HW2

Wednesday, March 6, 2019 9:09 PM

1. Compute $P(d \mid b, \neg a, j, m)$

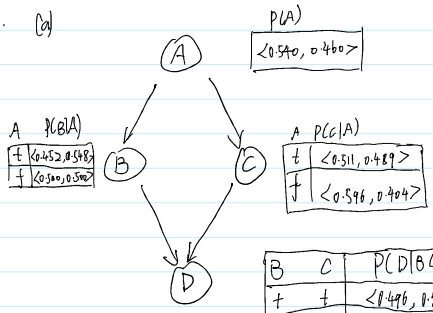
$$P(d, b, \neg a, j, m) = \sum_{e,\neg e} P(d \mid b, E) P(b) P(\neg a \mid b, E) P(j \mid d, \neg a) P(m \mid d, \neg a) P(E)$$
$$= P(b) P(j \mid d, \neg a) P(m \mid d, \neg a) \sum_{e,\neg e} P(d \mid b, E) P(\neg a \mid b, E) P(E)$$
$$= 0.001 \times 0.7 \times 0.3 \times (0.9 \times 0.05 \times 0.02 + 0.8 \times 0.1 \times 0.98)$$
$$= 0.000166853$$

$$P(\neg d, b, \neg a, j, m) = P(b) P(j \mid \neg d, \neg a) P(m \mid \neg d, \neg a) \sum_{e,\neg e} P(\neg d \mid b, E) P(\neg a \mid b, E) P(E)$$
$$= 0.001 \times 0.1 \times 0.2 \times (0.1 \times 0.05 \times 0.02 + 0.2 \times 0.1 \times 0.98)$$
$$= 0.000000394$$

$$P(b, \neg a, j, m) = P(d, b, \neg a, j, m) + P(\neg d, b, \neg a, j, m) = 0.00017047$$

$$P(d \mid b, \neg a, j, m) = \frac{P(d, b, \neg a, j, m)}{P(b, \neg a, j, m)} = \frac{0.000166853}{0.000170047} \approx 0.978887428887$$

2. (a)



(b) E step: $P(c \mid a, \neg b, d) = \frac{P(c, a, \neg b, d)}{P(c, a, \neg b, d) + P(\neg c, a, \neg b, d)} = \frac{0.540 \times 0.540 \times 0.511 \times 0.451}{0.540 \times 0.540 \times 0.511 \times 0.451 + 0.540 \times 0.500 \times 0.596 \times 0.512} \approx 0.430$

M step: $P(a) = \frac{270+10}{500+10} = 0.549$ $P(\neg a) = 0.451$ $\Rightarrow \langle 0.549, 0.451 \rangle$

$P(c \mid a) = \frac{138 + 10 \times 0.430}{280} = 0.508$ $P(\neg c \mid a) = 0.492$ $\Rightarrow$ A: t $\langle 0.508, 0.492 \rangle$

$P(c \mid \neg a) = \frac{137 + (1 - 0.43) \times 10}{230} = 0.620$ $P(\neg c \mid \neg a) = 0.380$ f $\langle 0.620, 0.380 \rangle$

$P(b \mid a) = \frac{122}{280} = 0.436$ $P(\neg b \mid a) = 0.564$ $\Rightarrow$ A: t $\langle 0.436, 0.564 \rangle$

$P(b \mid \neg a) = P(b \mid \neg a)$ = original value.

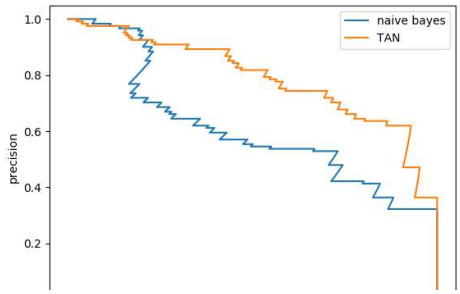
$P(d \mid b, c)$, $P(\neg d \mid b, c)$ = original value.

$P(d \mid b, \neg c)$, $P(\neg d \mid b, \neg c)$ = original value.

$P(d \mid \neg b, c) = \frac{64 + 0.43 \times 10}{182 + 0.43 \times 10} = 0.467$ $P(\neg d \mid \neg b, c) = 0.533$ $\Rightarrow$ B C: f t $\langle 0.467, 0.533 \rangle$

$P(d \mid \neg b, \neg c) = \frac{62 + (1 - 0.43) \times 10}{121 + (1 - 0.43) \times 10} = 0.534$ $P(\neg d \mid \neg b, \neg c) = 0.466$ f f $\langle 0.534, 0.466 \rangle$

part2 I think tan has more predicting power with higher precision at same recall.



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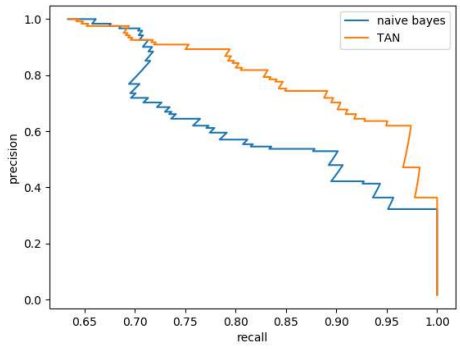

part3 degree of freedom $n-1 = 10-1 = 9$.
t on degree of freedom = 9 is 2.62.
Our t is higher than that!
⇒ 2 models have different predicting power,
with Tan has better accuracy, we can conclude that TAN is better than NB.

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(cs760) C:\Users\hanniewang\envs\cs760\hw2>python t_test.py tic-tac-toe.json
nb
0.7604166666666666
0.6666666666666666
0.6979166666666666
0.6770833333333334
0.7083333333333334
0.6770833333333334
0.7083333333333334
0.6875
0.75
0.6702127659574468
mean
0.7003546099290078

tan
0.8333333333333334
0.7083333333333334
0.7291666666666666
0.7291666666666666
0.78125
0.7083333333333334
0.75
0.7395833333333334
0.8541666666666666
0.7659574468085106
mean
0.7599290780141844

t
3.331022277444146
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