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CPTS 440

Artificial Intelligence

11-14-2019

Homework 10

1A)
P(HaveFun) =
{
P(haveFun=yes) = 6 / 11
P(haveFun=no) = 5 / 11
}

1B)
P(Weather | HaveFun) =
{
P(weather=cloudy | haveFun) = P(weather=cloudy ^ haveFun=yes) / P(haveFun=yes) = (1/11) / (6 /11) = 1/6,
P(weather=cloudy | ~haveFun) = P(weather=cloudy ^ haveFun=no) / P(haveFun=no) = (2/11) / (5/11) = 2/5,
P(weather=rain | haveFun=yes) = P(weather=rain ^ haveFun=yes) / P(haveFun=yes) = (2/11) / (6/11) = 1/3,
P(weather=rain | haveFun=no) = P(weather=rain ^ haveFun=no) / P(haveFun=no) = (2/11) / (5/11) = 2/5,
P(weather=clear | haveFun=yes) = P(weather=clear ^ haveFun=yes) / P(haveFun=yes) = (3/11) / (6/11) = 1/2,
P(weather=clear | haveFun=no) = P(weather=clear ^ haveFun=no) / P(haveFun=no) = (1/11) / (5/11) = 1/5
}

1C)
P(AiDone | HaveFun) =
{
P(aiDone=yes | haveFun=yes) = P(aiDone=yes ^ haveFun=yes) / P(haveFun=yes) = (5/11) / (6/11) = 5/6 ,
P(aiDone=yes | haveFun=no) = P(aiDone=yes ^ haveFun=no) / P(haveFun=no) = (0/11) / (5/11) = 0,
P(aiDone=yes | haveFun=yes) = P(aiDone=no ^ haveFun=yes) / P(haveFun=yes) = (1/11) / (6/11) = 1/6,
P(aiDone=no | haveFun=no) = P(aiDone=no ^ haveFun=no) / P(haveFun=no) = (5/11) / (5/11) = 1
}

1D)
P(Costume | HaveFun) =
{
P(costume=yes | haveFun=yes) = P(costume=yes ^ haveFun=yes) / P(haveFun=yes) = (4/11) / (6/11) = 2/3
P(costume=no | haveFun=yes) = P(costume=no ^ haveFun=yes) / P(haveFun=yes) = (2/11) / (6/11) = 1/3
P(costume=yes | haveFun=no) = P(costume=no ^ haveFun=yes) / P(haveFun=yes) = (2/11) / (5/11) = 2/5
P(costume=no | haveFun=no) = P(costume=yes ^ haveFun=no) / P(haveFun=no) = (3/11) / (5/11) = 3/5
}

1E)
P(haveFun=yes | weather=cloudy, aiDone=yes, costume=no) = a * P(haveFun=yes) * P(aiDone=yes | haveFun=yes) * P(weather=cloudy | haveFun=yes) * P(costume=no | haveFun=yes) = 6/11 * 5/6 * 1/6 * 1/3 = a * 0.0252525

P(haveFun=no | weather=cloudy, aiDone=yes, costume=no) = a * P(haveFun=no) * P(aiDone=yes | haveFun=no) * P(weather=cloudy | haveFun=no) * P(costume=yes | haveFun=no) = a * 5/11 * 1/5 * 2/5 * 3/5 = a * 0.02181818

a = 1 / (0.0252525 + 0.02181818) = 21.2446465

P(haveFun=yes | weather=cloudy, aiDone=yes, costume=no) = a * 0.0252525 = 21.2446465 * 0.0252525 = **0.5364804**
P(haveFun=no | weather=cloudy, aiDone=yes, costume=no) = a * 0.0099174 = 21.2446465 * 0.02181818 = **0.4635195**

1F)
Naive Bayes would choose haveFun=yes as 0.0252525 > 0.02181818.

2A)

Weather	AIDone	Costume	HaveFun
1	1	1	1
1	1	0	1
1	0	1	1
1	0	0	0
2	1	1	1
2	0	1	0
2	0	0	0
3	1	1	1
3	1	0	1
3	0	1	0
3	0	0	0

2B)

KEY:

X_0 = Bias

X_1 = Weather

X_2 = AIDone

X_3 = Costume

W_0 = Bias Weight

W_1 = Weather Weight

W_2 = AIDone Weight

W_3 = Costume Weight

$Y = (X_0W_0) + (X_1W_1) + (X_1W_1) + (X_1W_1)$

Y_{result} = Classification of Y (If $Y \geq 0$ then 1, else 0)

Y_{actual} = Havefun

ΔW_0 = Adjust Weights of Bias

ΔW_1 = Adjust Weights of Weather

ΔW_2 = Adjust Weights of AIDone

ΔW_3 = Adjust Weights of Costume

Key:

Correctly Classified
Incorrectly Classified

1st Generation

X_0	X_1	X_2	X_3	W_0	W_1	W_2	W_3	Y	Y_{result}	Y_{actual}	ΔW_0	ΔW_1	ΔW_2	ΔW_3
1	1	1	1	1	1	1	1	4	1	1	/	/	/	/
1	1	1	0	1	1	1	1	3	1	1	/	/	/	/
1	1	0	1	1	1	1	1	3	1	1	/	/	/	/
1	1	0	0	1	1	1	1	2	1	0	-0.5	-0.5	0	0
1	2	1	1	0.5	0.5	1	1	3.5	1	1	/	/	/	/
1	2	0	1	0.5	0.5	1	1	2.5	1	0	-0.5	-1	0	-0.5
1	2	0	0	0	-0.5	1	0.5	-1	0	0	/	/	/	/
1	3	1	1	0	-0.5	1	0.5	0	1	1	/	/	/	/
1	3	1	0	0	-0.5	1	0.5	-0.5	0	1	0.5	1.5	0.5	0
1	3	0	1	0.5	1	1.5	0.5	4	1	0	-0.5	-1.5	0	-0.5
1	3	0	0	0	-0.5	1.5	0	-1.5	0	0	/	/	/	/

2nd Generation

X_0	X_1	X_2	X_3	W_0	W_1	W_2	W_3	Y	Y_{result}	Y_{actual}	ΔW_0	ΔW_1	ΔW_2	ΔW_3
1	1	1	1	0	-0.5	1.5	0	1	1	1	/	/	/	/
1	1	1	0	0	-0.5	1.5	0	1	1	1	/	/	/	/
1	1	0	1	0	-0.5	1.5	0	-0.5	0	1	0.5	0.5	0	0.5
1	1	0	0	0.5	0	1.5	0.5	0.5	1	0	-0.5	-0.5	0	0
1	2	1	1	0	-0.5	1.5	0.5	1	1	1	/	/	/	/
1	2	0	1	0	-0.5	1.5	0.5	-0.5	0	0	/	/	/	/
1	2	0	0	0	-0.5	1.5	0.5	-1	0	0	/	/	/	/
1	3	1	1	0	-0.5	1.5	0.5	0.5	1	1	/	/	/	/
1	3	1	0	0	-0.5	1.5	0.5	0	1	1	/	/	/	/
1	3	0	1	0	-0.5	1.5	0.5	-1	0	0	/	/	/	/
1	3	0	0	0	-0.5	1.5	0.5	-1.5	0	0	/	/	/	/

3rd Generation

X_0	X_1	X_2	X_3	W_0	W_1	W_2	W_3	Y	Y_{result}	Y_{actual}	ΔW_0	ΔW_1	ΔW_2	ΔW_3
1	1	1	1	0	-0.5	1.5	0.5	1.5	1	1	/	/	/	/
1	1	1	0	0	-0.5	1.5	0.5	1	1	1	/	/	/	/
1	1	0	1	0	-0.5	1.5	0.5	0	1	1	/	/	/	/
1	1	0	0	0	-0.5	1.5	0.5	-0.5	0	0	/	/	/	/
1	2	1	1	0	-0.5	1.5	0.5	1	1	1	/	/	/	/
1	2	0	1	0	-0.5	1.5	0.5	-0.5	0	0	/	/	/	/
1	2	0	0	0	-0.5	1.5	0.5	-1	0	0	/	/	/	/
1	3	1	1	0	-0.5	1.5	0.5	0.5	1	1	/	/	/	/
1	3	1	0	0	-0.5	1.5	0.5	0	1	1	/	/	/	/
1	3	0	1	0	-0.5	1.5	0.5	-1	0	0	/	/	/	/
1	3	0	0	0	-0.5	1.5	0.5	-1.5	0	0	/	/	/	/

Final Perceptron Weights

$W_0 = 0$

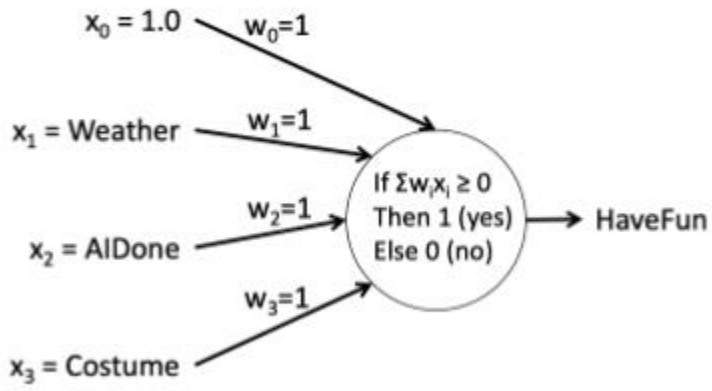
$W_1 = -0.5$

$W_2 = 1.5$

$W_3 = 0.5$

2C)

I assume we use the weights from our perceptron not the weights from the picture provided



$X_0 = 1$

Weather = Cloudy = 2

AIDone = Yes = 1

Costume = No = 0

X_0	X_1	X_2	X_3	W_0	W_1	W_2	W_3	Y	Y_{result}
1	2	1	0	0	-0.5	1.5	0.5	0.5	1

$(X_0W_0) + (X_1W_1) + (X_2W_2) + (X_3W_3) = Y$

(1*0) + (2*-0.5) + (1*1.5) + (0*0.5) = 0.5

$0.5 \geq 0$, so $Y_{result} = 1$

HaveFun = 1 = Yes