CS 662
Artificial Intelligence Programming
Homework #7
Various Topics

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1. D = {(x1, ‘yes’), (x2, ‘no’), (x3, ‘yes’), (x4, ‘yes’), (x5, ‘no’), (x6, ‘yes’)}

The values of the similarity function, K, for a new point x0 are: K(x0,x1)=2, K(x0,x2)=1.5, K(x0,x3)=1.8, K(x0,x4)=2.3, K(x0,x5)=2.1, K(x0,x6)=1.7

1)What is the 1-NN classification of x0?

min: K(x0,x2)=1.5, check x2, so the classification is no.

2)What is the 3-NN classification of x0?

min: K(x0,x2)=1.5, K(x0,x6)=1.7 and K(x0,x3)=1.8

check x2 = no, x6 = yes, x3 = yes, so the classification is yes.

2. Naïve Bayes

Given:

class A：money (4 times), finance (1 time), stock (10 times), and market (6 times)

class B：money (1 time), loss (20 times), finance (20 times), and gain (5 times)

Document: “money finance loss stock gain average”

In class A: P(money | categoryA) = 4/21,

P(finance | categoryA) = 1/21,
P(stock | categoryA) = 10/21,
P(market | categoryA) = 6/21,

In class B: P(money | categoryB) = 1/46,
P(loss | categoryB) = 20/46 =10/23,
P(finance | categoryB)= 20/46 = 10/23,
P(gain | categoryB) = 5/46,

P(A) = 5/15 = 1/3
P(B) = 10/15 = 2/3
So vA = P(A) * P(money | categoryA) * P(finance | categoryA) *1/10000 * P(stock | categoryA) * 1/10000 * 1/10000
= 1/3*4/21*1/21*1/10000*10/21*1/10000*1/10000
= 1.4397293e-15

vB = P(B) * P(money | categoryB) * P(finance | categoryB) * P(loss | categoryB) * 1/1000 * P(gain | categoryB) * 1/10000
= 2/3*1/46*10/23*10/23*1/10000*5/46*1/10000
= 2.9778815e-12
So the document is belong to class B.

3.

The accuracy without negation:
IntegratedCons.txt: pros -> 0.122, cons -> 0.878
IntegratedPros.txt: pros -> 0.748, cons -> 0.252
The accuracy with negation:
IntegratedCons.txt: pros -> 0.120, cons -> 0.880
IntegratedPros.txt: pros -> 0.749, cons -> 0.251

4. Utility & VPI

1) Suppose the ham:spam = 5 : 5

	spam -> spam	ham -> spam	spam -> ham
c1	85%	8%	1 - 85% = 15%
c2	70%	2%	1 - 70% = 30%
cost		$1	$0.05

So for c1, cost(c1) = 1000*50%*8%*1 + 1000*50%*15%*0.05 = 43.75($)
for c2, cost(c2) = 1000*50%*2%*1 + 1000*50%*30%*0.05 = 17.50 ($)
So c2 is better than c1.

2)

choice1: The value (utility) of buying an apartment building in good economic conditions is $50,000 and $30,000 in bad conditions.

choice2: The value of buying an office building in good economic conditions is $100,000 and -$40,000 in bad conditions.

choice3: The value of buying a warehouse in good economic conditions is $30,000 and $10,000 in bad conditions.

We know: The probability of being in good economic conditions is .6 and the probability of being in bad economic conditions is .4

EU(choice1) = 50000*0.6 + 30000*0.4 = 42000
EU(choice2) = 100000*0.6 + (-40000*0.4) = 44000
EU(choice3) = 30000*0.6 + (10000*0.4) = 22000

The value of knowing whether we are in good or bad economic conditions:
= 100000*0.6 + 30000*0.4 - EU(choice2)
= 28000 ($)

5. MDP

1)
After first step up:

1	2	3	4
5 0.8	6	7	8
9 0.1	10 0.1	11	12

After second step up:

1 0.64	2	3	4
5 0.24	6	7	8
9 0.02	10 0.09	11 0.01	12

After third step right:

1 0.088	2 0.512	3	4
5 0.258	6	7 0.001	8
9 0.026	10 0.034	11 0.073	12 0.008

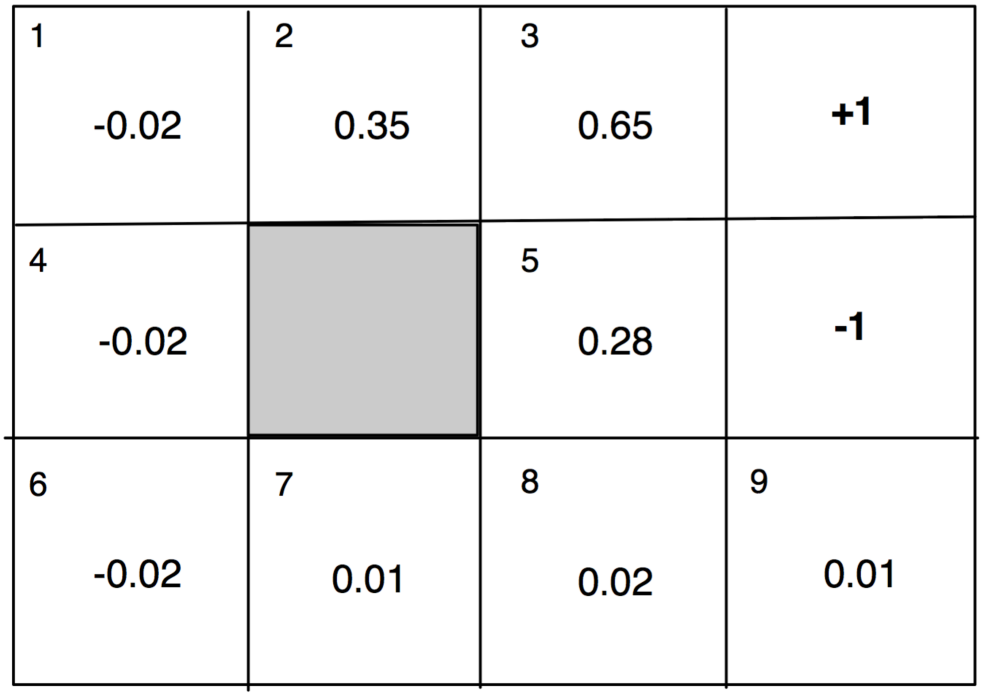
After fourth step right:

1 0.088	2 0.512	3	4
5 0.258	6	7 0.001	8
9 0.026	10 0.034	11 0.073	12 0.008

After fifth step right:

1 0.02524	2 0.06224	3 0.17994	4 0.32776
5 0.18054	6	7 0.04443	8 0.014
9 0.02462	10 0.02824	11 0.02627	12 0.08672

2)



Update rule:

$U_{i+1}(s)=R(s)+\gamma \max_{a} \sum_{s'} P(s|s,a)U_i(s)$

Assume γ = 0.8
Assume time cost is -0.04: (R(s) = −0.04)

There are 4 directions the square 3 can take:

a. left: 0.8U(2)+0.1U(3)+0.1U(5) = 0.8*0.35+0.1*0.65+0.1*0.28 = 0.373

b. right: 0.8*1+0.1U(3)+0.1U(5) = 0.8*1+0.1*0.65+0.1*0.28 = 0.893

c. down: 0.8*(5)+0.1U(2)+0.1*1 = 0.8*0.28+0.1*0.35+0.1*1 = 0.359

d. up: 0.8U(3)+0.1U(2)+0.1*1 = 0.8*0.65+0.1*0.35+0.1*1 = 0.655

so the max is right direction and according to the update rule:

U3’ = -0.04 + 0.8 * 0.893 = 0.6744