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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:

X0 = Bias

X1 = Weather

X2 = AIDone

X3 = Costume

W0 = Bias Weight

W1 = Weather Weight

W2 = AIDone Weight

W3 = Costume Weight

Y = (X0W0) + (X1W1) + (X1W1) + (X1W1)

Yresult = Classification of Y (If Y ≥ 0 then 1, else 0)

Yactual = Havefun

ΔW0 = Adjust Weights of Bias

ΔW1 = Adjust Weights of Weather

ΔW2 = Adjust Weights of AIDone

ΔW3 = Adjust Weights of Costume

Key:

|  |
| --- |
| Correctly Classified |
| Incorrectly Classified |

1st Generation

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **X0** | **X1** | **X2** | **X3** | **W0** | **W1** | **W2** | **W3** | **Y** | **Yresult** | **Yactual** | **ΔW0** | **ΔW1** | **ΔW2** | **ΔW3** |
| 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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **X0** | **X1** | **X2** | **X3** | **W0** | **W1** | **W2** | **W3** | **Y** | **Yresult** | **Yactual** | **ΔW0** | **ΔW1** | **ΔW2** | **ΔW3** |
| 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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **X0** | **X1** | **X2** | **X3** | **W0** | **W1** | **W2** | **W3** | **Y** | **Yresult** | **Yactual** | **ΔW0** | **ΔW1** | **ΔW2** | **ΔW3** |
| 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 | / | / | / | / |

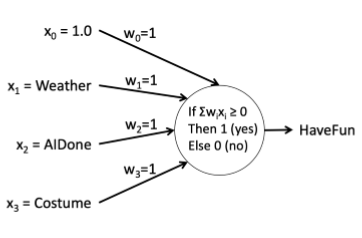
Final Perceptron Weights

W0 = 0

W1 = -0.5

W2 = 1.5

W3 = 0.5

2C)

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

X0 = 1

Weather = Cloudy = 2

AIDone = Yes = 1

Costume = No = 0

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **X0** | **X1** | **X2** | **X3** | **W0** | **W1** | **W2** | **W3** | **Y** | **Yresult** |
| 1 | 2 | 1 | 0 | 0 | -0.5 | 1.5 | 0.5 | 0.5 | 1 |

(X0W0) + (X1W1) + (X2W2) + (X3W3) = Y

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

0.5 ≥ 0, so Yresult = 1

**HaveFun = 1 = Yes**