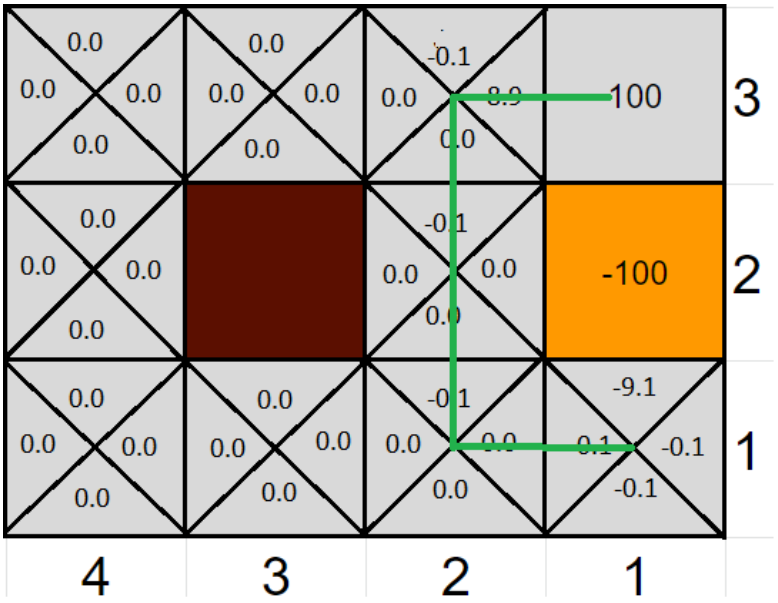
MSE (O1) = $(1-0.731)^2$ = 0.072
MSE (O2) = $(0-0.731)^2$ = 0.534
LOSS = 0.072+0.534 = 0.606

3.

a.


0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
-0.1
0.0
8.9
0.0
100
3
0.0
0.0
0.0
-0.1
0.0
0.0
0.0
-100
2
0.0
0.0
0.0
0.0
0.0
0.0
0.0
-0.1
0.0
0.0
0.0
-9.1
-0.1
-0.1
-0.1
1
4
3
2
1

b.


0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
0.0
-0.1
0.0
8.9
0.0
100
3
0.0
0.0
0.0
-0.1
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0.0
0.0
-100
2
0.0
0.0
0.0
0.0
0.0
0.0
0.0
-0.1
0.0
0.0
0.0
-9.1
0.1
-0.1
-0.1
1
4
3
2
1